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Guest Editors: *Robert Cull, Asli Demirgüç, and Justin Yifu Lin*

Water Nationalization and Service Quality

Fernando Borraz, Nicolás González Pampillón, and Marcelo Olarreaga

The objective of this paper is to explore the impact of Uruguay's privatization and subsequent nationalization of water services on network access and water quality. The results suggest that although the early privatization of water services had little impact on access to the sanitation network, the subsequent nationalization led to an increase in network access at the bottom of the income distribution as well as an improvement in water quality. JEL codes: D60, H51, I10, I30, L33, O12

In the 1970s, the government's role as the provider of basic services in sectors with a natural monopoly component, such as the water supply and sanitation, was rarely questioned. Indeed, it was thought that private firms were likely to abuse their monopoly power in this type of market because they would concentrate their supply on rich households, leaving poor households without access to basic services. However, public companies would have incentives to ensure access to the maximum number of potential voters (at least in democracies).

By the late 1980s, the weak economic performance and low productivity of many public companies around the world changed this view (World Bank 2004). Poor management practices due to political agendas rather than profit-oriented motives shed light on the substantial inefficiencies and poor service quality provided by these public companies. In the 1990s, the privatization of water services was perceived by some as a potential solution to the poor performance of publicly owned water monopolies that left more than one billion people in developing countries without access to clean and safe water and 40 percent of the world's population without access to safe and clean sanitation services (Segeredt 2005). In its Human Development Report of 2006, the UNDP notes, "not having access to water and sanitation is a polite euphemism for a form of deprivation that threatens life." Additionally, Galiani *et al.*

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(2005) provide empirical evidence that a transition toward privatized water services in Argentina in the 1990s led to a rapid decline in child mortality.

France was an early example of a country with privately provided water services. Throughout the 1990s, many countries privatized water services, beginning with England in 1989 and followed by Eastern European and Latin American countries. A few Asian and African countries followed in the mid- and late 1990s (Hall, Lobina, and Corral 2010). Nevertheless, the share of public water companies is still very large.[1] This share has increased over the last 10 years as negative reactions to privatization occurred in many countries.

Uruguay is a recent example of this reversal. Until 1993, all water services in Uruguay were publicly owned, with the exception of a few small, community-based private companies that operated in the Department of Canelones since the 1940s in areas that the public company did not serve.[2] In 1993, the initial wave of privatization was implemented in the Department of Maldonado, affecting approximately 3,000 customers. A second, larger wave of privatization followed in the same department, affecting over 20,000 customers, including some in the capital of Maldonado. The privatization was reversed in 2004 when an amendment to the Uruguayan constitution was passed declaring water "part of the public domain." The private provision of water was made illegal.[3]

The apparent reasons for Uruguay's renationalization of water companies were no different from those observed in other Latin American countries in the last decade (e.g., Bolivia, Argentina, Brazil). The privatization of water services did not achieve the promised results.[4] Private companies became deeply unpopular due to perceptions of low or declining water quality as well as the high prices charged by private companies. A series of highly publicized episodes of low quality water supplied by Uragua and Aguas de la Costa (subsidiaries of the Spanish water companies Aguas de Barcelona and Aguas de Bilbao) led (as early as 2003, in the middle of a financial crisis) to the well-publicized request by the then-Minister of Economics and Finance, Alejandro Atchugarry, for Uragua to leave the country.

Whether public or private water provision leads to better access and quality is an empirical question. The objective of this paper is to explore the impact of the privatization and subsequent nationalization of water services on water

1. According to Hall, Lobina, and Corral (2010), water services are owned and run by the public sector in 90 percent of the 400 largest cities in the world. This figure should be compared to the share of formal employment in public companies across all sectors, which is 5 percent, on average, according to Kikeri (1999).

2. For an assessment of the performance of community-driven water providers in developing countries, see Whittington *et al.* (2009).

3. Water privatization was also made illegal in the Netherlands.

4. The reason for the failure of privatization is not necessarily inherent to privatization but may also be explained by poorly designed contracts (in terms of required investments) or inadequate regulatory bodies. These are often associated with problems due to corruption (see Chong and Lopez-de-Silanes 2005).

quality (microbiological and inorganic tests) and access to sanitation networks (the percentage of households with water-sealed toilets connected to sewer lines) in Uruguay.

Studying Uruguay's water services is interesting because household access to Uruguay's piped sewerage network is particularly low compared to countries at similar levels of development. With an access rate below 50 percent, Uruguay performs poorly relative to other Latin American countries, such as Chile, Colombia, Mexico, and some comparable Brazilian states, in terms of income per capita. Additionally, as in many other Latin American countries, issues regarding the quality of water provided by private companies were part of the reason for nationalization.

The existing empirical evidence on the impact of privatization on water quality and access is relatively small and tends to suggest that privatization either has a positive impact or no impact. Barrera-Osorio, Olivera, and Ospino (2009) use a difference-in-difference methodology to assess the impact of water privatization in Colombia on several outcomes, such as coverage (the percentage of households connected to water services) and water quality (the frequency of the service and characteristics of the water, such as its color). They find that in urban areas, water access increases and water quality improves as a result of privatization, whereas negative effects on access are detected in rural areas. This finding is consistent with the notion that as water services are privatized, the poorest consumers may be left behind.

In a developed country context, Wallsten and Kosec (2005) analyze the effects of water ownership on water quality, measured as the number of violations of the Safe Drinking Water Act in the United States between 1997 and 2003. Using panel data at the community level and controlling for community fixed effects, they find that ownership is irrelevant with respect to compliance with the Safe Drinking Water Act. This result may have been observed be because the study was conducted in a developed country with high income levels and a strong demand for high quality water.[5]

Moreover, an important body of literature examines the impact of the privatization of water services on child mortality in developing countries. Child mortality is an indirect measure of water quality, but increases in water access and quality have been demonstrated to be negatively associated with child mortality (Lee, Rosenzweig, and Pitt 1997; Shi 2000; Galdo and Bertha 2005). Using a panel data framework, Galiani, Gertler and Schargrodsky (2005) provide convincing evidence that in Argentinean municipalities where water services were privatized, the incidence of child mortality from water-related diseases declined significantly (whereas the incidence of child mortality for

5. In their review of the literature, Nauges and Whittington (2009) suggest that income elasticities of demand oscillate between 0.1 and 0.4.

other reasons remained stagnant). They therefore provide indirect evidence of improvements in water quality and access.[6]

The empirical methodology that we followed is similar to that employed in Galiani, Gertler, and Schargrodosky (2005). Using panel data for the periods surrounding the episodes of privatization and nationalization, we identify differences in sanitation rates between regions that first privatized their water suppliers and later nationalized them and those that did not using a difference-in-difference estimator.[7] Our study has at least two important differences from Galiani, Gertler and Schargrodosky (2005). First, as explained above, we focus on the nationalization of water services, not only on their privatization. Second, our dependent variables are direct measures of the quality of service provided by water companies (access to and quality of water). Health outcomes are important, particularly child mortality, but they tend to be determined by many external factors other than water services. In a middle-income country such as Uruguay, child mortality is rarer than in low-income countries. Therefore, water quality may improve dramatically without any observable change in child mortality.[8] Direct measures of the quality of water services seem more appropriate in such a context.

Our results suggest that although the earlier privatization period had little impact in terms of access to the sanitation network, the nationalization of water services had a positive and statistically significant impact on access, particularly among households in the bottom 25 percent of the income distribution. Nationalization also seems to have led to improved water quality. Indeed, the impact of nationalization on the detection of abnormal levels in microbiological and inorganic water tests is consistently negative and has a relatively large coefficient.

It is important to note that although it may be tempting to conclude from our results that the public sector can provide water services as well as or better than the private sector, this conclusion cannot be supported on the basis of our empirical evidence. Indeed, the control group in our difference-in-difference strategy includes cities that were consistently served by public companies, making it impossible to answer such a question.[9] What the results suggest is that the privatization of water companies had little impact in terms of network

6. Note that the same critiques of private water suppliers that were present in Uruguay in the late 1990s and early 2000s were also made in the Argentinean press at the time (high prices, water provided by private companies being unfit for human consumption, or the fact that these private companies only honor half of their investment commitments).

7. Because the data on water quality only span the nationalization period, we cannot measure the impact of the privatization of water services.

8. Over the last decade, the average number of child deaths in Uruguay was 10 per jurisdiction. Of those, less than 10 percent were water related. See Borraz and Olarreaga (2011). The reason the effect of privatization on child mortality was estimated as being relatively large in Argentina, which is also a middle-income country, is that although the two countries have similar levels of income per capita, Uruguay is much more homogenous than Argentina in terms of both income and race.

9. We are grateful to a referee for this clarification.

access, confirming the public opinion that privatization did not deliver the promised results. However, the subsequent nationalization of the water companies delivered progress in terms of both network access and water quality relative to those companies that were consistently publicly owned. This finding contradicts most of the existing evidence for developing countries, which generally shows that water privatization leads to improved service quality.

The reminder of the paper is organized as follows. The next section describes the water system in Uruguay. Section II discusses the empirical methodology, and section III presents the data and some descriptive statistics. Section IV presents the results, and section V concludes.

I. The Water System in Uruguay

Until the early 1990s, water and sewage services in most of the country were exclusively provided by a publicly owned company, called Obras Sanitarias del Estado (OSE), except for a series of small, community-based providers that were created in the 1940s by residents with the objective of fostering land sales in the area of El Pinar in the Department of Canelones. The largest of these community-based providers was Aguas Corrientes El Pinar, which served fewer than 1,000 clients in the 1990s and only had 12 full-time staff.

In 1993, the first privatization of water services previously provided by OSE occurred in the Department of Maldonado. The new company, Aguas de la Costa, supplied water and sewage in the wealthier areas of La Barra, Manantiales, and José Ignacio, which are to the east of the internationally known resort of Punta del Este. This was a joint venture between a local company, S.T.A. Ingenieros and Benecio S.A., which had approximately 10 percent ownership, and the Spanish company Aguas de Barcelona, a subsidiary of Suez Lyonaisse des Eaux, which owned the rest of the company. Aguas de la Costa signed a 25-year concession in 1993. The company had approximately 3,100 customers.

A second water service privatization occurred in 2000. Uragua began providing water and sewage services in urban and suburban areas of Maldonado. Maldonado has 150,000 of the 3,300,000 inhabitants of Uruguay. Uragua served the area west of the Maldonado stream, with the exception of the city of Aiguá. Specifically, Uragua served the capital of Maldonado (50,417 inhabitants), San Carlos (23,878), Pan de Azúcar (6,969), Piriápolis (7,579), Cerros Azules, Nueva Carrara, Pueblo Gerona, West of River Solís, Silver River, Highway 9 North, and Punta del Este (7,298 inhabitants).[10] Uragua was owned by Aguas de Bilbao, a Spanish water provider.

Thus, by 2000, only the city of Aiguá in Maldonado was served by OSE, and all other jurisdictions in Maldonado were served by two private

10. We consider all year-round residents and not the tourist population, which can reach hundreds of thousands during the summer.

companies, Uragua and Aguas de la Costa. OSE had an exclusive monopoly in the rest of the country, except for the area of El Pinar, which was served by small, community-based providers. OSE accounted for over 90 percent of all connections.

In 2004, Uragua began litigation with OSE because of a breach of contract following some well-publicized episodes of colored water in Maldonado. This led to a referendum, which declared water to be part of the public domain, and an amendment to the Uruguayan constitution. Uragua and the Uruguayan government reached an agreement, and all of Uragua's assets were transferred to OSE by the end of 2005. After the agreement with the government, the company left the country in 2005. Aguas de la Costa's assets were transferred to OSE in 2005. Aguas Corrientes el Pinar was nationalized in December 2006, and its assets were also transferred to OSE.

Maldonado was particularly affected by the return to nationalization. At the turn of the century, the only city in Maldonado served by the publicly owned OSE was Aiguá, with 2,676 inhabitants. By 2006, OSE was the only provider of water services in Maldonado.

Our empirical analysis will therefore focus on the change of ownership in the Department of Maldonado because we do not have data at the city level for the small, community-based providers in the Department of Canelones. As discussed in the data section, when examining the impact of the privatization and subsequent nationalization of water services on network access, our treated group is restricted to three cities due to data availability, Maldonado, Pan de Azúcar, and San Carlos. We use 32 cities as a control group, including the 19 departmental capitals (except Maldonado) and other large cities. In our examination of the impact on water quality, we use six treated cities in the Department of Maldonado: Maldonado, Pan de Azúcar, Piriápolis, Punta Ballena, Punta del Este, and San Carlos. The control group has 26 cities, including all departments' capitals except Maldonado.

Table 1 presents the evolution of some indicators for the public company OSE before and after nationalization. Note that the number of employees did not change substantially following nationalization. This is important because we do not wish to attribute any change in the performance of the water companies to a change in the composition of the workforce due to layoffs at the time of nationalization. The absence of layoffs was confirmed through interviews with the managers of the water company, which indicated that only the top managers of the nationalized companies were removed by OSE. As expected, the volume of water produced increased following nationalization because the water service coverage increased. Moreover, the population served with sewerage rose from 531,300 in 2004 to 729,100 in 2006. Total gross fixed assets (including work in progress) increased sharply (by approximately 38 percent) between 2004 and 2006. This increase was partly due to the acquisitions of the private companies and partly the result of new infrastructure investments made through a sanitation project supported by the World Bank

TABLE 1. Indicators of the Public Company: OSE

	Units	2002	2003	2004	2005	2006
Service area						
Total population - water supply	'000 inhabitants	3,158.4	3,178.2	3,100.7	3,245.0	3,253.7
Total population - wastewater	'000 inhabitants	1,791.6	1,805.9	1,541.2	1,919.0	1,935.7
Total number of staff	# FTE	4.816	4.508	4.362	4.174	4.280
Water service						
Population served - water	'000 inhabitants	3,041.6	3,063.8	2,833.5	2,980.9	3,055.3
Water connections year end	'000 connections	735.1	732.9	737.7	799.9	822.5
Volume of water produced	Million m3/year	282.7	275.1	288.1	309.4	320.0
Total volume of water sold	Million m3/year	135.3	131.0	132.3	142.0	147.1
Sewerage Service						
Population served - sewerage	'000 inhabitants	467.8	479.7	531.3	633.8	729.1
Sewerage connections year end	'000 connections	162.2	166.1	169.5	195.6	205.9
Length of sewers	Km	1,683.0	1,759.6	1,872.5	2,410.8	2,494.5
Financial information						
Total operating revenues	Million URY of 2010	3,951.3	6,015.2	6,036.5	627.3	6,848.2
Total billings to residential customers	Million URY of 2010	2,252.1	3,417.8	3,537.0	3,718.0	4,070.0
Total billings to industrial customers	Million URY of 2010	840.9	12,19.0	1,269.5	1,340.1	1,499.5
Total water and wastewater operational expenses	Million URY of 2010	2,499.8	3,736.6	3,733.9	3,689.6	4,010.7
Labor costs	Million URY of 2010	1,342.1	1,851.9	1,842.9	1,688.4	1,848.8
Total gross fixed assets including work in progress	Million URY of 2010	17,907.5	24,051.4	2,356.2	24,330.8	2,4604.8
Tariff information						
Fixed charge per month for water and wastewater services for residential customers	URY of 2010 per month	86.4	140.7	144.5	145.7	145.0
Connection charges - water	URY of 2010	1,414.1	1,814.4	1,803.5	1,891.0	1,957.6
Connection charges - sewers	URY of 2010	567.3	726.7	722.3	757.1	784.3

Source: OSE.

following nationalization. Finally, OSE's prices increased sharply in 2003 during the privatization period and then remained stable following nationalization. Note that these are the prices of the public company, but during the privatization period, there were no major differences between the prices of public or private companies because the prices were controlled by the Uruguay Energy and Water Services regulator (URSEA).

II. Methodology

The identification strategy we followed is similar to that employed by Galiani *et al.* (2005), who searched for systematic differences in changes in child mortality rates between regions that have privatized and those that have not changed the ownership structure of water companies using a difference-in-difference approach.[11] We followed their approach but used a double treatment that included the privatization of water providers in some cities and their subsequent renationalization.

Selection bias due to cherry picking at the moment of privatization is an issue in this framework. Governments may decide to privatize companies in cities that are more profitable and have better prospects to maximize the short-run financial benefits of privatization. If profitability positively affects performance over time (i.e., performance is serially correlated), we will observe that nationalization will lead to a better-performing water company, but this effect will simply be due to the trend in the performance of water companies in that region. In this context, even if nationalization adversely affected performance, the estimation might not identify this effect because the treatment group includes a disproportionate number of utilities that perform well.

We address this issue, as we discuss in the data section below, using parallel trend tests for the outcome variables (access to sewage network and water quality) before privatization. In the absence of any difference in trends before privatization, there would be little evidence of cherry picking along these dimensions, and time fixed effects in our difference-in-difference specification can therefore control for these common trends.

Our econometric model is given by

$$y_u = \phi N_{it} + \gamma P_{it} + x'_{it}\beta + \alpha_t + \alpha_i + u_{it} \tag{1}$$

where y_{it} is the outcome variable in city i in year t. We consider two different outcome variables: sanitation rates and water quality. The units of observation i are cities. The parameter N_{it} is a dummy variable that is equal to one after

11. Lee, Rosenzweig, and Pitt (1997) show that this reduced form approach may downward bias the effects of the treatment because households adjust their behavior to the new environment and provide an alternative structural approach to estimate the impact of improved quality on health outcomes.

the renationalization in the three cities that were previously privatized. The parameter Pit is a dummy variable indicating that the water company in city i in period t is privately owned; x'_{it} is a vector of control variables; β is the corresponding vector of coefficients, α_t is a year effect; α_i is a city-specific fixed effect; and u_{it} is a city time-varying error (distributed independently across departments and time).

The parameters of interest are ϕ and γ, which measure the impact of the dual treatment of the privatization and the subsequent nationalization of water services. When the sanitation rate is the outcome variable, a positive value for ϕ or γ indicates that the nationalization or privatization of private companies led to higher sanitation rates relative to companies that were consistently publicly owned.

The water quality sample does not cover the preprivatization period, as discussed in the next section. Thus, when considering water quality tests (abnormal levels of microbiological and organoleptic elements) as the dependent variable, we only have one treatment, N_{it}. A positive coefficient implies that nationalization led to a higher number of tests with abnormal results relative to companies that were consistently publicly owned.

An important issue in panel data models is that observations tend to be correlated across time within individual cities. One possible solution to the serial correlation problem is to use robust standard errors clustered at the city level. In this context, asymptotic statistical inference depends on the number of clusters and time periods. A small number of clusters may result in biased (clustered) standard errors, tending to underestimate inference precision.

Bertrand, Duflo, and Mullainthan (2004) analyze the performance of the following alternative solutions to the serial correlation problem: 1) using parametric methods, that is, specifying an autocorrelation structure; 2) using the block bootstrap; 3) ignoring time series information, that is, averaging the data before and after treatment; and 4) using an empirical variance-covariance matrix. Bertrand, Duflo and Mullainthan (2004) find that the empirical variance-covariance matrix outperforms the others, but it does not work properly with small samples. Cameron, Gelbach, and Miller (2008) state that the block bootstrap works properly with small numbers of groups.[12]

In our case, bootstrapped, clustered standard errors are similar to clustered standard errors. In most cases, the latter method reports greater standard errors, and in some cases, conventional standard errors are larger than the latter method. As a conservative criterion, we decided to report the method with the largest standard errors in each case. Depending on the nature of the outcome variable, continuous, count, or fractional, we use different estimators that will be discussed in the results section.

12. An alternative solution is to use the method proposed by Bell and McCaffrey (2002), "bias correction of clustered standard errors," but this approach unfortunately cannot be applied in a difference-in-difference framework.

III. Data Sources and Variable Construction

We begin by describing the data sources and variable construction for the analysis of the impact of nationalization on access to water sanitation networks. We then turn to the data sources and variable construction for the analysis of the impact of nationalization on water quality.

Access to Sanitation Networks

The data regarding the percentage of households with water-sealed toilets connected to sewer lines are obtained from the annual Uruguayan national household survey, Encuesta Continua de Hogares (ECH), conducted by the National Statistical Office of Uruguay, Instituto Nacional de Estadística. The ECH is the main source of socioeconomic information on Uruguayan households and their members at the national level. The surveys were conducted throughout the year with the objective of generating a description of the socioeconomic situation of the entire population.

The ECH also includes questions about household living conditions. In particular, the survey asks whether water-sealed toilets are connected to sewer lines. Therefore, we generate a dummy variable that takes the value one if the household is connected to sewer lines and zero otherwise. Then, we aggregate the data by city to obtain the percentage of households with sanitation access in each city. We therefore consider panel data by city from 1986 to 2009. The time span includes the preprivatization period in the case of Maldonado because the two privatizations in Maldonado occurred in 1993 and 2000, as discussed above.

The ECH survey is only representative at the department level or at the city level for the largest cities in terms of population. Therefore, and to ensure a representative sample, we only retain the capital cities of the different departments and other large cities in our sample. We have a total of 35 cities, three in the treatment group (Maldonado, Pan de Azúcar, and San Carlos) and 32 in the control group (Artigas, Bella Unión, Canelones, Carmelo, Colonia, Dolores, Durazno, Florida, Fray Bentos, Lascano, Libertad, Melo, Mercedes, Minas, Montevideo, Paso de los Toros, Paysandú, Periferia Canelones, Rivera, Rocha, Rosario, Río Branco, Salto, San José de Mayo, San Ramón, Santa Lucía, Sarandí del Yí, Sarandí Grande, Tacuarembó, Tranqueras, Treinta y Tres, Trinidad, and Young).[13]

Because some of the selected cities were not surveyed in certain years (primarily in the older edition of the ECH), we have an unbalanced panel that may imply panel attrition bias. For instance, of the 24 time periods in the treatment group, Pan de Azúcar appears 15 times, and San Carlos appears 18 times. In the control group, we have observations for Lascano in 10 of the 24 time periods; for Bella Unión, Libertad, and Rosario in 12 of the years; for Santa

13. Of these 35 cities, only 19 are capital cities.

Lucía in 15 of the years; for Carmelo, Dolores, Paso de los Toros, Río Branco, San Ramón, Sarandí del Yí, and Sarandí Grande in 17 of the years; and for Young in 18 of the years. Therefore, we have a total of 735 observations.[14] Some cities began to appear in the ECH because of their rapid population growth; therefore, we checked the robustness of results to a smaller subsample in terms of the time span from 1993 to 2009.

Two observations must be made. First, there are far more control cities than treatment cities; hence, we also estimate our model restricting the number of controls to capital cities alone. The sanitation data for each capital city are available in every year of the full period; hence, in this instance, the panel attrition problems may be solved. Second, because we lose observations as we drop cities, small sample bias is a potential issue. Thus, a tradeoff exists between small sample bias and the potential for panel attrition bias, which provides some robustness checks for our results.

The top panel of table 2 provides descriptive statistics by treatment and control groups for the network access sample before and after privatization and nationalization. Overall, the treatment and control groups present similar characteristics with relatively small differences, on average, although they tend to be statistically significant. It will therefore be important to control for these characteristics in our econometric analysis.[15] More important, the network access rates are not significantly different between treated and control cities before privatization and before nationalization. However, treated cities have a statistically larger network access rate following nationalization. Whether this larger network access rate can be attributed to a causal effect will be addressed using the difference-in-difference method described in the previous section.

As discussed above, a concern one may have with our methodology is that although, on average, network access rates in control and treated cities did not differ before privatization (and nationalization), they may have had different trends, which would bias our estimates of the impacts of privatization and nationalization. To address this issue, we performed a test of parallel trends for the period before the privatization. Thus, we introduce a time trend in the specification of equation (1) and check for its statistical significance. The results of the different specifications and samples are reported in table 3. In all columns except D, the coefficient on the time trend for treated cities is statistically insignificant, suggesting that treated and control cities had common trends before and after privatization.[16] In column D, where we only use departmental capitals as treated and control cities, the coefficient is negative and statistically significant. This result would be a concern if we were to find that the

14. There are 35 cities. We have 21 cities times 24 years (1986–2009 period), yielding 504 observations. In addition, we have $1 \times 10 + 3 \times 12 + 2 \times 15 + 7 \times 17 + 2 \times 18 = 231$ observations.

15. These differences reflect that only a few cities' water services were privatized and subsequently nationalized.

16. We obtain qualitatively identical results from a parallel test in the trends for the period before the nationalization, which are available upon request.

TABLE 2. Descriptive Statistics for Treatment and Control Groups

	Publicly owned period (1986–2000)			Privately owned period (2001–2005)			Publicly owned period (2006–2009)		
	Treated (1)	Control (2)	Difference (1) − (2)	Treated (1)	Control (2)	Difference (1) − (2)	Treated (1)	Control (2)	Difference (1) − (2)
Access to sewage network sample									
Network evacuation rate	0.47 (0.10)	0.44 (0.19)	0.03	0.53 (0.07)	0.49 (0.21)	0.04	0.69 (0.10)	0.54 (0.22)	0.15**
Education (head of household)	6.78 (0.42)	6.58 (0.77)	0.20*	7.22 (0.55)	7.18 (0.73)	0.04	7.82 (0.38)	7.77 (0.75)	0.05
(log) Household per capita income	7.90 (0.10)	7.58 (0.25)	0.32***	7.52 (0.14)	7.43 (0.22)	0.09*	7.83 (0.18)	7.63 (0.21)	0.20***
(log) Accumulated precipitations	6.95 (0.17)	7.11 (0.23)	−0.16***	7.09 (0.20)	7.24 (0.27)	−0.15**	6.97 (0.17)	7.07 (0.31)	−0.10
Observations	31	385		15	165		11	128	
Water quality sample									
Fecal coliforms	NA	NA	NA	0.00 (0.00)	0.00 (0.00)	0.00	0.00 (0.00)	0.65 (6.19)	−0.65
Pseudomonas aeroginosa	NA	NA	NA	0.00 (0.00)	0.04 (0.19)	−0.04	0.00 (0.00)	0.14 (0.35)	−0.14**
pH	NA	NA	NA	7.11 (0.48)	7.35 (0.47)	−0.24*	6.94 (0.39)	7.31 (0.48)	−0.37***
Cloudiness	NA	NA	NA	1.57 (1.86)	1.73 (1.93)	−0.16	0.64 (0.63)	1.37 (1.74)	−0.73**
Count of noncompliance tests	NA	NA	NA	0.33 (0.49)	0.46 (0.79)	−0.13	0.05 (0.21)	0.45 (0.78)	−0.40***
Minimum temperature (°C)	NA	NA	NA	9.02 (0.30)	4.70 (1.11)	4.32***	8.62 (0.44)	4.86 (1.15)	3.76***
Average temperature (°C)	NA	NA	NA	16.96 (0.06)	17.50 (0.94)	−0.54**	16.74 (0.15)	17.55 (0.99)	−0.80***
(log) Accumulated precipitations	NA	NA	NA	4.18 (0.05)	4.33 (0.19)	−0.15***	4.20 (0.24)	4.29 (0.27)	−0.09*
Observations				12	54		22	94	

Note: Figures in parentheses are standard deviations.

*, **, and *** indicate statistical significance at the 10 percent level, 5 percent level, and 1 percent level, respectively.

Source: URSEA, ECH, and the National Meteorology Office.

TABLE 3. Test of Parallel Trends before Privatization in the Network Access Sample

Variables	A[a]		B[a]		C[b]		D[c]	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Time trend	0.002	−0.003	0.010**	0.008*	0.003	−0.002	0.006**	0.001
	(0.002)	(0.003)	(0.004)	(0.005)	(0.002)	(0.003)	(0.002)	(0.004)
Time trend by treatment status	0.004	0.004	0.004	0.004	−0.000	−0.005	−0.007**	−0.010**
	(0.004)	(0.006)	(0.004)	(0.006)	(0.003)	(0.005)	(0.003)	(0.005)
Education		0.030		0.038		0.037		0.041***
		(0.027)		(0.033)		(0.027)		(0.015)
(log) Household per capita income		0.205*		0.234**		0.185*		0.098
		(0.105)		(0.107)		(0.106)		(0.104)
(log) Accumulated precipitation		0.052**		0.050		0.046**		0.053***
		(0.021)		(0.043)		(0.021)		(0.020)
Year effects	No	Yes	No	Yes	No	Yes	No	Yes
Observations	416	416	261	261	400	400	270	270
Log likelihood	−199.18	−184.35	−126.12	−116.78	−191.76	−176.84	−124.75	−122.75
Sample period	1986–2000		1993–2000		1986–2000		1986–2000	

Note: Estimates are obtained using a Papke & Wooldridge Fractional Logit Model. Marginal effects are reported, and robust standard errors clustered at the city level are reported in parentheses. All models include city fixed effects.

Source: Authors' estimation using ECH and National Meteorology Office data.

*, **, and *** indicate statistical significance at the 10 percent level, 5 percent level, and 1 percent level, respectively.

[a]Treatment Units (three cities): Maldonado, San Carlos, and Pan de Azúcar; Control Units (32 cities): Artigas, Bella Unión, Canelones, Carmelo, Colonia, Dolores, Durazno, Florida, Fray Bentos, Lascano, Libertad, Melo, Mercedes, Minas, Montevideo, Paso de los Toros, Paysandú, Periferia Canelones, Rivera, Rocha, Rosario, Río Branco, Salto, San José de Mayo, San Ramón, Santa Lucía, Sarandí del Yí, Sarandí Grande, Tacuarembó, Tranqueras, Treinta y Tres, Trinidad, and Young.

[b]Treatment Unit (one city): Maldonado; same Control Units as in A.

[c]Treatment Unit (one city): Maldonado; Control Units (17 cities): Artigas, Canelones, Colonia, Durazno, Florida, Fray Bentos, Melo, Mercedes, Minas, Paysandú, Rivera, Rocha, Salto, San José de Mayo, Tacuarembó, Treinta y Tres, and Trinidad.

nationalization or privatization of water services led to a decline in network access, which could be explained by its trend before the change of ownership. However, as discussed in the results section, we find that network access increased before nationalization; therefore, the differences in trends could only downward bias the estimated positive impact of the nationalization.

Water Quality Tests

The data on water quality come from URSEA. In 2004, URSEA created a water quality unit, in partnership with the chemistry department of University of La República, which was charged with monitoring the water supply system nationwide according to the guidelines of the World Health Organization. This unit conducts a number of water tests (in the distribution network) to measure the quality of the water provided to consumers.

Our units of observation are cities from Uruguay's 19 departments. We use data for the 2004–2009 period, but some observations are missing for some of the cities. As treatment cities, we use Maldonado, Pan de Azúcar, Piriápolis, Punta Ballena, Punta del Este, and San Carlos. We use the following control cities: Artigas, Canelones, Colonia, Dolores, Durazno, Florida, Fray Bentos, La Paloma, La Paz, Las Piedras, Melo, Mercedes, Minas, Montevideo, Pando, Paysandú, Progreso, Rivera, Rocha, Salto, San José, Atlántida, Tacuarembó, Toledo, Treinta y Tres, and Trinidad.[17]

We use data for two different microbiological tests and two organoleptic tests that we will use as outcome variables because of their importance in terms of direct and indirect negative effects on health. The two microbiological tests are for fecal coliforms and pseudomonas aeruginosa. The two organoleptic tests are pH and cloudiness tests.

The first test indicates whether the fecal coliforms exceed the accepted maximum value. The second test indicates whether pseudomonas aeruginosa is present. In the case of organoleptic tests, the water quality unit reports the observed value. In the case of pH tests, the upper limit is 8 mg/L, and higher levels are considered abnormal. The upper limit in the cloudiness test is five; hence, a result greater than or equal to this value represents a high level of cloudiness in the water, which could indirectly affect health via a higher likelihood of bacteria formation and a reduction in the quantity of water consumed.

The outcome variable that captures abnormal levels of microbiological or organoleptic substances is constructed as follows. For each test, we generate a dummy variable that takes the value one if the test is above the accepted limit and zero otherwise. We then sum these four binary variables to create a count variable that measures the number of tests that showed abnormal levels in each city.

17. Note that we have six treated cities in the water sample instead of the three in the network access sample. This is still a relatively small number of treated cities, which suggests that the results should be interpreted with caution.

A potential drawback of these data is that the tests have improved and become more precise over time, making it possible to detect abnormal levels of substances more frequently. Thus, our estimates may be biased because we would observe a deterioration of the water quality throughout the period as a result of the improved testing techniques rather than the poor water quality. This issue is addressed in our econometric framework through the use of year fixed effects as control variables.

In the bottom panel of table 2, we provide descriptive statistics by treatment and control groups. It is important to note that there was no statistically significant difference in the count of abnormal results between treated and control cities before nationalization, whereas after nationalization, the count of abnormal results was significantly lower in treated cities.[18] This result seems to be driven by a lower count of abnormal levels of cloudiness and pseudomonas aeruginosa. Note that we cannot perform a test of parallel trends because we only have two periods (2004 and 2005) before nationalization in the water quality sample. The nationalization dummy therefore takes the value one in treated cities between 2006 and 2009 and zero otherwise. Note also that we do not have data for the preprivatization period. We therefore cannot control for privatization in treated cities because the privatization and nationalization of water services would be perfectly collinear with the city fixed effects.

IV. Results

We begin by discussing the results of the estimation of equation (1) when access to sanitation rates is the outcome variable. We then turn to the estimates obtained when water quality is the outcome variable.

Access to Sanitation Networks

We estimate equation (1) for different subsamples, with and without control variables. Because the left-hand variable is a fractional variable (percentage of households with water-sealed toilets connected to sewer lines), we use a Papke and Wooldridge (2008) estimator. Control variables include average completed years of education of the head of the household and average real per capita household income at the city level as well as accumulated precipitation at the department level. We expect the three control variables to be positively correlated with the sanitation rate.

Table 4 presents the results. There is a positive and statistically significant impact of nationalization on sanitation rates in all subsamples and specifications. A positive effect means that cities in which water services were nationalized experienced an increase in access to sanitation networks. The coefficient

18. Note that some of the control variables present relatively large differences between treated and control cities, which again reflects that only a few cities' water companies were privatized and subsequently nationalized.

that captures the causal impact is 0.15, on average, which means that nationalization led to a 15 percent increase in access to sanitation networks. However, the impact of privatization is never statistically significant, except in column D, where the coefficient is negative and statistically significant. This result suggests that in cities where sewer services were privatized, there was no increase in sanitation access rates relative to the preprivatization period.[19] Note that these results need to be interpreted with caution because we only have three treated cities in columns A and B and only one treated city in columns C and D because of the data constraints discussed in section III. However, the low number of treated cities makes it more difficult to identify a statistically significant coefficient, as discussed in McKenzie (2012), which is not the case for the impact of nationalization in the results reported in table 4.[20]

To determine whether the increase in access to sanitation networks occurred where we expect (i.e., among poor households), we aggregate the data at the city level using only the lower 25th household income percentile in one case and the higher 25th in the other.[21] We then append these data and introduce a dummy variable that indicates that the observation corresponds to the bottom 25 percent of the income distribution as well as interaction variables between this dummy and the nationalization and privatization dummies. A positive coefficient of the interaction of the bottom 25 percent income dummy and the nationalization dummy would indicate that poor households experienced a larger increase in their network access rate after nationalization. Table 5 presents the results for the four different samples with and without using the education level of the head of the household, household per capita income, and accumulated precipitation. Without these controls, the interaction of the bottom 25 percent income dummy with nationalization is always positive and statistically significant, but after introducing the control variables, the interaction is only significant for sample D. The interaction of the bottom 25 percent dummy with the privatization dummy is negative and statistically significant when using the control variables, but not in the specifications without them. If we combine these results, across all samples we find that the bottom 25 percent has greater access to the network during the nationalization period than during the privatization period.[22]

19. We also tested whether network access was higher during periods with the public provision of water services (i.e., the preprivatization period and postnationalization period) and found a statistically significant coefficient for most specifications (available upon request). However, the coefficients are 50 percent smaller when using this alternative definition, which confirms that most of the positive impact is due to the nationalization of water services and not to the preprivatization period.

20. This may explain the statistically insignificant results for privatization.

21. Unfortunately, the ECH data do not follow households over time. Therefore, we cannot implement our difference-in-difference methodology at the household level.

22. We also run these regressions for households above and below the poverty line. The results, which are available upon request, suggest that nationalization increased the network access rate of poor households.

TABLE 4. Impact of Privatization & Nationalization on Network Evacuation Rate in Maldonado

Variables	A[a]		B[a]		C[b]		D[c]	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Private provision	0.037	0.055	0.037	0.053	−0.003	−0.035	−0.086***	−0.081
	(0.042)	(0.066)	(0.042)	(0.067)	(0.036)	(0.054)	(0.031)	(0.049)
Renationalized provision	0.163***	0.143**	0.163***	0.140**	0.244***	0.173***	0.154***	0.139**
	(0.053)	(0.058)	(0.053)	(0.061)	(0.036)	(0.056)	(0.037)	(0.055)
Education		0.041		0.049		0.045		0.025**
		(0.028)		(0.031)		(0.029)		(0.012)
(log) Household per capita income		0.210***		0.221***		0.191***		0.169***
		(0.063)		(0.085)		(0.062)		(0.060)
(log) Accumulated precipitation		0.075**		0.072*		0.072**		0.063***
		(0.030)		(0.043)		(0.030)		(0.022)
Observations	735	735	580	580	702	702	432	432
Log likelihood	−355.21	−331.55	−282.16	−263.89	−340.11	−316.54	−198.54	−195.19
Sample period	1986–2009		1993–2009		1986–2009		1986–2009	

Note: Estimates are obtained using a Papke & Wooldridge Fractional Logit Model. Marginal effects are reported, and robust standard errors clustered at the city level are reported in parentheses. All models include city fixed effects.

Source: Authors' estimation using ECH and National Meteorology Office data.

*, **, and *** indicate statistical significance at the 10 percent level, 5 percent level, and 1 percent level, respectively.

[a] Treatment Units (three cities): Maldonado, San Carlos, and Pan de Azúcar; Control Units (32 cities): Artigas, Bella Unión, Canelones, Carmelo, Colonia, Dolores, Durazno, Florida, Fray Bentos, Lascano, Libertad, Melo, Mercedes, Minas, Montevideo, Paso de los Toros, Paysandú, Periferia Canelones, Rivera, Rocha, Rosario, Río Branco, Salto, San José de Mayo, San Ramón, Santa Lucía, Sarandí del Yí, Sarandí Grande, Tacuarembó, Tranqueras, Treinta y Tres, Trinidad, and Young.

[b] Treatment Unit (one city): Maldonado; same Control Units as in A.

[c] Treatment Unit (one city): Maldonado; Control Units (17 cities): Artigas, Canelones, Colonia, Durazno, Florida, Fray Bentos, Melo, Mercedes, Minas, Paysandú, Rivera, Rocha, Salto, San José de Mayo, Tacuarembó, Treinta y Tres, and Trinidad.

TABLE 5. Impact of Nationalization on Access to Sewage Network in Maldonado at the Bottom and Top 25 percent of the Income Distribution

	A[a]		B[a]		C[b]		D[c]	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Private provision	0.013	0.083	0.022	0.084	−0.030	−0.005	−0.152***	−0.119**
	(0.046)	(0.089)	(0.047)	(0.091)	(0.043)	(0.053)	(0.030)	(0.048)
Renationalized provision	0.093*	0.143**	0.105*	0.146**	0.158***	0.164***	0.016	0.044
	(0.056)	(0.063)	(0.056)	(0.066)	(0.045)	(0.053)	(0.035)	(0.052)
Private provision by Bottom 25 percent	0.032	−0.134*	0.013	−0.139*	0.025	−0.112***	0.101***	0.013
	(0.024)	(0.070)	(0.024)	(0.072)	(0.023)	(0.033)	(0.015)	(0.043)
Renationalized provision by Bottom 25 percent	0.109***	−0.047	0.091**	−0.049	0.108***	−0.028	0.177***	0.094**
	(0.036)	(0.041)	(0.037)	(0.043)	(0.022)	(0.033)	(0.013)	(0.042)
Bottom 25 percent	−0.362***	0.111	−0.348***	0.103	−0.364***	0.128	−0.415***	−0.185*
	(0.018)	(0.086)	(0.018)	(0.093)	(0.018)	(0.089)	(0.009)	(0.110)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Observations	1470	1470	1160	1160	1404	1404	864	864
Log likelihood	−653.93	−597.64	−524.11	−482.46	−625.26	−568.37	−341.32	−338.75
Sample period	1986–2009		1993–2009		1986–2009		1986–2009	

Note: Estimates are obtained using a Papke & Wooldridge Fractional Logit Model. Marginal effects are reported, and robust standard errors clustered at the city level are reported in parentheses. All models include city fixed effects.

Source: Authors' estimation using ECH and National Meteorology Office data.

*, **, and *** indicate statistical significance at the 10 percent level, 5 percent level, and 1 percent level, respectively.

[a] Treatment Units (three cities): Maldonado, San Carlos, and Pan de Azúcar; Control Units (32 cities): Artigas, Bella Unión, Canelones, Carmelo, Colonia, Dolores, Durazno, Florida, Fray Bentos, Lascano, Libertad, Melo, Mercedes, Minas, Montevideo, Paso de los Toros, Paysandú, Periferia Canelones, Rivera, Rocha, Rosario, Río Branco, Salto, San José de Mayo, San Ramón, Santa Lucía, Sarandí del Yí, Sarandí Grande, Tacuarembó, Tranqueras, Treinta y Tres, Trinidad, and Young.

[b] Treatment Unit (one city): Maldonado; same Control Units as in A.

[c] Treatment Unit (one city): Maldonado; Control Units (17 cities): Artigas, Canelones, Colonia, Durazno, Florida, Fray Bentos, Melo, Mercedes, Minas, Paysandú, Rivera, Rocha, Salto, San José de Mayo, Tacuarembó, Treinta y Tres, and Trinidad.

Because serial correlation may be an issue in this difference-in-difference framework, we parametrically model the serial correlation of the error term as a first-order autoregressive process. We use different estimation methods that imply different assumptions. The results are reported in table 6. In the first column, we report feasible generalized least squares estimates, allowing the error term to be correlated across cities (i.e., we allow for error correlation across panels, or what is typically termed spatial correlation). In the second column, the correlation of errors across individuals is assumed to be identically and independently distributed. In the third column, we use a within estimator with city fixed effects, and in the last column, we provide estimates using the Driscoll and Kraay (1998) method to obtain Newey-West standard errors, which allow error autocorrelation of the general form. We use the subsample, which only includes capital cities other than Montevideo. Again, in all cases, nationalization has a positive impact on access to the sanitation network.

This increase in sanitation access is consistent with the fact that a USD 50 million loan was obtained from the World Bank for an OSE project on sanitation and residual treatment after the nationalization of private companies. However, the external funding the World Bank provided to Uruguay's water company was not unusual. Three loans have been granted for the improvement of water services in Uruguay since 1999 that covered the preprivatization period, the privatization period, and the nationalization period.[23] Thus, there is no systematic bias toward the nationalization period. More important, we could not find any indication in the official documents that the last loan should be used primarily for improvements in treated cities (those that were nationalized). Thus, one should not expect that this last loan is the reason for the improvement in water services in treated cities. We obviously cannot exclude the possibility that the loan contributed to improved access and water quality in cities where nationalization took place, but this seems to have been driven by something deeper than the simple availability of funds. On its website, OSE reports that following nationalization, work related to sanitation improvements, which had ceased in 2002, was restarted. Sanitation projects in Ciudad de la Costa, Punta del Este, and Maldonado, where private companies were located, apparently became a priority in OSE's agenda regardless of the availability of funding from external sources.

23. The World Bank provided Uruguay with financial support to develop water and sanitation services through three investment loans at different time periods: 1) Water Supply Rehabilitation project (1988–1999), USD 22.3 million; 2) OSE Modernization and Systems Rehabilitation project, APL-1 (2000–2007), USD 27 million; 3) OSE Modernization and Systems Rehabilitation project, APL-2 (ongoing since 2007), USD 50 million. Other loans focused on technical support, such as the Public Services Modernization Technical Assistance project (2001–2008) for USD six million. The objective of these loans was to help Uruguay make investments in the water infrastructure, improving the efficiency and coverage of the water supply and sanitation services. See The World Bank (2010) for additional details.

TABLE 6. Impact of Nationalization on Network Access Controlling for First-order Autoregressive Disturbances

Variables	Pooled FGLS	Pooled OLS	Within Estimator	Within Estimator D-K
Private provision	−0.003	−0.019	−0.007	−0.024
	(0.019)	(0.037)	(0.048)	(0.038)
Renationalized provision	0.163***	0.159***	0.168***	0.168***
	(0.026)	(0.048)	(0.066)	(0.059)
Education	0.024***	0.023***	0.019**	0.032**
	(0.003)	(0.008)	(0.008)	(0.011)
(log) Household per capita income	0.159***	0.157***	0.164***	0.137***
	(0.013)	(0.035)	(0.035)	(0.037)
(log) Accumulated precipitation	0.017***	0.029	0.023	0.042*
	(0.007)	(0.018)	(0.016)	(0.021)
Observations	432	432	414	432
AR(1)	0.329	0.270	0.209	0.06
Sample period		1986–2009		

Notes: All columns report estimates using panel data estimators controlling for first-order autoregressive (AR(1)) disturbances. Marginal effects are reported, and robust standard errors clustered at the city level are reported in parentheses. All models include individual effects, year effects, and time trends by city. Treatment Unit (one city): Maldonado; Control Units (17 cities): Artigas, Canelones, Colonia, Durazno, Florida, Fray Bentos, Melo, Mercedes, Minas, Paysandú, Rivera, Rocha, Salto, San José de Mayo, Tacuarembó, Treinta y Tres, and Trinidad.

Source: Authors' estimation using ECH and National Meteorology Office data.

*, **, and *** indicate statistical significance at the 10 percent level, 5 percent level, and 1 percent level, respectively.

Water Quality Tests

The outcome variable is the number of tests that reported an abnormal level of microbiological or organoleptic substances. This type of right-hand variable requires an appropriate estimator. We will use Poisson and negative binomial estimators to account for overdispersion in the water tests (a nonconstant ratio of variance over a conditional mean). Because there is a large number of zeros in the data (see table 2), we also performed a Vuong test, which indicated that the zero-inflated Poisson was the appropriate model.[24]

For control variables, we used accumulated precipitation and the minimum and average temperatures at the department level. We expect precipitation to be positively correlated with the number of abnormal quality tests because a high level of precipitation is likely to negatively affect the functioning of the water network, making water tests more likely to detect higher levels of

24. When testing the negative binomial estimator, the Vuong test takes the value 5.79 in the specification without controls and 6.45 in the specification with controls. When testing the Poisson estimator, the Vuong test takes the value 1.81 without controls and the value 1.87 with controls. They all reject that the ordinary Poisson or negative binomial models should be preferred to the zero-inflated estimators at the 5 percent level, which is unsurprising given the large number of zeroes.

undesired substances. Low temperatures may increase the likelihood of failures in the distribution network, and a high average temperature may contribute to the reproduction of bacteria, such as coliforms. Hence, we expect a negative coefficient on the former and a positive coefficient on the latter.

Table 7 reports the estimates with and without control variables. The first two columns present the zero-inflated Poisson estimates, and the last two columns present the zero-inflated negative binomial estimates. The control variables have the expected signs in both specifications, but none of the variables are statistically significant. The nationalization of water services is always negatively associated with abnormal levels of undesirable substances in water quality tests, and the impact is statistically significant at the 10 percent level. It is also very large, with a reduction of 0.7 tests per city exhibiting abnormal levels after nationalization. Thus, the results suggest that water quality improved with nationalization. As discussed above, note that because of the small number of treated cities, the results should be interpreted with caution even

TABLE 7. Impact of Nationalization on Water Quality (count of abnormal tests of levels of microbiological elements)

	Poisson		Negative Binomial	
Variables	(1)	(2)	(3)	(4)
Renationalized provision	−0.651*	−0.642*	−0.650*	−0.665*
	(0.357)	(0.371)	(0.355)	(0.390)
Education		0.367		0.466
		(0.247)		(0.306)
(log) Household per capita income		−0.016		−0.145
		(0.865)		(0.848)
Precipitation		0.423		0.611
		(0.330)		(0.385)
Minimum temperature		−0.146		−0.235
		(0.118)		(0.165)
Average temperature		0.014		0.002
		(0.146)		(0.149)
Individual effects	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Observations	182	182	182	182
Log likelihood	−101	−100	−101	−100
Sample	2004–2009			

Notes: All columns report estimates using a zero inflated model. Marginal effects are reported, and robust standard errors clustered at the city level are reported in parentheses. All models include city and year fixed effects. Vuong tests indicate that the zero inflated models are appropriate. Treatment Units (six cities): Maldonado, Pan de Azúcar, Piriápolis, Punta del Este, Punta Ballena, and San Carlos. Control units (26 cities): Artigas, Canelones, Colonia, Dolores, Durazno, Florida, Fray Bentos, La Paloma, La Paz, Las Piedras, Melo, Mercedes, Minas, Montevideo, Pando, Paysandú, Progreso, Rivera, Rocha, Salto, San José, Atlántida, Tacuarembó, Toledo, Treinta y Tres, and Trinidad.

Source: Authors' estimation using URSEA, ECH and National Meteorology Office data.

*indicates statistical significance at the 10 percent level.

though we have a larger number of treated cities in the water quality sample than in the network access sample. Moreover, because the water quality sample does not cover the preprivatization period, we cannot control for the determinants of privatization, which leaves us with a weaker identification strategy than for the network access sample.[25]

V. Conclusions

The question of market versus government failures in the provision of water services is complex and unlikely to be answered without empirical evidence. In this paper, we examine the impacts of the privatization and nationalization of water services on service quality. Thus, in contrast to most of the existing literature, we identify the impact not only through the privatization of public firms but also through the nationalization of private firms. Another important aspect of the study is the focus on direct measures of service quality (access to the network and water quality) rather than on indirect measures, such as health outcomes.

Using difference-in-difference estimators, we find that Uruguay's privatization of water companies in 1993 and 2000 yielded little progress in terms of access to sanitation networks. However, the nationalization of all private companies in 2006 led to an improvement in access to the sewage network as well as an improvement in water quality. The improvement in access following the nationalization of water services tended to favor of the poor because greater increases in access were observed for poor households.

These results are in contrast to existing evidence on the privatization of water services in other Latin American countries, which finds that privatization led to a decline in child mortality and an increase in water access and quality.

Future research should attempt to disentangle the determinants of these two outcomes to improve understandings of why privatization and nationalization had different impacts in Uruguay. Private and public companies have different objectives: private firms tend to maximize profits, whereas the objectives of public companies are more varied and may include motives ranging from political consideration to corruption or social objectives. These differences in objectives frequently motivate calls for both privatization and nationalization (see Chong and Lopes-de-Silanes 2005) and may explain part of our empirical findings for Uruguay. However, other potential explanations may also be important. For example, the type of regulations at the time of privatization or nationalization such as required investment or the requirement to provide universal access, the functioning of regulatory bodies, or poorly designed contracts and bidding processes may help to reconcile the results found here and in the

25. Note that when using a public provider dummy that takes a value of one when the city is served by a publicly owned water company in lieu of a nationalization dummy, we obtain qualitatively and quantitatively similar results to those reported in table 7.

rest of the literature. A detailed examination of these differences will improve understandings of what works and what does not with respect to water privatization. Additionally, differences in the functioning of public companies (e.g., external funding, the composition of the board of directors) may help to explain differences at the time of the privatization or nationalization of water services.

Finally, the results of this paper suggest that the focus on private versus public ownership of natural monopolies such as water providers may be misleading. The institutional environment within which the natural monopoly operates may be much more important.

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References

Barrera-Osorio, F., M. Olivera, and C. Ospino. 2009. "Does Society Win or Lose as a Result of Privatization? The Case of Water Sector Privatization in Colombia." *Economica* 76 (304): 649–74.

Bertrand, M., E. Duflo, and S. Mullainthan. 2004. "How Much Should We Trust Differences-in-Differences Estimates?" *Quarterly Journal of Economics* 119 (1): 249–75.

Borraz, F., and M. Olarreaga. 2011. "Services Ownership and Access to Safe Water: Water Nationalization in Uruguay." In M. Mashayekhi, M. Olarreaga, and G. Porto, eds., *Services, Trade and Development,* 265–82. United Nations Conference on Trade and Development.

Cameron, A., J.B. Gelbach, and D.L. Miller. 2008. "Bootstrap-Base Improvements for Inference with Clustered Errors." *The Review of Economics and Statistics* 90 (3): 414–27.

Chong, A., and F. Lopez-de-Silanes. 2005. *Privatization in Latin America: Myths and Reality*. Palo Alto, CA: Stanford University Press.

Driscoll, J., and A. Kraay. 1998. "Consistent Covariance Matrix Estimation With Spatially Dependent Panel Data." *Review of Economics and Statistics* 80 (4): 549–60.

Galdo, G., and B. Bertha. 2005. "Evaluating the Impact on Child Mortality of a Water Supply and Sewerage Expansion in Quito: Is Water Enough?" OVE Working Papers 0105. Inter-American Development Bank, Office of Evaluation and Oversight (OVE), Washington, DC.

Galiani, S., P. Gertler, and E. Schargrodsky. 2005. "Water for Life: The Impact of the Privatization of Water Services on Child Mortality." *Journal of Political Economy* 113 (1): 83–120.

Galiani, S., P. Gertler, E. Schargrodsky, and F. Sturzenegger. 2005. "The Benefits and Costs of Privatization in Argentina: A Microeconomic Analysis." In A. Chong, and F. Lopez-de-Silanes, eds., *Privatization in Latin America: Myths and Realities*, 67–116. Palo Alto, CA: Stanford University Press.

Hall, D., E. Lobina, and V. Corral. 2010. "Replacing Failed Private Water Contracts." PSIRU report. Public Services International Research Unit, University of Greenwich, London, UK.

Kikeri, S.. 1999. "Privatization and Labor: What Happens to Workers when Governments Divest?" World Bank Technical Paper No. 396. World Bank, Washington, DC.

Lee, L., M. R. Rosenzweig, and M. M. Pitt. 1997. "The Effects of Improved Nutrition, Sanitation, and Water Quality on Child Health in High-Mortality Populations." *Journal of Econometrics* 77: 209–35.

McKenzie, D.. 2012. "Beyond Baseline and Follow-up: The Case for More T in Experiments." *Journal of Development Economics* 99 (2): 210–21.

Nauges, C., and D. Whittington. 2009. "Estimation of Water Demand in Developing Countries: An Overview." *World Bank Research Observer* 25 (2): 263–94.

Papke, L., and J.M. Wooldridge. 2008. "Panel Data Methods for Fractional Response Variables with an Application to Test Pass Rates." *Journal of Econometrics* 145 (1-2): 121–33.

Segerfeldt, F.. 2005. *Water for Sale: How Business and The Market Can Resolve the World's Water Crisis*. Washington, DC: Cato Institute.

Shi, A.. 2000. "How Access to Urban Potable Water and Sewerage Connection Affects Child Mortality." The World Bank, Policy Research Working Paper 2274. World Bank, Washington, DC.

Wallsten, S., and K. Kosec. 2005. "Public or Private Drinking Water? The Effects of Ownership and Benchmark Competition on U.S. Water System Regulatory Compliance and Household Water Expenditures." AEI-Brookings Joint Center Working Paper No. 05-05. AEI-Brookings Joint Center, Washington, DC.

Whittington, D., J. Davis, L. Prokopy, K. Komives, R. Thorsten, H. Lukacs, W. Wakeman, and A. Bakalian. 2009. "How Well is the Demand-Driven, Community Management Model for Rural Water Supply Systems Doing? Evidence from Bolivia, Peru, and Ghana." *Water Policy* 11 (6): 696–718.

World Bank. 2004. "Reforming Infrastructure: Privatization, Regulation and Competition." Washington, DC: World Bank and Oxford University Press.

———. 2010. "Modernizing Public Water Services in Uruguay through a long-term Partnership." Working Paper. World Bank, Washington, DC.

Mass Media and Public Policy: Global Evidence from Agricultural Policies

Alessandro Olper and Johan Swinnen

Mass media play a crucial role in information distribution and in the political market and public policy making. Theory predicts that information provided by the mass media reflects the media's incentives to provide news to different groups in society and affects these groups' influence in policy making. We use data on agricultural policy from 69 countries spanning a wide range of development stages and media markets to test these predictions. Our empirical results are consistent with theoretical hypotheses that public support for agriculture is affected by the mass media. In particular, an increase in media (television) diffusion is associated with policies that benefit the majority to a greater extent and is correlated with a reduction in agriculture taxation in poor countries and a reduction in the subsidization of agriculture in rich countries, ceteris paribus. The empirical results are consistent with the hypothesis that increased competition in commercial media reduces transfers to special interest groups and contributes to more efficient public policies. JEL Codes: D72, D83, Q18

There is a rapidly growing body of literature on the economics of the mass media. This literature has led to a series of important new hypotheses and insights in an area that has been long neglected by economists.[1] An important strand of this literature concerns the role of mass media in political markets and its effect on public policy making. Most of this literature on the relationship between the mass media and public policy is theoretical. A few empirical studies have attempted to assess the effect of media on policy outcomes. Some key findings from this literature suggest that access to mass media empowers

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1. See McCluskey and Swinnen (2010) and Pratt and Strömberg (2011) for reviews.

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people politically and, as such, increases the benefits they receive from government programs (Strömberg and Snyder 2008). This influence has been found for different types of government programs and different countries, such as unemployment relief in the United States (Strömberg 2004b), public food provision and disaster relief in India (Besley and Burgess 2001, 2002), and educational spending in Uganda and Madagascar (Reinikka and Svensson 2005; Francken et al. 2009). All of these studies measure the effect within a single country, which has the benefit of holding many other factors fixed but has the potential disadvantage of limited variation in policy and media.

Our paper seeks to contribute to this empirical literature by analyzing the impact of mass media on policy making for a specific type of policy across a wide variety of countries and years. We use a new dataset from the World Bank that includes measures of agricultural subsidization and taxation for a much wider set of countries and a longer period of time than has been previously available (Anderson and Valenzuela 2008). We use these data as the dependent variable.

Agricultural policy (subsidization or taxation) is an excellent policy instrument to study the impact of media on policy choice across a wide variation of countries for both empirical and theoretical reasons. Empirically, agricultural policy is an important policy for governments in both rich and poor countries. In poor countries where agriculture is a very important share of the economy and food is a major consumption item, the importance of agriculture as a public policy issue is obvious. However, in rich countries, agricultural policy remains disproportionately important compared to the relatively small share of agriculture in terms of economic output. For example in the European Union, the Common Agricultural Policy continues to absorb 40 percent of the entire European Union budget. Another symptom of the continued importance of agricultural policy for rich countries is the impasse in the current WTO negotiations, where disagreements over agricultural policies threaten to undermine the entire WTO agreement.

Another empirical factor is the substantial ad hoc and case study evidence that mass media can play an important role in influencing agricultural policy. Several studies have highlighted the important role of mass media in influencing voters and government policy on key recent agricultural and food policies, such as the use of genetically modified organisms (Curtiss et al. 2006; Marks, et al. 2003; Vigani and Olper 2012), policy reactions to food safety crises (Swinnen et al. 2005; Verbeke et al. 2000), and trade disputes (Kuzyk and McCluskey 2006; Swinnen and Francken 2006).

Agricultural policy is also an interesting case from a theoretical perspective. The literature on the political economy of agricultural policy identifies group size (the number of farmers versus the number of food consumers in the economy) as an important causal factor. Group size is argued to play an important role because it affects collective action costs (based on Olson 1965) and affects the per capita costs and benefits of agricultural policy, which, in turn, affects political outcomes in the presence of voter information costs

(based on Downs 1957) or when political activities are proportional to the size of potential policy costs and benefits (Swinnen 1994). Recent papers in the media economics literature claim that the mass media can play an important role in public policy by altering these political economy mechanisms (Stromberg 2001, 2004a; Kuzyk and McCluskey, 2006). Oberholzer-Gee and Waldfogel (2005) argue that the link between group size and political mobilization depends on the structure of media markets. In a series of influential papers, Strömberg (2001, 2004a) has shown that competition among mass media outlets leads to the provision of more news/information to large groups such as taxpayers and dispersed consumer interests, altering the trade-off in political competition and thus influencing public policy. He refers to this outcome as "mass media-competition-induced political bias."

The purpose of our paper is to evaluate whether the mass media have an impact on the political economy of agricultural policies by exploiting taxation and subsidization data from 69 countries that were observed from 1960 to 2004. The paper also contributes to an emerging body of literature analyzing whether the diffusion of free and independent media are key ingredients in more efficient public policies. Besley and Burgess (2001, 2002) use a political agency model to demonstrate that a more informed and politically active electorate increases the incentives for a government to be responsive. Prat and Strömberg (2005) find for Sweden that people who begin watching commercial television (TV) news programs increase their political knowledge and participation. Overall, this and other evidence (such as Besley and Burgess 2001, 2002; Francken et al. 2009, 2012; Reinikka and Svensson 2005; Strömberg and Snyder 2008) support the notion that the mass media reduce the power of special interest lobbies relative to unorganized interests.

The paper also contributes to the literature on the political economy of agricultural policies. There is extensive literature, both theoretical and empirical, on the determinants of agricultural policy making (see de Gorter and Swinnen 2002; Swinnen 2010; Anderson et al. 2013 for surveys), but no previous study has examined the role of the media in this process. Our paper is the first to do so.

Our analysis, which exploits both cross-country and time-series variation in the data, indicates that the mass media may have a substantive impact on public agricultural policy. In the developing world, agricultural taxation is reduced by the presence of mass media outlets, whereas agricultural support is reduced in developed countries. Our results thus suggest that competition in the media market is associated with a reduction of policy distortions in agricultural markets.

I. Conceptual Framework

In this section, we first present a conceptual framework based on Strömberg's (2004a) theory of mass media and political competition. Then, we discuss the main implications of the model in light of the worldwide characteristics and

regularities of agricultural policies, and we identify testable hypotheses regarding the effect of mass media competition on agricultural policy outcomes.

The Basic Theory

In Strömberg's (2004a) model, mass media outlets affect public policy because they provide the channel through which politicians convey campaign promises to the electorate. Political parties make binding announcements regarding the amount of public money they plan to spend on various government programs. The two parties propose public spending with the objective of maximizing their vote shares within a given budget constraint.

Commercial media[2] are the only channel through which the parties' platforms are announced to the voters. Media firms allocate a certain quantity of information on political platforms and proposed spending levels with the objective of maximizing their audiences (number of readers/viewers), all of which are voters. Voters purchase media products (e.g., newspapers) and adjust their expectations of how much the parties will spend on the basis of information provided by the media. They then vote for one of the parties. The party that wins the election implements the promised spending plan.

Voters value news related to political platforms in the media because it allows them to maximize the benefits they receive from government programs. It is assumed that readers (voters) use the news they receive from the media to decide on private action, which affects the value they realize from a government program. More precise news about future policies makes it more likely that readers will take the correct private actions. For example, early news about changes in agricultural subsidies help farmers to produce the correct crops to realize the full value of these subsidies.

Voters purchase the media product that provides them with the most information on the government programs they value, conditional on other (exogenous) characteristics, such as ideological preferences.

The media maximize expected profits. They have two types of costs: "first copy costs," or the cost of producing one unit of news space, and "reproduction and distribution costs," or the average cost of reproducing and delivering the media product to a certain audience. This cost function is consistent with the notion that there are roughly constant long-run marginal costs in distributing TV and radio news (or in printing and delivering newspapers). The revenue of the media includes the price they can charge for their product plus the price per reader/viewer paid by advertisers. This structure of the media industry implies that different groups receive different media coverage. News items of interest to small groups and groups with limited attractiveness for advertisers receive less coverage.

2. In his theoretical derivations, Stromberg (2004a) refers to the media as "newspapers" but explains that for the purposes of the main points of his analysis, the cost and revenue structures of TV and radio are similar in the relevant aspects.

This bias in the mass media's news coverage translates into policy bias. As media coverage of different issues changes, the efficiency with which politicians can reach different groups with campaign promises also changes. If a party promises a group that receives very little news coverage that it will raise spending, only a small fraction of the voters who would benefit become aware of the promise. Therefore, a spending promise to this group will not win many votes for the party. Consequently, this group of voters will not attract many favorable policies. Instead, promising to raise spending for groups that attract substantial media coverage (for example, because they are large groups or because the groups are more valuable to advertisers) will lead to a stronger voter response and thus to policies that are more favorable to these groups.

Implications for Agricultural Policy

What does this theory imply for the impact of mass media on agricultural policy?[3] The most important stylized fact about agricultural policy is the so-called development paradox, the policy switch from the taxation to the subsidization of agriculture associated with economic development (Anderson and Hayami, 1986; Anderson, 2009). The classic interpretation of this pattern is that when a country becomes richer, farm groups, compared to consumer and taxpayer groups, become more effective in collective action situations as the number of farmers declines and development reduces communication and transportation costs. Both factors reduce organizational costs and free rider problems in collective action situations (Olson, 1965). Moreover, because the per capita cost experienced by the rest of society falls with fewer farmers, the opposition of taxpayers and consumers to (agricultural) subsidies decreases as the number of farmers decreases as a result of economic development (Becker 1983; Swinnen 1994; Anderson 1995).

The model developed here suggests that the relationship between agricultural policy and economic development will be affected by the introduction of media competition in the political market. Voter preferences and government policies will be affected by how the media industry provides information to citizens.

One key prediction of the model is that, ceteris paribus, government transfers such as agricultural protection should be biased toward large groups as an effect of media competition. Because the agricultural group (the number of farmers) is relatively large in poor countries and relatively small in richer ones, an important implication of the model is that, ceteris paribus, the effect of media competition on agricultural policy should differ in poor versus rich countries. More specifically, we expect that the impact on agricultural protection induced by mass media competition should be positive in poor countries

3. Stromberg's (2004a) basic model has a fixed budget constraint. This assumption is later relaxed (see section 3.2 and footnote 16 of his paper) to allow for government programs, such as taxes and subsidies, which influence the budget itself. Endogenizing the government budget in this extended model does not affect the main results (or our hypotheses).

and negative in rich countries. Thus, we can formulate the following empirical prediction.

Hypothesis 1 (Group size effect): *Mass media competition-induced political bias will reduce agricultural protection in rich (developed) countries but will increase agricultural protection in poor (developing) countries, ceteris paribus.*

Another prediction of the model is that, ceteris paribus, government transfers will be biased toward groups that are more attractive to advertisers. Stromberg (2004a) refers to the case of the show *Gunsmoke*, which was cancelled despite its high ratings because its audience was perceived as "too old and too rural" to be of much interest to advertisers.

The implication for agricultural protection is not obvious because "being attractive to advertisers" may apply to many things, including age (young people are more easily influenced by advertisements than older people), income (richer people have more money to spend), and so forth. The latter argument would imply that mass media competition would induce government transfers to be biased toward *relatively* richer groups who have more income to spend and are therefore more attractive to advertisers.

Nevertheless, the implication for agricultural protection is not trivial. The relationship between economic development and the rural-urban income gap is the subject of some debate. Recent papers have argued that this relationship is nonlinear, with a relatively small gap in very poor countries (as incomes in both urban and rural areas are very low), urban incomes rising relative to rural incomes when countries grow, and the income gap narrowing again at high income levels (see Hayami 2007; McMillan and Rodrik, 2011). This nonlinear relationship would also follow if the spread of TV were uneven between urban and rural areas, reflecting the differences in income (demand for TVs). There would be a relatively small gap in very poor countries (as TV distribution in both urban and rural areas is very low) and a rise in urban TV distribution relative to rural TV distribution when countries grow, with the gap in TV distribution narrowing again at high income levels. In either case, this channel would add a nonlinear relationship between average incomes and media effects, with a prourban media bias effect that would be strongest at medium income levels.

However, a problem with using observed (sectoral) income to document this nonlinear relationship between the rural-urban income gap and overall income is that the observed sectoral income levels are obviously affected by the policies themselves. With occasionally very large subsidies or taxes, these policy transfers clearly affect the relative income measures. With transfers going from rural to urban areas in poor countries (and vice versa in rich countries), we would expect the pretransfer rural-urban income ratio to be higher (lower) than that observed in poor (rich) countries. In medium income countries, the transfers are relatively lower; thus, the observed income ratio is closer to the pretransfer ratio.

This situation would imply that the expected "advertiser-value effect" of media competition on agricultural protection should be as follows: small in

(very) poor countries, because pretransfer rural and urban incomes are similar, and low and negative in rich and emerging countries, where pretransfer urban incomes are much higher than rural incomes. Thus, we can formulate the following empirical prediction (conditional on an observed nonlinear relationship between the rural-urban income ratio and economic development).

Hypothesis 2 (Advertiser value effect): *Mass media competition-induced political bias will reduce agricultural protection in rich (developed) and emerging countries and will have little effect in poor (developing) countries, ceteris paribus*.

In combination, these two effects imply that the total media effect will increase agricultural protection (or reduce agricultural taxation) in poor countries owing to the group size effect, reduce agricultural protection in emerging countries owing to the advertiser value effect, and more strongly reduce agricultural protection in rich countries owing to the reinforcement of group size and advertiser value effects.

The next sections present the data and empirical strategy used to test the hypotheses.

II. Data and Empirical Specification

We test our predictions on annual observations from a sample of approximately 70 developing and developed countries from all continents. Overall, we employ a panel of more than 2,000 observations, but the panel structure is unbalanced. Specifically, for a few developed countries, the starting year is approximately 1960; for the majority of the sample, the starting year is approximately 1970; and for transition countries, it is approximately 1992. The last year of observations is 2004. Table S.1 (in the supplemental appendix, available at http://wber.oxfordjournals.org/) reports the full list of countries with data and the 1970 and 2002 values of key policy and media variables.

Dependent Variables

Our dependent variables are measures of agricultural protection. As an indicator of agricultural taxation and subsidization, we use the *relative rate of assistance* (*RRA*) to agriculture, taken from the Agricultural Distortions Database from the World Bank (see Anderson and Valenzuela 2008 for details). The *RRA* index is calculated as the ratio between the agricultural and nonagricultural nominal rates of assistance:

$$RRA = \left[\left(1 + NRA_{ag}\right)/\left(1 + NRA_{nonag}\right) - 1\right]$$

where NRA_{ag} is the nominal rate of assistance to agriculture and NRA_{nonag} is the nominal assistance to nonagricultural sectors. The NRA_{ag} measures total transfers to agriculture as a percentage of the undistorted unit value. It is

positive when agriculture is subsidized, negative when it is taxed, and zero when net transfers are zero. The NRA_{ag} at the agricultural level is obtained as the weighted average of assistance at the product level using the undistorted value of production as a weight. It includes a wide range of policies, such as the assistance provided by all tariff and nontariff trade measures applied to agricultural products and any domestic price-distorting measures. In addition, the price equivalent of any direct interventions on inputs is included.

One advantage of using *RRA* (instead of *NRA*) as the dependent variable is that, especially in developing countries, an important indirect source of agricultural taxation is trade protection for the manufacturing sector as a component of import-substitution policies. Thus, *RRA* is a more useful indicator in an international comparison of the extent to which a country's policy regime has an anti- or proagricultural bias. However, as a robustness check and to assess whether changes in agricultural policy or industrial protection are important elements in the media-protection relationship, we ran a series of additional regressions using the *NRA* as the dependent variable.

Mass Media Variables

To test our hypotheses, we use the penetration of TV sets as an indicator. More specifically, our variable is the natural logarithm of TV sets per 100 inhabitants, based on data from the Arthur S. Banks Cross National Time-Series Data Archive, supplemented by UNESCO Statistics on TV and data from the International Telecommunication Union (2010).[4]

The rationale for using this proxy is that, although the share of informed voters is not observed, we can observe the share of media users. Because both move together, it is sufficient to examine the levels and changes in the share of media users to test the effect of media bias (see Strömberg 2004b). Moreover, in our specific context, another justification for the use of these indicators is derived from Strömberg's (2004a, p. 266) argument that "the emergence of broadcast media increased the proportion of rural and low-education media consumers as it became less expensive to distribute radio waves than newspapers to remote areas, and as these groups preferred audible and visual entertainment to reading. As politicians could reach rural and low-education voters more efficiently, the model predicts an expansion in programs that benefits these voters."

4. Both the Arthur Banks and the International Telecommunication Union data are based on data originally collected by UNESCO. These data are collected annually from 1970 onward. From 1960 to 1970, the data were collected every five years. Thus, for that period, we only use data for 1960, 1965, and 1970 without any interpolation. A potential limitation of these data lies in the fact that some countries have a licensing scheme whereby TV sets (or radios) must be registered. Because households may have more than one TV receiver or may not register, the number of licensed receivers may understate the true number of TVs and radios. Our identification strategy exploits the within-country variation in the data (see section 5). As long as the number of licenses and of TVs/radios display similar growth paths, this limitation of the data should not pose a major problem.

Income and Group Size Variables

The hypotheses advanced in section II imply that the relationship between the *media* variable and *RRA* (*NRA*) is conditional on the level of development (income), partially due to group size effects. As an indicator of development (income), we use real per capita GDP in purchasing power parity (*gdppc*) taken from the Penn World Tables.[5] The most direct indicator of (relative) group size is the share of agricultural employment, *emps*, based on FAO data. However, as is well known, both are strongly correlated because the agricultural employment share decreases with economic development. Therefore, *gdppc* is itself an indicator of relative group size.

In our basic specifications, we use *gdppc* as the primary indicator for the conditional effect of media on agricultural protection because the employment share data are of poor quality, which precludes a consistent comparison across countries and over time, especially for developing countries (see Timmer and de Vries 2007 for a discussion). One reason for the poor quality is the differences in national definitions of "agricultural labor." Another reason is that the yearly "observations" in the FAO labor statistics are linear interpolations between census data collected once every decade. We understand that there are also problems with the measurement of *gdppc* because national accounts data are noisy over short time horizons (see Deaton 2005), but we believe the data problems are less important for *gdppc* than for *emps*. However, we perform a series of robustness checks using *emps* as indicator.

Both variables (the level of development and employment share) are also included as control variables because both have been identified as major determinants of agricultural protection outside the media effect.

Other Control Variables

In addition to the variables discussed above, in the empirical specifications, we include controls that are likely to affect the level of agricultural protection, as suggested by previous studies. Standard control variables in studies on the political economy of agricultural policies are indicators of comparative advantage, trade status, terms of trade effects, and political institutions (see Olper 2007; Swinnen 2010; Olper and Raimondi 2012). To control for comparative advantage, we include agricultural land per capita, *landpc*, and the agricultural export share, *exps*, measured as net exports over production. These two variables are based on data from FAO and the World Bank's Agricultural Distortions Database. Because of the possibility that governments set agricultural protection to exploit terms of trade effects, we also control for country size using the log of population, *logpop*. We proxy for political institutions by

5. Specifically, we use the variable *rgdpch* from the Penn World Tables, version 6.3.

TABLE 1. Descriptive Statistics

	Mean	Std. Dev.	Min.	Max.	Obs.	Countries
RRA	12.71	64.63	−94.62	404.87	2,020	69
NRA	20.11	67.19	−93.11	432.72	2,231	69
Log TVs (× 100 inhabitants)	1.89	2.10	−6.91	4.60	2,231	69
GDP per capita (in purchasing power parity)	9,808	10,313	259	45,947	2,231	69
Agricultural employment share	0.38	0.29	0.01	0.92	2,231	69
Land per capita	1.72	3.97	0.04	41.51	2,231	69
Net export share	0.01	0.36	−1.73	1.28	2,087	69
Log population	9.97	1.29	7.21	14.07	2,231	69
Democracy index (Polity2)	3.26	7.13	−9.00	10.00	2,231	69
Government consumption	17.13	9.18	1.38	85.37	2,230	69
Trade to GDP ratio	51.66	31.17	5.00	622.63	2,224	69
Sach-Warner trade policy index	0.61	0.49	0.00	1.00	2,178	69
Economic crisis	0.26	0.44	0.00	1.00	2,231	69

Source: Own calculations based on the data described in the text.

adding the Polity2 index of democracy taken from the Polity IV database (Marshall and Jaeggers 2007).[6]

In addition to these standard control variables, we use a series of covariates to check the robustness of our findings (Olper et al. 2013). They include two different indicators of (aggregated) openness: the ratio of trade to GDP from the Penn World Tables and the Sachs-Warner index of openness as defined by Wacziarg and Welch (2008).[7] We use government consumption to GDP from the Penn World Tables as a proxy for government size. Finally, because economic crises may trigger policy reforms, we add two lags of a crisis variable measured with a dummy equal to one for every year that the real GDP per capita growth rate is negative (zero otherwise). Table 1 presents summary statistics for the variables described above.

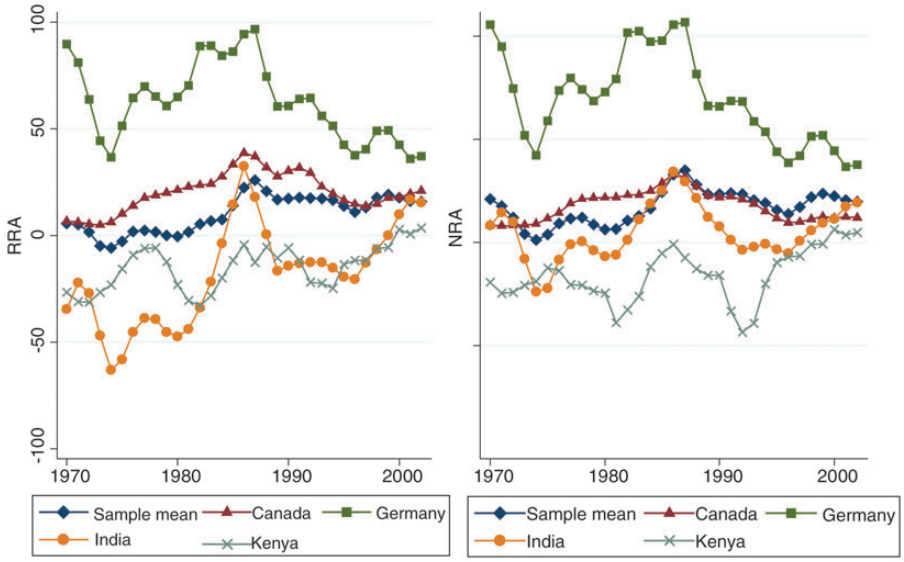
III. DESCRIPTIVE STATISTICS AND ANALYSIS

Figures 1 and 2 present trends in the agricultural policy indicators (*RRA* and *NRA*) and the media variable (number of TVs per 100 inhabitants) for the period from 1970 to 2004 for selected countries. Table S.1 in the online appendix presents the figures for 1970 and 2002 for all countries in the dataset. The

6. The Polity2 index assigns a value ranging from −10 (autocracy) to +10 (democracy) to each country and year, with higher values associated with stronger democracies.

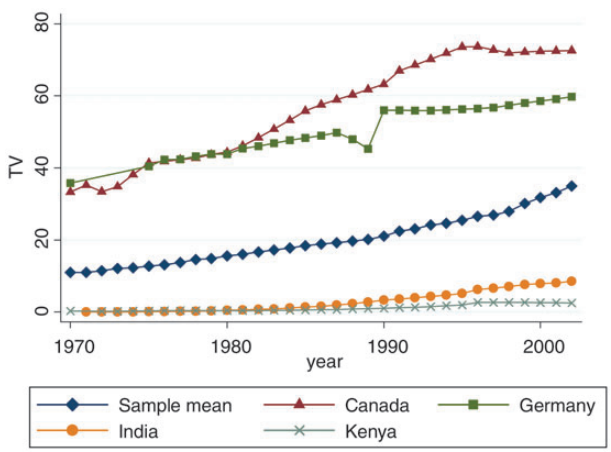
7. Wacziarg and Welch (2008) updated the Sachs and Warner index and exploited its time dimension. The index is equal to one when a country is considered open and zero otherwise. Thus, it captures reforms in the overall trade policy.

FIGURE 1. Indicators of Agricultural Policies (*RRA*, *NRA*) in Selected Countries (1970–2004)



Note: Three-year moving averages of both RRA and NRA.
Source: Own calculations based on data from the *Agridistortions* databases (World Bank).

FIGURE 2. Indicators of Mass Media: TVs per 100 Inhabitants in Selected Countries (1970–2004)



Source: Own calculations based on the data described in the text.

figures reveal that there is substantive variation in all indicators both over time and between countries.

Figure 1 illustrates the stylized fact that *RRA* and *NRA* are higher in rich countries (Canada and Germany) than in poor countries (India and Kenya).

Support for farmers was particularly high in Germany, with an *RRA* between 50 percent and 100 percent for much of the period. The level of taxation faced by farmers was particularly severe in India before 1980, with *RRA* figures of approximately 50 percent. Figure 1 also shows that the variation in *NRA* and *RRA* between countries has declined over time, with agricultural taxation declining (*RRA* increasing) in poor countries and agricultural subsidies for agriculture falling (*RRA* decreasing) in rich countries. On average, the *RRA* for the full sample increased from approximately 0 percent in the 1970s to approximately 20 percent in the 1980s, subsequently declining to approximately 10 percent in 2000 (the *NRA* values differ, but the patterns are similar).

Figure 2 illustrates the differences in TV penetration across countries and over time. The number of TVs increased everywhere over time, but, not surprisingly, the numbers are much higher in rich countries than in poor ones. The number of TVs increased from approximately 35 per 100 inhabitants in 1970 to approximately 60 in Germany and 75 in Canada by 2000. In the poor countries, the number of TVs was nearly zero until the mid-1980s. It remains very low in Kenya. The increase is somewhat more rapid in India, reaching approximately 10 per 100 inhabitants in 2000.

A comparison of figures 1 and 2 suggests a different relationship between agricultural policies and the spread of mass media in rich and poor countries: for poor countries (such as Kenya), the *RRA* increased over the 1970–2004 period, and mass media also grew. In contrast, for rich countries (such as Germany), the *RRA* declined, whereas mass media continued to grow.

To further analyze this relationship between mass media and agricultural policies, table 2 reports simple pair-wise correlations between the media variable and the agricultural protection indicators for different levels of development (organized as percentiles of per capita GDP). The pair-wise correlations

TABLE 2. Correlation Coefficients between TV Penetration and Agricultural Protection Indicators by Percentile of per Capita GDP

	TV vs. Agricultural protection	
Percentiles of gdppc	*RRA*	*NRA*
<5%	0.228	0.245
<10%	0.292	0.249
<25%	0.290	0.205
<50%	0.406	0.360
>50%	0.102	0.044
>75%	−0.352	−0.391
>90%	−0.624	−0.612
>95%	−0.656	−0.629

Note: The percentiles of *gdppc* refer to two different samples due to data availability for *RRA* and *NRA*. The samples have the following median values of *gdppc*: USD 5,949.5 for the *RRA* sample and USD 5,356.6 for the *NRA* sample.

Source: Own calculations based on the data described in the text.

are consistent with the suggestions from figures 1 and 2. The correlation coefficient is approximately +0.30 for percentiles below the median (<50 percent). For per capita GDP values above the 75th percentile, the correlation becomes negative, and increasingly so, reaching a value below −0.60 at the 95th percentile. These correlations are consistent with hypotheses 1 and 2: there is a different relationship between agricultural policies and the spread of mass media in rich and poor countries. For poor countries, the spread of mass media is associated with an increase in *RRA* (*NRA*), whereas in rich countries, the growth of mass media is associated with a decline in *RRA* (*NRA*).

Of course, these are merely descriptive statistics. For a more formal analysis, we now turn to an econometric analysis.

IV. Econometric Strategy and Identification Issues

Our hypotheses suggest that in countries with low *gdppc*, the media variables, and *RRA* should be positively related, and when *gdppc* is high, there should be an inverse relationship between these variables. A priori, we do not know at what level of *gdppc* the relationship changes sign. By using a general specification, we can derive the *gdppc* value at the turning point, if any, from the estimated coefficients:

$$RRA_{it} = \alpha_0 + \alpha_1 m_{it-1} + \alpha_2(m_{it-1} \times gdppc_{it-1}) + \alpha_3 gdppc_{it-1} + \beta x_{it-1} + \varepsilon_{it} \quad (1)$$

where RRA_{it} measures the relative rate of assistance in country i and year t, $m_{it\text{-}1}$ refers to the one-year lagged media variable, and $x_{it\text{-}1}$ is a vector of additional controls. Taking the partial derivative of *RRA* with respect to the media variable, we obtain

$$\frac{\partial RRA}{\partial m} = \alpha_1 + \alpha_2 gdppc.$$

Given our hypotheses, we expect that $\alpha_1 > 0$ and $\alpha_2 < 0$, such that $\alpha_1 + \alpha_2$ *gdppc* is positive (negative) as *gdppc* is higher (lower) than *gdppc**, with $gdppc^* = \alpha_1/-\alpha_2$ the level of development at which our media-protection relationship changes sign. We refer to this as the "turning point." Note that a key requirement for the predictions to hold is that *gdppc** should lie within the range of *gdppc* values in the dataset.

Regarding identification, our main concern is omitted variable bias. If the media variables are correlated with unobserved determinants of the protection level, our estimates will be inconsistent. Note that, a priori, the direction of the bias is not predictable. Therefore, our basic specification always includes a set of country (η_i) and year fixed effects (ϑ_t):

$$RRA_{it} = \alpha_1 m_{it-1} + \alpha_2(m_{it-1} \times gdppc_{it-1}) + \alpha_3 gdppc_{it-1} + \beta x_{it-1} + \eta_i + \vartheta_t + \varepsilon_{it}. \quad (2)$$

However, this approach does not allow us to properly isolate the causal effect of increased mass media consumption for two main reasons. First, country fixed effects do not control for unobservable, country-specific, time-varying factors correlated with both the media and agricultural protection. Second, potential measurement errors in the *gdppc* indicator may introduce further endogeneity problems (Deaton 2005). Indeed, the correlation between *gdppc* and the media variables may bias the estimated media coefficients (and the interaction term between the media and *gdppc*), a problem exacerbated by the fixed effects transformation (Wooldridge 2002). Thus, to make our identification assumption more credible, we adopt two additional strategies.

First, given our specific concern regarding (omitted) time-varying factors correlated with both media variables and protection, in addition to the time dummies, we include continent-year interaction effects to control for changes over time that affect countries within a region similarly.[8] In addition, as discussed in the data section, beyond the traditional determinants of agricultural protection that have been found relevant in previous studies, we include several other covariates, such as indicators of trade openness, trade policy reforms, government consumption, and economic crises, to increase the similarity between the countries.

Second, to directly address measurement error problems and other forms of endogeneity, we also employ dynamic panel methods. Specifically, we use the system generalized methods of moment (SYS-GMM), developed by Arellano and Bover (1995) and Blundell and Bond (1998). By estimating a system of equations in first differences and levels and employing instruments, this approach should allow for consistent estimations even in the presence of measurement errors and other forms of endogeneity (see Bond et al. 2001). Our SYS-GMM dynamic panel model has the following specification:

$$\Delta RRA_{it} = a_1 \Delta RRA_{it-1} + a_2 \Delta m_{it-1} + a_3 \Delta(m_{it-1} \times gdppc_{it-1}) + a_4 \Delta gdppc_{it-1} + \\ + b' \Delta x_{it-1} + \vartheta_t + \upsilon_{it} \tag{3a}$$

$$RRA_{it} = a_0 + a_1 RRA_{it-1} + a_2 m_{it-1} + a_3 (m_{it-1} \times gdppc_{it-1}) + a_4 gdppc_{it-1} + \\ + b' x_{it-1} + \vartheta_t + \upsilon_{it} \tag{3b}$$

where Δ denotes first differences, that is, $\Delta y_{it} = y_{it} - y_{it\text{-}1}$, $RRA_{it\text{-}1}$ is the lagged dependent variable and υ_{it} is a disturbance term. In estimating the system of equations (3a)–(3b), the (endogenous) lagged dependent variable is instrumented by its $t - 2$, $t - 3$, and longer lags, using the lagged levels for the first-

8. These interaction effects capture any regional differences in the agricultural protection dynamic. We also tested a second specification in which we included continent-specific polynomial terms over time, and the results were qualitatively and quantitatively similar.

differences equation (3a) and the lagged differences for the level equation (3b). Similarly, to address endogeneity in other explanatory variables (such as the media variable and its interaction with *gdppc*), they can be instrumented by their respective $t - 2$, $t - 3$, and longer lags. The validity of a particular assumption can then be tested using standard generalized methods of moment tests of overidentifying restrictions. In summary, the SYS-GMM specification should allow for greater flexibility, improved control for omitted time-varying factors through the lagged dependent variable and, finally, greater consistency even in the presence of endogenous regressors. However, it is important to stress that this estimator does not resolve endogeneity problems due to omitted variables with persistent effects, such as when the TV trend is correlated with the *RRA* (*NRA*) trend, as a result of an omitted (possibly time-invariant) variable.

V. Regression results

This section presents the results of our econometric analyses. We present first the results of the static model and afterward the dynamic panel results. We evaluate the robustness of the results by testing whether the results are sensitive to country and time coverage and to the use of different indicators for key variables.

Static Model

Table 3 reports the static fixed effects results of different specifications based on equation (2), with columns (1)–(4) using *RRA* and (5)–(6) using *NRA* as the dependent variable. In every regression, the standard errors are corrected for heteroskedasticity and autocorrelation of unknown form and are clustered within countries.

The results in column 1 show that the simple fixed effects specification, without controls apart from *gdppc*, yields statistically significant coefficients (p-value < 0.01) for both the linear effect and the interaction effect of TV penetration with *gdppc*. The positive sign for the linear term and the negative sign for the interaction effect are consistent with hypotheses 1 and 2. The penetration of TV is associated with a higher *RRA* at low levels of development but with a lower *RRA* at higher levels. In regression (1), the turning point for the relationship is a per capita GDP level of USD 6,013. This number is virtually identical to the sample median value, which is equal to USD 5,949.

Columns (2) and (3) report regressions that control for the standard agricultural protection covariates (agricultural employment share, comparative advantage, country size, and the quality of democracy) and additional variables, such as trade openness, government consumption to GDP, and crises indicators.

In column (4), we add a set of continent-year interaction effects to control for differences in regional protection dynamics. The different specifications

TABLE 3. Effect of TV Penetration on Agricultural Protection

Dependent variable Variables	*RRA* (1)	*RRA* (2)	*RRA* (3)	*RRA* (4)	*NRA* (5)	*NRA* (6)
Log TV	**8.839**	**6.912**	**8.358**	**8.131**	**9.433**	**8.025**
	(0.005)	*(0.012)*	*(0.003)*	*(0.004)*	*(0.004)*	*(0.014)*
*Log TV * GDP per capita*	**−0.147**	**−0.122**	**−0.138**	**−0.125**	**−0.177**	**−0.148**
(× 100)	*(0.006)*	*(0.006)*	*(0.004)*	*(0.003)*	*(0.001)*	*(0.001)*
GDP per capita	0.007	0.006	0.008	0.008	0.010	0.009
	(0.018)	*(0.024)*	*(0.008)*	*(0.010)*	*(0.009)*	*(0.013)*
Employment share		−1.200	−1.054	−0.909	−1.426	−1.247
		(0.050)	*(0.081)*	*(0.163)*	*(0.015)*	*(0.037)*
Land per capita		−1.622	−2.033	−1.712	−3.076	−2.905
		(0.137)	*(0.069)*	*(0.223)*	*(0.047)*	*(0.085)*
Export share		−10.885	−9.133	−8.974	−15.993	−12.964
		(0.264)	*(0.354)*	*(0.476)*	*(0.134)*	*(0.335)*
Log population		−0.071	−0.132	0.159	−0.096	−0.059
		(0.765)	*(0.574)*	*(0.629)*	*(0.733)*	*(0.848)*
Polity2 (democracy index)		0.951	0.926	0.831	1.314	1.224
		(0.002)	*(0.001)*	*(0.004)*	*(0.001)*	*(0.001)*
Government consumption			0.537	0.630	0.176	0.320
			(0.217)	*(0.137)*	*(0.726)*	*(0.544)*
Trade to GDP			0.014	−0.038	−0.007	−0.029
			(0.772)	*(0.510)*	*(0.884)*	*(0.607)*
Sachs-Warner trade policy index			20.975	17.553	18.127	16.444
			(0.000)	*(0.001)*	*(0.000)*	*(0.001)*
Lagged_1 crisis			−0.090	0.847	0.382	1.185
			(0.956)	*(0.601)*	*(0.815)*	*(0.463)*
Lagged_2 crisis			1.007	2.072	0.780	1.871
			(0.427)	*(0.121)*	*(0.536)*	*(0.166)*
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Continental-years interaction effects	No	No	No	Yes	No	Yes
Observations	2,025	1,996	1,935	1,935	2,001	2,001
Countries	69	69	67	67	69	69
Adj. R^2	0.857	0.865	0.871	0.880	0.858	0.866
Critical GDP per capita	**6,013**	**5,666**	**6,057**	**6,504**	**5,330**	**5,422**

Note: OLS regressions; *p*-values based on robust standard errors clustered by countries in parentheses; all controls entered with one year lagged; continental (Asia, Africa, Latin America) and year interaction effects included as indicated (see text).

Source: Own calculations based on the data described in the text.

yield consistent results both in terms of coefficients and the significance of the media variables.

Columns (5) and (6) report the results of regressions analogous to columns (3) and (4) but using the nominal rate of assistance (*NRA*) as the dependent variable instead of *RRA*. The estimated media coefficients are very similar, and the results are thus robust to using different indicators of agricultural support.

To put the estimates into perspective, we illustrate the size of the media effects using the Philippines and Taiwan as examples. These two countries have average per capita GDP values in the period covered by the analysis of USD 1,854 and USD 9,987, respectively, which are significantly lower and higher than the critical turning point of the estimated relationship. Using the estimated coefficients of the full model (column (4)), a 10 percent increase in the share of households with TVs would be associated with a 4.8 percent increase in agricultural protection in the Philippines, but the same increase would reduce the Taiwan' agricultural protection by 6.4 percent.[9] This finding suggests that if there is a causal affect, its magnitude could be substantial.

In a working paper version of this article (Olper and Swinnen 2012), we presented similar regressions using radio penetration as media variable. When using radio penetration as an indicator, the patterns of the results are similar to those obtained using TV, but the significance levels of the media variables are lower and less robust. More specifically, including additional controls, the radio penetration linear term is positively and significantly correlated with protection, but the interaction term with per capita GDP, while still negative, is no longer statistically significant. A possible interpretation of these results is that radio is a more important news source in poor countries, whereas TV matters most in emerging and rich countries.

Dynamic Panel Model

As discussed in section IV, the results obtained from the (static) fixed effects model may still suffer from endogeneity bias, particularly as a result of measurement errors. To account for this problem, table 4 reports the results of dynamic panel estimates that control for persistency in agricultural protection. To avoid problems resulting from the use of an excessive number of instruments in the SYS-GMM estimator, the specification only controls for the standard covariates (as in column (2) of table 3).[10]

Columns (1) and (2) report the results using ordinary least squares (OLS) and least squares with dummy variables. The OLS and least squares with dummy variables results serve as benchmarks for the evaluation of the SYS-GMM specification and should be upward and downward biased compared to the SYS-GMM, respectively. In the SYS-GMM estimates, the media variables and *per-capita* GDP are treated as endogenous variables and instrumented with their $t - 2$ and higher lagged values. The SYS-GMM results for *RRA* and *NRA* are presented in columns (3) and (4). As expected, the magnitude of the coefficient on lagged *RRA* is above the estimated least squares with dummy variables value and below the estimated OLS value (and similar for

9. Both elasticities are evaluated at the mean value of the *RRA* distribution, equal to 12.7 percent.

10. Note that this does not substantially affect our results because the autoregressive term largely absorbs these omitted terms (see Roodman, 2009).

TABLE 4. TV Penetration and Agricultural Protection: Dynamic Panel Model

Dependent variable	*RRA*	*RRA*	*RRA*	*NRA*
Estimation method	OLS	LSDV	SYS-GMM	SYS-GMM
Variables	(1)	(2)	(3)	(4)
Lagged RRA (NRA)	0.9104	0.7407	0.8309	0.8183
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*
Log TV	**0.838**	**2.058**	**2.956**	**3.218**
	(0.006)	*(0.020)*	*(0.010)*	*(0.017)*
*Log TV * GDP per capita (× 100)*	**−0.028**	**−0.037**	**−0.078**	**−0.092**
	(0.002)	*(0.006)*	*(0.000)*	*(0.000)*
GDP per capita	0.0014	0.0018	0.0037	0.0043
	(0.002)	*(0.028)*	*(0.000)*	*(0.000)*
Employment share	0.024	−0.195	0.145	0.181
	(0.396)	*(0.230)*	*(0.090)*	*(0.066)*
Land per capita	−0.248	−0.481	−0.459	−0.518
	(0.001)	*(0.133)*	*(0.000)*	*(0.002)*
Export share	−3.124	−1.153	−5.394	−7.618
	(0.001)	*(0.799)*	*(0.001)*	*(0.000)*
Log population	−0.022	0.261	−0.040	−0.049
	(0.411)	*(0.715)*	*(0.476)*	*(0.456)*
Polity2 (democracy index)	0.123	0.337	0.190	0.236
	(0.023)	*(0.001)*	*(0.023)*	*(0.008)*
Time fixed effects	Yes	Yes	Yes	Yes
AR2 test (*p*-value)			0.03	0.08
AR3 test (*p*-value)			0.25	0.34
Hansen (*p*-value)			0.39	0.65
Diff-in-Hansen (*p*-value)			0.65	0.43
Instruments			82	82
Observations	1,984	1,984	1,984	2,058
Countries	69	69	69	69
R^2	0.94	0.94		
Critical GDP per capita	**2,992**	**5,563**	**3,790**	**3,498**

Note: *p*-values based on robust standard errors clustered by countries in parentheses; SYS-GMM based on xtabond2 in Stata, with instruments structured with lag (3) for *RRA* (*NRA*), and lag (2) for the media variables and *gdppc*; Additional instruments used for the level equation are the $t - 3$ first difference of the *RRA* (*NRA*) and the $t - 2$ first difference for media variables and *gdppc*; the collapse option is also used to control for instrument proliferation. LSDV represents least squares with dummy variables.

Source: Own calculations based on the data described in the text.

NRA). Moreover, neither the basic Hansen test of overidentifying restrictions nor the Difference-in-Hansen test, related to the additional instruments used by the level equation, detects any problem with instrumental validity. These observations all suggest that our instruments are valid and informative and the SYS-GMM estimator is consistent.

The estimated coefficients of TV penetration presented in columns (3) and (4) are significant and consistent with hypotheses 1 and 2 in the SYS-GMM regressions. These estimated coefficients measure short-term correlations. To compare them with the static results, one should use the long-run correlations,

which can be obtained by dividing the estimated coefficients by one minus the autoregressive coefficient. We obtain values equal to 17.46 for the linear term and −0.0046 for the interaction with income level and similar values for the *NRA* specification. Thus, the magnitudes of the estimated (long-run) media correlations in the dynamic SYS-GMM model are (in absolute value) approximately two times higher than those of the static model (see columns (3) and (5) of table 3). This result is consistent with the presence of attenuation bias due to measurement errors in the variables. This problem is exacerbated in the fixed effect specification but is efficiently accounted for in the generalized methods of moment approach (see Wooldridge, 2002, p. 313).[11]

Further Robustness Tests

We performed a series of additional robustness tests to further check our results, testing whether the results are sensitive to country and time coverage and to the use of different indicators for the group size effect and development.

Columns (1)–(4) of table 5 report sensitivity analyses for the media-protection relationship with different ranges of countries and periods. One problem with our results may be that both the structural adjustment programs of the 1980s and the beginning of the GATT Uruguay Round in the mid-1980s caused an effect that interfered with our media-protection relationship: a reduction in agricultural taxation in developing countries and a reduction in agricultural protection in developed countries. Columns (1) and (2) examine this possibility by running the model using only observations before and after 1985, respectively. Although the magnitude of the estimated relationship is different in both periods (approximately three times larger in magnitude after 1985),[12] the relationship is also estimated with high precision for years before 1985, suggesting that the abovementioned confounding effects do not drive the results.

Another possibility is that our nonlinear media-protection relationship is driven by some group of sensitive observations related to a particular group of poor or rich countries. To check this possibility, in columns (3) and (4), we excluded from the regressions observations for countries with a *gdppc* lower than USD 1,000 and higher than USD 25,000, respectively.[13] The results remain consistent and significant, although the sizes of the coefficients change somewhat. Dropping observations for the poorest countries increases the magnitude

11. Note that when comparing the SYS-GMM and the static fixed effects results, at least in terms of the magnitude of the media effect, these may also differ because the two models differ not only in terms of the estimator used but also in terms of the covariates included.

12. One likely reason for this difference is that the expansion of TVs in developing and emerging countries did not begin before the early 1980s.

13. Note that the results are fairly robust to the use of other *gdppc* thresholds. For example, by excluding observations with *gdppc* values below USD 5,000 or higher than USD 20,000 and thus working with approximately half of the sample, the media-protection relationship is still statistically significant.

TABLE 5. Robustness Checks: SYS-GMM Regressions over Different Samples

Dependent variable Interaction with Variables	*RRA* *gdppc* (1)	*RRA* *gdppc* (2)	*RRA* *gdppc* (3)	*RRA* *gdppc* (4)	*RRA* *gdppc* (5)	*RRA* *emp* (6)	*NRA* *emp* (7)
Lagged RRA (NRA)	0.893	0.796	0.838	0.877	0.799	0.909	0.895
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
Log TV	**1.478**	**6.313**	**3.604**	**1.966**	**2.073**	−2.306	**− 3.094**
	(0.025)	*(0.011)*	*(0.050)*	*(0.004)*	*(0.016)*	*(0.104)*	*(0.028)*
*Log TV * GDP per capita (or emps)*	**0.029**	**0.093**	**0.088**	**0.038**	**0.084**	**3.996**	**5.277**
	(0.001)	*(0.005)*	*(0.000)*	*(0.002)*	*(0.001)*	*(0.011)*	*(0.001)*
GDP per capita	0.0014	0.0044	0.0041	0.0018	0.0039	0.0022	0.0032
	(0.002)	*(0.004)*	*(0.000)*	*(0.005)*	*(0.001)*	*(0.027)*	*(0.002)*
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR2 test (*p*-value)	0.35	0.01	0.04	0.04	0.07	0.03	0.08
AR3 test (*p*-value)	0.10	0.27	0.25	0.25	0.61	0.37	0.52
Hansen (*p*-value)	0.96	0.22	0.92	0.30	0.91	0.10	0.02
Instruments	69	70	76	79	84	69	69
Observations	834	1,206	1,720	1,698	1,785	1,984	2,058
Countries	55	68	63	69	63	69	69
Sample	<1985	>1985	gdppc > USD 1,000	gdppc < USD 25,000	Richer/poorest excluded	All	All
Critical GDP per capita (emps)	**5,097**	**6,788**	**4,096**	**5,173**	**2,468**	**(0.58)**	**(0.59)**

Notes: Each column reports a regression for a specific countries/years sample with characteristics indicated at the bottom of the table: < (>) 1985 means that the regression is run for data before or after 1985; *gdppc* > 1,000 (< 25,000) means that the regression considered only countries/years data with *gdppc* higher (lower) than 1,000 (25,000) international U.S. dollars; richer/poorest excluded are excluding the three richest and poorest countries from the regression (namely, the United States, Norway, and Switzerland and Mozambique, Ethiopia, and Zimbabwe). The *p*-values in parentheses are based on robust standard errors clustered by countries; SYS-GMM is based on xtabond2 in Stata, with instruments structured with lag (3) for *RRA* and lag (2) for media variables and *gdppc* (*emps*); additional instruments used for the level equation are the $t - 3$ first difference of the *RRA* and the $t - 2$ first difference for media variables and *gdppc*; the collapse option is used to control for instrument proliferation. Additional controls included in every regression are *emps*, *landpc*, *exps, log(pop)*, and *Polity2*, all lagged one year, and year fixed effects.

Source: Own calculations based on the data described in the text.

of the estimated relationship; dropping observations for the richest countries reduces the estimated effects compared to the benchmark SYS-GMM regression in Column (3) of table 4. These results are consistent with hypothesis 2 (advertiser value effect), suggesting that farmers in the poorest developing countries may be too poor to attract advertisers and media coverage. The findings may also be consistent with an unbalanced increase in media diffusion between rural and urban areas. If rural areas have some lag in media penetration compared to urban areas, the media protection relationship will be weaker in the poorest countries.

In column (5), we simultaneously exclude observations for the three richest (the United States, Norway, and Switzerland) and the three poorest countries (Mozambique, Ethiopia, and Zimbabwe) from the regression. Once again, the results are very robust.

Columns (6) and (7) of table 5 present an additional robustness check using the agricultural employment share (*emps*) to interact with the media effect. For both *RRA* and *NRA*, all key variables have signs consistent with our hypotheses. Although the regression results with *emps* are less stable than those with *gdppc* (likely as a result of severe measurement errors in the *emps* variable), the key conclusions are robust to a change in the structural variable.[14]

Finally, as discussed in the conceptual framework section, there may be additional nonlinearity in the relationship between media coverage and policies resulting from a nonlinear relationship between economic growth and the rural-urban income gap and the relative urban-rural gap in TV distribution, which would affect the value of both groups to advertisers and thus the channel through which the mass media affect agricultural protection. To test for this, we added an additional interaction effect between TV and the square of *gdppc* to the model specifications. In some specifications, this additional media interaction term is significant and negative, consistent with the hypothesis. However, the results are less robust than those without the additional nonlinear term. These results are presented in Olper and Swinnen (2012).

VI. Conclusions

This paper provides evidence of the relationship between mass media competition and agricultural protection for a large group of countries. Strömberg's (2004a) theory predicts that information provided by the mass media, reflecting

14. There are well-known problems with the agricultural employment data, which are generally linear interpolations between a few observations (often one per decade) and suffer from serious measurement errors (see Timmer and de Vries, 2007). The model specification tests reported at the bottom of the table indicate a well-specified SYS-GMM model for the *RRA* regression but not for the *NRA* regression, where the Hansen test rejects the null of the validity of the additional overidentifying restrictions. However, the autocorrelation tests indicate that the model is well specified. Considering the strong measurement errors in the employment data and that Hansen tests have weak power, such results are unsurprising.

the media's incentives to provide news to different groups in society, affects government policy making and who benefits from government policies. The theory predicts that mass media competition will induce a policy bias toward large groups and groups that are more valuable to advertisers; these groups are more informed because the mass media target them.

We apply this theory to agricultural policy. This results in the hypotheses that (*a*) given the changing role of the agricultural sector due to economic development, the impact of mass media competition on agricultural policy will differ between poor and rich countries, ceteris paribus, and (*b*) this effect is contrary to the so-called development paradox of agricultural policies. Thus, the traditional change in agricultural policy from taxation to subsidization that is associated with economic development will be smoothed in the presence of mass media competition. We hypothesize that this is due to a combination of the group size effect, with larger groups being more attractive to the media, and the advertiser value effect, with richer groups being more attractive audiences for the media.

We use data on agricultural policy from 69 countries spanning a wide range of development stages and media markets to test these predictions. Our empirical results are consistent with the theoretical hypotheses. We find a significant and robust correlation between public support for agriculture and TV penetration, which is conditional on the structure of the economy. In particular, an increase in media penetration is correlated with policies that benefit the majority to a greater extent; it is correlated with a reduction in agricultural taxation in poor countries and a reduction in agricultural subsidies in rich countries, ceteris paribus.

These results are robust to the use of different indicators of agricultural policies, different media variables and different control variables and estimation techniques.

References

Anderson, K. 1995. "Lobbying Incentives and the Pattern of Protection in Rich and Poor Countries." *Economic Development and Cultural Change* 43(2): 401–23.

——— 2009. "Five Decades of Distortions to Agricultural Incentives." In K. Anderson, ed., *Distortions to Agricultural Incentives*, 3–64. Washington, DC: The World Bank.

Anderson, K., and Y. Hayami. 1986. *The Political Economy of Agricultural Protection*. Sydney, Australia: Allen and Unwin.

Anderson, K., and E. Valenzuela. 2008. "Estimates of Distortions to Agricultural Incentives, 1955 to 2007." Washington, DC: The World Bank.

Anderson, K., G. Rausser, and J. Swinnen. Forthcoming. "Political Economy of Public Policies: Insights from Distortions to Agricultural and Food Markets." *Journal of Economic Literature*.

Arellano, M., and O. Bover. 1995. "Another Look at the Instrumental Variable Estimation of Error-Components Models." *Journal of Econometrics* 68: 29–51.

Becker, G. S. 1983. "A Theory of Competition among Pressure Groups for Political Influence." *Quarterly Journal of Economics* 98: 371–400.

Besley, T., and R. Burgess. 2001. "Political Agency, Government Responsiveness and the Role of the Media." *European Economic Review* 45: 629–40.

———. 2002. "The Political Economy of Government Responsiveness: Theory and Evidence from India." *The Quarterly Journal of Economics* 117(4): 1415–51.

Blundell, R. W., and S. R. Bond. 1998. "Initial Conditions and Moment Restrictions in Dynamic Panel Data Model." *Journal of Econometrics* 87: 115–43.

Bond, S., A. Hoeffler, and J. Temple. 2001. "GMM Estimation of Empirical Growth Model." CEPR Discussion Papers 3048. Center for Economic and Policy Research, Washington, DC.

Curtis, K., J.J. McCluskey, and J. Swinnen. 2008. "Differences in Global Risk Perceptions of Biotechnology and the Political Economy of the Media." *International Journal of Global Environmental Issues* 8 (1/2): 77–89.

Deaton, A. 2005. "Measuring Poverty in a Growing World (or Measuring Growth in a Poor World)."*Review of Economics and Statistics* 87 (1):1–19.

De Gorter, H., and J. Swinnen. 2002. "Political Economy of Agricultural Policy." In B. Gardner, and G. Rausser, eds., *Handbook of Agricultural Economics*, Vol. 2B, 1893–1943. Amsterdam, The Netherlands: Elsevier.

Downs, A. 1957. *An Economic Theory of Democracy*. New York: Harper and Row.

Francken, N., B. Minten, and J. Swinnen. 2009. "Media, Monitoring, and Capture of Public Funds: Evidence from Madagascar." *World Development* 37 (1): 242–55.

———. 2012. "The Political Economy of Relief Aid Allocation: Evidence from Madagascar." *World Development* 40 (3): 486–500.

Hayami, Y. 2007. "An Emerging Agricultural Problem in High-Performing Asian Economies." Policy Research Working Paper 4312. The World Bank, Washington, DC.

International Telecommunication Union (ITU). 2010. *World Telecommunication Indicators 2009*. Geneva, Switzerland: ITU. http://www.itu.int/.

Kuzyk, P., and J.J. McCluskey. 2006. "The Political Economy of the Media: Coverage of the U.S.-Canadian Lumber Trade Dispute." *World Economy* 29 (5): 637–54.

McMillan, M.S., and D. Rodrik. 2011. *Globalization, Structural Change and Productivity Growth*. NBER Working Paper 17143. National Bureau of Economic Research, Cambridge, MA.

Marks, L. A., N. Kalaitzandonakes, and S. S. Vickner. 2003. "Evaluating Consumer Response to GM Foods: Some Methodological Considerations." *Current Agriculture, Food & Resource Issues* 4: 80–94.

Marshall, M. G., and K. Jaggers. 2007. *Polity IV Project: Dataset Users' Manual*. Arlington, VA: Polity IV Project.

McCluskey, J., and J. Swinnen. 2010. "Media Economics and the Political Economy of Information." In D. Coen, W. Grant, and G. Wilson, eds., *The Oxford Handbook of Business and Government*, 643–62. Oxford: Oxford University Press.

Oberholzer-Gee, R., and J. Waldfogel. 2005. "Strengh in Numbers: Group Size and Political Mobilization." *Journal of Law and Economics* 48: 73–91.

Olper, A. 2007. "Land Inequality, Government Ideology and Agricultural Protection." *Food Policy* 32: 67–83.

Olper, A., J. Falkowski, and J. Swinnen. 2013. "Political Reforms and Public Policies: Evidence from Agricultural Protection." *World Bank Economic Review*. doi:10.1093/wber/lht003.

Olper, A., and V. Raimondi. Forthcoming. "Electoral Rules, Forms of Government and Redistributive Policy: Evidence from Agriculture and Food Policies." *Journal of Comparative Economics*. doi:10.1016/j.jce.2012.03.002.

Olper, A., and J. Swinnen. 2012. "Mass Media and Public Policy: Global Evidence from Agricultural Policies." LICOS Discussion Paper 320. LICOS Centre for Institutions and Economic Performance, Leuven, Belgium.

Olson, M. Jr. 1965. *The Logic of Collective Action. Public Goods and the Theory of Groups*. Cambridge, MA: Harvard University Press.

Prat, A., and D. Strömberg. 2005. "Commercial Television and Voter Information." CEPR Discussion Papers 4989. Center for Economic and Policy Research, Washington, DC.

———. 2011. "The Political Economy of Mass Media." CEPR Discussion Papers 8246. Center for Economic and Policy Research, Washington, DC.

Reinikka, R., and J. Svensson. 2005. "Fighting Corruption to Improve Schooling: Evidence from a Newspaper Campaign in Uganda." *European Economic Review* 3 (2–3): 259–67.

Roodman, D. 2009. "A Note on the Theme of Too Many Instruments." *Oxford Bulletin of Economics and Statistics* 71 (1): 135–58.

Strömberg, D. 2001. "Mass Media and Public Policy." *European Economic Review* 45: 652–63.

——— 2004a. "Mass Media Competition, Political Competition, and Public Policy." *Review of Economic Studies* 71: 265–84.

——— 2004b. "Radio's Impact on Public Spending." *Quarterly Journal of Economics* 119: 189–221.

Strömberg, D., and J.M. Snyder. 2008. "The Media's Influence on Public Policy Decisions." In R. Islam, ed., *Information and Public Choice. From Media Markets to Policy Making*, 17–31. Washington, DC: The World Bank.

Swinnen, J. 1994. "A Positive Theory of Agricultural Protection." *American Journal of Agricultural Economics* 76 (1): 1–14.

——— 2010. "The Political Economy of Agricultural Distortions: The Literature to Date." In K. Anderson, ed., *Political Economy of Distortions to Agricultural Incentives*, 81–104. Cambridge, UK: Cambridge University Press.

Swinnen, J., and N. Francken. 2006. "Summits, Riots, and Media Attention: The Political Economy of Information on Trade and Globalization." *The World Economy* 29 (5): 637–54.

Swinnen, J., J. McCluskey, and N. Francken. 2005. "Food Safety, the Media, and the Information Market." *Agricultural Economics* 32 (1): 175–88.

Timmer, M. P., and G. J. de Vries. 2007. *A Cross-Country Database for Sectoral Employment and Productivity in Asia and Latin America, 1950-2005*. Groningen, The Netherlands: Groningen Growth and Development Centre Research Memorandum, GD-98, University of Groningen.

Verbeke, W., R.W. Ward, and J. Viaene. 2000. "Probit Analysis of Fresh Meat Consumption in Belgium: Exploring BSE and Television Communication Impact." *Agribusiness* 16: 215–34.

Vigani, M., and A. Olper. 2012. "GMO Standards, Endogenous Policy and the Market for Information." LICOS Discussion Paper No. 306/2012. LICOS Centre for Institutions and Economic Performance, Leuven, Belgium.

Wacziarg, R., and K.H. Welch. 2008. "Trade Liberalization and Growth: New Evidence." *The World Bank Economic Review* 22 (2): 187–231.

Wooldridge, J. M. 2002. *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.

Liability Structure in Small-Scale Finance: Evidence from a Natural Experiment

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Microfinance, the provision of small individual and business loans, has experienced dramatic growth, reaching over 150 million borrowers worldwide. Much of the success of microfinance has been attributed to attempts to overcome the challenges of information asymmetries in uncollateralized lending. However, very little is known about the optimal contract structure of these loans, and there is substantial variation across lenders, even within a particular setting. This paper exploits a plausibly exogenous change in the liability structure offered by a microfinance program in India, which shifted from individual to group liability lending. We find evidence that the lending model matters: for the same borrower, the required monthly loan installments are 11 percent less likely to be missed under the group liability setting in comparison with individual liability. In addition, compulsory savings deposits are 20 percent less likely to be missed under group liability contracts. JEL codes: D14, O12, O16, O17

Theory and evidence highlight financial market imperfections as a central cause of poverty and a key impediment to growth (Banerjee and Newman, 1993; Rajan and Zingales, 1998). In theories of capital accumulation, for example, financial market imperfections influence the ability of the poor to borrow for investments in education and physical capital. Additionally, in models that explain entrepreneurship, information asymmetries and transaction costs prevent the poor from undertaking profitable entrepreneurial activities because they often have no collateral. The lack of access to financial services

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may thus leave many productive opportunities for the poor untapped and may generate persistent income inequality and low growth (Beck et al., 2007).[1]

Microfinance, which is the provision of credit, savings, and other financial services to low-income households and entrepreneurs, has exploded in popularity and coverage in recent years, particularly in its ability to meet the large unmet demand for finance (Morduch, 1999; Armendáriz de Aghion and Morduch, 2010). Both emerging markets and developed economies, including the United States, now provide microfinance services through a variety of public and private channels. The growth of microfinance has been unprecedented: between 2004 and 2008, the sector's average annual asset growth rate was 39 percent, reaching US$60 billion in total assets by the end of 2008 (Chen et al., 2010). A careful evaluation of microfinance in Banerjee et al. (2009) reveals that microcredit has important effects on business outcomes and the composition of household expenditures. The rapid growth of microfinance and its potential for promoting development have attracted the interest not only of governments, donors, and socially oriented investors but also of mainstream commercial banks.

Perhaps the most celebrated feature of microfinance is the group liability contract, which is a lending methodology pioneered by the Grameen Bank in Bangladesh. Under this contract, loans without collateral are extended to a group of borrowers whose members are jointly liable for each other's repayment. Because groups form voluntarily and group members are responsible for paying off each other's debts, borrowers have the incentive to screen for risky clients, monitor their peers, and enforce repayment. The success of this model with the Grameen Bank led to its replication in many countries around the world, reaching more than 150 million individuals by the end of 2007 (Daley-Harris, 2009). This model is particularly important because small firms suffer the most from institutional weakness (Beck et al., 2005) and because the structure of the banking sector may have important distributional impacts on growth (Cetorelli and Gambera, 2001).

Although most microfinance organizations use group liability, not all do so. On the one hand, group liability may solve information asymmetry problems by leveraging social ties and the borrower's knowledge about the community, and it may reduce monitoring costs to the lender by motivating borrowers to monitor each other. On the other hand, social sanctions may be limited, bad clients may free-ride on good clients, and borrower groups may collude against the lender. In addition to group liability lending, many microfinance programs employ a variety of approaches to maintain high repayment rates. For example, some programs implement frequent repayment schedules and progressive lending, or they require collateral substitutes. However, very little is known about the efficiency of these designs in ensuring repayment.

1. See World Bank (2008) for a literature summary.

The question of an optimal loan contract structure remains largely unanswered in both the theoretical and the empirical microfinance literature. Theoretical studies have primarily focused on explaining how and why the group liability mechanism works and offering competing predictions on its benefits, whereas the empirical literature lags behind the theory. Two important exceptions are Giné and Karlan (2009) and Attanasio et al. (2011). Giné and Karlan (2009) report on a field experiment in the Philippines to test the effect of individual versus group liability lending. Their analysis focuses on the importance of peer monitoring and finds no significant difference in default among individual and group borrowers. Giné and Karlan identify the effects of peer monitoring, but they do not focus on the effects of joint liability. In contrast, our paper examines the effect of the contract structure on the group of borrowers who are willing to borrow with either individual or group liability. Attanasio et al. (2011) conducted a field experiment in Mongolia in which villages were randomly assigned to obtain access to group loans, individual loans, or no loans. The main objective of Attanasio et al. (2011) is to measure the impact of both types of microcredit on different poverty measures. The authors find a positive impact for group liability loans on food consumption and entrepreneurship, with no difference in repayment rates between individual and group liability.

The identification of the impact of group liability on outcomes such as the default rate is complicated by the standard problems of selection and omitted variable bias. Individuals with different financial habits might choose one form of contract but not the other. Alternatively, lenders with different levels of sophistication may attract different client mixes and offer different contracts. One cannot simply compare clients across lending contracts because self-selection or other aspects of the program may be the cause of any observed differences.

In this paper, we use a natural experiment to compare loan repayment and savings discipline between individual and group lending models.[2] In this setting, group lending differs from individual lending in both the liability structure and the repayment practices. In group lending, borrowers are liable for the scheduled payments of group members, and the loan officer interacts primarily with the group leader, who collects payments from the other group members. Under individual lending, the borrowers are personally liable and interact directly with the loan officer. Our empirical strategy takes advantage of a change in the lending policies of Saath, a non-government organization providing microfinance services in India. Saath switched from individual to group lending. This transition was governed by a strict policy rule: after a particular date, all of the borrowers completing an individual liability cycle were offered a group liability loan in their next loan cycle. The individual liability loan completion dates were distributed relatively uniformly throughout the year, offering

2. Throughout this paper, we use the terms "group liability" and "joint liability" interchangeably.

a natural variation in the timing of the loan contract transitions. Thus, in July, for example, individual liability borrowers completing a loan cycle would switch to group liability in the following loan, whereas those whose loan cycle ended after July would remain under an individual contract setting until the end of their cycle. This plausibly exogenous change, which was phased in over time, generates natural control groups and allows us to credibly identify the causal impact of the group liability structure in what amounts to a repeated difference-in-difference framework. At any particular point in time, our "treatment" group consists of clients who have fully repaid their individual liability loan and who currently have a group liability loan, whereas our "control" group consists of individual liability loan clients who will eventually convert to a group liability loan.

Our primary analysis focuses on loan performance and estimates the effect of group liability on these outcomes. We find that the group liability structure significantly improves repayment rates. In particular, clients are approximately 11 percent less likely to miss a monthly repayment in the group liability setting relative to individual liability; this effect holds even with individual fixed effects. We also find that there is greater discipline regarding the monthly compulsory savings deposits when clients have a group liability loan. Specifically, compulsory deposits are approximately 20 percent less likely to be missed in the group liability setting. Our results provide the first credible evidence that group liability contracts improve upon individual liability, particularly in ensuring repayment and increasing savings discipline among clients.

These results, however, are subject to some important caveats. First, the transition to group liability lending was accompanied by other changes to the lending structure, particularly an increase in the loan size, which may have raised the continuation value of borrowing. Nevertheless, we argue that our estimates of the impact of these changes in the lending model should be in the lower bounds. Second, because our empirical strategy focuses on clients who chose to borrow under both individual and group liability settings, the external validity of our results may be limited. Third, limitations in the data availability preclude us from examining loan outcomes such as delinquency or prepayment. Finally, our empirical strategy does not allow us to test for the specific mechanisms by which group lending improves repayment. Based on our discussions with Saath, interviews of field officers, and our reading of the evidence, we speculate that "peer pressure" is the mechanism at work. We discuss these caveats further in Section IV.

From a practical and policy perspective, our results are quite timely. Microlenders worldwide are increasingly weakening joint liability in their lending approaches (Armendáriz de Aghion and Morduch, 2010). BancoSol in Bolivia has shifted a significant proportion of its lending portfolio from group to individual lending, and even the Grameen Bank has moderated its joint liability clause, allowing defaulters to get back on track without invoking group pressure. Therefore, our results suggest a cautionary tale for microfinance.

Many MFIs are moving away from joint liability to individual liability, but this transition is not supported by strong empirical evidence. This finding is important because, to our knowledge, only two other papers examine the relative merits of joint and individual liability contracts. Our paper underscores the fact that more research is required to provide better policy guidance for MFI practitioners worldwide.

The rest of this paper is organized as follows. Section I reviews the existing literature on the liability structure in microfinance. Section II provides the background for the microfinance program that we study and explains the change in the liability structure of its loan products. In Section III, we provide a description of the data and summary statistics. We discuss our empirical strategy and results in Section IV. Finally, Section V concludes the paper.

I. Predictions of Group Liability

A wealth of theoretical literature in microfinance explores the mechanisms behind group liability contracts, particularly in terms of how they mitigate information asymmetries and enforcement problems. Stiglitz (1990) shows that the group liability structure overcomes ex ante moral hazard because it creates incentives for group members to monitor each other's loans. Similarly, Banerjee et al. (1994) study credit cooperatives and underscore the role of peer monitoring. These authors describe a model in which higher monitoring results in higher borrower effort and, hence, a higher probability of project success.

Even if a project succeeds, however, borrowers may refuse to repay or may claim that the project failed so that they can avoid repayment. This type of strategic default is captured in several theoretical studies on group liability. For example, Besley and Coate (1995) provide a model demonstrating that joint liability may harness social capital to increase a borrower's willingness to repay. Likewise, Armendáriz de Aghion (1999) demonstrates that joint liability agreements may reduce the incidence of strategic default because borrowers may impose social sanctions on the defaulter.

In addition to examining moral hazard, the theoretical literature investigates how joint liability mitigates adverse selection. Ghatak (2000) describes a model in a scenario in which borrowers have ex-ante information about the riskiness of other borrowers' investment projects, but lenders do not. Joint liability thus acts as a screening device that induces "assortative matching." Specifically, borrowers with safe investments partner with other safe borrowers, leaving risky borrowers to form groups among themselves.

These theoretical models, among others, have shown that group liability may improve repayment rates by alleviating imperfections in the credit market. However, whether group liability outperforms other contract structures remains an open question in the microfinance literature. For example, Besley and Coate (1995) point out in their model that if borrowers cannot repay as a group, then some group members will not find it worthwhile to contribute

their share of repayment even though they would have repaid under individual lending.

Inconclusive empirical evidence accompanies these ambiguous theoretical predictions. Some empirical studies support the theoretical advantages of group liability. For instance, in Bangladesh, Sharma and Zeller (1997) show that groups that were formed through self-selection had better repayment rates; however, this study may suffer from omitted variable biases. Other studies provide little empirical support for this theory. For example, Ahlin and Townsend (2007) use Thai data to show that repayment rates are negatively associated with social ties.

Only a handful of studies examine the merits of group liability relative to other contract structures. Fischer (2010) conducts a series of lab experiments with actual microfinance clients and provides evidence that the contract structure affects project selection. Specifically, he finds that group liability increases risk-taking relative to individual liability contracts because borrowers free-ride on the insurance provided by their partners. In a randomized experiment in India in which borrowers were assigned to either weekly or monthly repayment meetings, Feigenberg et al. (2010) find that more frequent repayment meetings build social capital among borrowers, which, in turn, leads to reduced default.

The most relevant studies on repayment rates under different loan liability structures are Giné and Karlan (2009) and Attanasio et al. (2011). Giné and Karlan (2009) report evidence from two field experiments in the Philippines. In the first experiment, borrowers who had signed up under a group liability structure were converted to individual liability. Because both the joint and individual liability groups previously underwent the same screening, the authors can independently identify the peer monitoring effect under group liability. However, they cannot identify or rule out any impact of screening with this methodology. In addition, the group repayment and monitoring mechanisms may be entrenched and difficult to undo, even with an individual liability structure. Their second experiment randomly introduced either group or individual liability lending to new borrowers. However, the experiment was conducted at the loan center level, and take-up was quite uneven between the group and individual loan centers, resulting in potential statistical power concerns. In both instances, the authors find that the default rates are invariant to the contract structure.

Attanasio et al. (2011) conduct a field experiment in Mongolia where villages were randomly assigned to group loans, individual loans, or no loans. The authors seek to measure the impact of individual and group loans on reducing poverty. In particular, the study finds that clients who received group loans had higher food consumption and were more likely to operate a business than clients in the control villages. Clients in the individual-lending villages had no significant increases on any of these measures. For the repayment outcomes, the authors find no significant differences in the repayment rates between individual and group liability.

Although loan default and repayment are the primary outcomes of interest when examining group liability contracts, the economics literature on rotating savings and credit organizations (Roscas) suggests that group liability may have positive effects on savings. Bouman (1995) argues that participating in credit and savings groups allows individuals to avoid demands for financial support from their relatives because contributions to a Rosca are generally recognized by society as senior claims. In a theoretical model, Ambec and Treich (2007) show that Roscas can serve as a commitment device that helps people to overcome self-control problems. Gugerty (2007) provides support for this model, reporting that many Rosca participants in rural Kenya cite "you can't save alone" or "sitting with other members helps you to save" as their primary motivation for participating in a Rosca.

Our paper complements Giné and Karlan (2009) by examining the optimal contract structure in an alternative setting. Although the original experiment in Giné and Karlan (2009) focuses on moving from group to individual liability contracts, we explore the reverse; that is, we explore the shift from individual to group liability. The following section describes the setting and our empirical strategy in more detail.

II. Empirical Setting

Our partner institution, Saath, is a non-government organization based in Ahmedabad, India. Founded in 1989, Saath implements development initiatives in slum communities, including health, infrastructure improvement, and livelihood training programs. Additionally, Saath provides credit and savings services to the urban poor through its microfinance unit. In 2009, Saath Microfinance had over 6,400 active clients in 4 branches with a savings portfolio of INR 18 million (USD 390,000) and a loan portfolio of INR 19 million (USD 410,000).[3]

Although Saath has provided mentoring support to community-based credit and savings groups since the mid-1990s, its microfinance unit was not formally established until 2002. In that year, Saath integrated these credit and savings groups into its organization and registered them as cooperative societies with the Indian government. Saath also began managing these credit and savings cooperatives at this time, evolving into the Saath Microfinance Unit. Today, Saath Microfinance provides various financial services to slum communities, including voluntary savings accounts, compulsory savings accounts, and group liability loans.

Savings Products

Since its inception in 2002, Saath Microfinance has offeredvoluntary savings accounts to its clients. These voluntary savings accounts earn an interest rate of

3. Based on Saath's 2008–2009 Annual Report.

6 percent per year and do not require a minimum balance. As the name suggests, members are not obliged to make regular deposits into voluntary savings accounts. Any amount can be deposited, but only six withdrawals can be made per year.

In November 2007, Saath Microfinance initiated compulsory savings accounts for its members. Specifically, members are required to deposit INR 100 (USD 2) every month into compulsory savings accounts for the duration of their membership with Saath Microfinance. Clients may withdraw any amount from their compulsory savings at any time as long as a minimum balance of INR 3,500 (USD 70) is maintained. Similar to voluntary savings, compulsory savings earn an interest of 6 percent per year. Any amount that the client deposits over the compulsory savings of INR 100 is deposited into the client's voluntary savings account. The goal of the compulsory savings account is to allow clients to build a financial buffer stock against adverse shocks and to provide low-cost capital to Saath. These compulsory deposits were mandated for all borrowers independent of the switch to group liability loans. Hence, all outstanding loans under both individual and group liability were required to make compulsory deposits after November 2007. In Section IV, we compare adherence to these compulsory deposits for the same person as she moves from individual to group liability.

Loan Products

In addition to savings products, Saath Microfinance provides loans for asset creation (e.g., house repairs), production (e.g., business working capital), and consumption (e.g., health, social functions). From Saath's beginnings in 2002 until November 2007, it provided credit through individual liability loans. Beginning in November 2007, Saath discontinued its individual liability loans, instead offering group liability loans to members applying for credit.

Under the individual liability loan model, a client was required to have been a member of Saath for at least six months with a savings account to be eligible for a loan. Members could borrow up to three times their savings account balance at an interest rate of 18 percent per year.[4] These individual-liability loans generally require no collateral; however, each loan applicant must meet two requirements. First, the loan applicant must have two "guarantors" who also have savings accounts with Saath. Second, the combined savings balances of the loan applicant and the two guarantors must be greater than or equal to the loan amount applied for. Although the guarantors are, in principle, required to maintain these savings balances throughout the duration of the loan, in practice, this rule is not strictly enforced. The guarantors are not eligible for

4. Microfinance organizations typically quote interest rates in one of two forms: "declining," the standard used in developed markets, where the amount of interest due each period is calculated based on the interest rate and the remaining principal, and "flat," where the interest payments are calculated using the original principal amount. Thus a 10 percent "flat" rate is significantly higher than a 10 percent "declining" rate. Saath quotes rates using the standard declining balance approach.

a loan until the loan that they guaranteed has been fully repaid, but loan repayment is the sole responsibility of the borrower. The borrowers are required to make monthly installments that cover principal and interest. The monthly principal installment is a fixed amount, and because the interest rate reflects a declining balance, the total installment amount (principal plus interest) varies every month. If the borrower defaults, Saath reserves the right to seize the borrower's savings. If the savings are not sufficient to cover the loan, Saath reserves the right to take the guarantor's savings as well. However, in practice, as an NGO whose mission is to empower the poor, Saath has never seized any of its individual borrowers' or guarantors' savings.

With the group liability model, however, Saath extends credit to groups of individuals at an interest rate of 24 percent per year. Four loan size categories are available to clients: (1) Rs. 3,000–5,000, (2) Rs. 6,000–10,000, (3) Rs. 11,000–20,000, and (4) Rs. 21,000–30,000. These groups are formed primarily through self-selection with joint applications submitted to Saath. The groups are composed of three to six individuals, all of whom must be Saath Microfinance members. Within each group, several criteria must be fulfilled. First, at least 50 percent of the group must have been Saath Microfinance members for at least 6 months and must have at least asavings account. Second, at least 50 percent of the group must be female. Third, relatives or individuals from the same household are not allowed in the same group. Finally, the loan terms must be homogenous across group members; that is, the number of installments and the monthly installment due dates must be the same, and the loan amount must not vary widely within each group. As in the individual liability model, group liability borrowers are required to make monthly installment payments for both principal and interest, although in this setting, the total installment amounts (principal plus interest) are equal every month. (In the individual liability model, the monthly principal installment repayment is fixed, but the interest and, therefore, the installment size vary each month.) Before any loans are disbursed, the group members are also required to sign a "mutual agreement form" stating that they are liable to pay each other's debts in the event of default or delinquency. Borrower groups who have defaulted or are delinquent are not eligible to receive another loan from Saath.

The Shift from Individual to Group Liability

Saath's decision to shift from offering individual liability to group liability loans in November 2007 was driven by a change in the management's priorities. Saath wanted to lend to more people, provide larger loan amounts, and expand its microfinance operations geographically, but its lending activities had become stagnant under the individual liability model. In particular, the "guarantors" requirement for individual liability loans restricted credit eligibility because Saath had already reached a point where almost all of its members were either borrowers or guarantors. Additionally, savings clients were reluctant to stand as guarantors for other clients' loans, and the loan amounts were

limited to 3 times the total savings account balance of the borrower. Saath's management thus shifted to group liability loans to overcome these restrictions in its individual liability model. In terms of the models discussed above, the limited ability of Saath members to pledge savings as collateral prevented Saath from expanding, and Saath saw group liability as a way to solve this problem. In the year following this change, Saath gained almost 800 new clients and increased its reach from 11 to 20 wards.

The transition from individual liability to group liability loans was implemented using the following rule. Beginning in November 2007, all new loans disbursed were group liability loans; Saath would no longer disburse individual liability loans. However, existing loans whose terms lasted beyond November 2007 were unaffected. For example, individual liability loan clients who completed their loan in February 2008 continued under the individual liability contract until then. After February 2008, if they chose to borrow again, they received a group liability loan. The date to switch from individual to group liability was therefore determined by the individual liability loan completion dates. These completion dates and the subsequent conversion to group liability loans were distributed relatively uniformly throughout the year.

Although Saath's loan product moved from individual to group liability beginning in late 2007, the location for repayments, the frequency of loan repayment collection, and the salaries for the field officers remained similar across time in our dataset. An empirical concern for the subsequent analysis is whether Saath's policy shift from individual to joint liability was accompanied by a shift in its loan collection techniques. In June 2010, we conducted short interviews with Saath field officers regarding repayment collection. We were able to interview 10 out of the 12 Saath field officers who collected repayment among the sample of clients we study; the remaining field officers are no longer with Saath. The results from this survey confirm that the location and frequency of loan repayments remained the same across the two settings. Specifically, for both individual and group liability loans, we find that field officers collected repayment at the client's household every month 100 percent of the time. Additionally, 90 percent of the time under both regimes, the lender turned down future loan requests from defaulting clients.

For group liability borrowers, Saath does not require a group to designate one of its members as the "group leader." However, in practice, all groups have a leader who is in charge of collecting repayments from the other members. Hence, for individual borrowers, the field officers visit each borrower, whereas for group borrowers, the field officers typically visit only the group leader's household. If any member of a particular borrower group fails to make a scheduled payment, the field officer assembles all of the group members together and collects the installment amount from the other members, as stipulated in the group liability contract. Both individual liability borrowers and joint liability borrower groups in default are not granted future

loans. In addition, over the period that we study, there was no change in wages among the field officers, who continued to receive a fixed monthly sum.[5]

In summary, borrowing conditions changed in the following ways: (1) borrowers were obliged to enter joint liability lending groups rather than borrowing independently from Saath; (2) the loan officers collected repayment from the group leader rather than from each individual borrower; (3) monthly installments became fixed rather than varying; and (4) the interest rate increased from 18 percent to 24 percent. Given that multiple dimensions of the contract structure were changing, we discuss the implications of each of these changes on our analysis in Section IV.

III. Data Collection and Summary Statistics

In this study, we use data from Saath Microfinance's administrative software systems. The loan data cover outstanding loans every month from April 2005 through March 2009. Because the change in the type of loan contract occurred in November 2007, the data contain more than two years of monthly data on individual liability loans and more than one year on group liability loans. Data are available electronically from only 2 of the 4 Saath Microfinance branches, Behrampura and Vasna; we focus on these branches. These two branches are the largest and the oldest, accounting for the vast majority of Saath's clients.

The data were maintained for accounting purposes to record cash flowing in and out of each branch. The data are therefore of very high quality. The data do not, however, contain information on the terms of each loan, such as maturity dates, installment amounts, and amounts outstanding. These data were recorded by the loan officers in the client passbooks and administrative ledgers. As a result, we are unable to examine the overdue amounts, prepayments, and similar measures.[6]

The data on loans cover April 2005 to March 2009, but savings data were only available from January 2008 to March 2009. The savings data include the monthly aggregate deposit and withdrawal amounts for the compulsory savings accounts.

5. After March 2009, field officers received 1 percent of the loan interest they collect. Surveys of field officers indicate that they were not aware of this change in compensation structure before it occurred. Nevertheless, to isolate the focus of our study on contract structure, we exclude months after March 2009 in the analysis.

6. The loan data come from three software systems that Saath Microfinance has used at different points in time. Each of the two branches in our dataset used a separate system until early 2008, when the current system was introduced in both branches. Because client identifiers were not carried over from one software system to another, we had to rely on using client names to track individuals over time. These names were unique because they included first, middle, and last names. In identifying clients across systems, 80 percent of the clients had exact name matches, while 14 percent had to be matched by hand due to name spelling errors. The remaining 6 percent, however, could not be matched to the current software system. It is likely that these clients have withdrawn their membership with Saath Microfinance and therefore have not borrowed under the group liability setting because Saath migrated information from the previous to the current software system only for existing members.

As previously described, in our main analysis, we study borrowers who received both individual and group liability loans to overcome the selection problem. Hence, in our dataset, these clients begin with an individual liability loan and, after November 2007, receive a group liability loan. In Saath's Behrampura and Vasna locations, we identified a sample of 276 such clients, representing 22 percent of the loan client base in these two branches as of March 2009.

Table 1 provides the summary statistics for our sample. Collectively, these clients received a total of 748 loans from Saath, of which 450 were individual liability loans and 298 were group liability loans. The average individual liability loan amount was approximately INR 10,000 (USD 220), and the group liability loan average was approximately INR18,000 (USD 390). Figure 1 plots the number of group liability loans disbursed over time. As the figure shows, the borrowers in our sample, all of whom received individual liability loans, switched to group liability loans in varying months. Our empirical strategy takes advantage of this staggered timing to compare individual liability loan clients who received group liability loans to future recipients to identify the impact of group liability on loan repayment behavior and savings discipline.

IV. Empirical Strategy and Analysis

Empirical Strategy

To study the effect of contract structure on lending outcomes, we exploit the natural experiment provided by Saath's change in policy. The presence of an exogenous policy change is important. Without exogenous variation, it would be very difficult to determine whether differences in outcomes were attributable to contract structure or to any number of other unobservable characteristics of either the borrowers or the lending institutions. Indeed, theory predicts that different contracts are optimal for different types of borrowers.

To overcome the selection problem, we focus our attention on the Saath borrowers who received both individual and group liability loans. We exploit the

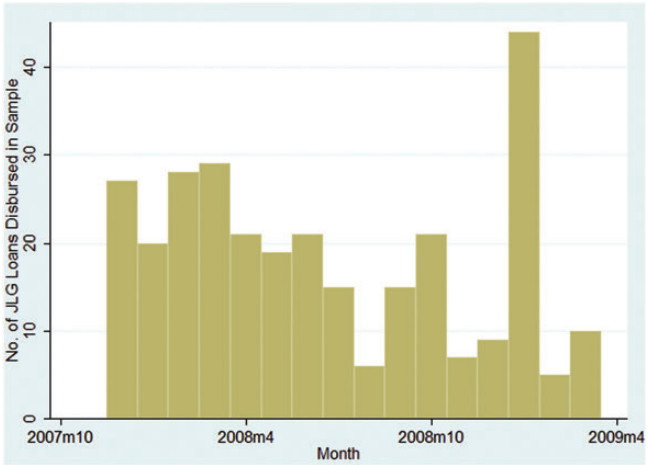
Table 1. Summary Statistics

			Individual Liability		Group Liability	
Branch	Total No. of Clients	Total No. of Loans	No. of Loans	Ave. Loan Amt (Rs.)	No. of Loans	Ave. Loan Amt (Rs.)
Behrampura	198	512	303	9981.1	209	19081.34
Vasna	78	236	147	9927.211	89	16764.04
Full Sample	276	748	450	9963.014	298	18389.26

Notes: This table reports the summary statistics for the borrowers in our sample. These borrowers received both individual liability and group liability loans.

Source: Authors' analysis based on data sources discussed in the text.

FIGURE 1. Group Liability Loans Disbursement in Sample



Notes: This figure plots the number of group liability loans disbursed over time in our sample. All of the borrowers were individual liability borrowers who subsequently received a group liability loan after the policy change.

Source: Authors' analysis based on the data sources discussed in the text.

natural phasing-in of group liability in what amounts to a repeated difference-in-difference framework. At any point in time, our "treatment" group thus consists of clients who have fully repaid their individual liability loan and who currently have a group liability loan, whereas our "control" group consists of individual liability loan clients who will eventually convert to a group liability loan. Specifically, we estimate the following equation:

$$y_{ilt} = \alpha + \beta T_{il} + \gamma_i + \delta_t + \varepsilon_{ilt} \tag{1}$$

where the subscript i refers to individuals, l refers to loans, and t refers to months. T is a dummy variable equal to 1 if loan l of client i is a group liability loan and 0 if it is an individual liability loan. y_{ilt} is a measure of loan repayment or savings discipline. The estimate of β then provides the effect of switching an individual who is already borrowing to the group liability loan. We include time effects δ_t because the conversion to group liability loans was staggered across individuals, and the individual fixed effects γ_i absorb the time-invariant characteristics of each borrower.

Limitations

In what follows, we note some features of our setting that may limit the generalizability of the empirical results.

Concurrent Changes in Loan and Savings Products. As discussed in Section II, the shift from individual to group liability lending contracts was

accompanied by other changes in the contract features. Specifically, in the group liability setting, the loan officers collected repayment from the group leader rather than from each individual borrower, monthly installments became fixed rather than varying, and the interest rate increased from 18 percent to 24 percent. Furthermore, simultaneous with the change to joint liability loan products, the savings rules shifted because Saath began requiring all of its members to maintain compulsory savings accounts.

In our view, an ideal experimental evaluation would include (1) requiring borrowers to enter joint liability lending groups rather than borrowing on their own and (2) loan officers collecting repayment from the group leader rather than from each individual borrower, leaving the installment sizes and the interest rate fixed. The group lending contracts offered by the majority of MFIs in India collect repayment either from one person (an assigned leader) or from every borrower in the group simultaneously. Hence, we believe that the change in the mode of payment is a feature of the group liability contract.

Although the interest rate change and the change in monthly installments are not typical, our regression coefficients, which estimate the impact of the contract change, are likely to be lower bounds. In theory, the increase in the interest rate could have several effects: a price effect might reduce demand, whereas a higher interest rate could increase the repayment burden and induce default. Most evidence suggests that microfinance borrowers are not very price elastic, so we are not overly concerned about the demand effects. The increase in the interest rate should bias us against a finding that joint liability lending reduces default. Furthermore, our empirical analysis only considers individuals who borrowed under both the individual and group liability regimes, thus accounting for any self-screening among clients based on the increase in interest rates between the two loan contracts.

The change in monthly repayment installments and the mode of payment also warrants further discussion. The repayment schedule for individual liability loans required fixed principal repayments along with interest. Hence, the nominal size of the monthly payments declined over the cycle of the loan. In contrast, the group liability repayment structure is based on a fixed monthly repayment throughout the term of the loan. Because our analysis focuses on the shift from individual to joint liability loans for the same person, for the same loan amount, we pick up the effect of a lower payment under individual liability (because the borrower is at the end of her loan cycle) versus a relatively higher fixed payment under joint liability. This shift should bias us against finding a reduction in default. This bias effect is likely even greater in our case because the average loan size and the corresponding repayment installment size are higher under joint liability.

The mode of payment also shifted under the individual and group liability settings. In the former, the field officer visited each individual liability borrower to collect repayment, whereas in the latter, the field officer only visited the group leader, who was in charge of collecting repayment from the other

members. Nevertheless, this change in the mode of payment is a feature of group lending because in the setting that we study, group liability is a lending contract that involves both joint repayment to a group leader and joint liability. Thus, the "group" features, such as repayment to a group leader, may lower default, whereas the higher interest rates may increase default, so the effect that we capture may well be a lower bound.

Saath's savings products also changed during our study period, as discussed in Section II. However, we note first that in our main analysis of loan repayment and savings discipline, we focus only on the individuals who converted to group liability loans, exploiting the timing of their switch. This focus allows us to control for any changes that occurred at the microfinance institution level under the two loan contract regimes. Thus, in the context of the MFI-wide change in savings requirements, we are comparing a shift from individual to joint liability for the same person (when we include individual fixed effects) who faces mandatory savings under both liability structures. Because our empirical strategy rests on the continuous, rolling changeover from individual to joint liability after the announcement, our sample consists of borrowers who are opening and maintaining mandatory savings accounts prior to shifting to a joint liability loan. Although the introduction of a mandatory savings account may have influenced the composition of borrowers, the internal validity of our results remains unaffected because our analysis considers only those individuals who chose to renew their loans with Saath.

Theoretically, the imposition of mandatory savings may have two opposing effects: (a) it may discourage borrowers from renewing their loans because the real cost of borrowing has increased through the imposition of a mandatory savings plan; or (b) it may encourage borrowers to renew their loans because individuals appreciate the saving discipline provided by compulsory accounts. This latter point is not trivial. Individuals may fail to save enough because they consistently put off saving for their future (Laibson, 1997), they may be tempted to spend on immediate consumption (Banerjee and Mullainathan, 2010), or they may face intra-household constraints (Ashraf et al., 2010). In a recent field experiment, Atkinson et al. (2010) find that prompting individuals to save at the time of loan repayment doubles the amount of savings.

The overall effect of mandatory savings on borrower selection is therefore ambiguous. Unfortunately, we lack any household-level data that would allow us to empirically differentiate these effects. In addition, we only have basic socioeconomic data from Saath records for the clients who eventually joined the joint liability groups. Nevertheless, we run a simple regression of renewal on the percentage payments missed and find a strong statistically significant negative coefficient. Clearly, there is screening based on past loan performance. However, we also find that this screening occurs even for previous individual-to-individual renewals and therefore cannot be considered an effect of either joint liability or mandatory savings.

External Validity. Our study sample consists of individual borrowers who have repaid their individual loans and choose to borrow under joint liability. We therefore estimate the effect of joint liability on improving repayment rates among those who choose to borrow under joint liability. Although restricting our analysis to this sample may compromise external validity, we believe that this sample is highly relevant; measuring the effect on those who decline to borrow under joint liability would have little relevance for the outside world. Of course, the sample is also selected based on individuals who chose to borrow in an individual liability setting. However, given that most theory suggests that joint liability leads to stricter screening and stricter monitoring, this additional screen may not be that restrictive.

The setting that we study may be anomalous in that the typical transition in the microfinance industry is presently the reverse, but we believe that careful study of the effects of shifts in liability in either direction is informative and valuable. Indeed, the recent collapse of Banco del Exito (BANEX), one of the largest microlenders in Nicaragua, highlights the importance of examining the relative merits of group liability and individual liability contracts. Furthermore, the main question that we ask—whether conditional on borrowing, liability rules impact repayment performance—has important policy and theoretical implications because we consider how joint liability lending may improve upon individual liability lending. It is difficult to imagine how any single study could capture both the compositional effects and the effect of contract structure on those who have borrowed in individual and joint liability settings.

By focusing on clients who borrowed under both individual and joint liability, our study further highlights the importance of examining the impact of lending contracts on financial inclusion. In the setting that we study, almost 80 percent of the borrowers who completed their individual liability loan and could have borrowed under joint liability did not do so. Although this high percentage indicates that it is possible for the shift in joint liability to have negative consequences on financial inclusion, we do not have data on why people chose to borrow or not to borrowwith Saath. Many new clients (who had not previously borrowed under individual liability) joined Saath after joint liability and may have chosen to stop borrowing for a number of reasons (e.g., no further project/investment needs, shifting business or employment status). Without further data, we cannot determine the impact of joint liability on financial inclusion.

Finally, although we find strong evidence that joint liability improves upon individual liability lending in terms of repayment behavior, we cannot be certain that the treatment effect is similar for other MFIs. The MFI that we study, Saath, has operations that are fairly typical of small MFIs around the world. However,we evaluate a particular joint liability lending program in which borrower groups have a group leader who collects repayment for the group as opposed to public repayment (e.g., at the village center), a collection

method that may bemore common among other MFIs. In this sense, the external validity of our findings may be limited.

Data Limitations. Because the data that are available were used primarily for accounting purposes, the dataset does not contain information on the terms of each loan, such as maturity dates, installment amounts, and outstanding loan amounts, all of which were recorded by loan officers in paper ledgers. Thus, our analysis is limited to observing whether a client made a loan repayment or a compulsory savings deposit for a particular month, and we are unable to consider outcomes on overdue loan amounts, prepayments, and other measures. Furthermore, aside from data on gender and the client's neighborhood, the data do not contain information on other demographic or household characteristics of the clients.

Because of data limitations, our ability to understand why borrowing amounts increase is limited. Under individual liability, borrowers were limited to loan amounts that were a fixed proportion of their savings and their guarantors' savings. These restrictions were removed under joint liability and replaced with a strict appraisal process for group members. Ideally, if we had deposit data under individual liability, we could determine whether these borrowing constraints were binding under individual liability. Unfortunately, Saath did not keep good historical records of these data; hence, it is not possible to statistically distinguish demand and supply effects on loan size.

Effect of Lending Structure on Loan Repayment

We now turn to the critical question of loan repayment. We note that the joint liability structure will, in theory, induce not only better screening but also greater monitoring efforts. Our empirical design does not distinguish between the two potential causes of improved repayment but rather estimates the combined causal effect.

Table 2 presents the OLS estimates of Equation 1, where the outcome of interest is a dummy variable for a missed payment. This dummy variable indicates whether the client failed to make a repayment for a particular month. Saath Microfinance clients are required to make monthly repayments until the principal balance is paid in full, beginning 30 days after disbursement. Hence, the dependent variable takes the value of 1 for a particular month if the total amount repaid by the borrower for that month is nil and 0 otherwise. We use this dummy variable as our first measure of monthly loan repayment discipline.

In our sample, almost 20 percent of the individual liability but only 0.1 percent of the group liability monthly loan repayments were not made. Our main results are presented in Table 2. Column (1) presents the regression results with no fixed effects, controlling only for which branch the borrower uses. Taken at face value, group lending reduces the probability of missing a payment by 17.5 percentage points. In columns (2)-(4), we add individual fixed effects, calendar month fixed effects, and both sets of fixed effects, respectively.

TABLE 2. Dependent Variable: Missed Payment Dummy

	(1)	(2)	(3)	(4)	(5)	(6)
Group Liability Loan Dummy	−0.175***	−0.163***	−0.152***	−0.112***	−0.159***	−0.081**
	(0.014)	(0.012)	(0.042)	(0.026)	(0.015)	(0.033)
Behrampura Branch	0.067***		0.072***		0.067***	
	(0.016)		(0.015)		(0.016)	
Number of Previous Loans					−0.008	0.045***
					(0.007)	(0.017)
Loan Age in Months					−0.028***	−0.014**
					(0.007)	(0.007)
Loan Age Squared					0.003***	0.002***
					(0.001)	(0.001)
Loan Age Cubed					−0.000***	−0.000***
					(0.000)	(0.000)
Constant	0.128***	0.091***	0.217**	0.181***	0.167***	0.272***
	(0.013)	(0.004)	(0.087)	(0.086)	(0.020)	(0.086)
Control for Calendar Month	No	No	Yes	Yes	No	Yes
Individual FEs	No	Yes	No	Yes	No	Yes
R-squared	0.082	0.229	0.098	0.246	0.095	0.253
N	6055	6055	6055	6055	6055	6055
Mean of Dep Var	0.105	0.105	0.105	0.105	0.105	0.105

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Notes: This table reports the results from the OLS regressions using panel data from April 2005 to March 2009, where the dependent variable is a dummy for missing a payment. This dummy takes the value of 1 for a particular month if the total amount repaid by the borrower for that month is nil and 0 otherwise. The observations are at the loan-month level. The sample includes the loans of clients who received both an individual and a group liability loan. The variable Group Liability Loan Dummy is a dummy variable equal to 1 if the loan is a group liability loan and 0 if it is an individual liability loan. Behrampura Branch is a dummy for one of the two MFI branches in the sample. Number of Previous Loans is the number of loans that the client received before the current loan. Loan Age in Months is the difference between the month of the observation and the month when the loan was disbursed, plus 1. Standard errors, clustered at the individual level, are given in parentheses beneath each point estimate.

Source: Authors' analysis based on data sources discussed in the text.

Finally, in columns (5) and (6), we add controls for the age of the loan: repayments may be higher early in the cycle, when borrowers are flush with cash, or later in the cycle, when borrowers seek to repay a loan to obtain a new one. The coefficient drops, although only coefficients (1) and (6) have 95 percent confidence intervals that (barely) do not overlap. Because only overdue loans last over 12 months, the loan age coefficients may "soak up" some of the treatment effect, particularly when individual and month fixed effects are present.[7]

Our preferred point estimate is column (4), which indicates that group lending reduces the probability of a missed payment by 11.2 percentage points. This effect is large and meaningful and may have significant implications for the profitability of a lender.

Internal Validity. We conduct a number of robustness tests. First, we report a direct "falsification" test of our analysis by using data from our clients' previous individual-to-individual loan renewals. Specifically, we focus on the clients in our sample who had at least two individual liability loans. The sample is reduced because many clients did not have multiple loans in the past. Among these clients, we study whether the borrowing experience with the microlender is related to loan repayment; in other words, does having a second loan lead borrowers to repay more reliably? Table 5 presents these results and shows no significant effect on missed payments.[8]

A second concern regarding the internal validity of our analysis is the fact that joint liability contracts are a completely new contractual arrangement. In particular, because the arrangement is new, clients may be in a "honeymoon" period.[9] During this period, clients may be on their best repayment behavior while they are learning the rules of the game. As they gain a betterunderstanding of the consequences of missing a payment, they may begin to behave more strategically. To test for this "honeymoon" effect, we compare the default rates of new clients (i.e., first-time Saath borrowers) under the individual and joint liability regimes over our sample period. Specifically, we find that first-time Saath borrowers make late payments 49 percent of the time in the individual liability setting and 2 percent of the time under joint liability. Because we are comparing clients who are borrowing for the first time in either setting, this result suggests that the "honeymoon" effect does not drive clients' repayment behavior.

7. A simple way to address the relationship between loan age and repayment status is to to restrict the sample to the first twelve months of repayment data: doing so with the same specifications as reported in Table 2 yields point estimates ranging from −.074 to −.153, statistically indistinguishable from each other, but all statistically different from 0 at the one percent level.

8. The specific date (November 2007) for the falsification test was not chosen arbitrarily (rather, it was precisely one year prior to the actual change in date), but we have conducted the analysis for all months at least one year before the policy change and find that our effect is dramatically larger than at any other date. Specifically, we re-ran our specification with each of the previous twelve months as our placebo date and found only two cases to be significant, but of much lower magnitude.

9. We thank an anonymous referee for raising this point.

A third concern is that a client's propensity to repay may be correlated with the time in the loan cycle. Specifically, clients may be more likely to make repayments toward the end of their last individual liability cycle to ensure their eligibility for a group liability loan in the future. We note that this situation would bias estimates against finding that group liability improves borrower performance. Nevertheless, we investigate this possibility using an event-time regression with the dependent variable for missed payment as previously described, where the event is the conversion from an individual liability loan to a group liability loan.

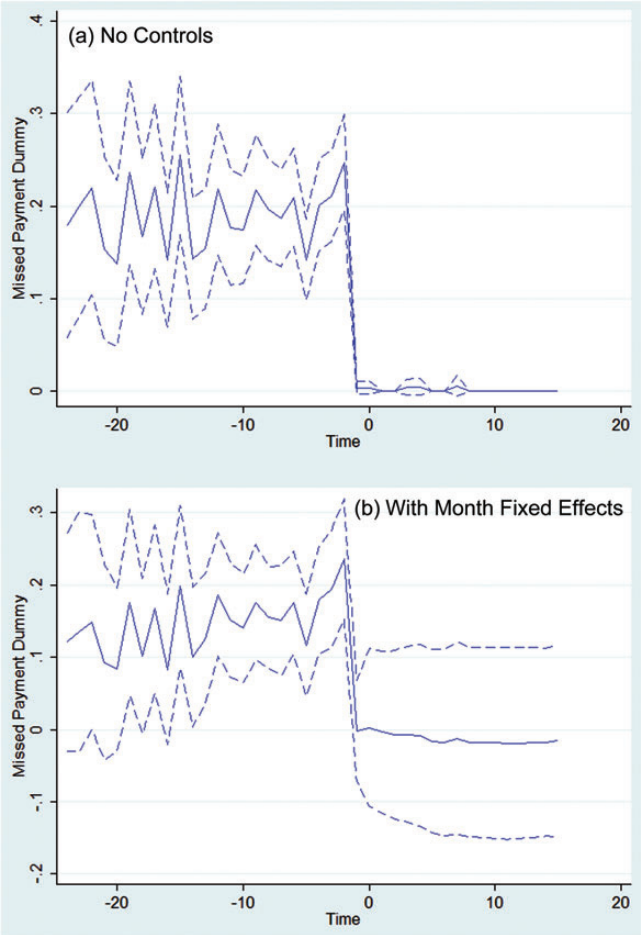
Figure 2 plots the coefficients for each event-time dummy. The first month of repayment in the group liability setting is $time = 0$, the final repayment month for the individual liability loan is $time = -1$, the second-to-last individual liability loan repayment month is $time = -2$, and so on. Thus, the figure describes loan repayment behavior under the individual liability contract before switching to group liability. Saath requires its borrowers to pay their current loan in full before they are given their next loan. Therefore, by definition, all clients in our sample made a repayment at $time = -1$. Examining the periods in which $time \leq 7 - 2$ reveals no pattern to support the idea that clients strategically repaid their individual liability loans so that they could borrow under the group liability setting.

Alternatively, clients may be more likely to make repayments early in the loan cycle because they may be flush with cash from a recent loan disbursal. We examine this possibility, again using an event-time regression, as shown in Figure 3. We estimate how repayment rates change around loan renewal times when a client pays off an individual liability loan and renews another individual liability loan (blue line) as well as cases in which a client pays off a group liability loan and renews a second group liability loan (red line). Note that the first month of repayment in the second loan cycle is $time = 0$, and the final repayment in the first loan cycle is $time = -1$. Similar to Figure 2, at $time = -1$, all of the clients made a repayment by definition, so the missed payment dummy must mechanically equal zero. Figure 4 shows that the prior missed payments are uncorrelated with the number of months since loan origination.

Our study sample consists of individual liability clients who chose to renew their borrowing under the group liability setting. These clients may be better at repayment than borrowers who did not want to enter into a group liability loan contract. However, our analysis focuses exclusively on those who renew and includes individual fixed effects. Hence, an interpretation of our results is that even "good" clients exhibited higher repayment discipline under the group liability setting in comparison with the individual liability setting. However, we acknowledge that by focusing only on those clients who borrowed under both types of contracts, we limit the external validity of our results.

The outcome that we have considered thus far, whether a client missed a loan installment for a particular month, is a rough measure because repayments may be partial. That is, a client may have repaid an amount greater than

FIGURE 2. Event Time Regression: Missed Payment on Event Time Dummies of Switching from Individual to Group Liability Loan

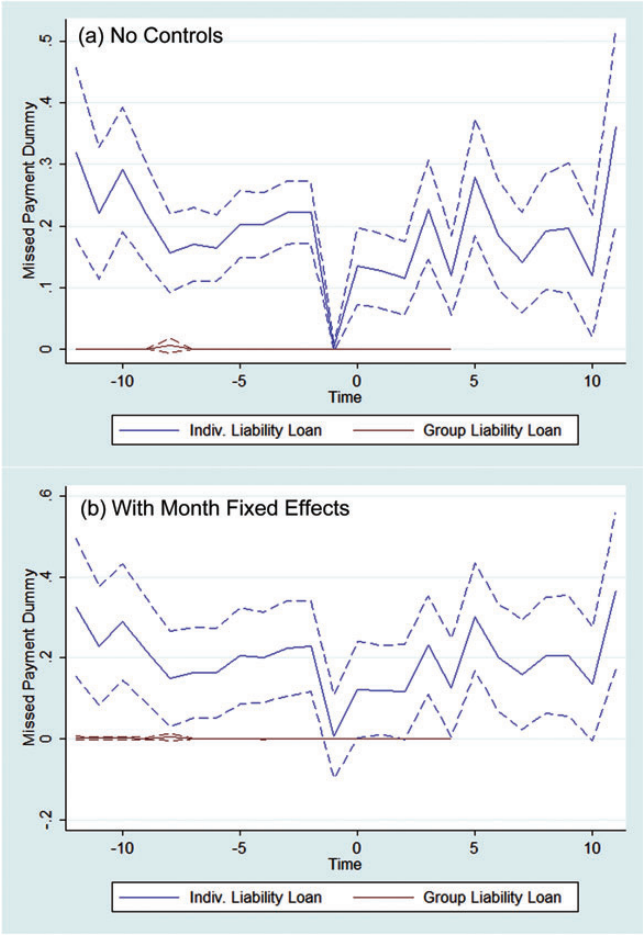


Notes: This figure plots coefficients for the event-time dummies where the event is the conversion from an individual liability to a group liability loan. The dependent variable is a dummy for missing a monthly repayment, which takes the value 1 for a particular month if the total amount repaid by the borrower for that month is nil and 0 otherwise. The first month of repayment in the group liability setting is $time = 0$; the final repayment month in the individual liability setting is $time = -1$. The dashed lines indicate the 95 percent confidence interval.

Source: Authors' analysis based on the data sources discussed in the text.

zero but less than the required installment amount. Thus, another measure of repayment discipline is the standard deviation of the principal amount repaid for individual liability loans and the total amount repaid for group liability loans. As described in Section 2, only the principal installment amount is fixed in the individual liability setting, whereas in group liability, the required total installment amount (principal plus interest) is equal every month. If the

FIGURE 3. Event Time Regression: Missed Payment on the Event Time Dummies for Switching from the First to the Second Loan Cycle

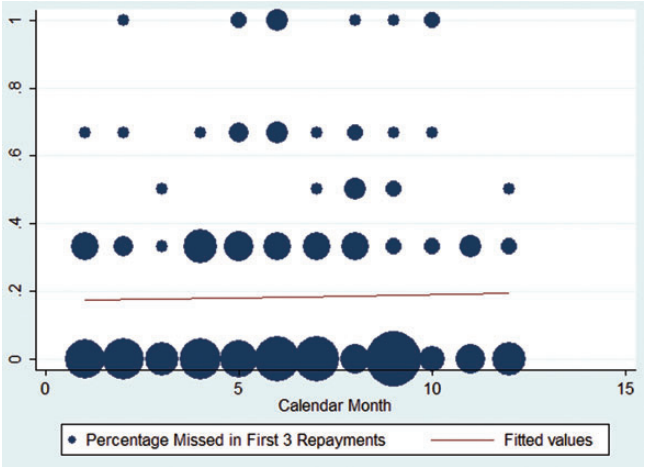


Notes: This figure plots the coefficients for the event-time dummies where the event is the shift from the client's first loan cycle to the second loan cycle for each of the individual and group liability loans. The dependent variable is a dummy for missing a monthly repayment, which takes the value 1 for a particular month if the total amount repaid by the borrower for that month is nil and 0 otherwise. The first month of repayment in the second loan cycle is $time = 0$, and the final repayment month in the first loan cycle is $time = -1$. The dashed lines indicate the 95 percent confidence interval.

Source: Authors' analysis based on the data sources discussed in the text.

required amount is repaid each month, then the standard deviation would be zero. However, if there are many months in which people pay less or more than the required amount, then the standard deviation would be higher. Table 6 provides OLS estimates in which the dependent variable is the standard deviation of repayment. Again, our estimates show that there is greater loan

FIGURE 4. Calendar Month of Loan Origination and Missed Payments



Notes: This figure plots the percentage of monthly repayments that were missed using the first three repayments from the loan disbursement of the client's most recent individual liability loan. The calendar month of loan origination refers to the calendar month when the loan was disbursed. The size of the bubbles represents frequencies. The red line represents the best-fit line. The sample includes clients who received both an individual and a group liability loan.

Source: Authors' analysis based on the data sources discussed in the text.

repayment discipline in the group liability setting relative to individual liability, although this effect is not statistically significant.

Finally, we note that the average loan size increased from 10,000 INR under individual liability to 18,000 INR under joint liability (see Table 1). This increase is large and warrants further discussion. In some ways, the increase can be thought of as an effect of the group lending model because Saath was willing to extend larger loans to borrowers on the strength of *social* collateral. Indeed, Saath management told us that they were willing to give larger loans precisely because of the joint liability framework.

However, one may reasonably wonder whether the increase in loan size itself affects repayment rates. For example, if borrowers invest in convex production technologies, higher credit limits could increase repayment. We test for this possibility in two ways. First, we split the sample into four quartiles based on the percentage increase in the credit limit from which a borrower benefited when she or he converted to joint liability lending. We do not observe any systematic variation in the treatment effect estimate along this dimension (results not reported). Second, because our dataset includes the reported purpose of each group liability loan, we can conduct separate analyses for loans taken for the purpose of consumption, productive activities, and asset creation. Again, we find no evidence that the treatment effect varies across these three categories (results not reported).

Discussion. Given these results, a natural question that arises is why group liability outperforms individual liability for clients who are already borrowing. Although the guarantors requirement in individual liability contracts provided incentives for guarantors to monitor loans and enforce repayment, in practice, these incentives were quite weak; the microlender rarely seized the savings of the guarantors of defaulting clients and did not strictly enforce that the guarantors maintain their savings account balance. The microlender collected repayment from the guarantors only if all other options (e.g., seizing the defaulting borrower's savings, revisiting the defaulting borrower, threatening to charge penalties, rescheduling the loan, and having the branch manager intervene) had been exhausted. In contrast, the group liability structure strengthens cooperation and trust among the group members, as indicated by the fact that almost all of the joint liability borrower groups designate a group leader, even though it is not required. It is possible that having a group leader increases incentives for monitoring and enforcing repayment. For example, having a group leader may create a person of authority who can enforce repayment or impose sanctions in the event of default.

We also note that the borrowing requirements for individual liability loans suggest that the effects that we find would likely be smaller in magnitude if these requirements were not in place. Because individual liability loan borrowers must have two guarantors and because Saath may use the guarantors' savings in the event of default, it is possible that these requirements encourage the screening of potential individual liability loan borrowers. We are not able to control for such effects.

Savings Discipline

We now turn our attention to the compulsory savings deposits required by Saath. As discussed in Section I, we might expect savings to be higher in the joint liability setting because participating in a borrower group may allow individuals to avoid financial demands from their families or to overcome self-control problems. Furthermore, compulsory savings are required to continue as a member in good standing with Saath; those who do not meet the compulsory savings requirements are not allowed to borrow until these requirements have been met. Thus, the same form of peer pressure that applies to loan repayment may apply to compulsory savings.

Although Saath initiated both a shift to group liability lending and compulsory deposits in November 2007, we can separately identify the effect of group liability on compulsory savings by exploiting the time-series variation in loan renewals. Specifically, although the compulsory savings were mandated across the board for all borrowers after November 2007, the shift from individual to group liability was staggered depending on when each individual loan term expired. As explained previously, these renewals were distributed relatively uniformly throughout the year, resulting in variations in loan contracts at a time when compulsory savings were uniform. Hence, we can study adherence to

compulsory savings for the same person who borrowed under an individual liability contract after November 2007 and who eventually converted to a group liability contract.[10]

Table 3 presents the OLS estimates in which our dependent variable is a dummy for missing a compulsory savings deposit. The dependent variable takes the value of 1 if the client deposited less then INR 100 and 0 otherwise. The point estimate in column (4), which includes month and individual fixed effects, indicates that the same borrower is 20.5 percentage points less likely to miss a compulsory deposit in a group lending arrangement than when borrowing individually.

This finding suggests that one possible mechanism through which group liability reduces loan delinquency may be increased savings; a greater savings balance may provide a buffer for borrowers hit with liquidity shocks.

Heterogeneous Effects

We test for heterogeneous effects along two dimensions. As before, our dependent variable is a dummy for whether a client missed a loan repayment for a particular month. Columns (1)-(3) indicate a significantly larger impact of group liability in reducing missed payments among men, although the effect for women remains negative and significant. It is important to note, however, that the control group means for females are also significantly lower, with missed payment rates at 16 percent for females and 23 percent for males.[11] The results suggest that group liability effectively neutralizes this gender differential in missed payments.

In columns (4)-(6), we examine whether group lending improves repayment behavior more for clients who initially exhibited poor repayment discipline under individual liability. We define 'borrower quality' as the percentage of missed payments in the client's first individual liability loan in the data, and we divide the sample in two along this measure. Note that because our definition of borrower quality makes use of a client's repayment behavior in her first individual loan, the regression columns (4)-(6) are restricted to the subsample of clients who had at least two individual loans and include repayment data only from the client's second individual loan onwards.

In terms of past missed payments, we find that group liability has a larger impact on borrowers who, at the outset, were of poor quality. Clients who missed 10 percent of their first individual loan monthly payments were 2.4 percent less likely to miss repayments under the group liability regime. Hence, similar to the gender results, the introduction of group liability is effective in reducing missed payments among those with inconsistent payment records.

10. because we only have savings data from January 2008 onwards, we cannot study the effect of compulsory savings under the individual liability setting, as we have no pre-period data (i.e. savings data pre-November 2007).

11. A difference in means test is significant at the 1 percent level.

TABLE 3. Dependent Variable: Missed Compulsory Deposit

	(1)	(2)	(3)	(4)	(5)	(6)
Group Liability Loan Dummy	−0.234***	−0.338***	−0.074*	−0.205**	−0.230***	−0.198***
	(0.035)	(0.032)	(0.041)	(0.045)	(0.038)	(0.069)
Behrampura Branch	0.003		−0.008		−0.000	
	(0.036)		(0.034)		(0.035)	
Number of Previous Loans					−0.001	0.124
					(0.017)	(0.098)
Loan Age in Months					−0.040**	0.050***
					(0.019)	(0.019)
Loan Age Squared					0.004	−0.006**
					(0.003)	(0.003)
Loan Age Cubed					−0.000	0.000**
					(0.000)	(0.000)
Constant	0.389***	0.698***	0.607***	0.807***	0.461***	0.623***
	(0.039)	(0.027)	(0.045)	(0.040)	(0.049)	(0.123)
Control for Calendar Month	No	No	Yes	Yes	No	Yes
Individual FEs	No	Yes	No	Yes	No	Yes
R-squared	0.054	0.489	0.103	0.511	0.059	0.514
N	2929	2929	2929	2929	2929	2929
Mean of Dep Var	0.205	0.205	0.205	0.205	0.205	0.205

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

Notes: This table reports the results from the OLS regressions with panel data from January 2008 to March 2009, where the dependent variable is a dummy for missing a compulsory deposit. This dummy takes the value of 1 for a particular month if the client deposited less than the required amount of Rs. 100 and 0 otherwise. The observations are at the individual-month level. The sample includes clients who received both an individual and a group liability loan. The variable Group Liability Loan Dummy is a dummy variable equal to 1 if the client had a group liability loan and 0 if it is an individual liability loan. Behrampura Branch is a dummy for one of the two MFI branches in the sample. Number of Previous Loans is the number of loans that the client received before the current loan. Loan Age in Months is the difference between the month of the observation and the month when the loan was disbursed, plus 1. Standard errors, clustered at the individual level, are given in parentheses beneath each point estimate.

Source: Authors' analysis based on data sources discussed in the text.

TABLE 4. Heterogeneous Effects by Gender and Borrower Quality

	(1)	(2)	(3)	(4)	(5)	(6)
Group Liability Loan Dummy	−0.224***	−0.212***	−0.132***	−0.137***	−0.122***	−0.075
	(0.034)	(0.032)	(0.042)	(0.028)	(0.025)	(0.048)
Female	−0.041					
	(0.039)					
Group Liability Loan*	0.063*	0.065*	0.070**			
Female	(0.037)	(0.035)	(0.032)			
Borrower Quality				0.223**		
				(0.111)		
Group Liability Loan*				−0.234*	−0.240*	−0.248**
Borrower Quality				(0.119)	(0.123)	(0.121)
Behrampura Branch	0.061***			0.079***		
	(0.017)			(0.024)		
Number of Previous Loans			0.045***			0.025
			(0.017)			(0.023)
Loan Age in Months			−0.014*			0.012
			(0.007)			(0.008)
Loan Age Squared			0.002***			−0.001
			(0.001)			(0.001)
Loan Age Cubed			−0.000***			0.000
			(0.000)			(0.000)
Constant	0.165***	0.108***	0.296***	0.088***	0.075***	0.147
	(0.038)	(0.011)	(0.087)	(0.022)	(0.010)	(0.144)
Individual FEs	No	Yes	Yes	No	Yes	Yes
Month FEs	No	No	Yes	No	No	Yes
R-squared	0.084	0.231	0.255	0.095	0.239	0.268
N	6055	6055	6055	2579	2579	2579

(Continued)

TABLE 4. Continued

	(1)	(2)	(3)	(4)	(5)	(6)
Mean of Dep Var in Control (Males)	0.226	0.226	0.226			
Mean of Dep Var in Control (Females)	0.157	0.157	0.157			

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Notes: This table reports the results from the OLS regressions where the dependent variable is a dummy for missing a payment. This dummy takes the value of 1 for a particular month if the total amount repaid by the borrower for that month is nil and 0 otherwise. The regressions in columns 1 to 3 provide the heterogeneous effects by gender and include the full sample of clients. The regressions in columns 4 to 6 provide the heterogeneous effects by borrower quality, defined by the percentage of missed payments in the client's first individual liability loan in the data. The regressions in columns 4 to 6 include only the subsample of clients who had at least two individual liability loans and only loans from the 2nd loan onwards. All of the observations are at the loan-month level. The variable Group Liability Loan Dummy is a dummy variable equal to 1 if the loan is a group liability loan and 0 if it is an individual liability loan. Borrower Quality is the percentage of missed payments in the client's first individual liability loan in the data. Behrampura Branch is a dummy for one of the two MFI branches in the sample. Number of Previous Loans is the number of loans that the client received before the current loan. Loan Age in Months is the difference between the month of the observation and the month when the loan was disbursed, plus 1. Standard errors, clustered at the individual level, are given in parentheses beneath each point estimate.

Source: Authors' analysis based on data sources discussed in the text.

TABLE 5. Falsification Test

	(1)	(2)	(3)	(4)	(5)	(6)
False Treatment	−0.004	−0.011	0.049	0.002	0.021	0.058
	(0.023)	(0.026)	(0.041)	(0.025)	(0.025)	(0.050)
Behrampura Branch	0.076***		0.089***		0.066***	
	(0.027)		(0.027)		(0.029)	
Number of Previous Loans					−0.028**	0.046
					(0.014)	(0.035)
Loan Age in Months					−0.025	−0.014
					(0.019)	(0.022)
Loan Age Squared					0.003	0.004
					(0.003)	(0.003)
Loan Age Cubed					−0.000	−0.000
					(0.000)	(0.000)
Constant	0.095***	0.058***	0.222	0.139***	0.158***	0.319**
	(0.025)	(0.013)	(0.142)	(0.020)	(0.043)	(0.129)
Control for Calendar Month	No	No	Yes	No	No	Yes
Individual FEs	No	Yes	No	No	No	Yes
R-squared	0.011	0.140	0.042	0.000	0.016	0.175
N	1584	1584	1584	1584	1584	1584
Mean of Dep Var	0.140	0.140	0.140	0.140	0.140	0.140

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Notes: This table reports the results from a falsification test, where the dependent variable is a dummy for missed payment. This dummy variable takes on the value of 1 for a particular month if the total amount repaid by the borrower for that month is nil and 0 otherwise. The regressions correspond with those in Table 2. The sample contains the observations of the individual liability loans among clients who received both an individual and a group liability loan and who obtained at least 2 individual liability loans, the most recent of which was disbursed after November 2006. Observations are at the loan-month level. False Treatment is a dummy variable equal to 1 if the loan was disbursed after November 2006 and 0 otherwise. Behrampura Branch is a dummy for one of the MFI branches in the sample. Number of Previous Loans is the number of loans that the client received before the current loan. Loan Age in Months is the difference between the month of the observation and the month when the loan was disbursed, plus 1. Standard errors, clustered at the individual level, are given in parentheses beneath each point estimate.

Source: Authors' analysis based on data sources discussed in the text.

TABLE 6. Dependent Variable: Standard Deviation of Repayment

	(1)	(2)	(3)
Group Liability Loan Dummy	−288.666	−306.367*	−220.794
	(185.204)	(185.391)	(251.901)
Behrampura Branch		839.101***	
		(149.442)	
Constant	1352.427***	798.894***	281.277***
	(100.308)	(120.412)	(83.967)
Individual FEs	No	No	Yes
R-squared	0.005	0.041	0.472
N	689	689	689
Mean of Dep Var	1243.496	1243.496	1243.496

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Notes: This table reports results from the OLS regressions using cross-sectional data, where the dependent variable is the standard deviation of monthly repayment. If the required amount is repaid every month, then the standard deviation would be zero. If there are many months where people pay less or more than the required amount, then the standard deviation would be higher. The observations are at the loan level. The sample includes the loans of clients who received both an individual and a group liability loan. The variable Group Liability Loan Dummy is a dummy variable equal to 1 if the loan is a group liability loan and 0 if it is an individual liability loan. Behrampura Branch is a dummy for one of the two MFI branches in the sample. Standard errors, clustered at the individual level, are given in parentheses beneath each point estimate.

Source: Authors' analysis based on data sources discussed in the text.

V. DISCUSSION AND CONCLUSION

Microfinance has reached over 150 million borrowers worldwide and is growing at a cumulative 40 percent average growth rate. Recent initial public offerings (IPOs), which valued the Mexican microfinance institution Compartamos at $2 billion and SKS in India at $1.5 billion, have attracted the attention of the global financial markets. However, there have also been spectacular failures, such as the collapse of Banco del Exito (BANEX), which was recently the largest micro, small, and medium enterprise lender in Nicaragua, with a $125 million dollar loan portfolio. Suffering from a 45 percent delinquency rate, BANEX was ordered into liquidation.[12]

As many microlenders around the world weaken their group liability approach and shift toward individual lending, understanding the role of group liability in enhancing performance has become critical in microfinance programs. However, the empirical literature provides little guidance for policy makers and microfinance practitioners because few empirical studies have compared group liability contracts with other lending strategies.

In this paper, we exploit an exogenous change in the liability structure in an Indian microfinance program, in which the program shifted from an individual liability structure to a group liability structure. We find evidence that for the

12. See: http://financialaccess.org/node/3547

same borrower, the shift to group liability reduces default rates and improves savings discipline. Under the group liability setting, the required monthly loan installments are 11 percent less likely to be missed, and compulsory savings deposits are approximately 20 percent less likely to be missed relative to individual liability. Thus, our findings indicate that group lending outperforms individual lending in loan repayment and savings discipline.

We see our study as an important piece of evidence rather than a definitive answer to the question of the optimal lending structure for microfinance. The microlender that we study, Saath, has operations that are fairly typical of MFIs that lend in urban areas. Moreover, the management, infrastructure, and stated goals of Saath are not markedly different from other lenders throughout India or in other low-income settings. Saath's most remarkable characteristic is probably its small size; the microfinance industry includes an important right tail of very large lenders. However, small institutions such as Saath (an NGO with $410,000 dollars in its total loan portfolio as of 2009) make up a non-trivial portion of the industry.

Second, as with any natural experiment, we caution that there are limitations to our study. Our sample consists of only those who elected to continue from the individual to the group lending model and thus may not be representative of the entire population that would be effected by changes in lending models. We are unable to clearly identify the mechanisms through which group lending improves repayment, and our data are not sufficient to allow us to precisely calculate the effect of the lending structure change on lender profitability. An ideal experiment to answer these questions might have randomly assigned individuals to a range of different lending models, such as group lending with self-selected group members, group lending with randomly assigned group members, and group lending without group liability.

Nevertheless, it may be useful to discuss our view of the mechanisms at work based on our reading of the evidence and on numerous conversations with Saath clients, staff, and management. We believe that peer pressure is important. The Saath operations manual states, "The concept of peer pressure must be executed properly in favor of the organization and concept of micro finance," arguing that the group leader should take responsibility for ensuring that the members repay and stressing the importance of joint liability. In the case of repeated missed payments, the manual instructs staff to ensure that "the members take the responsibility of closing the loan amount of" a delinquent borrower. We also interviewed 10 Saath field officers regarding their views of changes to the loan collection process with group lending. All ten field officers mentioned that collection under joint liability was easier because clients were more disciplined about paying on time, and several others mentioned the importance of "collective responsibility" within the group. These qualitative reports are consistent with a recent paper on microfinance in Andhra Pradesh, which finds that peer pressure is an important determinant of loan repayment (see Breza (2012)).

Taken as a whole, we believe that our results provide a cautionary tale for policy-makers and microfinance institutions that are eager to convert from group to individual lending models. Although most microfinance organizations around the world have reported repayment rates that are impressively high, the industry has also witnessed both idiosyncratic failure and widespread collapse, such as the recent crisis in Andhra Pradesh. Our results highlight the importance of the group lending structure in facilitating the sustainable provision of credit to the poor. Our findings suggest a need for further research to identify the precise mechanisms of how joint liability affects borrower behavior, the role of savings as a mechanism for improving repayment, and the relative merits of peer screening versus peer monitoring under group liability contracts. Finally, it would be useful to understand whether the group lending structure itself could be improved upon, perhaps by introducing formal group or subgroup level repayment incentives or insurance mechanisms.

References

Ahlin, C., and R. M. Townsend. 2007. "Using Repayment Data to Test Across Models of Joint Liability Lending." *The Economic Journal* 117 (517): F11–F51.

Ambec, S., and N. Treich. 2007. "Roscas as Financial Agreements to Cope with Self-Control Problems." *Journal of Development Economics* 82 (1): 120–37.

Armendáriz de Aghion, B. 1999. "On the Design of a Credit Agreement with Peer Monitoring." *Journal of Development Economics* 60 (1): 79–104.

Armendáriz de Aghion, B., and J. Morduch. 2010. *The Economics of Microfinance*. Cambridge, MA: MIT Press.

Ashraf, N., D. Karlan, and W. Yin. 2010. "Female Empowerment: Further Evidence from a Commitment Savings Product in the Philippines." *World Development* 38 (3): 333–44.

Atkinson, J., A. de Janvry, C. McIntosh, and E. Sadoulet. 2010. "Prompting Microfinance Borrowers to Save: A Field Experiment from Guatemala." *Economic Development and Cultural Change* (forthcoming).

Attanasio, O., B. Augsburg, R. D. Haas, E. Fitzimons, and H. Harmgart. 2011. "Group Lending or Individual Lending? Evidence from a Randomized Field Experiment in Mongolia." Working Paper W11/20. Institute for Financial Studies, London, UK.

Banerjee, A., T. Besley, and T. Guinnane. 1994. "Thy Neighbor's Keeper: The Design of a Credit Cooperative with Theory and a Test." *Quarterly Journal of Economics* 109 (2): 491–515.

Banerjee, A., E. Duflo, R. Glennerster, and C. Kinnan. 2009. "The Miracle of Microfinance? Evidence from a Randomized Evaluation." Working Paper. Massachusetts Institute of Technology, Department of Economics, Cambridge, MA.

Banerjee, A., and S. Mullainathan. 2010. The Shape of Temptation: Implications for the Economic Lives of the Poor. Working Paper. Massachusetts Institute of Technology, Department of Economics, Cambridge, MA.

Banerjee, A. V., and A. F. Newman. 1993. "Occupational Choice and the Process of Development." *Journal of Political Economy* 101 (2): 274–98.

Beck, T., A. Demirgüç-Kunt, and V. Maksimovic. 2005. "Financial and Legal Constraints to Growth: Does Firm Size Matter?" *The Journal of Finance* 60 (1): 137–77.

Beck, T., A. Demirgüç-Kunt, and M. S. Martinez-Peria. 2007. "Reaching Out: Access to and Use of Banking Services across Countries." *Journal of Financial Economics* 85 (1): 234–66.

Besley, T., and S. Coate. 1995. "Group Lending, Repayment Incentives and Social Collateral." *Journal of Development Economics* 46 (1): 1–18.

Bouman, F. J. A. 1995. "Rotating and Accumulating Savings and Credit Associations: A Development Perspective." *World Development* 23: 371–84.

Breza, E. 2012. "Peer Effects and Loan Repayment: Evidence from the Krishna Default Crisis." Working Paper. Massachusetts Institute of Technology, Department of Economics, Cambridge, MA.

Cetorelli, N., and M. Gambera. 2001. "Banking Market Structure, Financial Dependence and Growth: International Evidence from Industry Data." *The Journal of Finance* 56 (2): 617–48.

Chen, G., S. Rasmussen, and X. Reille. 2010. "Growth and Vulnerabilities in Microfinance." CGAP Focus Note No. 61.

Daley-Harris, S. 2009. *State of the Microcredit Summit Campaign Report 2009*. Washington, DC: Microcredit Summit Campaign.

Feigenberg, B., E. Field, and R. Pande. 2010. "Building Social Capital through Microfinance." Working Paper 16018. National Bureau of Economic Research, Cambridge, MA.

Fischer, G. 2010. "Contract Structure, Risk Sharing and Investment Choice." Working Paper EOPP/2011/23. London School of Economics, London, UK.

Ghatak, M. 2000. "Screening by the Company You Keep: Joint Liability Lending and the Peer Selection Effect." *Economic Journal* 110 (465): 601–31.

Giné, X., and D. Karlan. 2009. "Group versus Individual Liability: Long Term Evidence from Philippines Microcredit Lending Groups." Policy Research Working Paper 4008. World Bank, Policy Research Department, Washington, DC.

Gugerty, M. K. 2007. "You Can't Save Alone: Commitment in Rotating Savings and Credit Associations in Kenya." *Economic Development and Cultural Change* 55 (2): 251–82.

Laibson, D., 1997. "Golden Eggs and Hyperbolic Discounting." *Quarterly Journal of Economics* 112, 443–477.

Morduch, J. 1999. "The Microfinance Promise." *Journal of Economic Literature* XXXVII (4): 1569–1614.

Rajan, R., and L. Zingales. 1998. "Financial Dependence and Growth." *American Economic Review* 88 (3): 559–86.

Sharma, M., and M. Zeller. 1997. "Repayment Performance in Group-Based Credit Programs in Bangladesh: An Empirical Analysis." *World Development* 25 (10): 1731–42.

Stiglitz, J. E. 1990. "Peer Monitoring and Credit Markets." *World Bank Economic Review* 4 (3): 351–66.

World Bank. 2008. *Finance for All? Policies and Pitfalls in Expanding Access*. Washington, DC: World Bank.

SYMPOSIUM ON FINANCIAL STRUCTURE AND DEVELOPMENT

Financial Structure and Economic Development: A Reassessment♣

Robert Cull, Asli Demirgüç-Kunt, and Justin Yifu Lin

While the literature on the effects of financial development is large, relatively few studies have examined whether and how financial structure—the mix of financial institutions and the services that they offer—matters for economic growth and inequality. Moreover, the literature has been largely silent about whether the relationships between financial structure and firm outcomes (performance and access to finance) change as a country develops. The group of papers published in this special section helps to fill those gaps in the literature. The four that appear here were part of a larger conference on "Financial Structure and Economic Development" that took place at the World Bank on June 16, 2011. Further information on the issue of financial structure in development can be found in other papers presented at the conference and available in World Bank Working Papers (Lin, Sun, and Jiang, 2009; Beck, Demirgüç-Kunt, and Singer, 2011; Kpodar and Singh, 2011).[1]

The first of the papers in this issue by Asli Demirgüç-Kunt, Erik Feyen, and Ross Levine, uses quantile regressions to assess the relationship between economic and financial development at each percentile of the distribution of economic development. Thus, the quantile regressions provide information on how the associations between economic development and both bank and securities market development change as countries grow richer.

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1. Lin, Sun, and Jiang study these issues through the lens of economic theory. Beck, Demirgüç-Kunt, and Singer offer new data and analysis that pushes beyond measures of financial structure based only on banks and stock markets to include credit unions, building societies, community banks, microfinance institutions, finance companies, and factoring companies. Kpodar and Singh examine the effects of financial structure on poverty and inequality.

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The main results are that as economies develop (1) both banks and markets become larger relative to the size of the overall economy; (2) the association between an increase in bank development and an increase in economic output becomes smaller; and (3) the association between an increase in securities market development and an increase in economic output becomes larger.

The quantile regressions suggest that financial structure changes—becoming more market-oriented—as economies develop. This is consistent with theoretical arguments that economic development increases the demand for the services provided by securities markets relative to services provided by banks (Allen and Gale, 2000; Boyd and Smith, 1998). Hence these findings support theoretical predictions that suggest securities markets become more important for economic activity and that banks become less important as countries develop economically. This finding is also of significant policy relevance. If the mixture of banks and markets should change as indicated as economies develop, then policy and institutional impediments to the evolution of the financial system can have significant costs for economic development.

In the next paper, Fenghua Song and Anjan Thakor provide a theoretical analysis to explain how banks and capital markets compete with each other to attract borrowers, but also complement each other and co-evolve over time. In their model, banks are superior to markets in credit analysis because they can more accurately certify borrowers that are worthy of credit. In contrast, capital markets hold the advantage in aggregating information. By providing a trading venue, informed investors' private information about project payoff enhancement opportunities is impounded into security prices, thereby reducing the probability that valuable investment opportunities are passed up. Banks and markets compete with each other to attract borrowers based on their relative advantages.

Their model also incorporates two novel features absent from other theories of financial system architecture: securitization and risk-based bank capital. Securitization creates a natural symbiosis by involving the bank in the origination and screening of loans and capital markets in the provision of financing. This, in turn, creates a positive feedback loop from bank development to market development. In addition, improvements in banks' screening that derive from banking sector evolution increase the confidence that capital market investors have in the quality of securitized borrowers, which stimulates greater informed trading in the capital market and thus capital market evolution.

Capital market evolution also affects bank lending through its effects on bank capital. As informed trading through markets increases, the costs of equity capital declines for firms, including banks. By raising additional capital at reduced cost, banks can extend more credit, lending to riskier borrowers who were previously excluded from credit markets. Expansion into riskier market segments provides an incentive for banks to improve the precision of their screening efforts. Thus, capital markets improvements spur banking sector development through bank capital. The analysis can therefore account not only for competition and complementarity between bank and market financing, but also their co-evolution.

Their theoretical framework can also account for political intervention in financial sector development where the political goal is to expand credit availability. By giving politicians a choice in how to intervene in the financial system, the authors endogenize the manner of political intervention at different stages of financial development. There are two methods of intervention: equity capital subsidies in exchange for government ownership of banks (as we see in many emerging economies), and direct-lending regulations that force banks to increase their lending to low-quality borrowers that banks would not extend credit to in the absence of regulation. By contrast, regulations do not subsidize banks, and in fact impose a cost on them.

In the early stages of development, capital is very expensive due to less developed financial markets. Banks therefore find the capital subsidy attractive, and are willing to increase size by lending to low-quality borrowers in order to obtain it. Direct-lending regulations do not work well because banks are making low profits in the early development stage, so they will not incur losses by lending to more borrowers (of lower quality) without some form of compensation. At the intermediate development stage, capital becomes sufficiently cheap that the capital subsidy no longer works well as an inducement to expand lending to lower-quality borrowers. At the same time, directed-lending regulations also do not work well, because bank profits are still not sufficiently high. Thus, there is no political intervention to promote expanded credit availability.

At the advanced stage of financial development, capital becomes even cheaper, so capital subsidies continue to not to be effective in inducing banks to expand lending. What is left is for politicians to directly push/force the banks to expand lending to low-quality borrowers, which imposes costs on the banks. Regulation becomes more effective in the advanced stage because banks are making enough profits to cover these additional costs. Banks will obey the regulations, because failing to do so would result in revocation of the banking license and the loss of large future profit streams. In summary, the model predicts a U-shaped pattern of political intervention: It is highest in the early and advanced stages of financial development, though in different forms, but lowest in the intermediate stage.

The main reason for this stage-dependent intervention is that the value of capital subsidies depends on the cost of equity capital for banks, which in turn depends on the level of development of the capital market. While direct empirical tests of these hypotheses are not pursued, the paper provides insights as to how the incentives of financial services providers, borrowers, and politicians shape the structure of the financial sector, and how that changes over time.

In the third paper, Augusto de la Torre, Erik Feyen, and Alain Ize use a battery of sixteen indicators of the size, depth, and efficiency of financial sectors to describe the path of development across countries over the past 35 years, and to benchmark that development using regressions that control for each country's stage of economic development and other arguably exogenous factors (such as population size and density). The authors then view these

paths of financial development through the lens of the frictions that hindered financial contracting. They define two broad categories of frictions. The first set restricts agents' capacity to establish and enforce bilateral contracts (so-called agency frictions), while the second impedes agents' capacity to participate and coordinate their financial activities in collectively desirable ways (collective frictions). The authors go on to argue that the arc of financial development reflects countries' efforts to find the path of least resistance around those frictions.

Data on financial structure support the notion that the sequencing of financial services broadly conformed with what one would expect based on the gradual grinding down of the frictions along the paths of least resistance. For example, agency frictions associated with the costs of information and contract enforcement meant that bank deposits preceded bank credit, credit to governments developed before credit to private actors, and the full development of credit markets lagged that for bank credit. With regard to collective action frictions and network effects, the cross-country patterns show that external funding of the government preceded domestic funding, and wholesale (non-deposit) funding lagged retail deposit funding, but often took off rapidly once minimum thresholds had been reached. Finally, the development of capital markets showed large returns to scale reflecting network effects, and interconnectedness within the financial system and globalization exploded as financial systems matured.

Countries often deviated from their development paths as predicted by the benchmark regressions and, though the regressions summarize strong central tendencies, lower income countries generally have not retraced the past steps taken by high income countries. The authors therefore speculate that across-the-board innovations (that lifted all countries, regardless of their stage of development) and path dependencies reflecting dynamic interactions between financial and economic development both have factored in the financial development experiences of individual countries.

The paper concludes with an empirical analysis of factors that could potentially account for some countries' large deviations from benchmark development paths. They show that deviations were linked to policy-related variables that affected the enabling environment for financial contracting such as enforcement costs, creditor and property rights, and the quality of credit information, though contractual rather than informational frictions explain a larger share of the policy-induced development differences across countries. The authors also point out that contractual frictions are likely to be more difficult to resolve because they tend to require reform of local institutions, whereas many informational frictions could conceivably be eased through technological innovations. Not surprisingly, deviations from benchmark development paths were also strongly linked to financial crashes. And the associated lags in financial development were long-lived and evident across a large number of indicators. However, because the empirical analysis is based on cross-country regressions, it does not lend itself to identifying the best policies to avert financial crashes.

In the final paper of the collection, Robert Cull and Colin Xu use firm-level data from 89 countries to test whether financial structure affects labor growth rates. One of the predictions of New Structural Economics is that, because labor is more abundant than capital in poor countries, labor-intensive industries should characterize the early stages of development. Businesses in labor-intensive industries tend to start out small, and small, local banks are likely to be better positioned than large banks and stock markets to collect the soft information and undertake the sustained monitoring that enables financial institutions to lend to small businesses.[2] The authors find that labor growth is in fact swifter in low-income countries that have a higher level of private credit/GDP, consistent with the predictions from new structural economics. There is also evidence from a variety of instrumental variables regressions that the relationship is causal. In high-income countries, labor growth rates are increasing in the level of stock market capitalization, also consistent with predictions from new structural economics, though the authors are unable to provide evidence that the association is causal. The authors find no evidence that small-scale firms in low-income countries benefit most from private credit market development. Rather, the labor growth rates of large firms increase more with the level of private credit market development, a finding consistent with the history-based political economy view that banking systems in low-income countries serve the interests of the elite, rather than providing broad-based access to financial services (see Calomiris and Haber, 2011).

A limitation of the study is that the measure of banking sector development, private credit/GDP, does not provide information on the size distribution of banks, making it impossible to test fully all of the predictions from new structural economics regarding the suitability of financial structures at different stages of development. Still, the results do suggest that larger firms are capturing a disproportionately large share of the credit in poor countries with relatively well-developed banks.

Though the methods vary, all four papers in this special section provide evidence or arguments that financial structure should vary with the stage of economic development, a point which has been under-emphasized in the literature to date. Implicit or explicit in those analyses is the notion that bank-based structures are likely to be better at promoting growth during the early stages of development, and that they gradually give way to capital markets as economies develop. Another theme from these papers that has been underplayed in the literature is the dynamic interplay between banks and capital markets that leads to their co-evolution. While the papers are successful in describing the development of financial systems from both theoretical and empirical perspectives, more research is needed to identify the triggers and catalysts that ignite the interplay between banks and markets. The paper by de la Torre, Feyen and Ize provides important clues about the types of financial market frictions have

2. See Lin, Sun, and Wu (2012) for a more detailed development of these themes.

been easiest to resolve at different stages of economic development and Song and Thakor offer a theory that shows how political interventions shape financial structure at different development stages. But these are only a beginning. Identifying specific policy priorities for different stages of development and explaining why some countries pursue suitable paths while other do not remains a challenge. Our guess is that many of the reasons why countries adopt seemingly inappropriate financial sector policies are rooted in political economy, both at the national and international levels, but much more work is needed to establish that conjecture in a meaningful, actionable way. Our overall hope is that these papers provide a fresh perspective on an under-researched, but potentially important issue to a wide audience of readers.

References

Allen, F., and D. Gale. 2000. *Comparative Financial Systems*. Cambridge, MA: MIT Press.

Beck, T., A. Demirgüç-Kunt, and D. Singer. 2011. "Is Small Beautiful? Financial Structure, Size, and Access to Finance." World Bank Policy Research Working Paper 5806. Washington, DC.

Boyd, J.H., and B.D. Smith. 1998. "The Evolution of Debt and Equity Markets in Economic Development." *Economic Theory* 12(3): 519–60.

Calomiris, C., and S. Haber. 2011. "Fragile Banks, Durable Bargains: Why Banking is All About Politics and Always Has Been." Stanford University, mimeo, Stanford, CA.

Kpodar, K., and R. Singh. 2011. "Does Financial Structure Matter for Poverty? Evidence from Developing Countries." World Bank Policy Research Working Paper 5915. Washington, DC.

Lin, J. Y., X. Sun, and Y. Jiang. 2009. "Toward a Theory of Optimal Financial Structure." World Bank Policy Research Working Paper 5038. Washington, DC.

Lin, J.Y., X. Sun, and H.X. Wu. 2012. "Banking Structure, Labor Intensity, and Industrial Growth: Evidence from China." World Bank, mimeo, Washington, DC.

The Evolving Importance of Banks and Securities Markets

Asli Demirgüç-Kunt, Erik Feyen, and Ross Levine

The roles of banks and securities markets evolve during the process of economic development. As countries develop economically, (1) the size of both banks and securities markets increases relative to the size of the economy, (2) the association between an increase in economic output and an increase in bank development becomes smaller, and (3) the association between an increase in economic output and an increase in securities market development becomes larger. These findings are consistent with theories predicting that as economies develop, the services provided by securities markets become more important for economic activity, whereas those provided by banks become less important. JEL codes: O16, G1, G2, O43

Several economic theories stress that banks provide services to the economy that differ from those provided by securities markets, predicting that both the operation of banks and the functioning of securities markets have independent influences on economic development. For example, Acemoglu and Zilibotti (1997), Allen and Gale (1997, 1999), Boot and Thakor (1997, 2000), Dewatripont and Maskin (1995), Holmstrom and Tirole (1993), and Rajan (1992) argue that banks have a comparative advantage in reducing the market frictions associated with financing standardized, shorter-term, lower-risk, well-collateralized endeavors, whereas decentralized markets are relatively more effective in custom designing arrangements to finance more novel, longer-run, higher-risk projects that rely on intangible inputs. Consistent with these

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theories, Demirgüç-Kunt and Maksimovic (1998), Levine and Zervos (1998), and Beck and Levine (2004) provide evidence that better-functioning banks and securities markets exert robust, independent, and positive effects on economic activity.

A substantial body of economic theory emphasizes that the comparative importance of banks and markets for economic activity changes during the process of economic development, with markets becoming relatively more important for economic activity. For example, the concepts articulated in Goldsmith (1969), Allen and Gale (1995, 2000), Boot and Thakor (1997, 2000), Boyd and Smith (1998), Weinstein and Yafeh (1998), Morck and Nakamura (1999), and Song and Thakor (forthcoming) suggest that (1) banks and markets provide different, though sometimes complementary, financial services and that (2) the services provided by markets become comparatively more important for promoting economic activity as countries develop economically. In particular, these theories suggest that as economies develop, a greater number of projects require customized financial arrangements rather than standardized contracts and rely on intangible assets rather than easily collateralized capital inputs. Because these models also suggest that banks have a comparative advantage in financing standardized, well-collateralized endeavors, whereas securities markets are better at custom designing arrangements to finance novel projects that rely on intangible inputs, these theories imply that the services provided by securities markets have a greater impact on economic activity as economies grow, whereas those provided by banks become less important.

Empirical research has been largely unsuccessful at clarifying the evolving importance of banks and markets during the process of economic development, as exemplified by Beck and Levine (2002), Demirgüç-Kunt and Maksimovic (2002), and Levine (2002). Demirgüç-Kunt and Levine (2001) show that banks and securities markets tend to become more developed as economies grow and that securities markets tend to develop more rapidly than banks. Thus, financial systems generally become more market-based during the process of economic development. However, this pattern could simply reflect reverse causality. Economic progress may boost the development of securities markets more than it boosts the development of banks. The observation that financial systems tend to become more market-based as economies develop does not necessarily imply that securities markets exert a larger impact on economic activity in more economically advanced economies.

In this paper, the changing importance of banks and securities markets with the development of economies is evaluated in two steps. First, using a newly developed database, the evolution of banks and securities markets during the process of economic development is reassessed. That is, as countries develop economically, what happens to the size of banks and securities markets relative to the size of the overall economy? Second, the changes to the associations between economic activity and bank and stock market development as

countries develop economically are examined. This investigation involves regressing economic activity on both bank and securities market development and assessing how the estimated coefficients change as countries develop economically. This analysis provides information on how the associations between economic activity and the different components of the financial system evolve during economic development.

The primary methodological contribution of this paper is the use of quantile regressions to assess how the associations between economic activity and bank and securities market development evolve as countries grow (Koenker and Basset 1978). Ordinary least squares (OLS) regressions provide information on the association between, for example, economic development and bank development for the average country, defined as a country at the average level of economic development. However, quantile regressions provide information on the relationship between economic activity and bank development at each percentile of the distribution of economic development. As emphasized throughout the paper, these quantile analyses do not yield a sharp causal interpretation. Rather, they show how the estimated coefficients of the financial development indicators vary at different levels of economic development. In this way, the analyses illustrate how the associations between economic development and both bank and securities market development change during the process of economic development.

New data contribute to these analyses of finance and development with the construction of a database that covers 72 countries over the period from 1980 through 2008. For the analyses, the data are aggregated into five-year averages (data permitting), so there are a maximum of six observations per country. In addition to using standard indicators, such as bank credit to the private sector as a share of gross domestic product (GDP), stock market capitalization relative to GDP, and the value of stock market transactions relative to GDP, the analyses employ data on the capitalization of private domestic bond markets relative to GDP (for country averages, please see table S1 in the supplemental appendix, available at http://wber.oxfordjournals.org/).

Both banks and securities markets become larger relative to the size of the overall economy as countries develop economically, confirming the results in Demirgüç-Kunt and Levine (2001). These findings hold across various measures of bank and securities market development, including measures incorporating private domestic bond markets. It is important to note that the measures of bank and securities market development are scaled by GDP. Thus, the findings show that the growth of marketable securities and bank loans outpaces the growth of economic activity as countries develop economically.

The analyses also indicate that (1) the association between economic activity and bank development decreases with economic development, but (2) the association between economic activity and securities market development increases as countries grow. Put differently, as economies develop, the marginal increase in economic activity associated with an increase in bank development falls,

whereas the marginal increase in economic activity associated with an increase in securities market development rises. Although instrumental variables are not employed to identify a causal effect, these results are consistent with the predictions emerging from the large body of theoretical research discussed above: as economies develop economically, the services provided by securities markets will become more important for future economic development, whereas those provided by banks will become less important.

This research is policy relevant. First, if the optimal mixture of banks and markets changes as an economy develops, such a relationship is an indication of the costs of policy and institutional impediments to the evolution of the financial system. This is the first paper to show that the association between economic activity and stock market development increases as economies grow, whereas the association between economic activity and bank development decreases. Furthermore, this work suggests that the associations between economic activity and both bank and securities market development change with economic development. This change implies that the estimated elasticities from previous research regarding the impact of changes in bank or stock market development on economic development will yield misleading information about countries with incomes that are far from the sample average. Previous studies do not account for the *evolving* importance of banks and markets during the process of economic development.

The new data, methods, and analyses contribute to a better understanding of the dynamic relationships among economic development, financial institutions, and securities markets, but these contributions come with qualifications and limitations. First, although the analyses are policy relevant, direct policy instruments and levers are not studied. Thus, the results suggest that impediments to the evolution of financial systems will hinder economic activity, but they do not provide guidance on exactly which types of policies foster the healthy development of financial systems.

Second, although the analyses reduce concerns about reverse causality, they do not specify a particular causal mechanism, nor do they rule out reverse causality or omitted variable bias. A substantial body of theory predicts that as economies develop, financial systems will become more market based and the marginal impact of securities markets on economic activity will increase, whereas that of banks will decrease. Our findings are consistent with these predictions and inconsistent with simple reverse causality scenarios. Although a simple reverse causality scenario might predict that economic development increases the size of banks and securities markets relative to the size of the overall economy and that securities markets grow faster than banks, a simple reverse causality scenario does not yield predictions about the differential change in the association between economic activity and bank and securities market development as economies grow. That is, a simple reverse causality scenario does not predict that the association between economic activity and bank development diminishes in magnitude while the association between economic

activity and securities market development increases in magnitude as countries develop economically. Although these differential effects might be accounted for by sophisticated reverse causality scenarios, potential omitted variable biases, or as yet unformalized theories of finance and development, this paper provides the first empirical evidence that is consistent with an influential theoretical body of literature predicting that securities markets become more important for economic activity and that banks become less important as countries develop economically.

Data and Summary Statistics

Several measures of bank and stock market development are constructed and used to analyze the relationship between economic activity and the structure of the financial system. Economic theory highlights the advantages of developing indicators reflecting the degree to which banks and markets ameliorate market frictions and thereby (1) improve ex ante information about possible investments; (2) enhance the monitoring of investments after financing occurs; (3) facilitate the trading, diversification, and management of risk; (4) ease the mobilization and pooling of savings; and (5) foster the exchange of goods, services, and financial claims. However, such empirical proxies do not exist for a broad cross-section of countries over the last few decades. Instead, measures of the size and activity of banks and securities markets are compiled and employed to examine the relationship between financial systems and economic development. These measures are constructed over the period from 1980 to 2008, and the primary sources of these indicators are provided in table 1.

Private credit is used to measure bank development and equals deposit money bank credit to the domestic private sector as a share of GDP. Private credit isolates the credit issued to the private sector and excludes the credit issued to governments, government agencies, and public enterprises. Private credit also excludes credits issued by central banks. Not surprisingly, there is enormous cross-country variation in private credit. For example, averaging the 1980–2008 period, private credit was less than 10 percent of GDP in Angola, Cambodia, and Yemen, and it was greater than 85 percent of GDP in Austria, China, and the United Kingdom. Table 2 indicates that the annual average value of private credit across countries was 39 percent, with a standard deviation of 36 percent.

Stock value traded is used to measure market development and equals the value of the stock market transactions as a share of GDP. This market development indicator incorporates information on the size and activity of the stock market, not simply the value of the listed shares. Previous work by Levine and Zervos (1998) indicates that the trading of ownership claims on firms in an economy is closely tied to the rate of economic development. There is substantial variation across counties. As shown in table 2, although the mean value of the stock value traded is approximately 29 percent of GDP, the standard

TABLE 1. Variable Definitions and Sources

Name	Source	Definition
Dependent variable and baseline financial sector controls		
Log real GDP per capita	World Development Indicators	Logarithm of real GDP per capita (constant 2000 USD).
Private credit	International Financial Statistics	Deposit money bank credit to the private sector as a percentage of GDP.
Stock value traded	Standard & Poor's	Value of stock market transactions as a percentage of GDP.
Stock market capitalization	Standard & Poor's	The value of listed shares on a country's stock exchange as a percentage of GDP.
Securities market capitalization	Standard & Poor's; Bank of International Settlements	Stock market capitalization plus domestic private bond market capitalization as a percentage of GDP.
Standard controls		
Log initial GDP per capita	World Development Indicators	Log initial real GDP per capita (constant 2000 USD).
Log average years of schooling	Barro and Lee (2010)	Log (1 + average years of schooling).
Log openness to trade	World Development Indicators	Log sum exports and imports of goods and services as a percentage of GDP.
Log government size	World Development Indicators	Log general government consumption as a percentage of GDP.
Log inflation rate	International Financial Statistics	Log (1 + annual change of CPI).

TABLE 2. Descriptive Statistics

Variable	Mean	Standard deviation	Maximum	Minimum
Dependent variable and baseline controls				
Log real GDP per capita (constant 2000 USD)	7.58	1.57	10.94	4.13
Private credit	39.28	35.90	319.71	0.00
Stock value traded	28.80	57.44	632.34	0.00
Stock market capitalization	47.70	58.39	561.44	0.00
Securities market capitalization	59.08	71.20	588.27	0.00
Standard controls				
Log average years of schooling	1.86	0.50	2.65	0.03
Log openness to trade	4.26	0.61	6.12	−1.18
Log inflation rate	0.15	0.37	5.48	−0.52
Log government size	2.72	0.43	4.42	0.32

Note: Descriptive statistics are calculated on all available annual data for the 1980–2008 period.

deviation is approximately double this value. In Armenia, Tanzania, and Uruguay, the stock value traded annually averaged less than 0.23 percent over the 1980–2008 sample (10th percentile). In contrast, the stock value traded

averaged over 75 percent in Hong Kong, Saudi Arabia, Switzerland, and the United States (90th percentile). This paper's results are robust to using other market development indicators, such as *stock market capitalization*, which simply measures the value of the listed shares on a country's stock exchanges as a share of GDP, and *securities market capitalization*, which equals the capitalization of the stock market plus the capitalization of the private domestic bond markets divided by GDP.

Log real GDP per capita is used to measure economic activity and equals the logarithm of GDP per capita in constant 2000 US dollars. Consistent with theories guiding the empirical analyses (which are discussed in the introduction), log real GDP per capita is examined rather than GDP per capita growth to obtain estimates of the association between economic activity and both bank and securities market development. With the current specification, the estimated coefficients provide information on how log real GDP per capita changes when, for example, securities market development changes.

To assess the independent link between finance and economic development, the regressions control for many country characteristics. Some specifications include standard controls, such as years of schooling, openness to trade, inflation, government size, initial GDP per capita of the economy in 1980, and dummy variables for the five-year periods of analysis.

The correlations in table 3 highlight the key features of the financial system and economic development. First, both bank development and securities market development are positively correlated with economic development. Second, bank development and securities market development are positively correlated with each other, suggesting that financial development involves both larger banks and larger markets. Although these are simple correlations, these basic patterns hold when controlling for many other national traits.

The Relationships among Banks, Markets, and Economic Development

To assess how the relationships between economic activity and both bank development and stock market development evolve with economic development, quantile regressions are used with data averaged over non-overlapping five-year periods. OLS provides information on the relationship between log real GDP per capita and financial development for a country at an average level of economic development. However, OLS does not provide information on how the relationship between economic activity and financial development differs for countries at different levels of economic activity.

The quantile regressions model the relationship between log real GDP per capita and financial development at the specific percentiles (or quantiles) of the log real GDP per capita. Thus, in a quantile regression of log real GDP per capita on private credit, the procedure is able to yield a different estimated coefficient of private credit for each percentile (or quantile) of log real GDP per

TABLE 3. Correlations

Correlations	Log real GDP per capita	Private credit	Stock value traded	Log average years of schooling	Log openness to trade	Log inflation rate	Log government size
Private credit	0.67***	1					
Stock value traded	0.41***	0.51***	1				
Log average years of schooling	0.71***	0.49***	0.26***	1			
Log openness to trade	0.25***	0.21***	0.08***	0.31***	1		
Log inflation rate	−0.15***	−0.16***	−0.12***	−0.03**	−0.13***	1	
Log government size	0.28***	0.21***	0.04**	0.25***	0.28***	−0.08***	1

Source: Author's analysis based on data described in the text.

Note: Correlations are calculated on all available annual data for the 1980–2008 period.

*, **, and *** denote the significance level of correlation at the 10, 5, and 1 percent levels, respectively.

capita. For example, the estimated coefficient at the 50th percentile is a median regression, yielding the estimated relationship between the log real GDP per capita and private credit at the median level of economic activity. By computing the quantile regression for each of the 5th to the 95th quantiles, the analyses provide information on how the relationship between economic activity and financial development differs across distinct levels of log real GDP per capita.

Neither the OLS nor the quantile regressions identify the causal impact of bank and securities market development on economic development. Rather, the goal is to explore whether and how the relationship between changes in economic activity and changes in both bank and market development varies with the level of economic development.

Illustrating the Quantile Regression Results

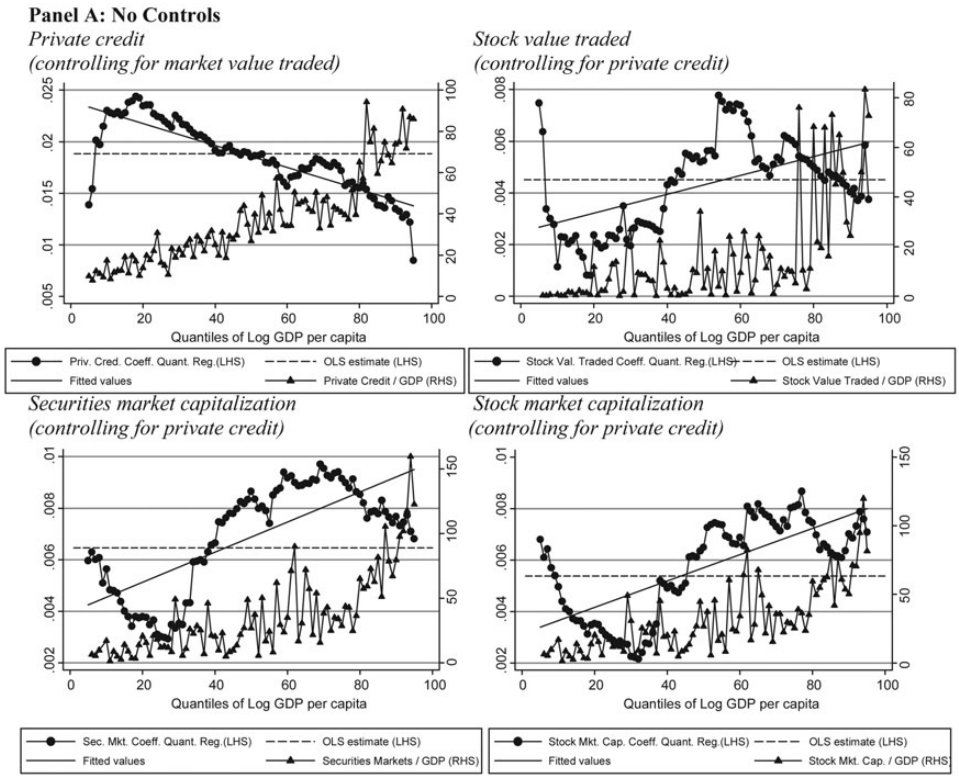
In panel A of figure 1, the graph on the upper left side plots the coefficients from 91 separate quantile regressions for each percentile from the 5th through the 95th percentiles of log real GDP per capita, where the dependent variable is log real GDP per capita, and the main regressor is private credit. The regressions control for stock value traded. A circle represents each coefficient estimate produced by the quantile regression associated with the corresponding percentile. The left axis provides information on the values of the coefficient estimates. Thus, the estimated coefficient depicts the sensitivity of log real GDP per capita associated with a change in private credit at each percentile of economic development. These estimates are statistically significant. Additional information on the sensitivity of these estimates is provided below. The graph also plots the actual values of private credit at each percentile, which are designated with a triangle. The scale of the values of private credit is provided on the right axis. The graphs in the remainder of panel A of figure 1 provide similar information on the relationship between economic activity and stock market development. The upper-right graph provides information for stock value traded. The lower graphs confirm the increasingly relevant role of securities markets by documenting similar upward trends for both securities market capitalization and stock market capitalization.

Panel B of figure 1 provides the same types of quantile analyses while controlling for other characteristics of the national economies. The standard controls are log real GDP per capita in 1980, government size, openness to trade, inflation, average years of schooling, and period fixed effects.

Each of the eight graphs in panels A and B of figure 1 provides two additional pieces of information. First, the horizontal dotted line is the OLS estimate of the coefficient of the financial development indicator. Thus, in the graph on the upper left side of panel A in figure 1, this line is simply the coefficient of private credit from an OLS regression of log real GDP per capita on private credit for the full sample of country-year observations, controlling for stock value traded. When moving away for the mean log real GDP per capita, the quantile estimates become statistically different from the OLS estimates. The

nature of these deviations is explored below. Second, the solid line shows the estimated linear relationship between each estimated coefficient of the financial development indicator (i.e., the circles) and the GDP per capita percentile associated with the coefficient. As a specific example, consider the graph in the upper-right quadrant of panel B in figure 1. The estimated coefficients of stock value traded after conditioning on the standard controls and period fixed

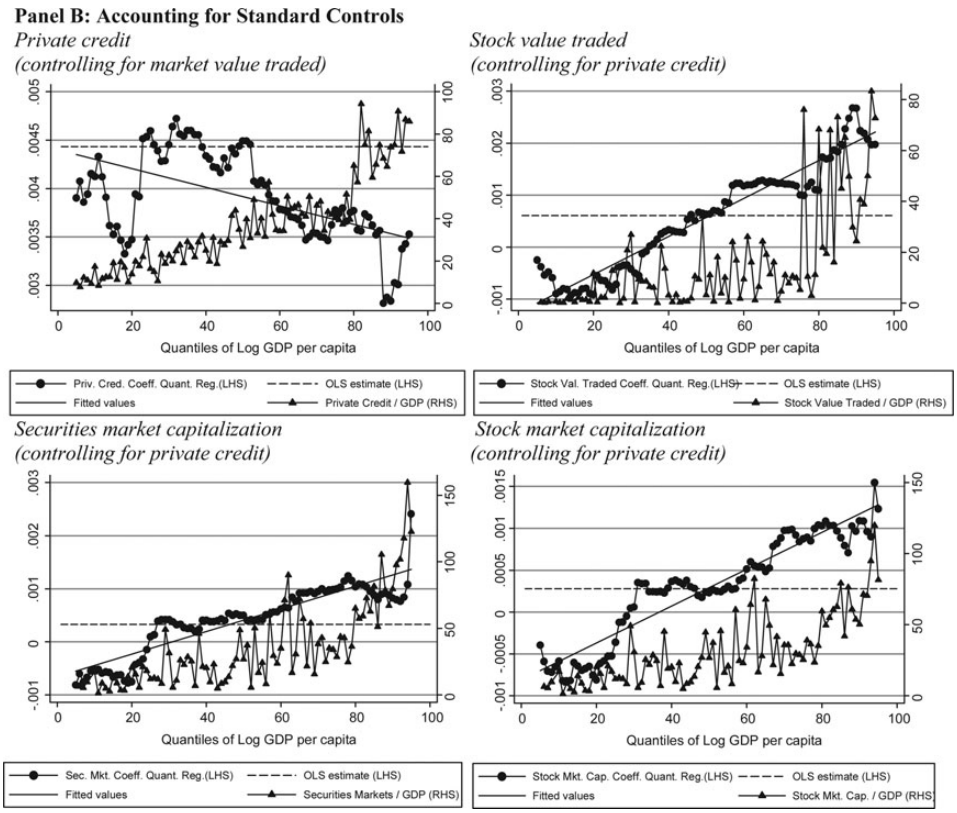
Figure 1. Quantile Coefficients for Private Credit and Securities Market Activity



Source: Author's analysis based on the data described in the text.

Note: The dependent variable is log real GDP per capita. The figure depicts the coefficients of the quantile regressions of private credit, stock value traded, securities market capitalization, and stock market capitalization as independent variables for each of the 5th to 95th percentiles of the GDP per capita distribution on the left axis. Private credit is defined as deposit money bank credit to the private sector as a percentage of GDP. Stock value traded is the value of stock value transactions as a percentage of GDP. Stock market capitalization is the value of listed shares on a country's stock exchanges as a percentage of GDP. Securities market capitalization is defined as stock market capitalization plus sdmestic private bond market capitalization as a percentage of GDP. Percentile values are reported on the right axis. Data are five-year non-overlapping country averages. Panel A does not control for additional variables. Panel B controls for standard controls: initial GDP per capita, government size, openness to trade, inflation, average years of schooling, and time-fixed effects. The horizontal dotted line depicts the OLS estimate. The solid lines represent the linear fit.

Figure 1. Continued



effects are collected. Then, these estimated coefficients are regressed on the GDP per capita percentile associated with the estimates. Panel A in table 4, column (4) provides the results of this regression. The estimated coefficient for each GDP per capita percentile provides the trend line graphed in figure 1.

Discussing the Quantile Regression Results

In terms of bank development, figure 1 shows that as the log real GDP per capita rises, (1) private credit rises (triangles) and (2) the marginal increase in the log real GDP per capita associated with an increase in private credit diminishes (circles). Put differently, the level of bank development increases, but its association with economic activity diminishes. In panel A of table 4, the significance of this association is tested formally. In this panel, the dependent variable is the estimated linear association between economic activity and either bank development or securities market development at each percentile of the distribution of GDP per capita underlying figure 1. Regressions (1) and (2) show that this relationship is statistically significant: as economic activity

TABLE 4. Robust Regression Results of the Linear Regression Fits from Figure 1

Panel A: Linear model	*Dep. Var.: Percentile regression coefficient Private credit*		*Dep. Var.: Percentile regression coefficient Stock value traded*	
	1 (No controls)	2 (With all controls)	3 (No controls)	4 (With all controls)
Percentile	−1.24E − 04***	−1.02E − 05***	4.18E − 05***	3.79E − 05***
	[0.00]	[0.00]	[0.00]	[0.00]
Constant	2.51E − 02***	4.45E − 03***	2.05E − 03***	−1.34E − 03
	[0.00]	[0.00]	[0.00]	[0.00]
Controls	No	Yes	No	Yes
Observations	91	91	91	91
Panel B: Quadratic model				
Percentile	−1.09E − 04***	2.67E − 05***	2.13E − 04***	4.88E − 05***
	[0.00]	[0.00]	[0.00]	[0.00]
Square of percentile	−1.37E − 07	−3.69E − 07***	−1.63E − 06***	−1.02E − 07**
	[0.00]	[0.00]	[0.00]	[0.00]
Constant	2.48E − 02***	3.77E − 03***	−1.44E − 03***	−1.58E − 03
	[0.00]	[0.00]	[0.00]	[0.00]
Controls	No	Yes	No	Yes
Observations	91	91	91	91

Source: Author's analysis based on data described in the text.

Note: The table displays the robust regressions results of the linear fits depicted in figure 1. The dependent variables are coefficients of the quantile regressions of private credit and stock value traded for each of the 5th to 95th percentiles of the GDP per capita distribution, respectively, on five-year non-overlapping country averages. Panel A reports a linear model where the regressors are a constant and the income percentile associated with the coefficient. Panel B shows the results for the quadratic model using the same independent variables in the linear model plus the square of the percentile associated with the coefficient. Columns 1 and 3 use the coefficients of quantile regressions without additional controls (panel A of figure 1). Columns 2 and 4 use the coefficients of quantile regressions that include standard controls: Initial GDP per capita, Government size, Openness to trade, Inflation, Average years of schooling, and time-fixed effects (panel B of figure 1). The p-values in brackets are based on robust country-level clustered standard errors.

*, **, and *** denote the significance on the 10, 5, and 1 percent levels, respectively.

increases, there is a significant reduction in the estimated coefficient of private credit.

The results are the opposite for securities market development. As log real GDP per capita rises, (1) stock value traded rises, and (2) the marginal increase in log real GDP per capita associated with an increase in stock value traded rises. That is, as countries develop economically, securities market development increases, and its association with economic activity increases. Regressions (3) and (4) in panel A of table 4 show that this effect is statistically significant: the association between economic activity and stock value traded increases as the log real GDP per capita rises. These results suggest that the relationship between bank development and economic activity differs from the relationship between securities market development and economic activity.

Figure 1 suggests that there might be a nonlinear relationship (1) between economic activity and bank development and (2) between economic activity and securities market development. To assess the sensitivity of our findings and provide more information on the nature of the relationship, we examine these relationships more rigorously in panel B of table 4, which includes a quadratic term to allow for a potential nonlinear, parabolic relationship. This potential relationship makes it possible to estimate the level of economic activity at which the associations between financial and economic development start to decrease as the economy develops further.

Consistent with figure 1, the regression results in panel B of table 4 suggest that there are a nonlinear associations between economic activity and both bank and securities market development. At very low levels of economic development, the association between economic activity and bank development is increasing in economic development, but the slope quickly becomes negative. In particular, regressions (1) and (2) of panel B indicate that the slope of the association between economic activity and bank development becomes negative after real GDP per capita reaches $1,032 in 2000 US dollars (36th percentile). For securities market development, panel B of table 4 indicates that the association between economic activity and securities is always increasing in the 5th to 95th percentile interval of economic development, but at a decreasing rate (regressions (3) and (4)). In other words, only the upward sloping part of the estimated parabola is relevant. For example, the regression (4) estimates suggest that as economies grow and move to the next percentile, the coefficient increases by more than 5 percent for countries below the 20th percentile. In contrast, the coefficient increases by just 0.7–1.0 percent for each additional percentile from the 78th percentile upward.

Broader Implications of Quantile Analyses

The results of the above analysis are consistent with several lines of theoretical research on the evolving importance of banks and financial markets during the process of economic development. As noted in the introduction of this paper, Allen and Gale (2000), Boot and Thakor (1997, 2000), Boyd and Smith

(1998), Song and Thakor (forthcoming), and others stress that at higher levels of economic development, economies require the types of custom-designed financial arrangements that ease the financing of novel, longer-term investments that often employ more intangible inputs than the types of projects that dominate economic activity at lower levels of economic development. These theories predict that securities markets are comparatively better than banks at financing these activities. Thus, influential lines of theoretical analysis predict that the services provided by securities markets will become more important for fostering economic activity as economies grow, whereas those provided by banks will tend to become less important. The quantile regression results are consistent with these predictions. However, the quantile regression results are inconsistent with the view that economic development is simply associated with an increase in bank and stock market development with no differential effect on their association with economic activity. That is, as countries develop economically, the association between economic activity and bank development tends to weaken, whereas the association with securities market development tends to strengthen.

Conclusions

Banks and markets evolve during the process of economic development. As economies grow, both the banking system and financial markets become more developed, but the association between economic activity and bank development tends to fall, and the association between economic activity and securities market development tends to increase. For the first time, the quantile analyses employed in this paper directly assess the predictions emerging from an influential line of theoretical work on financial structure. The findings are consistent with the view that (a) financial institutions provide different financial services from those provided by financial markets, and (b) as economies grow, the services provided by securities markets become more important for promoting economic activity, whereas those provided by banks become less important. As such, this research suggests that policies and institutions that impede the evolution of the structure of financial systems as economies grow can have detrimental ramifications for economic development.

References

Acemoglu, D., and F. Zilibotti. 1997. "Was Prometheus Unbound by Chance? Risk, Diversification, and Growth." *Journal of Political Economy* 105: 709–775.

Allen, F., and D. Gale. 1995. "A Welfare Comparison of the German and U.S. Financial Systems." *European Economic Review* 39: 179–209.

———. 1997. "Financial Markets, Intermediaries, and Intertemporal Smoothing." *Journal of Political Economy* 105: 523–546.

———. 1999. "Diversity of Opinion and Financing of New Technologies." *European Economic Review* 39: 179–209.

———. 2000. *Comparing Financial Systems*. Cambridge, MA: MIT Press.

Beck, T., and R. Levine. 2002. "Industry Growth and Capital Accumulation: Does Having a Market- or Bank-based System Matter?" *Journal of Financial Economics* 64: 147–180.

———. 2004. "Stock Markets, Banks, and Growth: Panel Evidence." *Journal of Banking and Finance* 28: 423–442.

Boot, A. W. A., and A. Thakor. 1997. "Financial System Architecture." *Review of Financial Studies* 10: 693–733.

———. 2000. "Can Relationship Banking Survive Competition?" *Journal of Finance* 55: 679–713.

Boyd, J. H., R. Levine, and B. D. Smith. 2001. "The Impact of Inflation on Financial Sector Performance." *Journal of Monetary Economics* 47: 221–248.

Boyd, J. H., and B. D. Smith. 1998. "The Evolution of Debt and Equity Markets in Economic Development." *Economic Theory* 12: 519–560.

Demirgüç-Kunt, A., and R. Levine. 2001. *Financial Structures and Economic Growth: A Cross-Country Comparison of Banks, Markets, and Development*. Cambridge, MA: MIT Press.

Demirgüç-Kunt, A., and V. Maksimovic. 1998. "Law, Finance, and Firm Growth." *Journal of Finance* 53: 2107–2137.

———. 2002. "Funding Growth in Bank-based and Market-based Financial Systems: Evidence from Firm Level Data." *Journal of Financial Economics* 65: 337–363.

Dewatripont, M., and E. Maskin. 1995. "Credit Efficiency in Centralized and Decentralized Economies." *Review of Economic Studies* 62: 541–555.

Goldsmith, R. W. 1969. *Financial Structure and Development*. New Haven, CT: Yale University Press.

Holmstrom, B., and J. Tirole. 1993. "Market Liquidity and Performance Monitoring," *Journal of Political Economy* 101: 678–709.

Koenker, T., and G. Basset. 1978. "Quantile Regressions." *Econometrica* 46(1): 33–50.

Levine, R. 2002. "Bank-based or Market-based Financial Systems: Which Is Better?" *Journal of Financial Intermediation* 11: 398–428.

Levine, R., and S. Zervos. 1998. "Stock Markets, Banks, and Economic Growth." *American Economic Review* 88: 537–558.

Morck, R., and M. Nakamura. 1999. "Banks and Corporate Control in Japan." *Journal of Finance* 54: 319–340.

Rajan, R. G. 1992. "Insiders and Outsiders: The Choice between Informed and Arm's Length Debt." *Journal of Finance* 47: 1367–1400.

Song, F., and A.V. Thakor. Forthcoming. "Financial System Architecture and the Co-evolution of Bank and Capital Markets." *Economic Journal*.

Weinstein, D. E., and Y. Yafeh. 1998. "On the Costs of a Bank-centered Financial System: Evidence from the Changing Main Bank Relations in Japan." *Journal of Finance* 53: 635–672.

Notes on Financial System Development and Political Intervention*

Fenghua Song and Anjan Thakor

We study the impact of political intervention on a financial system that consists of banks and financial markets and develops over time. In this financial system, banks and markets exhibit three forms of interaction: they compete, they complement each other, and they co-evolve. Co-evolution is generated by two new ingredients of financial system architecture relative to the existing theories: securitization and risk-sensitive bank capital. We show that securitization propagates banking advances to the financial market, permitting market evolution to be driven by bank evolution, and market advances are transmitted to banks through bank capital. We then examine how politicians determine the nature of political intervention designed to expand credit availability. We find that political intervention in banking exhibits a U-shaped pattern, where it is most notable in the early stage of financial system development (through bank capital subsidy in exchange for state ownership of banks) and in the advanced stage (through direct lending regulation). Despite expanding credit access, political intervention results in an increase in financial system risk and does not contribute to financial system evolution. Numerous policy implications are drawn out. JEL codes: G21, G28

There is strong evidence that the development of the financial system – consisting of banks and financial markets – positively affects real-sector growth through the efficient mobilization and allocation of capital. This point was recognized at least as far back as Gurley and Shaw's (1955, 1956) discussions of the relationship between financial system development and growth in the real sector. Gurley and Shaw (1955) note, "Conventional theories of income, interest, and money have given insufficient attention to important reciprocal relationships

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between real development and financial development . . . An additional complexity is that development of financial institutions, including nonbank intermediaries, is both a determined and a determining variable in the growth process." More recently, this point has been made by various authors. For example, Gertler (1988) points out the financial system matters because it impinges on the resolution of informational asymmetries that have real effects, and that financial contracts and institutions are determined simultaneously with real variables. This view is well exemplified in the following statement by Levine (2010) in a debate on the role of the financial system: "Finance is powerful . . . the last few centuries demonstrate that financial innovation is crucial, indeed indispensable, for sustained economic growth and prosperity."

This recognition of the role of the financial system in economic development notwithstanding, it is less clear whether the effect of the financial system can be attributed to the development of capital markets or banks and other financial institutions, or even whether the architecture of the financial system (i.e., the configuration/mix of markets and institutions within a financial system) matters for the real-sector growth. Complicating this picture is the fact that political intervention in credit markets seems to be ubiquitous, and often has telling consequences (Brown and Dinç 2005; Calomiris and Wallison 2009). This raises interesting questions about the manner in which financial systems evolve, how they affect economic growth, and the *endogenous* nature of political intervention at different stages of financial system development. The purpose of this paper is to theoretically address these questions.

To put our research in perspective, it is useful to begin by briefly reviewing the existing literature on financial system architecture, which deals with the mix of bank and market financing in the overall allocation of credit. Financial systems are typically classified as bank-based or market-based, depending on the relative shares of financing activities performed through banks and other financial intermediaries as compared to those conducted through capital markets.[1] An important issue in this regard has to do with which system maximizes real-sector economic growth, but on this the empirical evidence is mixed. For example, Beck and Levine (2002), Demirgüç-Kunt and Levine (2001), and Levine (2002) show that the positive impact of financial system development on economic growth is unaffected by whether the evolution of the financial system is due to bank or financial market development, and the correlation between a country's economic growth and the architecture of its financial system is rather low. Deidda and Fattouh (2008) find, however, that a change from a bank-dominated system to one with both banks and markets can actually hurt economic growth.[2]

1. Typical examples of market-based systems are those in the U.S. and U.K., and Japan and Eurozone countries like Germany are traditionally viewed as having bank-based systems.

2. See also the growing body of other empirical research on financial system architecture as well as its impact on growth (Levine and Zervos 1998; Tadesse 2002).

The theoretical literature on financial system architecture has been largely focused on examining how banks and markets compete for borrowers and the comparative capital allocational efficiencies of bank-based systems versus market-based systems, in terms of providing risk sharing (Allen and Gale 1997), generating information feedback from security prices (Boot and Thakor 1997a; Subrahmanyam and Titman 1999), creating financial innovation incentives (Boot and Thakor 1997b), resolving asset-substitution moral hazard (Boot and Thakor 1997a), and protecting borrower proprietary information and strengthening R&D incentives (Bhattacharya and Chiesa 1995; Yosha 1995).[3]

This "banks versus markets" distinction, based on the dominant view that banks and markets compete, clearly has powerful policy implications. It means that regulators must make choices of focus to seek the right balance between the two sectors when attempting to influence the trajectory of financial system development. However, this neat distinction between banks and markets, rooted in historical patterns of financial system evolution from many decades ago, seems to be rapidly losing relevance in an era in which securitization and widespread use of capital market financing by banks have largely eroded the boundaries between banks and markets, if not dissolved them completely.

Mindful of these contemporary developments, we pose the following specific questions about financial system development:

(1) What are the various forms of interaction that banks and markets engage in at different stages of development of the financial system; and
(2) What forms of *endogenously determined* political interventions in the financial system should we expect in these different stages and what are the potential consequences of such intervention?

To address these questions, we develop a theoretical framework in which we do not restrict the interaction between banks and markets to competition, but permit them to interact in a richer manner. Our analysis reveals that banks and markets exhibit three forms of interaction. They compete, they complement each other, and they co-evolve. Strong institutions like banks are necessary for markets to perform well, and well-functioning markets are essential for banks to be induced to be sufficiently well capitalized to expand credit availability to borrowers without exposing themselves to excessive risk. Thus, the notion that one part of the financial system takes precedence over the other at a particular stage in terms of the development focus of policymakers is rendered obsolete.

Our analysis pivots on two key frictions that impede a borrower's ability to obtain external financing and influence the cost of this financing. One is the "certification friction," which arises from the fact that there is imperfect information about borrower credit quality. As a result, a creditworthy borrower may be erroneously denied credit were it not be "certified" as worthy of credit.

3. See also Allen and Gale (1999), Dewatripont and Maskin (1995), and von Thadden (1995).

The other is the "financing friction," which arises due to uncertainty about the availability of opportunities for the borrower to enhance its project payoff. This means that good investment opportunities may be passed up, which increases a borrower's cost of obtaining funds from the capital market.

We show that banks are better at diminishing the certification friction due to their credit-analysis expertise, whereas capital markets are superior at resolving the financing friction by providing a trading venue through which informed investors' private information about the project payoff enhancement opportunity is (noisily) impounded into security prices, thereby lowering the probability that valuable investment opportunities are passed up. Banks and markets compete to attract borrowers based on their relative advantages in resolving the two frictions.

Relative to the existing theories of financial system architecture, the recipe for our analysis includes two new ingredients: securitization and (risk-based) bank capital. Securitization blends the roles of banks and markets by involving the bank in the origination and screening of the loan and the market in the provision of financing. This, in turn, generates a positive feedback loop from bank development to market development. Improvements in the bank's screening technology, as a result of bank evolution, increase the confidence that capital market investors have in a securitized borrower's credit quality, which stimulates greater informed trading in the capital market. This lowers the financing friction and spurs capital market evolution.

Bank capital connects the two sectors in a different way. As the capital market evolves, informed trading in the market increases, which reduces the financing friction for all seeking market financing, including banks which now confront a lower cost of equity capital. This enables the bank to raise additional equity from the capital market to extend riskier loans that were previously eschewed, and expands the banking sector's lending scope. Moreover, as banks lend to riskier borrowers with lower prior credit qualities, they find it privately optimal to improve the precision of their screening to better distinguish creditworthy borrowers from those who are not creditworthy. This stimulates evolution of the banking sector. That is, advances in the capital market are propagated to the banking sector through bank capital.

The analysis thus uncovers not only competition and complementarity between bank and market financing, but also co-evolution. Bank evolution spurs capital market evolution, and capital market evolution in turn spurs bank evolution. That is, banks and capital markets co-evolve with each other. The limitation of the standard approach that views banks and capital markets as competitive tubs on their own bottoms in the analysis of financial system development becomes starkly apparent.

Securitization plays a key role in the co-evolution of banks and markets in our analysis. Thus, the shadow banking system, where securitization-related activities are featured prominently, is of pivotal importance for the issues we examine. In a sense, our analysis highlights the "bright side" of the interaction between banks

and markets through shadow banking. But the shadow banking system also played a key role in the recent financial crisis (see, for example, Stein 2010). Gennaioli, Shleifer, and Vishny (2011) present a formal model of the link between securitization and trading of asset-backed securities in the shadow banking sector and show that securitization forges market-based connections between banks, leading to a reduction in idiosyncratic risk but an increase in systemic risk. This may be viewed as the "dark side" of shadow banking.

In addition, our framework also provides a setting in which we can investigate the role of political intervention in financial system development, something with potential ramifications for financial crises and stability. This is virgin territory in the theory of financial system architecture. Nonetheless, political intervention in the financial system is not only commonplace but appears to be on the rise. Credit markets are hard for politicians to resist intervening in because expanded credit availability for potential voters can generate large perceived political benefits. It has been empirically documented that in emerging markets, cozy ties between bankers and politicians as well as state ownership of banks allow for a great deal of political influence in credit markets (e.g., Brown and Dinç 2005; Dinç 2005; La Porta, Lopez-de-Silanes, and Shleifer 2002). And the recent financial crisis has shown that even advanced financial systems, such as the one in the U.S., are not immune to political influence. See Calomiris and Wallison (2009), for example, for a discussion of how political influences on securitization agencies like Fannie Mae and Freddie Mac, as well as on credit rating agencies and banks, gave shape to some of the initial forces that influenced the course of the 2007-09 financial crisis. Giving politicians a choice of how to intervene in the financial system, we endogenize the manner of political intervention at different stages of financial system development, where the political goal is to expand credit availability.

We find that in the early stage of financial development, when both the certification friction and the financing friction are large, political intervention to expand credit availability takes the form of government ownership of banks in exchange for direct capital subsidies to banks. In the intermediate stage, there is little political intervention. In the advanced stage, political intervention returns, but this time takes the form of direct lending regulation that mandates that banks invest in low-quality, high-risk (excluded) borrowers, even if doing so imposes a loss on the banking sector. The reason for this stage-dependent intervention is that the value of capital subsidies depends on the cost of equity capital for banks, which in turn depends on the stage of development of the capital market. Moreover, bank profitability is also dependent on the stage of financial market development, so the feasibility of enacting regulations that impose losses on banks is also stage dependent. In the intermediate stage, bank capital is neither sufficiently costly to make an equity subsidy attractive to banks, nor are the banking sector's profits sufficiently high to absorb the losses imposed by direct lending regulations. Thus, political intervention in banking exhibits a U-shaped pattern: it is most notable in underdeveloped and highly

developed financial systems, but it takes different forms. Differences in form notwithstanding, the effect of political intervention is the same – an increase in financial system risk.

The rest of the paper is organized as follows. In Section I, we describe the theoretical framework. Section II analyzes the three forms of interaction between banks and markets. Section III examines political intervention at different stages of financial system development. Section VI concludes with a discussion of policy implications of our analysis.

I. The framework

In this section, we describe the economic framework, with a minimum of mathematical details. The reader is referred to Song and Thakor (2010, 2011) for more formal treatments of these ideas, including proofs of results. The focus here is on explaining the logical structure that leads to these results and the economic intuition underlying them.

Agents and Economic Environment

Consider an economy where each borrower needs outside finance to invest in a project. The success of the investment depends on the borrower's type. The borrower may be either authentic or a crook, and only an authentic borrower will invest in the project, whereas a crook will just abscond with the funds, leaving nothing for the financiers. Each borrower's type is its private information. The credit quality of a borrower, $q \in [0,1]$, is simply the common prior assessment about the probability with which the borrower is authentic, with a higher q representing a better credit quality. An authentic borrower will have an opportunity to enhance its project payoff, given a particular macroeconomic state; this will be discussed in more detail shortly.

We study a financial system in which there are two frictions affecting an authentic borrower's ability to obtain external finance and the cost of this financing.

(1) The first is a *certification friction*, which arises due to imperfect information about borrower type. As a result, even a creditworthy (i.e., authentic) borrower may be (erroneously) denied credit.
(2) The second friction, *financing friction*, arises as follows. Each borrower's project value depends on whether the borrower invests in costly payoff enhancement. The investment in payoff enhancement achieves its goal only if the macroeconomic condition turns out to be favorable (e.g., a strong consumer demand for the borrower's product, and a viable supply of labor force). Absent information about the macroeconomic condition, an authentic borrower finds it privately unprofitable to invest in payoff enhancement, since the expected return from such an investment is less than its cost, where the expectation is calculated based on the borrower's *prior assessment* about the macroeconomic condition.

There are traders in the capital market who find it personally profitable to invest in acquiring information about the macroeconomic condition that is useful to authentic borrowers for making their payoff-enhancement investment decisions. The motivation for the informed traders is that acquisition of this information can be used by these traders to take profitable long positions in the security issued by the borrower when the traders learn the macroeconomic condition is conducive to making the project-payoff enhancement decision. In addition to informed traders, there are also liquidity traders who are uninformed about the macroeconomic condition and trade for pure liquidity needs in the capital market. Trading by liquidity traders introduces noise in the price formation process and masks informed trades, but the informed traders' information will still be (noisily) transmitted to borrowers through the equilibrium prices of securities traded in the capital market. To see this more clearly, suppose the informed traders first observe a favorable macroeconomic condition that they conjecture the authentic borrower will exploit to enhance the project payoff, and then they take long positions in the borrower's security that (noisily) reveal their conjecture. By observing capital market trading and the market-clearing price for its security, the authentic borrower infers the macroeconomic state and decides to make the payoff-enhancement investment, thereby rationalizing the informed traders' initial conjecture. That is, the capital market provides borrowers valuable information through the feedback effect of security prices.

The larger the number of informed traders, the greater the impact of their trading on the price of the security, so security prices become more informative about the macroeconomic condition when there are more informed traders present in the capital market. Hence, the authentic borrowers' investment in project-payoff enhancement becomes more efficient when there are more informed traders. However, to become an informed trader requires personal investment in information acquisition by the trader, which is costly. This cost will be greater the less developed the financial system. As the financial system develops, an increasing amount of payoff-relevant information is available in the public domain for investors, so it costs less to acquire additional information. This induces more investors to become informed in more advanced financial systems, making borrowers' payoff-enhancement decisions more informative. Think of the larger number of informed and sophisticated traders in the U.S. compared to say Zambia.

Banks and Capital Markets

Banks are better than markets at diminishing the *certification friction* because of their expertise in credit screening that may help to attenuate asymmetric-information problems (e.g., Allen 1990; Boyd and Prescott 1986;

Coval and Thakor 2005; Ramakrishnan and Thakor 1984). Specifically, bank screening yields an informative signal that *noisily* reveals the borrower's type, where the precision of the signal is increasing in the bank's investment in a screening technology, which is privately costly to the bank. Banks may also arise to reduce state-verification costs that endogenously give rise to debt contracts (Townsend 1979). Nonetheless, not all information asymmetries may be eliminated by banks, so credit market distortions associated with practices like credit rationing, that do not resemble standard Walrasian market-clearing outcomes, may persist (Stiglitz and Weiss 1981). This may create a role for capital market financing in different forms to provide amelioration that is unattainable with bank-intermediated contracting.

Capital markets are better than banks at resolving the *financing friction* by providing a setting in which security trading leads to the (noisy) impounding of informed traders' private information about the macroeconomic condition. As explained earlier, this friction is dissipated to a greater extent in more developed financial systems, where borrowers learn more accurately about the macroeconomic condition and make more efficient investment decisions.

We have modeled the financing friction resolved by the capital market purely in terms of the feedback effect of market prices as, for example, in Boot and Thakor (1997a). However, the literature has highlighted various other economic functions served by markets. For example, Allen and Gale (1999) show how markets can aggregate divergent opinions about new technologies.[4] This can enhance synergies between financial system development and real-sector development, as shown by Laeven, Levine, and Michalopoulos (2012). Such information aggregation may be particularly important when equity rather than debt is used for financing, since opinions may diverge more about the *upside* potential of a new technology. Thus, markets may rely on equity to a greater extent than banks do, even if banks were allowed to take equity positions in borrowers.[5] Viewed in this light, the resolution of the financing friction by the market may be viewed more broadly as the resolution of an information aggregation problem. Nonetheless, our specification of the role of markets as communicating valuable payoff-relevant information to firms is entirely consistent with this alternative aggregation-of-diverse-opinions viewpoint, since it is precisely this form of aggregation that paves the way for the market to generate information that may not be readily available even to the firm's manager.

Financing Sources

Each borrower has three sources from which it can choose to finance its project: (1) borrow directly from the capital market by issuing a debt security;

4. Other papers have also used heterogeneous prior beliefs to explore issues in banking, e.g., Song and Thakor (2007).

5. Since credit rationing in models like Stiglitz and Weiss (1981) results from the use of debt contracts, the market can eliminate it by relying on equity.

(2) let a bank screen and certify its credit quality first and then borrow from the capital market via securitization; or (3) take a loan from a bank.

With *direct capital market financing*, the bank is out of the picture, so there is no "bank certification" provided to the borrower. With *securitization*, the bank screens the borrower's credit quality first, and then seeks financing for the borrower from the capital market via securitized debt only if the screening yields a favorable outcome. The bank incurs a fixed cost to set up a trust for securitization.

With a *bank loan* too, the bank screens the borrower's credit quality first, and then extends the loan only if the screening outcome turns out to be favorable. Of course, since the screening is noisy, the bank's credit decision is subject to both Type-1 and Type-2 errors. Thus, with both securitization and bank financing, the borrower's credit quality is "certified" by the bank, albeit with the recognition that the certification is not perfect. A key difference between a direct bank loan and securitization is that, with the former, the bank has to raise funding for the loan, whereas with the latter, the funding comes from the capital market. For the bank loan, there is a risk-sensitive capital requirement that is increasing in borrower risk. The bank funds the rest of the loan from deposits. Deposit gathering is costly due to the cost of setting up branches, employing tellers, etc., and the total cost of deposit gathering is increasing in the amount of deposits raised by the bank.

As we will discuss in more depth later, bank certification will influence the credit terms that the borrower can obtain from the market with securitization. Moreover, bank certification also impinges on how many traders choose to become informed in the capital market and hence the accuracy of the payoff-relevant information that the borrower can infer from security prices.

II. Results

In this section, we discuss two main results arising from our analysis of the model described in the previous section. The first result concerns the borrower's choice of financing source. The second result characterizes the interaction between banks and capital markets: how does the evolution of one sector of the financial system affect the other sector, and how does a financial system evolve as a whole?

Borrower's Choice of Financing Source

We first analyze a borrower's choice of financing source. We focus on authentic borrowers, as crooks will make the same financing choices as authentic borrowers in equilibrium to avoid being identified. First, consider borrowers with the lowest credit quality, i.e., borrowers in cohorts with the highest probability of having crooks. It is clear that as a borrower's credit quality (q) declines, a bank's expected payoff from lending to the borrower declines as well due to the increasingly high likelihood of lending money to a crook; this is because

the bank's screening is noisy. Thus, there exists a credit quality cutoff, call it $q_l > 0$, below which a borrower cannot obtain financing. This cutoff determines the banking sector's lending scope, with a lower cutoff corresponding to a broader lending scope.

To examine the borrower's choice of financing source beyond the credit exclusion cutoff of q_l, it is useful to introduce a little notation. The benefit to the borrower of having its loan originated by the bank is that the bank provides screening and hence "certifies" an affirmatively-screened borrower as creditworthy, which reduces the borrower's cost of credit. Let V_S represent this screening benefit. It is clear that $\partial V_S/\partial q < 0$, that is, the certification benefit declines as the borrower's observable quality improves. This screening benefit is available only with a bank loan and securitization.

Bank certification produces another benefit for the borrower if it chooses securitization. Because a certified borrower is more likely to be authentic, the project-payoff enhancement conjectured by informed traders who observe a favorable macroeconomic state is more likely to be realized with a certified borrower; note that a crook will not invest in payoff enhancement even if the macroeconomic condition is favorable. This means that when a borrower is bank-certified and has securitized its debt, a larger number of capital market investors will acquire information about the payoff-enhancement-relevant macroeconomic condition than if the borrower finances in the capital market without bank certification. Thus, bank certification enables an authentic borrower to make a more informed decision about its investment in payoff enhancement. Let V_{PE}^{m} be the value of payoff enhancement to the borrower with direct market financing, and V_{PE}^{sec} be the value of payoff enhancement with securitization. Our arguments above indicate that $V_{PE}^{sec}(q) > V_{PE}^{m}(q)$, $\partial V_{PE}^{sec}(q)/\partial q > 0$, and $\partial V_{PE}^{m}(q)/\partial q > 0$. Moreover, since the borrower's bank-certification benefit will get smaller as q increases, we expect $\partial[V_{PE}^{sec}(q) - V_{PE}^{m}(q)]/\partial q < 0$.

Recall that bank financing is also associated with a deposit-gathering cost that is increasing in the amount of deposits gathered. Denote this cost by $D(q)$. Since the bank faces a risk-sensitive (equity) capital requirement that is decreasing in q, it follows that $\partial D(q)/\partial q > 0$.

With these preliminaries, we can write down the incremental value of bank financing *relative* to capital market financing as

$$\Delta_{bank} = V_S(q) - D(q) - V_{PE}^{m}(q), \tag{1}$$

and the incremental value of securitization *relative* to capital market financing as

$$\Delta_{sec} = V_S(q) - F + V_{PE}^{sec}(q) - V_{PE}^{m}(q), \tag{2}$$

where F is the fixed cost of setting up the securitization trust.

Let us now focus on borrowers who are not subject to credit exclusion, that is, $q \geq q_l$. For these borrowers, if q is relatively low, then $V_S(q)$ is relatively high. Moreover, for low q, banks face high capital requirements, so $D(q)$ will be relatively low. The low q also implies that $V_{PE}^m(q)$ will be relatively low; $V_{PE}^{sec}(q)$ will be low too but higher than $V_{PE}^m(q)$. Hence, for low q, both Δ_{bank} and Δ_{sec} will be strictly positive. But if F is large enough, we will have $\Delta_{bank} > \Delta_{sec}$.

Now, as q increases, we see that

$$\frac{\partial \Delta_{bank}}{\partial q} = \frac{\partial V_S(q)}{\partial q} - \frac{\partial V_{PE}^m(q)}{\partial q} - \frac{\partial D(q)}{\partial q} < 0, \tag{3}$$

$$\frac{\partial \Delta_{sec}}{\partial q} = \frac{\partial V_S(q)}{\partial q} - \frac{\partial V_{PE}^m(q)}{\partial q} + \frac{\partial V_{PE}^{sec}(q)}{\partial q} < 0. \tag{4}$$

Since $\partial D(q)/\partial q > 0$ and $\partial V_{PE}^{sec}(q)/\partial q > 0$, we see that $|\partial \Delta_{bank}/\partial q| > |\partial \Delta_{sec}/\partial q|$. Thus, as q increases, the benefit of bank financing relative to market financing falls faster than does the benefit of securitization relative to market financing. This is intuitive. As observable borrower quality improves, banks need to keep less capital and therefore gather more deposits, which is costly and diminishes the advantage of bank financing relative to market financing. Moreover, the certification benefit of bank origination also declines as observable borrower quality goes up; this decrease in the relative advantage of bank financing over market financing also occurs with securitization. However, since the fixed cost of setting up securitization trust (F) is invariant to borrower quality, the advantage of securitization relative to market financing does not decline as fast as the relative advantage of bank financing. Figure 1 depicts these pictorially.

Summarizing, we have our first result:

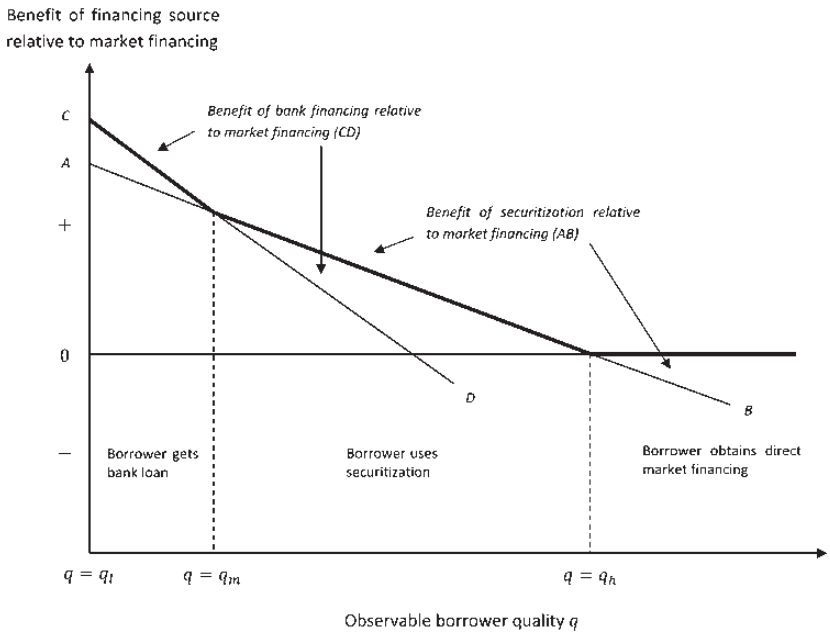
Result 1. *An authentic borrower chooses its financing source in equilibrium as follows:*

(1) *There exists a low quality cutoff,* $q_l > 0$, *such that an authentic borrower with* $q < q_l$ *cannot obtain financing.*
(2) *There exists a high quality cutoff,* $q_h > q_l$, *such that an authentic borrower with* $q \geq q_h$ *directly borrows from the capital market and the one with* $q \in [q_l, q_h)$ *approaches a bank.*
(3) *There exists a medium quality cutoff,* $q_m \in (q_l, q_h)$, *such that an authentic borrower with* $q \in [q_l, q_m)$ *prefers a bank loan and the one with* $q \in [q_m, q_h)$ *prefers securitization.*

In equilibrium, every crook within a prior quality cohort q *chooses the same financing source as the authentic borrower in that cohort.*

Note that the equilibrium above is pooling in the sense that the observationally indistinguishable crooks *within* any observable quality cohort always

FIGURE 1. Borrower's Choice of Financing Source



choose the same financing source as the authentic borrowers in that cohort. This is a sequential equilibrium that satisfies the universal divinity refinement of Banks and Sobel (1987), as proved in Song and Thakor (2010). The basic idea is that the set of pricing responses that would induce defection of the crooks from the equilibrium has a larger measure than the set of responses that would induce defection of the authentic borrowers from the equilibrium. Thus, financiers would view a defector to be more likely to be a crook, and this means the defector would receive a worse price by defecting than staying with the equilibrium. Thus, "hiding in the crowd" is an optimal strategy for the crooks.

As for the financing-source-choice dichotomy, the intuition can be summarized as follows. Both bank screening and capital market information revelation give rise to noisy signals, and the noise-to-information ratio increases as the borrower's observable credit quality declines. Thus, when this credit quality (q) is sufficiently low, the borrower is deemed insufficiently creditworthy to receive credit from *any* source. Borrowers of very high quality go directly to the capital market. These are borrowers who may be viewed as having sufficiently high credit reputations that they do not need bank certification. For example, we know that the highest-credit-quality firms are able to avail of commercial paper as a source of direct market financing, but this is not available to lower-quality firms. The intuition here is when observable credit quality is high, not only is the marginal value of bank certification low, but the incentives for

investors to become informed in the capital market are high, so market prices are very informative to the managers of firms in making real decisions. This quality-cutoff division between bank and market financing also appears in previous research (Bolton and Freixas 2000; Boot and Thakor 1997a). However, our analysis goes a step further to argue that borrowers of intermediate quality prefer to take bank loans that are then securitized. This allows them to take advantage of bank screening and certification, which stimulates information production in the capital market and hence elevates price informativeness, while at the same time avoiding bank funding which embeds the bank's cost of complying with capital requirements.

One might wonder if the result that it is the borrowers of *intermediate* quality who are securitized is consistent with the observed securitization of highly-risky subprime mortgages preceding the recent financial crisis. There are two points to note on this. First, the securitization of subprime mortgages is a relatively recent phenomenon, and for much of the time period over which mortgage securitization has existed, only qualifying prime mortgages were securitized, whereas riskier mortgages were not. Moreover, government subsidies and various other forms of political intervention played a role in the emergence of subprime mortgage securitization, an issue that we explicitly discuss later in our analysis. Second, the term "intermediate quality" is a *relative* term. These could still be fairly risky borrowers. The point is that there are even riskier borrowers who are served by bank loans that stay on the books of banks.

Co-evolution of Banks and Markets

Our previous analysis highlights competition between banks and markets. In this section, we discuss a richer form of bank-market interaction and examine collaboration and co-dependence between banks and markets, and how a financial system evolves as a whole.

Our framework shows that markets and banks are linked in the manner of co-dependence through two channels: securitization and risk-sensitive bank capital requirements. Let us explain the intuition. With securitization, the bank certifies a borrower's credit quality via credit analysis and the capital market finances the borrower, so each sector of the financial system operates at its best – banks focus on credit analysis and markets focus on providing financing. Improvements in the bank's credit analysis technology, as a result of development in the banking sector, enhance the capital market investors' confidence in a securitized borrower's credit quality. This, in turn, encourages greater informed trading in the capital market, since payoff enhancement is more probable with an authentic borrower, which then improves the information conveyed by the market price of securitized debt regarding the payoff-enhancement-relevant macroeconomic condition. The consequence is a lowering of the financing friction and a spurring of capital market evolution. That

is, securitization propagates banking advances to the capital market, permitting market evolution to be driven by bank evolution.

We next examine how development in the capital market affects banks. Note that banks need to raise costly equity capital from the market to support their lending, which forges a natural link between banks and markets. When the capital market develops, there is an improvement in the infrastructure for information acquisition and processing, so it costs less for investors to become informed, leading to an increase in the number of informed traders. With greater informed trading, the informativeness of the price of traded claims increases, which enables the authentic borrower to extract more precise information about the payoff-enhancement opportunity. Better investment decisions by the borrower result in a lowering of the cost of equity capital for the bank lending to the borrower. This allows the bank to raise additional equity capital (that is mandated by the risk-based capital requirement) to extend riskier loans that were previously eschewed. That is, advances in the capital market enable banks to expand their lending scope (i.e., q_l decreases) and lend to riskier borrowers that were previously excluded from credit availability.

Moreover, as banks lend to riskier borrowers, they find it privately optimal to improve their credit analysis precision to distinguish more accurately between authentic borrowers and crooks, even in the absence of a general improvement in information technology. That is, development in the capital market feeds the development of the banking sector through risk-sensitive bank capital. This means that it is through (risk-sensitive) bank capital that market advances that diminish the financing friction end up being transmitted to banks, permitting banks to more effectively resolve the certification friction for borrowers and expand their lending scope.

These feedback loops generate a virtuous cycle in which each sector of the financial system benefits from the development of the other, so banks and markets not only act as competitors as Result 1 shows, but also as collaborators that complement each other. To summarize, we have:

Result 2. *Bank evolution spurs capital market evolution, and capital market evolution spurs bank evolution: banks and markets co-evolve with each other.*

The key to this co-evolution result is two-fold. On the one hand, banks need equity capital to support on-balance-sheet loans, and the capital market is the source. Advances in the capital market make this equity capital cheaper, benefiting banks and permitting an expansion in lending scope. On the other hand, banks act as "filters" for the capital market, screening out egregiously bad credit risks and thereby increasing the marginal return to information production for investors, leading to more efficient security prices and capital market evolution.

In this sense, our analysis complements the important observation by Laeven, Levine, and Michalopoulos (2012) about the synergies between financial development and real-sector development. In their analysis, real-sector development makes financial-sector screening technologies obsolete. So profitable

investments are not financed, unless screening technology innovations allow the financial sector to catch up. The contrast is that we focus on the interaction between banks and markets *within* the financial system, whereas they focus on the interaction between the financial system as a whole and the real sector.

III. Political Intervention

In this section, we examine how political intervention can play a role at various stages of the financial system development.

Why Do Politicians Intervene? Objective of Political Intervention

Why do politicians want to intervene in the financial system? One reason is that politicians seek to increase their wealth and power.[6] This is achieved by increasing the likelihood of getting re-elected, as a longer tenure in office allows for greater accumulation of power and influence and better opportunities for wealth accumulation both while holding office and after. In turn, this may be facilitated by increasing the number of borrowers receiving credit from the financial system, which then creates an incentive for politicians to intervene in the financial system to expand credit availability. The idea is as follows. Being able to tout expanded credit availability as a benefit generated for potential voters provides politicians with a way to curry favor with their voter base and increase the odds of being re-elected. Even apart from such private benefits, politicians may be philosophically aligned with the idea that having credit available to a broader set of people is a good social goal. As an example, the idea of universal homeownership for Americans has been appealing to many U.S. politicians, and this may induce them to push banks to expand credit availability to more Americans to enable a higher number of home purchases. Specifically, in our framework the objective of political intervention is to expand the lending scope of the financial system, that is, to decrease the credit exclusion cutoff, q_l: recall only borrowers with credit qualities $q \in [q_l, 1]$ are able to access the financial system for credit (either from the banking sector or the capital market), so a lower q_l corresponds to a wider lending scope. Having said this, we wish to emphasize that there are plausible circumstances in which such a goal is consonant with the goal of maximizing power and wealth.

How Do Politicians Intervene?

What kind of intervention do politicians engage in? In terms of specific strategies for political intervention, we consider two sets of strategies. First, politicians may expand the lending scope of the banking sector by providing capital subsidies to banks in exchange for government ownership. The capital infusion

6. A direct, albeit crude, way to do this would be to accept bribes from certain groups and engage in other illegal activities. While this is a realistic alternative specification, we rule it out in our analysis.

is subsidized in the sense that the ownership taken by the government is smaller than what its equity infusion would justify in a competitive capital market. Because banks receiving subsidized equity capital have more capital to satisfy risk-based capital requirements, they are willing to lend to riskier (lower-quality) borrowers that were previously excluded. That way, politicians can influence the financial system to expand its lending scope.

Alternatively, politicians may enact direct lending legislation that requires banks to expand lending scope and extend credit to riskier borrowers, even if doing so imposes losses on the banking sector. Banks failing to obey the regulations face revocation of their licenses to operate. As long as banks are sufficiently profitable, the licenses will be valuable and banks will comply.[7]

To analyze political intervention at different stages of financial system development, we use the cost of acquiring information about the payoff-enhancement-relevant macroeconomic condition as a measure of the stage of financial system development, with the cost declining as the financial system develops from a primitive stage to an advance stage. The idea is that this cost is high in the early stage of financial system development because the necessary infrastructure for obtaining information about firms' investment condition is still primitive and processing information can be quite costly. By contrast, in an advanced financial system, there is considerable information that can be acquired and processed at a relatively low cost.

Political Intervention at the Early Stage of Financial System Development

At the early stage of financial system development, the high cost of becoming an informed investor leads to a relatively small number of informed traders. With low informed trading, market prices are not very informative, so the borrower is more likely to pass up value-enhancing investment opportunities, which in turn drives up the cost of equity capital for the bank lending to the borrower. This relatively high cost of bank equity reduces the bank's profit, which leads to denial of credit to high-risk (low-quality) borrowers, that is, the bank's lending scope is narrow at this stage (q_l being relatively high). This narrow lending scope prompts politicians to intervene in the banking sector to expand its lending scope. What form of intervention will politicians find optimal?

First, consider direct lending regulation in which politicians enact regulations that force banks to expand the lending scope without any subsidy. This strategy of intervention is unlikely to work out at the early stage, because banks' profits from lending are too low to absorb the losses such risky lending imposes on banks. If politicians force banks to lend to low-quality borrowers,

7. Clearly, the intervention strategy space of politicians is much richer in practice than the two strategies we have chosen to analyze. However, we believe those are two commonly deployed strategies, and analyzing a more complex set of strategies becomes analytically intractable.

the loss to the banks may lead them to voluntarily surrender their banking licenses and quit the banking industry.

A second approach for politicians is to induce each bank to increase its lending scope to lend to low-quality borrowers who were initially denied credit access (i.e., those with $q < q_l$) by "compensating" the banks. We consider government ownership in exchange for subsidized equity as a tool to achieve this. Specifically, the subsidy manifests itself through a government ownership of the bank that is smaller than what is justified by the amount of equity capital subsidized, if the subsidized capital were to be raised from a competitive capital market. Note that equity capital is more costly at the early stage due to less informed trading in the financial market, so each bank will value subsidized equity capital relatively highly. Clearly, a larger capital subsidy corresponds to a larger increase in the banks' lending scope, which increases the private benefits that politicians obtain from broader credit access.

What are the consequences of an expanded bank lending scope with a government equity subsidy? Will it also induce banks to increase their screening precision and hence spurs capital market evolution as it does without political intervention (see Section II)? To analyze this, note that, without a government equity subsidy, a bank finds it *privately* optimal to increase its screening precision as it lends to risky, previously excluded borrowers, as the bank bears the entire cost of not being able to screen crooks accurately. With an equity subsidy, the government has part ownership of the bank and hence shares the cost of imprecise screening, so a bank's incentive to improve its screening precision is weakened. As a result, we do not get the same positive propagation of development from banks to capital markets, and the financial system does not experience the same evolutionary boost, despite its lending scope being expanded. In fact, the larger the government equity subsidy, the less likely it is that the banking sector will improve its screening technology. Thus, political intervention at the early stage of a financial system may retard its development, despite a broader lending scope. Moreover, because the expansion of the banking sector's lending scope is not accompanied by a concomitant increase in bank screening precision, systemic risk in the financial system increases as well.

Political Intervention at the Intermediate Stage of Financial System Development

The cost of becoming informed is lower at the intermediate stage, so there are more informed traders in the capital market than in the early stage of development. Thus, equity capital is less expensive for banks in the intermediate stage than in the early stage. As our previous analysis shows, the financial system's lending scope is broader (lower q_l) in the intermediate stage. Politicians, however, may want to expand the scope even further. But an equity subsidy is now less attractive to a bank, and for each unit of equity subsidized, the bank responds by increasing its lending scope less in the intermediate stage than in

the early stage. An equity subsidy is thus less efficient for politicians in the intermediate stage than in the early stage. Direct regulation may not work either because banks are not yet profitable enough to absorb the accompanying losses.

Thus, at the intermediate stage, we see that political intervention is muted compared to the early stage. It is even possible that when equity capital is sufficiently less expensive for banks, an equity subsidy from the government may disappear altogether at the intermediate stage. At the same time, if banks' profits are still not high enough to absorb the loss associated with direct lending regulation, direct lending regulation that mandates lending to high-risk borrowers will not be feasible either. That is, there may be no political intervention at all at some specific intermediate stage of financial system development.

Political Intervention at the Advanced Stage of Financial System Development

At an advanced stage of financial system development, information acquisition in the capital market is the least costly, so the number of informed traders in the capital market is the largest. Thus, politicians view a capital subsidy as even less attractive now than at the intermediate stage.

The relatively low cost of bank equity generates relatively high profits for banks in this stage of financial system development. Direct lending regulations that mandate that banks lend to risky, excluded borrowers now become feasible. Banks comply because their high profits make their banking licenses valuable.

What are the consequences of the expansion of the banking sector's lending scope at this stage of financial system development? Note that although banks bear the full cost of imprecise screening as they lend to risky, previously-excluded borrowers under the lending regulation, they will *not* increase their screening precision by investing more in the screening technology. To see why, note that if banks were to improve their screening precision when they are compelled to expand their lending scope, they would have done so voluntarily even without such regulatory pressure. The reason why banks had chosen not to lend to those highly risky (previously excluded) borrowers in the first place is because the marginal benefit of improved screening is outweighed by its marginal cost. Direct lending regulations compel banks to lend but do not fundamentally alter this benefit-cost tradeoff. As a result, political invention at the advanced stage of financial system development also increases financial system risk, as it does at the early stage. We can summarize this discussion as follows:

Result 3. *Political intervention in the financial system is stage dependent*:

(1) *At an early stage of financial system development, when information acquisition and processing in the capital market are sufficiently costly so informed trading is sufficiently low and bank equity cost is sufficiently high, politicians intervene by providing subsidized capital to banks.*

(2) *At an intermediate stage of financial system development, when information acquisition and processing cost in the capital market increases but banks' profit is still low, politicians avoid intervening with either equity subsidy or direct lending regulations.*
(3) *At an advanced stage of financial system development, when information acquisition and processing cost becomes even lower and banks' profits become higher, politicians intervene by enacting direct lending regulations to force banks to expand lending scope to low-quality borrowers that create losses for banks.*

To capture the intuition for this result in a summary form, note that the choice of political intervention rests on the tradeoff between the cost to the taxpayers/voters of the chosen intervention and the effectiveness of the intervention in influencing banks to expand lending scope. At an early stage of financial development, bank lending scope is constrained by the high cost of raising the equity capital needed to support risky lending. Because capital is a costly resource, politicians are able to significantly influence banks by providing it at a subsidy via government ownership of banks. So that is the chosen mode of intervention. At an advanced stage, capital is cheap, so offering that as a carrot to banks to expand lending scope is far less effective. But banks are also more profitable at this stage, so a license to operate has high value, and politicians can simply enact regulations requiring banks to engage in risky lending (even at an expected loss) because there is a sufficient profit cushion for each bank to satisfy its participation constraint. It is in the middle – the intermediate stage of development – that capital is not costly enough and bank profits are not high enough to make either intervention strategy viable.

IV. Policy Implications and Conclusion

In this paper we have discussed the theoretical underpinnings of financial system evolution. The main result is that banks and capital markets within the financial system exhibit three forms of interaction: competition, complementarity and co-evolution. This is in contrast to the standard view that banks and markets only compete with each other.

This new perspective is rich in implications about development policy, but as our analysis indicates, we should be careful to distinguish between policy interventions aimed at correcting market failures and those driven by political economy factors. In the past, development agencies have sometimes adopted the view that emerging capitalistic economies, like say Romania and other former Soviet-bloc countries, needed to develop capital markets first in order to have the financial systems needed to support vigorous economic growth (e.g., see Meyendorff and Thakor 2002). In many instances, this led to considerable resources being devoted to developing stock exchanges and over-the-counter markets like RASDAQ, the Romanian version of NASDAQ,

well before robust financial institutions were developed. What our analysis shows, consistent with the policy conclusions in Meyendorff and Thakor (2002), is that such a policy prescription is misguided. Banks and markets have to be developed together; focusing first on markets and not on banks actually *runs the risk of retarding capital market growth itself*. With a policy not focused on co-evolution, one may sacrifice the efficacy of *both* market and banking system development. Thus, in the interest of correcting potential market failure, development policy should focus on the *simultaneous* development of banks and markets. What is interesting is that this can also deal effectively with political economy forces, since it can make political intervention *less* likely as politicians would be unable to use the perceived failure of the financial system as a politically convenient reason to intervene.

This brings us to our examination of endogenous political intervention in financial system development. Such intervention can be broadly viewed as being one of two types – either motivated by the desire to correct a market failure or motivated by the selfish interests of politicians. An example of the former motivation is the liquidity-provision intervention by the Federal Reserve during the recent crisis when the private provision of liquidity in the shadow banking system dried up. Such intervention is ex post efficient in the sense that it minimizes market-failure-related distortions. This is *not* the kind of political intervention that our analysis focuses on. Specifically, the intervention in our analysis is motivated by the selfish interests of politicians – the desire to (inefficiently) expand credit availability to enhance the re-electability prospects of politicians. We showed that political intervention is just as likely in well-developed financial systems as it is in emerging, underdeveloped systems. In emerging financial systems, politicians provide subsidized equity in exchange for ownership of banks. In well-developed financial system, politicians enact regulations that mandate that banks lend to previously excluded high-risk borrowers. In both cases, the effect is the same – systemic risk of the financial system is increased. Thus, if the goal is to improve financial system stability, the discussion cannot proceed without explicitly considering political incentives to undertake initiatives that increase financial system risk. In case this increased systemic risk leads to a financial crisis, there may be an opportunity for political intervention that is aimed at correcting a market failure. There can thus be an *interaction* between the two motivations for policy intervention by the government. Purely politically motivated intervention can increase the likelihood of intervention aimed at correcting market failures.

Also interesting is the potential *interaction* between policy mis-steps due to the failure to recognize that banks and markets must co-evolve on the one hand and the likelihood and nature of political intervention in the financial system on the other hand, an issue touched upon briefly earlier. This takes us beyond the issues analyzed earlier because the nature of political intervention now becomes less predictable, since it is likely to be targeted at whatever is perceived to be a failure in the financial system. This introduces a form of

endogenous uncertainty into the financial system and further elevates systemic risk.

A key point emerging from our analysis is that securitization is one of the elements that is responsible for the virtuous loop that positively connects the co-evolution of banks and markets. Thus, if there is any government intervention that our analysis supports, it is in the form of encouraging the development of securitization markets, and *not* any direct intervention to expand bank lending either through government ownership of banks or direct lending legislation that compels banks to lend to otherwise-excluded high-risk borrowers.[8] The reason is that the encouragement of securitization helps to improve economic efficiency by reducing the impact of frictions related to asymmetric information that can lead to market failures (e.g., credit rationing or other forms of credit exclusion due to a limited scope of direct bank lending), whereas direct intervention to expand credit availability is motivated solely by political considerations and comes at the expense of economic efficiency. In other words, politicians need to distinguish between market failures arising from coordination failures among profit-maximizing participants – that may be subject to attenuation through selective ex post government intervention – and those that are linked to the endogenous uncertainty created by government mis-steps.

We have not considered the impact of the judicial system on the interactions we have examined, so a few remarks on that are appropriate. As La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998) have shown, legal systems and the implied property rights have important consequences for finance and growth. There are at least two major issues here. One is the impact of the judicial system on how much information about potential borrowers is available in the public domain. Laws differ across countries when it comes to how much credit information lenders, credit reporting bureaus and others can share about borrowers. Our analysis suggests that the more the judicial system permits the release and dissemination of such information, the smaller will be the (screening) advantage of banks over markets. Hence, capital markets will experience a greater share of total credit extension in economies with judicial systems of this sort. The other issue is creditor versus borrower (shareholder) rights. Again, legal systems differ in the extent to which they favor one group over the other (La Porta, Lopez-de-Silanes, Shleifer, and Vishny 1998). Since the economic forces that propel banks and markets to develop further originate from creditors in our model, the analysis hints at the superiority of legal systems that favor creditor rights, at least in terms of correcting market failures and facilitating bank-market co-evolution. However, this is no more than a hint, so it would be an interesting one to examine in future research.

8. Clearly, our model does not argue that ex post efficient government interventions during financial crises are not worthwhile.

References

Allen, Franklin. 1990. "The Market for Information and the Origin of Financial Intermediation." *Journal of Financial Intermediation* 1(1): 3–30.

Allen, Franklin, and Douglas Gale. 1997. "Financial Markets, Intermediaries, and Intertemporal Smoothing." *Journal of Political Economy* 105(3): 523–46.

———. 1999. "Diversity of Opinion and Financing of New Technologies." *Journal of Financial Intermediation* 8(1–2): 68–89.

Banks, Jeffrey, and Joel Sobel. 1987. "Equilibrium Selection in Signaling Games." *Econometrica* 55(3): 647–61.

Beck, Thorsten, and Ross Levine. 2002. "Industry Growth and Capital Allocation: Does Having a Market– or Bank–Based System Matter?" *Journal of Financial Economics* 64(2): 147–80.

Bhattacharya, Sudipto, and Gabriella Chiesa. 1995. "Proprietary Information, Financial Intermediation, and Research Incentives." *Journal of Financial Intermediation* 4(4): 328–57.

Bolton, Patrick, and Xavier Freixas. 2000. "Equity, Bonds, and Bank Debt: Capital Structure and Financial Market Equilibrium under Asymmetric Information." *Journal of Political Economy* 108(2): 324–51.

Boot, Arnoud, and Anjan Thakor. 1997a. "Financial System Architecture." *Review of Financial Studies* 10(3): 693–733.

———. 1997b. "Banking Scope and Financial Innovation." *Review of Financial Studies* 10(4): 1099–131.

Boyd, John, and Edward Prescott. 1986. "Financial Intermediary–Coalitions." *Journal of Economic Theory* 38(2): 211–32.

Brown, Craig, and Serdar Dinç. 2005. "The Politics of Bank Failures: Evidence from Emerging Markets." *Quarterly Journal of Economics* 120(4): 1413–44.

Calomiris, Charles, and Peter Wallison. 2009. "The Last Trillion–Dollar Commitment: The Destruction of Fannie Mae and Freddie Mac." *Journal of Structured Finance* 15(1): 71–80.

Coval, Joshua, and Anjan Thakor. 2005. "Financial Intermediation as a Beliefs–Bridge between Optimists and Pessimists." *Journal of Financial Economics* 75(3): 535–69.

Deidda, Luca, and Bassam Fattouh. 2008. "Banks, Financial Markets and Growth." *Journal of Financial Intermediation* 17(1): 6–36.

Demirgüç-Kunt, Asli, and Ross Levine. 2001. *Financial Structure and Economic Growth: A Cross–Country Comparison of Banks, Markets, and Development*. Cambridge, MA: The MIT Press.

Dewatripont, Mathias, and Eric Maskin. 1995. "Credit and Efficiency in Centralized and Decentralized Economies." *Review of Economic Studies* 62(4): 541–55.

Dinç, Serdar. 2005. "Politicians and Banks: Political Influences on Government–Owned Banks in Emerging Markets." *Journal of Financial Economics* 77(2): 453–79.

Gennaioli, Nicola, Andrei Shleifer, and Robert Vishny. 2011. "A Model of Shadow Banking." Working Paper, Harvard University, Cambridge, MA.

Gertler, Mark. 1988. "Financial Structure and Aggregate Economic Activity: An Overview." *Journal of Money, Credit and Banking* 20(3): 559–88.

Gurley, John, and Edward Shaw. 1955. "Financial Aspects of Economic Development." *American Economic Review* 45(4): 515–38.

———. 1956. "Financial Intermediaries and the Saving–Investment Process." *Journal of Finance* 11(2): 257–76.

La Porta, Rafael, Florencio Lopez-de-Silanes, and Andrei Shleifer. 2002. "Government Ownership of Banks." *Journal of Finance* 57(1): 265–301.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny. 1998. "Law and Finance." *Journal of Political Economy* 106(6): 1113–55.

Laeven, Luc, Ross Levine, and Stelios Michalopoulos. 2012. "Financial Innovation and Endogenous Growth." Working Paper, Brown University, Providence, RI.

Levine, Ross. 2002. "Bank–Based or Market–Based Financial Systems: Which Is Better?" *Journal of Financial Intermediation* 11(4): 398–428.

———. 2010. "Financial Innovation Boosts Economic Growth: A Debate with Joseph Stiglitz." *The Economist* (February – March). London: The Economist Newspaper Ltd.

Levine, Ross, and Sara Zervos. 1998. "Stock Markets, Banks, and Economic Growth." *American Economic Review* 88(3): 537–58.

Meyendorff, Anna, and Anjan Thakor. 2002. *Designing Financial Systems in Transition Economies: Strategies for Reform in Central and Eastern Europe*. Cambridge, MA: The MIT Press.

Ramakrishnan, Ram, and Anjan Thakor. 1984. "Information Reliability and a Theory of Financial Intermediation." *Review of Economic Studies* 51(3): 415–32.

Song, Fenghua, and Anjan Thakor. 2007. "Relationship Banking, Fragility, and the Asset–Liability Matching Problem." *Review of Financial Studies* 20(6): 2129–77.

———. 2010. "Financial System Architecture and the Co–evolution of Banks and Capital Markets." *The Economic Journal* 120(547): 1021–55.

———. 2011. "Financial Markets, Banks, and Politicians." Working Paper, Pennsylvania State University, University Park, PA.

Stein, Jeremy. 2010. "Securitization, Shadow Banking, and Financial Fragility." *Daedalus* 139(4): 41–51.

Stiglitz, Joseph, and Andrew Weiss. 1981. "Credit Rationing in Markets with Imperfect Information." *American Economic Review* 71(3): 393–410.

Subrahmanyam, Avanidhar, and Sheridan Titman. 1999. "The Going–Public Decision and the Development of Financial Markets." *Journal of Finance* 54(3): 1045–82.

Tadesse, Solomon. 2002. "Financial Architecture and Economic Performance: International Evidence." *Journal of Financial Intermediation* 11(4): 429–54.

Townsend, Robert. 1979. "Optimal Contracts and Competitive Markets with Costly State Verification." *Journal of Economic Theory* 21(2): 265–93.

von Thadden, Ernst-Ludwig. 1995. "Long–Term Contracts, Short–Term Investment and Monitoring." *Review of Economic Studies* 62(4): 557–75.

Yosha, Oved. 1995. "Information Disclosure Costs and the Choice of Financing Source." *Journal of Financial Intermediation* 4(1): 3–20.

Financial Development: Structure and Dynamics

Augusto de la Torre, Erik Feyen, and Alain Ize[1]

This paper analyzes the process of financial development over the last three to four decades from the perspective of the fundamental frictions (agency and collective) to which economic agents were exposed. A comprehensive statistical benchmarking analysis showed that financial development followed regular dynamics that can be largely explained by the underlying frictions. In particular, the sequencing, returns to scale, and shape of the developmental paths for various types of financial activities—including public debt, banking, insurance, asset management, and capital markets—broadly matched benchmark predictions. Reflecting financial innovation and the dynamic interaction between financial and economic development, financial development paths were also found to be strongly dependent on initial conditions. At the same time, policy differences, including the failure to improve the quality of the enabling environment and prevent financial crashes (the dark side of finance), were found to explain a sizable share of the deviations of individual country paths from the benchmarks. JEL codes: G2, G38, O16, O54

What has shaped the process of financial development (FD), and how regular has it been? Has this process followed a single or multiple paths? What were the sequences and shapes of the paths followed by different financial services and activities (as measured by FD indicators) as economies developed? How did policy—whether aimed at strengthening the enabling environment for financial contracting or ensuring the sustainability of FD—affect these paths?

Remarkably, the literature (particularly the empirical literature) that attempts to explain how economic development and financial sector policies jointly affect FD is still nascent.[2] The proposition that financial structure is shaped by the efforts of market participants to circumvent and reduce the

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2. See Huang (2005) for a comprehensive review of the literature on the determinants of FD.

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frictions that hinder financial contracting is of course a familiar one.[3] However, few papers have attempted to analyze these frictions in terms of the way they interact and what this interaction may imply for the dynamics of FD.[4] At the same time, FD has typically been understood as a relatively smooth and predictable march from "relationship-based finance" to "arm's-length finance" involving a systematic process of market completion driven by a gradual reduction of agency frictions.[5] However, the global financial crisis showed that FD has a "dark side" associated with volatile boom-bust cycles. Thus, what may appear as progress in market completion can, in fact, exacerbate market failures, thereby undermining the sustainability of FD.

This paper begins by exploring and explaining the patterns of FD based on a simple typology of the frictions that hinder financial contracting. Following work by de la Torre and Ize (2010, 2011), the paper separates the frictions into agency frictions, which restrict the scope of bilateral contracting, and collective frictions, which restrict the scope of multilateral interaction and participation.[6] The structure of the financial system and its evolution over time (hence FD) reflect efforts to find the path of least resistance around these frictions. This hypothesis leads to broad predictions regarding the sequencing of financial activities, the shape of their development paths, the importance of scale effects, and the role of public policy. The hypothesis also suggests that the same easing of frictions that underlies the "bright side" of FD (innovation, market completion, improved allocation of funds and risks) can breed the tensions and fault lines of the "dark side" (systemic fragility, excessive fluctuations, crises).

3. See, for example, Merton and Bodie (2004).

4. Interestingly, more work has been done on measuring the impact of FD on economic growth than on exploring how FD is affected by policy and economic growth (see, for example, Beck and Levine, 2004). When discussing the impact of financial structure on growth, the literature, at least until very recently, generally concluded that function matters more than form. See Demirgüç-Kunt and Levine (1999) or Allen and Gale (2000). More recent papers (such as Demirgüç-Kunt, Feyen, and Levine, 2011) have come closer to recognizing that there might be such a thing as an "optimal" financial structure, that is, that form might also matter.

5. An earlier strand of thought viewed FD as driven by the steady mitigation of asymmetric information failures, such as moral hazard and adverse selection (see, for instance, Akerlof [1970], Spence [1973], and Stiglitz and Weiss [1981]). A more recent strand has emphasized enforcement costs and lack of collateral leading to problems of limited pledgeability (see Holmstrom and Tirole [1996], and Geanakoplos, [2009]). Rajan and Zingales (2003) present a more complete narrative rooted in the same basic threads.

6. Failures to reduce agency frictions continue to dominate the FD literature. Such failures may occur at the level of the investor (reflecting an inability to monitor or a lack of interest in doing so), at the level of the borrower (reflecting problems of governance), or somewhere in between (reflecting problems of incentives and "skin in the game" at some level of the contractual chain or the monitoring pyramid). Failures to resolve multilateral-participation frictions, although less frequently discussed, are equally important. These failures are a routine occurrence in less-developed financial systems and justify much of the state's catalytic and financial infrastructure-building role. However, such failures may also occur in well-developed systems, particularly in the process of spreading risk (see Anginer, de la Torre, and Ize [2011]).

To explore such issues, we use a battery of 16 financial indicators that relate to different dimensions (depth-size or liquidity-efficiency) and channels (markets or institutions) of FD. To create a uniform set of dynamic benchmarks that facilitates comparisons across countries, we use a comprehensive set of country-level controls consisting of variables that reflect the stage of economic development (initial and current per capita income) as well as structural variables that are arguably exogenous to financial policy, including population size and density. We find that FD, as measured by the benchmarks, followed regular dynamics. However, development paths depended on the initial level of per capita income. Thus, the lower-income countries did not generally retrace the steps followed in the past by the current higher-income countries. This finding suggests that across-the-board innovations (that lift all boats at the same time) and path dependencies (that reflect dynamic interactions between financial and economic development) are both relevant for a country's FD trajectory. The fact that the data we use cover only a small slice of the world's FD history (35 years at most) compounds the importance of such initial income effects.

Reflecting the differential impact of frictions on different financial activities, paths differed widely across FD indicators. Indeed, the sequencing of financial services broadly conformed to what one would expect based on the gradual smoothing of the frictions along the paths of least resistance. For example, reflecting differences in the difficulty of coping with bilateral agency frictions (information or contract enforcement costs) across financial services, credit to governments developed before credit to private participants, bank deposits preceded bank credit, and the development of capital markets and associated institutions, such as mutual funds and other forms of asset managers, followed the development of bank credit. At the same time, reflecting collective frictions and network effects, external funding of the government preceded domestic funding, retail funding preceded wholesale funding, casualty insurance preceded life insurance, the development of capital markets lagged behind and was highly convex (a manifestation of large scale and network effects), and interconnectedness increased significantly as financial systems matured.

We further explore the dynamics of FD based on an analysis of how and why countries deviated from their benchmark paths. For this exploration, we use as additional controls a number of policy-related variables proxied by various enabling-environment indicators. We also include a financial crash variable to capture the dark side of FD. We find that enabling-environment factors, such as enforcement costs, creditor or property rights, and credit information, played an important role in promoting FD. However, we find that contractual frictions (rather than informational frictions) explained the bulk of policy-induced developmental differences across countries. Although informational frictions could be mostly overcome through technological innovations that could be more easily imported, contractual frictions mostly reflected weaknesses in local (nonimportable) institutions that were more difficult to resolve.

Regarding booms and busts, we find that financial crashes accounted for large and lasting lags in FD that cut across a surprisingly large number of indicators and dimensions of FD. The lasting impact of financial crashes clearly puts a premium on central bankers' and supervisors' capacity to anticipate and control unsustainable booms through monetary or macroprudential policies.

The rest of the paper is organized as follows. Section 2 briefly presents the conceptual framework for financial frictions that underpins FD (the bright side of finance) and links it with financial instability (the dark side of finance). Section 3 describes the data and procedures that are used to estimate the FD paths. Section 4 presents the dynamics of FD as given by the benchmark paths. Section 5 explores the role of policy in explaining deviations from the benchmarks. Section 6 concludes.

I. Financial Frictions, Financial Development, and Financial Stability

The financial services industry emerges to help market participants find ways to reduce or circumvent the two classes of frictions that hinder financial contracting: bilateral agency frictions and multilateral collective frictions. Each class can be subdivided into two categories: informational frictions (which relate to agents' limited and often asymmetric capacity to understand information and to the costs of obtaining information) and relational frictions (which hinder agents' capacity to agree, act upon, and enforce bilaterally or collectively beneficial financial contracts). This simple dichotomy underpins four paradigms, of which two (asymmetric information and costly enforcement) are associated with agency frictions and two (collective action and collective cognition) are associated with collective frictions.[7]

Asymmetric information frictions hinder FD because they lead to a misalignment of incentives between the principal and the agent. This misalignment, in turn, can trigger the commonly known market failures of adverse selection, risk shifting, shirking, and false reporting. Thus, information asymmetry frictions limit financial contracts to those contracts in which the agent has sufficient resources of its own at risk ("skin in the game") and/or where the principal can adequately screen and monitor the agent. Enforcement frictions also lead to a misalignment of incentives between the principal and the agent and, in this case, because of imperfect pledgeability, to a situation in which the agent is unable to credibly commit to honor the contract. Imperfect pledgeability thus restricts financial contracts to those contracts that can be effectively collateralized.

Collective frictions hinder FD by constraining collective (rather than bilateral) participation. Much of the gains from financial activity relate to the reduction in transaction costs and the increase in liquidity and risk diversification benefits that result from multilateral arrangements in which many players

7. For more details on the paradigms, see de la Torre and Ize (2010, 2011).

participate. Such arrangements can either take place in markets, where transactions can be conducted around a trading platform, or through financial institutions that offer services whose benefits are pooled across a large number of customers. The higher the number of participants is, the higher the benefits of participation will be. However, although participation creates positive externalities for society at large, it may be hindered by coordination failures. For example, because of first-mover disadvantages, an investor may abstain from buying a long-term security for which there is no secondary market and, hence, no liquidity. In this case, there is a multilateral (individual versus social) misalignment of incentives. Participation may also be hindered by collective (even symmetric) cognition frictions; one does not participate in an activity that is not well understood.

Therefore, market participants who wish to engage in financial contracting must find the path of least resistance around these frictions and the associated market failures. Once a decision is made to participate, private responses to coping with frictions can be divided into two subsets: responses aimed at lessening the frictions themselves (acquiring information, using collateral, delegating) and responses aimed at lessening the exposure to these frictions (diversifying and pooling risk, buying insurance and hedges, staying liquid). In turn, the state facilitates these private responses through a set of progressively more intrusive public interventions: (i) the provision of a basic contractual and informational infrastructure that facilitates contracting; (ii) coordination arrangements that facilitate participation (catalytic involvement to promote market development, systemic lending of last resort, government guarantees); (iii) the regulation and taxation needed to internalize externalities or protect consumers; and (iv) the direct provision by the state of financial services.

Financial structure is a snapshot, at a given point in time (hence, for a given technological and state of market development), of the composition of financial services aimed at coping with financial frictions. FD reflects the evolution of financial structure over time. At lower stages of FD, financial institutions resolve agency frictions by relying on nontradable and immovable collateral and relationship-based transactions. However, as the informational and contractual environment improves, private information becomes public, other types of collateral become available and tradable, and monitoring can increasingly rely on third parties, statistical methods, and accounting and disclosure standards.[8]

8. Different components of the financial system help address frictions in different ways. Consider information frictions: Capital markets provide price signals and motivate the supply of hard, public information by borrowing firms; banks generate proprietary information on clients; fund managers contribute to information gathering by monitoring marketable assets; and market facilitators (auditors, rating agencies, credit bureaus) contribute by selling specialized information and analysis. Consider risk management: Capital markets allow investors to diversify risk by buying assets with different risk profiles, and banks, insurance companies, and asset managers provide diversification through pooling. Finally, consider liquidity: Capital markets provide the liquidity that allows participants to unwind assets at limited cost, and banks offer deposits that can be redeemed on demand and at par.

The gradual easing of agency frictions thus helps boost participation, which unleashes positive network and scale externalities (e.g., liquidity, learning spillovers, efficiency) and sets in motion a virtuous development cycle. In turn, rising participation gradually increases the degree to which financial institutions and capital markets complement each other. The entire process is accelerated by financial innovation.[9]

The gradual easing of finance frictions provides a few predictable regularities that can be empirically verified. The first regularity concerns the sequence in which various financial activities are likely to develop, the second regularity concerns the shape of the paths they are likely to follow once they begin, and the third concerns the volatility of FD, reflecting the seeds of financial instability that germinate while FD takes place and that may eventually develop into a financial crisis.

The order of development of financial activities should reflect the intensity of the frictions to which they are exposed. The activities that are the least constrained should develop first. However, those financial services that are strongly inhibited by collective frictions should develop only after a critical mass of participation has been reached that is sufficient to trigger the positive network externalities needed to sustain their development. We would thus expect participation-intensive financial activities to be those that have the most rapid development paths (the most "buoyant" or convex) once they have passed this initial threshold. Because activities that exhibit the highest returns to scale are expected to be those exposed to the highest collective frictions, scale effects should correlate with the order in which financial activities develop and, subsequently, the buoyancy of their development.[10]

9. The history of FD is marked by major waves of innovation. Consider, for instance, the role in the exponential ascent of finance in the Western world stemming from the invention of Italian banking (based originally on trade-related bills of exchange) by the Medici in the late 14th century; the introduction of payment systems based on checking accounts, fractional reserve banking, and central banking during the 17th century; the development of the government bond market, its seeds already visible in the late middle ages; the invention of the joint-stock, limited liability company in the early 17th century and the associated mushrooming of stock exchanges; the emergence of marine insurance and life insurance in the second half of the 17th century; or, in the latter part of the 20th century, the development of securitization and derivative products. For an insightful and entertaining rendition of the history of finance in the Western world, see Ferguson (2008). For a recently updated review of the roots and dynamics of financial innovation, see Lerner and Tufano (2011). For the role of competition and deregulation in FD, see Rajan and Zingales (2003). Examples of theoretical and methodological breakthroughs that have dramatically influenced FD include double-entry bookkeeping, probability theory, life expectancy tables and actuarial science, and the Black-Scholes option theory.

10. The pattern can be broadly corroborated through comparative historical studies. The literature on the history of finance in the Western world is vast. See, for instance, Ferguson (2008) and Rajan and Zingales (2003).

However, the same frictions that underlie FD (the bright side of finance) are also likely to be at the root of its dark side (financial instability). We define the "dark side" as the type of financial malady in which the actual success in the process of smoothing frictions can endogenously lead to systemic instability.[11] This type of adverse dynamic may ensue if the easing of frictions boosts participation in such a way that it unleashes new and possibly more severe forms of frictions. FD may thus advance along a fragile or self-destructive trajectory that may lead to large and lasting reversals in developmental indices.

The dark side may arise at the interface between agency and collective action frictions. The smoothing of agency frictions facilitates a switch from private to public information, which, in turn, promotes participation but leads to a socially insufficient supply of screening and monitoring. Investors free ride on the increased availability of public information and choose to remain short and rely on market liquidity and public information to exit at the first sign of possible trouble.[12] The boost in participation can also promote risk origination without sufficient "skin in the game." As observed in the global crisis, this situation can give rise to a complex and opaque chain of transactions, which is ultimately unstable.[13]

This situation may also arise from dynamics associated with the intensification of collective action problems. The positive externalities of increased market participation in good times may turn into crippling negative externalities in bad times. Thus, market withdrawal in times of stress may be individually optimal but socially harmful because it can trigger self-fulfilling liquidity collapses.[14] Financial institutions may become too large (from a social point of view) because participants may not internalize the negative externalities (e.g., domino effects and contagion) associated with the failure of systemically important financial institutions and the too-big-to-fail or too-interconnected-to-fail syndromes that are associated with these failures.

The dark side may also be associated with the swelling of collective cognition problems. The successful easing of frictions (including through innovation) may lead to problems of collective cognition that, in a world of collective uncertainty, may result in wide mood swings. The bonanza associated with enhanced participation feeds a collective mood of optimism that unleashes bouts

11. There are other types of FD maladies. For instance, the lack of success in smoothing the frictions that make some forms of financial contracting impossible can itself be considered a malady. The success in smoothing frictions that leads to developmental inefficiencies can also be considered a malady. For example, financial innovations that are designed only to evade taxes or regulations may be beneficial to their creators and users, but not to society at large. Indeed, much of the increase in funds mobilization and allocation prior to the subprime crisis was arguably socially wasteful, even if it did not have adverse systemic stability consequences (Haldane, 2010). We are indebted to one of the referees for noting this point.

12. Huang and Ratnovski (2010) show that the dark side of bank wholesale funding dominates if bank assets are at arm's length and tradable.

13. See Ashcraft and Schuerman (2008) and Gorton and Metrick (2010).

14. See Shleifer and Vishny (2011).

of exuberance. The euphoric mood initially accentuates the upswing; however, once unexpected realities emerge, euphoria can easily turn into despair, worsening the collapse.[15]

II. Data and Estimation Procedures

In this section, we conduct a simple empirical analysis of FD indicators. Our aim is to illustrate the above conceptual framework by showing that the sequence of development of various financial activities and the shape of the path that they follow as they develop is consistent with (and thus validates, at least broadly) the broad footprints described above.

We measure domestic FD based on 14 depth-size indicators that include the following:[16]

- Key components of commercial banks' operations (retail and wholesale funding, credit to the private sector, credit to government, and claims on other domestic financial institutions)
- Insurance company premia (life and casualty)
- Mutual fund and pension fund assets
- Public and private debt securities (domestic and international capitalization)
- Equity (total stock market capitalization)

We complement these indicators with two indicators of efficiency-liquidity for which there is sufficient cross-country data:

- Banks' net interest margin
- Equity market turnover

To make the data as comparable as possible across countries, we create FD benchmark paths for each FD indicator by controlling for structural factors that can be considered policy exogenous (at least in the short term), including population (size and density) and three other country-specific characteristics that, for a given level of economic development, have a sizable impact (positive or negative) on FD (fuel exporter, offshore financial center, transition

15. The South Sea bubble and panic of 1720, which materialized in the wake of the financial revolution of the late 18th century, is an early example of bright side leading to dark side. The importance of mood swings for financial bubbles and panics has its roots in Keynes's animal spirits and Hyman Minsky's writings on financial crises (see Minsky 1975). More recently, the importance of mood swings was popularized by Kindleberger (1989) and Shiller (2006).

16. The data are from FinStats, a worldwide financial database compiled by the World Bank, which covers 40 key financial indicators for the 1980–2010 period (coverage quality varies between variables). The data come from a variety of sources, including the IMF's International Financial Statistics, BIS, *WDI*, S&P, Bankscope, Axco, and national sources.

country).[17] We also control for economic development, as proxied by per capita GDP. Although the latter is clearly not exogenous to FD, this fact is not a significant concern for what we want to achieve here.[18]

Reflecting that FD can be expected to be generally path dependent, we also include as controls the initial level of GDP per capita (as measured for the earliest date for which financial statistics are available) and its interaction with current GDP per capita. By introducing a level effect, including initial GDP per capita allows countries at different initial levels of economic development to follow their own dynamic FD path. The interaction term, for its part, allows the slope of this dynamic FD path to vary with the level of initial economic development.

As shown in the supplemental appendix S.II, this specification is key to properly representing the dynamics of FD, whether they reflect the impact of financial innovations or the interactions between economic and FD. Financial innovations are typically transferable across countries and thus tend to be introduced across the board (in low- as well as high-income countries)—that is, financial innovations can cause a boost in financial activity that "lifts all boats at the same time," with dynamic paths suddenly surging above the cross-section (benchmark) line at all per capita income levels in a parallel fashion.[19] In addition to allowing for such parallel surges, including the initial income level in the estimating regressions also helps to capture path dependence. Initial conditions matter because today's FD depends on today's output, which in turn depends on yesterday's FD. Path dependence thus implies that better initial institutions can become self-reinforcing.[20]

To facilitate the interpretation of the coefficients, we decompose the income effects into an initial income effect, y_0^i, and an income-growth effect, $y_t^i - y_0^i$ (all in logs). The estimating equation is as follows:[21]

17. The controls were selected iteratively, based on individual statistical significance and collective explanatory power.

18. Detecting FD patterns does not require identifying and isolating the ways in which the dynamics of financial and economic development interact. In addition, as long as FD affects economic development with a longer lag than the other way around, financial sector policies will have at least a temporary impact on FD that is not fully captured by economic development. If so, generating a benchmark path for each FD indicator and comparing countries against the benchmark is informative in terms of the quality of FD policies. Thus, deviations from benchmarks can be at least partially interpreted as reflecting differences in policies and (policy-driven) institutions. See supplemental appendix S.I (available at http://wber.oxfordjournals.org/) for a formalization of this argument.

19. Consider, for example, the cases of credit card services and e-banking. These services are now found in most developing countries, and although they cover a smaller fraction of the adult population, they work with comparable functionality and quality as in rich countries. In both cases, developing countries have been able to leapfrog because the associated technology is relatively easy to import and adapt and the services do not depend significantly on local contractual institutions.

20. See North (1990).

21. To better capture the underlying FD patterns, we employ quantile (median) regressions, which are less influenced by outliers.

$$(1) \qquad FD_t^{i,j} = \alpha_0^j + \alpha_1^j y_0^i + \left(\alpha_2^j + \alpha_3^j y_0^i\right)\left(y_t^i - y_0^i\right) + \alpha_4^j s_t^i + \Omega_0^j X_t^i + \Omega_1^j Z_t^i + \varepsilon_t^j$$

where $FD_t^{i,j}$ is the (log of) the indicator j of FD for country i at time t, s_t^i is the (log of) the country's population size, X_t^i is a vector of other country-specific structural characteristics, and Z_t^i is a vector of policy variables.

The α_1 coefficient measures the elasticity of FD with respect to the country's initial per capita income. The higher this elasticity is, the more dependent the development of the financial indicator (or financial activity) is on the country's initial level of economic development (per capita income). Thus, this coefficient can be viewed as a proxy for sequencing: The activities that are more income elastic develop "later" than those activities that are less income elastic. Similarly, the α_2+$\alpha_3 y_0$ coefficient measures the elasticity of FD with respect to the country's per capita income growth.[22] The higher this elasticity is, the faster the activity develops with the country's economic development. Thus, growth elasticity characterizes the "buoyancy" of the financial-activity path. Finally, the α_4 coefficient measures returns to scale (elasticity relative to population size). Activities with higher returns to scale prosper in larger countries.

We run this regression in two stages. First, to fully capture the longer-run dynamics of FD and thus obtain a more meaningful benchmark, we estimate the regression over the whole panel but without policy and institutional variables. The results of this first stage are discussed in section 3. In the second stage, we reestimate the equation with policy-related institutional variables to capture their specific impact on FD. This second stage, whose results are examined in section 4, is conducted over a narrower sample because of limitations in the data on enabling-environment indicators.

III. FD Growth Patterns

Table 1 reports the results of the first-stage regressions over the full sample. Note first the impact of the structural controls. Reflecting returns to scale and network effects, FD tended to lag in countries with smaller or more dispersed populations. In contrast, reflecting uneven growth across sectors, FD in oil-exporting economies lagged behind FD in other economies at similar levels of income. Similarly, FD lagged behind in transition economies, in this case reflecting a pretransition economic system that did not favor FD. Inversely, and for obvious reasons, FD in offshore centers generally led FD in other countries.

Table 2 shows the variance decomposition of these estimates, expressed by groups of variables, in terms of simple averages (of absolute values) over all indicators as well as ranges (maxima and minima). The initial level of economic development (per capita income) accounts for the bulk (nearly half) of the

22. The coefficient is measured for, $y_0 = \bar{y}_0$ where $\bar{y}_0$ is the median initial income level for the entire country sample.

TABLE 1. Basic Benchmark Regressions

	Bank Private Credit 1	*Net Interest Margin* 2	*Bank Claims On Dom. Fin. Sector* 3	*Bank Credit To Government* 4	*Bank Domestic Deposits* 5	*Bank Non-Deposit Funding* 6	*Insurance Premiums (Life)* 7	*Insurance Premiums (Non-Life)* 8
Panel A								
Log Initial GDPPC	0.372***	−0.261***	0.822***	0.285***	0.288***	0.380***	0.619***	0.267***
Log GDPPC minus Log Initial GDPPC	0.840***	0.120	−0.286	1.634***	1.535***	−0.271	0.745**	−0.155
Interaction	7.95^{e-05}	−0.0837***	0.223***	−0.183***	−0.0964***	0.146***	0.133***	0.0686***
Log Population	0.0721***	−0.0660***	0.243***	0.0940***	0.0367***	0.0717***	0.0424**	−0.0496***
Log Population density	0.0193***	−0.0293***	0.339***	0.200***	0.0870***	0.0452***	0.0999***	−0.0403***
Fuel dummy	−0.272***	0.00729	−0.256***	−0.262***	−0.163***	−0.0551	−0.687***	−0.202***
Offshore dummy	0.331***	0.105**	−0.634***	0.166***	0.333***	0.428***	−0.130	0.107**
Transition dummy	−0.0350	0.187***	−0.102	−0.0864	−0.170***	0.220***	−0.779***	−0.0863*
Constant	0.285***	3.709***	−8.413***	−1.285***	0.815***	−0.441***	−6.126***	−1.708***
Observations	4,075	1,785	1,643	4,003	4,097	3,983	2,138	2,308
Pseudo R^2	0.388	0.294	0.247	0.141	0.401	0.285	0.384	0.357
Panel B								
Log initial GDPPC	0.317***	0.734***	0.672***	0.415***	1.010***	0.159***	1.030***	−0.134***
Log GDPPC minus Log initial GDPPC	−3.501**	−1.423***	1.853***	0.253	2.332***	0.0639	−0.426	−2.144***
Interaction	0.566***	0.472***	−0.0452	0.0900	−0.0578	−0.0207	0.239***	0.167**
Log population	−0.0994	0.135***	0.462***	0.118***	0.112***	0.0973***	0.122***	−0.243***
Log population density	−0.152***	0.00934	0.0661***	0.0756***	−0.131***	0.0571***	−0.0115	−0.253***
Fuel dummy	0.360**	−0.224**	−0.0575	0.0716	−0.785***	−0.357***	0.0507	−0.00290
Offshore dummy	−0.278	0.960***	−0.592***	0.391***	−0.0158	−0.345***	0.150	−0.0280
Transition dummy	−1.834***	−1.421***	0.722***	−0.669***	−0.504**	−0.118	−0.499***	−0.474***
Constant	0.247	−5.554***	−4.359***	−0.975***	−6.488***	1.579***	−7.983***	4.601***
Observations	568	613	1,682	1,818	889	978	985	1,198
Pseudo R^2	0.169	0.383	0.375	0.274	0.353	0.0808	0.382	0.138

Notes: This table displays the median regression results of equation (1) using a panel of country-year data for the 1980–2010 period. GDPPC stands for gross domestic product per capita.

Source: Authors' analysis based on data described in the text.

TABLE 2. Variance Decomposition of the Benchmark Regressions

% of total variance	Log initial GDPPC	Current adjusted GDPPC	Population size	Other structural characteristics	Private credit crash	Strength of legal rights index	Credit information index	Strength of investor protection index	Enforcement costs	Residual
Without policy variables										
Average	22	15	4	7	..	..	..	..	..	52
Min.	1	4	0	1	..	..	..	..	..	32
Max.	44	33	24	17	..	..	..	..	..	80
With policy variables										
Average	18.4	17.9	4.1	6.8	4.4	3.3	2	1.7	1.3	40.2
Min.	0.5	5.5	0	1	0.5	0	0.1	0.4	0	23.5
Max.	42	32.8	25.7	21.2	18.7	18.2	4.3	4.8	3.3	63.9

Notes: This table provides a variance decomposition (using the regression coefficients from tables 1 and 4), calculated for indicator F as $VAR(F) = \Sigma\beta COV(F, X) + COV(F,\varepsilon)$. Other structural characteristics refer to the joint variance component of population density, fuel exporters, offshore centers, and the transition dummy. GDPPC stands for gross domestic product per capita.

Source: Authors' analysis based on data described in the text.

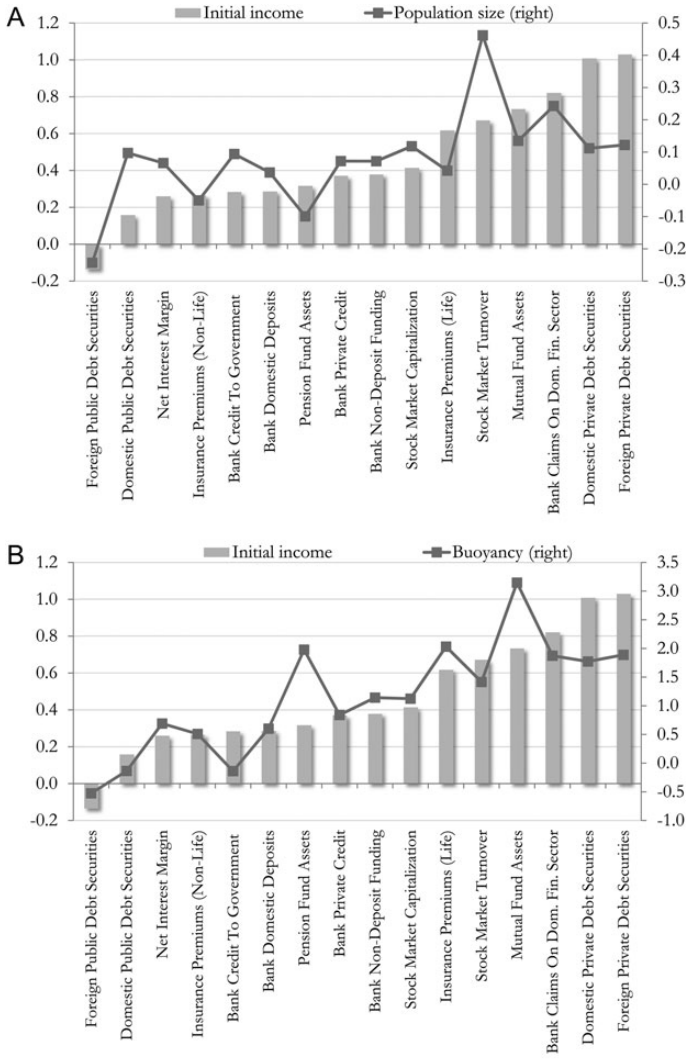
explained cross-country variations in FD, which, in turn, account for approximately half of the total variance. Thus, much of the cross-country FD pattern is simply explained by initial conditions, which, in an important sense, summarize the entire history of the economic and FD of a given country prior to the first observation in the sample period. However, countries' economic growth thereafter and over the sample period explains a substantial portion (approximately 30 percent) of the explained portion of FD paths, with population size and other structural controls accounting for the rest.

Figure 1 orders financial indicators in accordance with their elasticities with respect to initial per capita income and contrasts these elasticities with the growth and returns-to-scale elasticities. Panel C of figure 1 shows the matrix of cross-correlations across indicators. As a whole, figure 1 broadly validates one of the three main predictions of section 2: Sequencing, buoyancy, and returns to scale are all substantially correlated. The correlation between sequencing and buoyancy is particularly high; the later an activity develops, the faster it develops once it takes off. This result is expected once strong collective (participation) frictions are overcome. The positive correlation between sequencing and returns to scale also confirms that returns to scale relate to collective frictions. Larger returns to scale require higher critical mass for an activity to develop, and thus, it is more difficult for this activity to develop in the presence of substantial collective frictions.

To further test the hypothesis that sequencing, buoyancy, and returns to scale are interrelated, we group the indicators according to their initial income, income growth, and size elasticities (table 3). Regarding income, the high correlation between initial income and income growth elasticities simplifies this task because all FD indicators can be placed in three groups (column headings of table 3): early developers with low buoyancy ($\alpha_1 < 0; \alpha_2 + \alpha_3\bar{y}_0 < -0.1$), middle developers with average buoyancy ($\alpha_1 \in [0, 0.5]; \alpha_2 + \alpha_3\bar{y}_0 \in [-0.1, 1]$), and late developers with high buoyancy ($\alpha_1 > .5; \alpha_2 + \alpha_3\bar{y}_0 > 1$). Financial indicators in the first group developed early but declined in importance as income grew. In contrast, the third group appeared late but grew very quickly. The middle group was somewhere in between.

Regarding size, we divide activities into those with negative returns to scale ($\alpha_4 < 0$), low returns to scale ($\alpha_4 \in [0, 0.1]$), and high returns to scale ($\alpha_4 > .1$) (row headings of table 3). Most financial activities (12 out of 16) cluster in the diagonal cells of the table, fully matching the predictions of section 3. That is, the later the initial level of economic development at which a financial activity developed is, the faster it developed as income grew and as it was increasingly subject to increasing returns to scale. The financial services above the diagonal or below the diagonal do not fully match the predictions of section 3. Above the diagonal are financial services that, given their low returns to scale,

FIGURE 1. Sequencing, Buoyancy, and Returns to Scale



C

Correlations of elasticities series

	Initial income	*Population size*
Population size	0.60	1.00
Buoyancy	0.88	0.61

Notes: On the basis of equation (1), this figure present elasticities of initial income (α_1) and population size (α_4)–panel A-, and "buoyancy" ($\alpha_2+\alpha_3\bar{y}_0$), where $\bar{y}_0$ is the median of the initial income distribution–panel B-. The buoyancy elasticity, which depends on initial income, measures the financial development response to GDP per capita growth. Panel C contains the pairwise correlations between these three series.

TABLE 3. Typology of Financial Activities Based on Sequencing and Returns to Scale

	Early developers $\alpha_1 < 0; \alpha_2 + \alpha_3\bar{y}_0 < -0.1$	**Middle developers** $\alpha_1 \in [0, 0.5]; \alpha_2 + \alpha_3\bar{y}_0 \in [-0.1, 1]$	**Late developers** $\alpha_1 > 0.5; \alpha_2 + \alpha_3\bar{y}_0 > 1$
Negative returns to scale ($\alpha_4 < 0$)	Foreign public debt	Casualty insurance Pension fund assets*	
Low returns to scale ($\alpha_4 \in [0.0.1]$)		Domestic public debt Bank credit to government Bank private credit Bank retail funding Bank wholesale funding Net interest margins	Life insurance
High returns to scale ($\alpha_4 > 0.1$)		Stock market capitalization	Domestic private debt Stock market turnover Bank claims on financial sector Mutual fund assets Foreign private debt

Notes: This table presents a taxonomy of financial activities grouped along two dimensions: (1) sensitivity to population size (returns to scale) and (2) sensitivity to GDP per capita (both initial income and income growth effects). The returns to scale dimension is based on elasticity α_4 from equation (1). Sensitivity to GDP per capita is based on the initial income elasticity (α_1) and the buoyancy term ($\alpha_2 + \alpha_3\bar{y}_0$), where $\bar{y}_0$ is the median of the initial income distribution. The regression coefficients are taken from table 2. The Net interest margin coefficients were multiplied by -1 to ensure that an increasing value signifies a financial development improvement.

* indicates not significantly different from zero.

developed later than expected (casualty insurance) or more buoyantly than expected (life insurance).[23] Below the diagonal is one financial indicator (stock market capitalization) that, considering its high returns to scale, developed earlier than expected. However, these three FD indicators that deviate from predictions are only mildly deviant (there are no activities in the top-right cell or in the bottom-left cell of table 3), and the reasons underlying their deviancy can be easily identified, as discussed below.

To better comprehend the process of FD, we examine each financial activity by grouping them into four categories (government borrowing, banking services, capital markets, and institutional investors) that are broadly ordered according to the sequencing of their development. To illustrate the dynamics, we chart the predicted growth trajectories followed by some of the indicators for individual countries as their income grew over their initial income level (figures 2 and 3). We plot the initial and current income on the horizontal axis and the value of the indicator on the vertical axis. The continuous lines correspond to the initial cross-country benchmarks (i.e., the projected values of the indicators when initial income varies across countries while current income remains equal to initial income). The dotted lines correspond to the expected country-specific FD trajectories, given its initial income (i.e., the values of an FD indicator projected for a country as its per capita income grows above its initial income).[24]

Government Borrowing

Somewhat surprisingly, public-sector borrowing was the financial activity that developed the earliest. Furthermore, public-sector borrowing developed in international markets before it did at home (figure 1). These features are easy to explain based on frictions. Public-sector borrowing developed early because sovereigns are well known; hence, agency frictions were comparatively easier to overcome.[25] However, public-sector borrowing developed abroad first because well-established international markets, by definition, have overcome the relevant collective frictions. Hence, it is not surprising that government borrowing initially took place abroad and in foreign currency.[26] As frictions eroded and countries' FD deepened, governments were able to substitute external

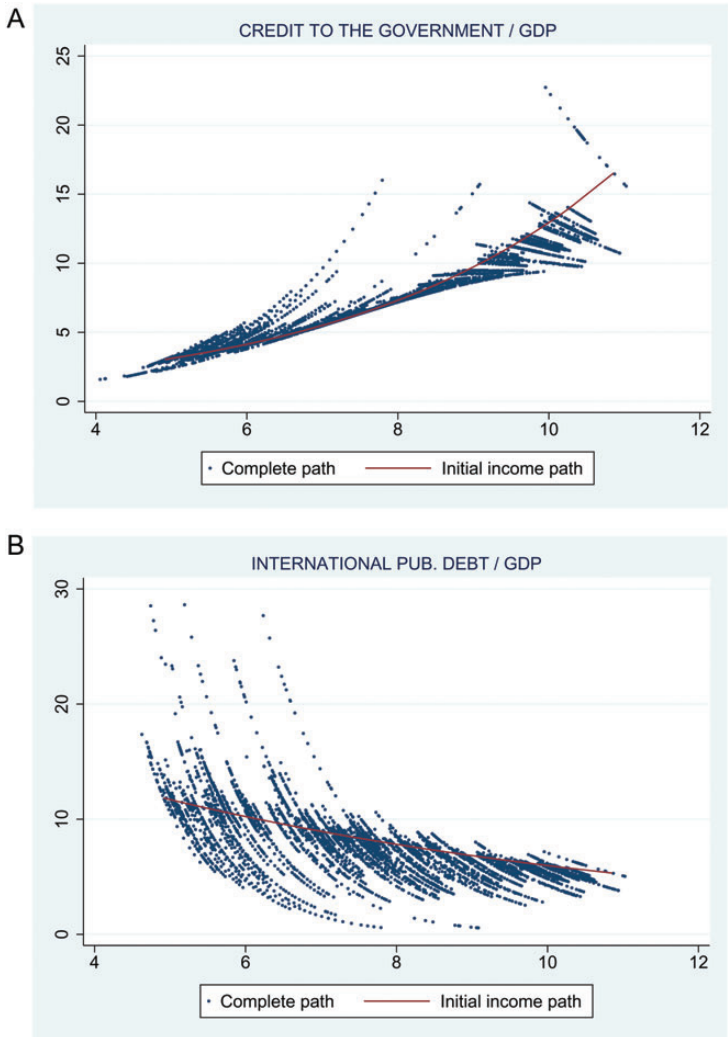
23. The indicator for pension fund assets also appears above the diagonal; however, its size elasticity is not significantly different from zero.

24. In both cases, to better reveal the income dynamics, the values of all structural controls are kept equal to their median values over the whole sample.

25. Nonetheless, governments' capacity to issue debt may be subject to establishing minimum credibility as a debtor. See, for example, Dickson (1967) for a discussion of the measures taken by the English monarchy to bolster the credibility of its debt in the late 18th century.

26. This is, of course, the basic premise of the original sin literature, which focuses on the inability of emerging economy sovereigns and corporates to issue long-term debt denominated in local currency (Calvo and Reinhart [2002]; Eichengreen, Hausmann, and Panizza [2003]). The fact that a better foreign institutional framework facilitates enforcement (especially postdefault value recovery) is an important driver of the "original sin" story (De la Torre and Schmukler [2004]).

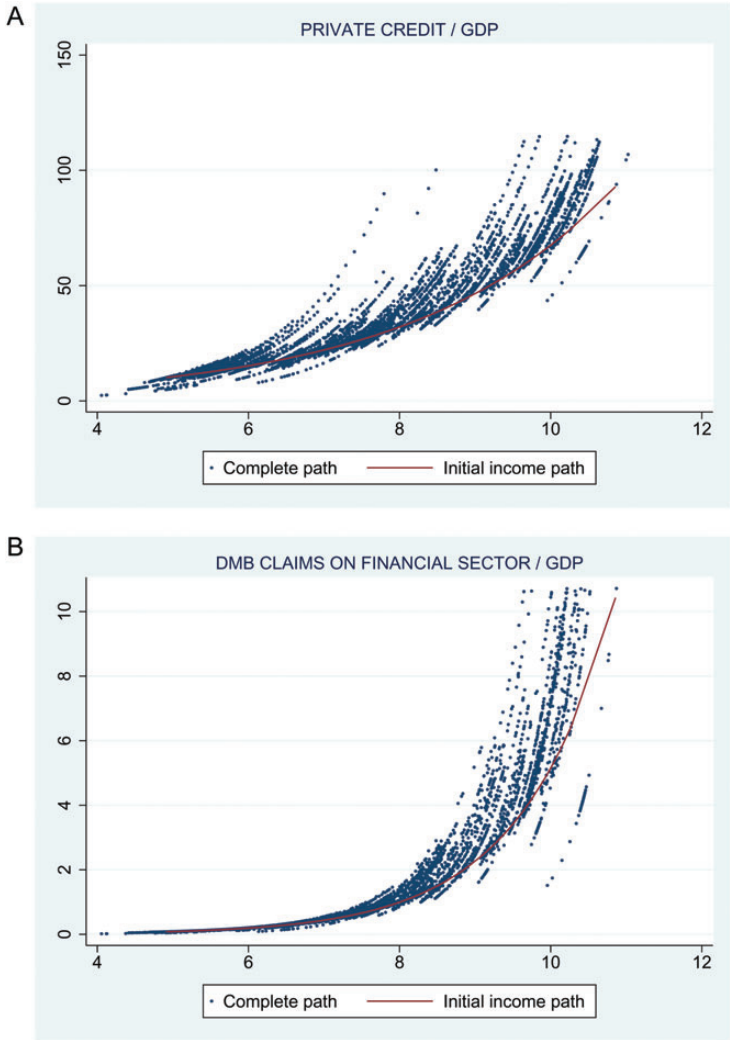
FIGURE 2. Estimated Development paths for Government Funding



Notes: The figure presents the development paths of bank credit to government and state-owned entities (A) and international public debt (B) (both as a percentage of GDP), based on equation (1). The initial income path line is plotted against log initial income and is constructed by multiplying initial income by its estimated coefficient and adding a constant term to preserve scale. This constant is calculated as the sum of the sample median values of all right-hand variables in equation (1), with the exception of the estimated growth term, multiplied by the associated estimated coefficients and the estimated constant. The complete path is plotted against log GDP per capita and is composed of the predicted country-year values from equation (1).

borrowing with domestic borrowing. However, reflecting collective-participation frictions, governments typically started by borrowing from local banks instead of markets (figure 2). Thus, domestic public debt developed later than domestic bank credit to government or foreign public debt.

FIGURE 3. Estimated Development Paths for Bank Intermediation



Note: This figure uses the same derivations as figure 2 as applied to bank credit to the private, nonfinancial sector (A) and bank claims on other financial institutions (B).

Banking Services

At the initial stages of FD, the lack of public information, a sound contractual framework, and tradable collateral restricts lending to mostly relationship lending based on private information rather than at arm's length (based on public information). Hence, banks would be expected to develop relatively

early, ahead of capital markets or asset managers such as mutual funds.[27] The fact that banks can also solve collective frictions efficiently through liquidity pooling and the provision of basic payment services further enhances their early attractiveness. Indeed, this early attractiveness is exactly what one observes. Banking services were the next financial activity to develop (figure 1). However, because attracting deposits is easier than overcoming agency frictions that limit lending, bank deposit taking should precede bank lending. Moreover, banks initially lent to governments rather than to private agents. Indeed, both features are corroborated by figure 1. At the same time, bank retail funding (deposits) took off before wholesale funding. As frictions eased, retail investors were increasingly able to shift into higher yielding, market-based instruments or to have their funds managed by asset managers or institutional investors rather than banks.[28] Reflecting participation frictions, bank claims on other financial institutions developed later but grew much faster once they developed (figure 3).[29] The gradual overcoming of collective frictions allowed banks to increasingly participate in an interinstitutional market that became denser as the number of players rose and the latter became more interconnected. Finally, note in figure 1 that improvements in bank efficiency (a reduction in net interest margins) began occurring very early, presumably as soon as banks started to operate.

Capital Markets

In view of the stronger agency frictions associated with arm's-length transactions, capital markets should only develop once public information has improved sufficiently. This hypothesis is largely consistent with the evidence. In view of high returns to scale, stock markets developed after banking (figure 1). Nonetheless, they developed ahead of prediction, which may be explained by the fact that equity issuance is an essential component of corporate finance (and governance) for larger firms. However, reflecting size thresholds and collective frictions that limit participation, the development of primary markets (market capitalization) should precede the development of secondary markets (market turnover), where trading liquidity is essential. As corroborated by figure 1, the secondary market developed after the primary market. At the same time, equity markets are likely to develop ahead of corporate bond markets because their

27. In particular, unlike markets, banks can develop even without a good legal framework (Rajan and Zingales [2001]).

28. Although our sample indicates that retail funding preceded wholesale funding, this sequence need not apply at all times and to all financial systems. For example, much of the precrisis banking growth in the Eastern European countries, which started from relatively limited levels of FD, originated from wholesale funding (mostly external) rather than domestic funding. Moreover, there appears to have been a shift (at least temporary) in many advanced economies back to retail funding following the global financial crisis.

29. The late but very rapid growth of interbank lending can be viewed as growth analogous to the rapid rise of bank interconnectedness that preceded the subprime crisis in the United States (Shin [2010]).

unlimited upsides can better compensate for the downsides associated with agency frictions. Again, figure 1 shows that this sequencing held: Private debt securities followed equity and developed abroad before developing at home.

Institutional Investors

The development of asset managers is likely to be constrained by the development of capital markets. In particular, the growth of mutual and pension funds should reflect the fact that marketable, liquid assets—which the funds need to invest in—appear relatively late. Furthermore, pension funds developed earlier than mutual funds (figure 1) because the collective frictions that needed to be overcome for their development were largely solved by an act of government (e.g., the creation of privately administered, fully funded, individual retirement savings accounts, often of a mandatory nature). In contrast, the frictions hampering the development of mutual funds (large returns to scale) had to be resolved by market forces. In both cases, however, their growth was extremely buoyant, reflecting the fact that marketable, liquid assets in which these funds invested grew very rapidly once they began to develop. Regarding insurance, life insurance companies are likely to develop relatively late because, in addition to being exposed to collective frictions (they also need to invest in market-based assets), they are exposed to larger agency frictions that reflect their longer investment horizons. This fact may explain why life insurance developed later than predicted. In contrast, casualty insurance is likely to develop earlier, both because it is partly influenced by policy (as in the case of mandatory insurance for motor vehicles) and because the risks it faces are normally distributed and can be more easily addressed through risk pooling. Furthermore, their negative returns to scale, which make this activity somewhat of an outlier, can be explained by the predominance of foreign trade insurance in smaller open economies.[30]

IV. The Role of Policy

In this section, we briefly explore the role of policy and institutions in explaining the deviations from benchmark paths. We use three variables (creditor rights, investor protection, and enforcement costs) that reflect the quality of the contractual environment and one variable (creditor information) that reflects the quality of the informational environment.[31] To measure the quality of

30. The latter accounts for a disproportionally high share of total casualty insurance, reflecting the importance of foreign trade for the smaller economies (see Feyen, Lester and Rocha [2011]).

31. The investor protection index, creditor rights and creditor information indices are taken from the World Bank's Doing Business database. Although the creditor information quality variable only measures one dimension of the quality of the informational environment (namely, the quality and coverage of credit bureaus), we used only this variable because it had the best coverage and was generally highly correlated with other information indices. The contract enforcement index is the first principal component of the following indicators (also from Doing Business): contract enforcement costs, number of days to enforce a contract (in logs), and number of procedures to enforce a contract.

macroprudential management, we construct a credit crash dummy that measures severe annual drops in the ratio of private credit to GDP.[32] Table 4 presents the results of the regressions similar to table 1 but with the policy variables included, estimated over the more limited period for which the data are available. The variance decomposition for these new estimates, which is similar to the decomposition shown for the regressions without policy variables, appears in table 2.

Together, the enabling-environment indicators account for a significant (albeit limited) fraction of the total explained variance of the financial indicators, which rises from 48 to 60 percent when the policy variables are incorporated.[33] As expected, better creditor rights promoted banking activity (not only private credit but also, and apparently even more, bank claims on other financial institutions) as well as capital markets (stock market capitalization and, even more strongly, private bond market capitalization) and life insurance. Similarly, lower enforcement costs facilitated bank funding (both retail and wholesale) and bank private lending while contributing to lowering intermediation margins. Unsurprisingly, the quality of investor protection had a particularly large impact on stock market activity (both in the primary and secondary markets). Furthermore, as expected, the quality of the informational environment was important for bank private lending and, even more so, for private (corporate) debt capitalization (particularly at home).[34]

It is noteworthy, however, that the contractual variables (particularly creditor rights) accounted for the lion's share of the cross-country differences, with information accounting for only a relatively small fraction.[35] This result likely reflects the fact that improvements in the informational environment, which are more technology dependent, could be more simply introduced and imported from abroad.[36] In contrast, improvements in the contractual environment required a strengthening of local institutions that was harder to deliver. This

32. The "crash variable" for a particular country is the fraction of years of the entire period in which annual private credit dropped by 20 percent or more.

33. Many of the enabling-environment indicators face measurement problems and only cover limited dimensions of policy. Thus, the share of variation across countries explained by policy may be, in practice, substantially higher than identified here.

34. Somewhat surprisingly, however, the credit information variable appears to discourage bank funding and results in higher bank intermediation margins. The reduction in bank funding may reflect the emergence of alternative (market-based) channels of financial intermediation. Furthermore, as the more competitive segments of the borrowing market (particularly corporates) migrate to the capital markets, bank loans become increasingly concentrated in households and smaller enterprises, where margins are higher owing to lower competition and higher risk.

35. The importance of the legal and institutional environment for financial and economic development is consistent with the evidence discussed in Beck and Levine (2005).

36. This conclusion deserves an important qualification because of the already noted limitations of our index, which only measures one dimension of a broader, multifaceted reality. To the extent that informational frictions reflect both information gathering and information processing costs (i.e., problems of bounded understanding and rationality in an increasingly complex environment), it could be argued that such frictions are unlikely to vanish any time soon.

TABLE 4. Extended Benchmark Regressions

Panel A

	Bank Private Credit 1	*Net Interest Margin* 2	*Bank Claims On Dom. Fin. Sector* 3	*Bank Credit To Government* 4	*Bank Domestic Deposits* 5	*Bank Non-Deposit Funding* 6	*Insurance Premiums (Life)* 7	*Insurance Premiums (Non-Life)* 8
Log initial GDPPC	0.266***	−0.260***	0.664***	0.415***	0.269***	0.411***	0.508***	0.199***
Log GDPPC minus Log initial GDPPC	0.456***	0.524***	−0.817	2.065***	1.049***	−0.378*	0.391	−1.114***
Interaction	−0.00235	−0.134***	0.283***	−0.253***	−0.0817***	0.115***	0.0998**	0.187***
Log population	0.0406***	−0.112***	0.294***	0.204***	0.0576***	0.0754***	0.0626***	−0.0520***
Log population density	0.0465***	−0.0167	0.348***	0.175***	0.0623***	0.0152	0.139***	−0.0284***
Fuel dummy	−0.233***	−0.0135	0.289*	−0.464***	−0.227***	−0.145***	−0.519***	−0.183***
Offshore dummy	0.271***	0.00753	−0.767***	0.157*	0.362***	0.675***	−0.195*	0.0437
Transition dummy	−0.373***	0.152**	−1.572***	−0.146	−0.319***	−0.118	−1.645***	−0.272***
Private credit crash	−5.963***	2.945***	−3.188**	−1.724***	−3.329***	−5.281***	−1.782***	−0.409
Strength of legal rights index	0.0288***	−0.00336	0.242***	−0.0454***	0.00687	0.0178*	0.277***	0.0561***
Credit information index	0.0425***	0.0857***	−0.0264	−0.210***	−0.0449***	−0.0560***	0.0546***	0.0180**
Strength of investor protection index	0.0167	0.0103	−0.0933*	0.155***	0.0570***	−0.0390**	−0.0250	−0.0414***
Enforcement costs	−0.00326***	0.00178**	−0.00486*	−0.00268**	−0.00238***	−0.00378***	0.00668***	0.000972
Observations	2,148	1,731	1,056	2,140	2,160	2,094	1,805	1,857
R^2	0.710	0.479	0.395	0.317	0.662	0.604	0.633	0.537

(Continued)

TABLE 4. Continued

Panel B

	Pension Fund Assets	*Mutual Fund Assets*	*Stock Market Turnover*	*Stock Market Capitalization*	*Domestic Private Debt Securities*	*Domestic Public Debt Securities*	*Foreign Private Debt Securities*	*Foreign Public Debt Securities*
	1	2	3	4	5	6	7	8
Log initial GDPPC	−0.0629	0.713***	0.593***	0.481***	1.173***	0.346***	1.006***	−0.224***
Log GDPPC minusLog initial GDPPC	−2.166	−2.300***	1.268***	0.644*	5.861***	1.311**	−0.894	−1.431**
Interaction	0.285	0.476***	−0.0795	−0.000579	−0.487***	−0.224***	0.327***	0.133
Log population	−0.0525	0.287***	0.619***	0.155***	−0.0301	0.154***	0.123***	−0.467***
Log population density	−0.142***	−0.119***	0.00520	0.0397**	−0.0740*	0.129***	−0.0179	−0.184***
Fuel dummy	0.182	−0.335**	−0.183**	0.0137	−0.380***	−0.00603	0.0845	−0.0817
Offshore dummy	0.121	1.230***	−0.334***	0.0959	−0.567***	−0.509***	−0.243*	−0.478***
Transition dummy	−3.052***	−1.387***	0.635***	−0.926***	−0.744**	0.359*	−0.673***	−0.460***
Private credit crash	−5.985***	−7.414***	−6.495***	−4.187***	4.262**	−2.988**	−0.742	8.200***
Strength of legal rights index	0.189***	0.000925	0.00960	0.0372**	0.176***	−0.0530**	0.0421*	−0.0906***
Credit information index	0.275***	−0.324***	−0.0881***	−0.132***	0.181***	0.108***	−0.111***	0.115***
Strength of investor protection index	0.0476	0.0617	0.157***	0.121***	0.0480	0.0952***	−0.0470	−0.0532
Enforcement costs	−0.00971	−0.00576	−0.0127***	0.00268	0.00390	−0.00294	0.00623**	−0.00164
Observations	565	567	1,292	1,344	645	707	883	1,073
R^2	0.378	0.669	0.598	0.490	0.567	0.277	0.617	0.330

Notes: This table extends table 1 by adding the following additional policy variables: *Private credit crash* (which assumes a value of 1 if private credit to GDP drops by over 20 percent for a particular country-year) and a set of variables taken from the World Bank Doing Business Database, including the *Strength of legal rights index* (the extent to which creditors are legally protected), the *Credit information index* (the quality of credit information), the *Investor protection index* (the extent to which investors are protected by law), and *Enforcement costs* (the cost to enforce a contract). The contract enforcement index is the first principal component of the following indicators (also from Doing Business): contract enforcement costs, number of days to enforce a contract (in logs), and number of procedures to enforce a contract. GDPPC stands for gross domestic product per capita.

***, **, and * indicate $p < .01$, $p < .05$, and $p < .1$

Source: Authors' analysis based on data described in the text.

interpretation is bolstered by the results of a regression of creditor rights and credit information against country income (incorporated through both a linear term and a quadratic term). The creditor rights index is convex, whereas the credit information index is concave.[37] This result suggests that improvements in the informational environment are achieved early on, whereas improvements in creditor rights take much longer to materialize. Thus, one should observe fewer cross-country differences regarding the quality of information compared to the quality of contracts.

Remarkably, the credit crash dummy accounts for a sizable share of total explained variance, particularly in the case of private credit (where it accounts for nearly 30 percent) but also for other banking indicators, such as bank funding and bank margins, and even for financial activity outside banking. For example, the credit crash dummy had a sizable negative impact on stock trading. It is also remarkable that banking systems took such a long time to recover from such impacts. This finding can be inferred from the fact that the credit cash dummy, which is estimated over a 30-year time span, remains highly significant when regressed against the pure cross-section of last period indicators rather than the full panel.[38] This result is a noteworthy reminder that FD (the bright side) and financial instability (the dark side) strongly interact in lasting, complex ways.

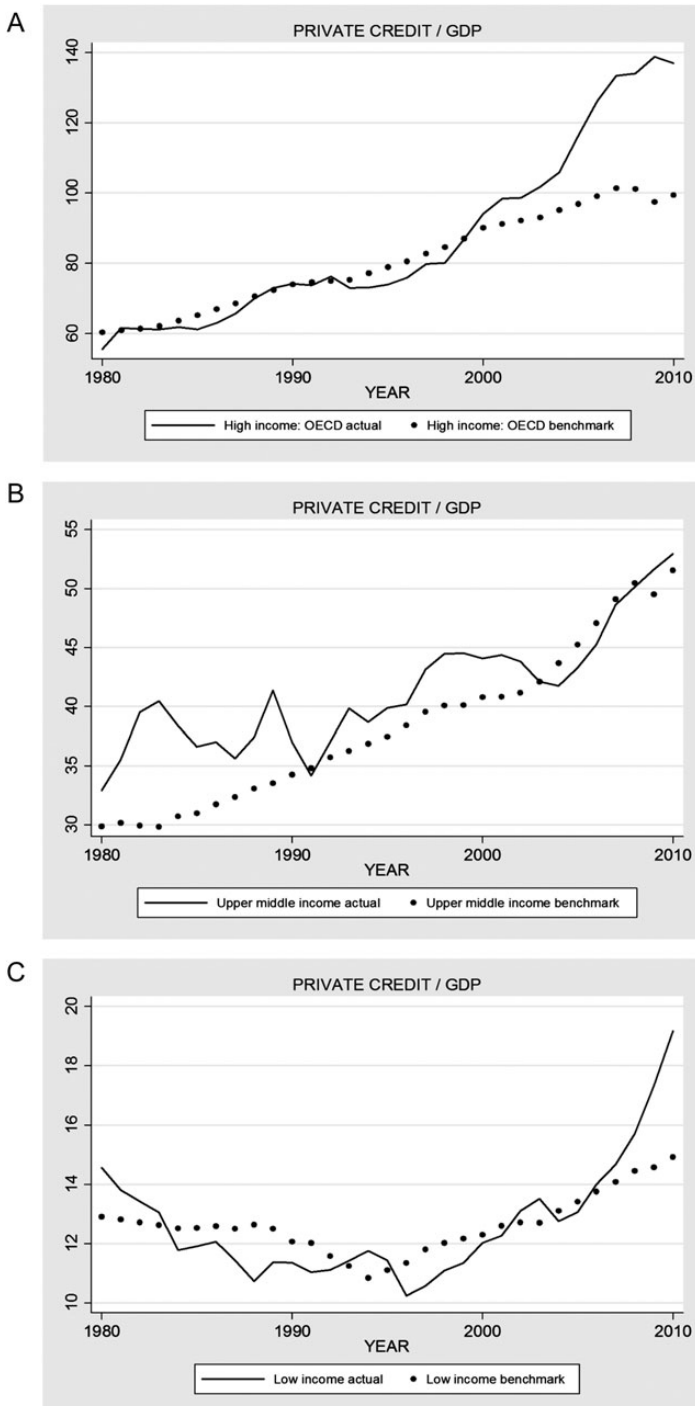
The interaction between bright and dark sides is illustrated further in figure 4, which plots the predicted and actual dynamic paths of private bank credit for all countries in the database, separated into three groups according to their initial income levels. Even at such an aggregate level of analysis, a cursory inspection suggests that, in most cases, busts occurred following booms in which the actual development paths went over their predicted values. Thus, financial unsustainability (the dark side of FD) appears to be related to abnormal deviations from the regular development paths inferred from a cross-country benchmarking analysis (the bright side of FD). Of course, this hypothesis must be validated by a detailed statistical analysis at the country level, a topic left for further research.

V. Final Thoughts

The broad cross-country benchmarking approach we have developed here can help to measure the quality of policies at any point in time and to identify the forces and frictions shaping FD. This approach began from the premise that both the evolution of financial structure (FD) and its sustainability (financial stability) are shaped by four fundamental types of frictions and their associated market failures. Two such frictions restrict agents' capacity to establish and enforce bilateral contracts (agency frictions), and the other two frictions restrict

37. The underlying regression is available from the authors upon request.
38. The underlying regression is available from the authors upon request.

FIGURE 4. Estimated Private Credit Development Paths by Region



Notes: This figure presents the actual and predicted paths of bank credit to the private sector (as a percentage of GDP) for high-income (A), middle-income (B), and low-income (C) countries. Predicted paths are derived from equation (1) using group medians. The samples are restricted to the countries for which data are available back to 1980.

agents' capacity to participate and coordinate their financial activities in ways that are collectively desirable (collective frictions). The predictions derived from this approach regarding the order of development, returns to scale, and the shape of the developmental paths of various financial activities were broadly satisfied. In particular, where strong participation frictions were responsible for hindering the growth of financial activities, development only began after some threshold. However, once this threshold was passed, it was followed by buoyant dynamics because rising participation and interconnectedness generated positive externalities that promoted further participation and interconnectedness.

This paper has also argued that the same frictions that feed the development forces of the bright side feed the forces of instability from the dark side, making them interact in complex and unexpected ways and leading to booms followed by busts.[39] Indeed, the paper has shown that FD was substantially volatile and that countries paid a heavy and lasting price for financial collapses. Avoiding such collapses requires the early identification of the buildup of systemic stress. By inferring a predicted development path from a broad universe of observations, our benchmarking approach may help to discriminate between sustainable and unsustainable trajectories. A key topic for further research is to investigate whether deviations from benchmarks can help to predict crashes on a country-by-country basis.

An important caveat applies, however. Although our analysis suggests the presence of developmental regularities, it does not ensure predictability, particularly as one goes farther into the future. On the one hand, financial innovations may introduce inflexion points that are undetectable from the existing historical data. If so, apparent short-term upward deviations from the benchmark paths could, in fact, become sustainable because the benchmark paths themselves bend upward. On the other hand, it is possible for the benchmark paths to bend downward, at least in the longer term. For example, some of the indicators that have exhibited rapidly growing paths may eventually slow down, in accordance with logistic (S-shaped) trajectories.

39. The evidence presented on our measure of "buoyancy" is arguably consistent with the empirical suggestion that there can be "too much finance" (see Arcand, Berkes and Panizza [2012]). In effect, high buoyancy implies a decreasing impact of FD on economic growth. In this sense, finance may resemble a luxury good; its use increases significantly as income rises, yet its benefits (whether in welfare or growth) exhibit falling marginal returns. To be sure, buoyancy by itself does not necessarily imply that there can be "too much finance." If one reasonably assumes nonsatiation, more finance should always be better. However, once the "dark side" is factored in, it is no longer clear that more finance is necessarily better because the marginal costs of financial instability may eventually come to dominate the marginal benefits of more FD. Ultimately, however, the balance between marginal costs and marginal benefits depends on the policy response, which puts a premium on keeping the forces of the dark side at bay as FD deepens.

References

Akerlof, G. 1970. "The Market for Lemons: Quality Uncertainty and the Market Mechanism." *Quarterly Journal of Economics* 84 (3): 488–500.

Anginer, D., A. de la Torre, and A. Ize. 2011. "Risk-Absorption by the State: When is it Good Public Policy?" World Bank Policy Working Paper 5893. Washington, DC.

Arcand, J.L., E. Berkes, and U. Panizza. 2012. "Too Much Finance?" IMF Working Paper WP/12/161. International Monetary Fund, Washington, DC.

Ashcraft, A., and T. Schuermann. 2008. "7 Deadly Frictions in Subprime Mortgage Securitization." PRMIA Credit Forum. Professional Risk Managers' International Association, Northfield, MN.

Allen, F., and D. Gale. 2000. *Comparing Financial Systems*. Cambridge, MA: MIT Press.

Beck, T., and R. Levine. 2004. "Stock Markets, Banks and Growth: Panel Evidence." *Journal of Banking and Finance* 28 (3): 423–42.

———. 2005. "Legal Institutions and Financial Development." In C. Ménard, and M. M. Shirley, eds., *Handbook of New Institutional Economics*, 251–78. The Netherlands: Springer.

Calvo, G., and C. Reinhart. 2002. "Fear of Floating." *Quarterly Journal of Economics* 117 (2): 379–408.

Claessens, S., and L. Laeven. 2003. "Financial Development, Property Rights, and Growth." *Journal of Finance* 58 (6): 2285–812.

De la Torre, A., and A. Ize. 2010. "Regulatory Reform: Integrating Paradigms." *International Finance* 13 (1): 109–39.

———. 2011. "Containing Systemic Risk: Paradigm-Based Perspectives on Regulatory Reform." *Economia* 11(1): 25–64.

De la Torre, A., and S. Schmukler. 2004. "Coping with Risk through Mismatches: Domestic and International Financial Contracts for Emerging Economies." *International Finance* 7: 349–90.

Demirgüç-Kunt, A., and R. Levine. 1999. "Bank-Based and Market-Based Financial Systems: Cross-Country Comparisons." World Bank Policy Working Paper 2143. Washington, DC.

Demirgüç-Kunt, A., E. Feyen, and R. Levine. 2011. "The Evolving Importance of Banks and Securities Markets." World Bank Policy Research Working Paper 5805. Washington, DC.

Dickson, P. 1967. *The Financial Revolution in England*. London: Macmillan

Eichengreen, B., R. Hausmann, and U. Panizza. 2003. "Currency Mismatches, Debt Intolerance and Original Sin: Why They are Not the Same and Why it Matters." NBER Working Paper No. 10036. National Bureau of Economic Research, Cambridge, MA.

Ferguson, Niall. 2008. *The Ascent of Money: A Financial History of the World*. New York: The Penguin Press.

Feyen, E., R. Lester, and R. Rocha. 2011. "What Drives the Development of the Insurance Sector: An Empirical Analysis Based on a Panel of Developed and Developing economies." World Bank Policy Research Working Paper 5572. Washington, DC.

Geanakoplos, J. 2009. "The Leverage Cycle." Cowles Foundation Discussion Paper 1715. Cowles Foundation for Research in Economics, Yale University, New Haven, CT.

Gorton, G., and A. Metrick. 2010. "Securitized Banking and the Run on Repo." Yale ICF Working Paper 09-14. International Center for Finance, Yale University, New Haven, CT.

Haldane, A., S. Brennan, and V. Madouros. 2010. "What is the Contribution of the Financial System: Miracle or Mirage?" In *The Future of Finance: The LSE Report*, 87-120, London: London School of Economics.

Holmstrom, B., and J. Tirole. 1996. "Private and Public Supply of Liquidity." NBER Working Paper 5817. National Bureau of Economic Research, Cambridge, MA.

Huang, R., and L. Ratnovski. 2010. "The Dark Side of Bank Wholesale Funding." Working Paper 1223. European Central Bank, Frankfurt, Germany.

Huang, Y. 2005. "What Determines Financial Development?" Discussion Paper 05/580. University of Bristol, Bristol, UK.

Kindleberger, C.P. 1989. *Manias, Panics and Crashes: A History of Financial Crises. Wiley Investment Classics*. Hoboken, NJ: Wiley.

Lerner, J., and P. Tufano. 2011. "The Consequences of Financial Innovation: A Counterfactual Research Agenda." NBER Working Paper 16780. National Bureau of Economic Research, Cambridge, MA.

Merton, R., and Z. Bodie. 2004. "The Design of Financial Systems: Towards A Synthesis of Function and Structure." NBER Working Paper 10620. National Bureau of Economic Research, Cambridge, MA.

Minsky, H. 1975. *John Maynard Keynes*. New York: Columbia University Press.

North, D.C. 1990. *Institutions, Institutional Change and Economic Performance*. Cambridge, UK: Cambridge University Press.

Rajan, R., and L. Zingales. 2001. "Financial Systems, Industrial Structure and Growth." *Oxford Review of Economic Policy* 17: 467–82.

———. 2003. *Saving Capitalism from the Capitalists: Unleashing the Power of Financial Markets to Create Wealth and Spread Opportunity*. New York: Crown Business Division of Random House.

Shiller, R. 2006. *Irrational Exuberance*. New York: Random House.

Shin, H.S. 2010. "Securitization and the Financial System." In *Risk and Liquidity, Clarendon Lectures in Finance*, 152–70. Oxford: Oxford University Press.

Shleifer, A., and R. Vishny. 2011. "Fire Sales in Finance and Macroeconomics." *Journal of Economic Perspectives* 25 (1): 29–48.

Spence, M. 1973. "Job Market Signaling" *Quarterly Journal of Economics* 87 (3): 355–74.

Stiglitz, J., and A. Weiss. 1981. "Credit Rationing in Markets with Imperfect Information." *American Economic Review* 71 (3): 393–410.

Job Growth and Finance: Are Some Financial Institutions Better Suited to the Early Stages of Development than Others?[1]

Robert Cull and L. Colin Xu

Evidence based on firm-level data from 89 countries with updated country-level data on financial structure suggests that in low-income countries, labor growth is more rapid in countries with a higher level of private credit/GDP. This positive relationship with private credit is especially pronounced in industries that depend heavily on external finance. The results, which are robust to multiple estimation approaches, are consistent with the predictions of new structural economics. In high-income countries, labor growth rates increase with the level of stock market capitalization, consistent with predictions from new structural economics. However, the association disappears when stock market development is treated as an endogenous explanatory variable using instrumental variable regressions. There is no evidence that small-scale firms in low-income countries benefit the most from the development of the private credit market. Rather, the labor growth rates of larger firms increase to a greater extent than others with the level of private credit market development, a finding consistent with the perspective from historical political economy that banking systems in low-income countries serve the interests of the elite rather than providing broad-based access to financial services.

JEL codes: G2, O1

Although the relative advantages of bank- and market-based systems have been clearly presented in the literature, the available empirical evidence does not

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indicate that either type is more effective in promoting growth.[2] Cross-country evidence has demonstrated that the overall level of financial development, rather than its institutional composition, is robustly linked to economic growth (Demirgüç-Kunt and Levine 2001; Levine 2002). Although cross-country indicators of financial development have proliferated and been refined over the past decade, they necessarily entail limitations when describing the nuances of the financial structure of a given country. Therefore, it is possible, and even likely, that in a given country or at a specific point in time, productive activities would be better supported by banks or markets.

This paper examines whether firms from countries in the early stages of development grow more rapidly under a bank-based system that harnesses local information than under a market-based system that does not. Our approach relies on a measure of firm growth from the WBES database, the percentage increase in the number of workers over the two years prior to the survey. Labor growth is a topic of intense interest, but there are also practical reasons for focusing on this measure in this analysis.[3] Other measures of firm growth (such as sales growth) are available, but our measure of labor growth is available for a larger set of firms and countries. Testing the hypothesis that financial structure has different effects on firm growth depending on a country's level of economic development requires the widest possible sample of countries because the financial structure indicators are measured at the country level. Our most expansive regression models employ information from over 50,000 firms in 89 countries.[4] Relying on labor (rather than sales) growth has an additional advantage: labor is likely to be measured with less error than sales for both accounting and tax reasons, and such measurement errors may differ systematically by the level of development.

2. The relative advantages of different types of financial systems have been long debated, most notably in comparisons between market-based and bank-based financial structures (Gershenkron 1962; Demirgüç-Kunt and Levine 2001). Banks, for example, are able to exploit economies in processing information regarding the creditworthiness of prospective borrowers and often form long-run relationships with firms that reduce information asymmetries and permit the effective monitoring of firms' activities. Securities markets provide an incentive to gather information about firms, provide a liquid platform for investors to buy and sell shares in those firms, and may improve the corporate governance of firms by facilitating takeovers. More generally, markets are likely to do a better job of aggregating and transmitting information signals to investors than banks, which could improve the allocation of financial resources and thus promote growth. See Levine (2002) for an extensive review of the literature on the relative merits of banks versus markets.

3. For example, job growth is the topic of the upcoming World Development Report for 2013 and a key concern of the current U.S. administration.

4. The firm-level survey information as well as a steady expansion in the number of countries that have financial structure data available enables us to undertake this analysis. For comparison, the original financial structure indicators presented in Levine (2002) were available for only 48 countries.

These themes were recently developed in the "New Structural Economics" approach to studying economic development (Lin 2010). With respect to financial sector development, Lin, Sun, and Wu (2012) note,

> In a poor country, where the endowment structure is characterized by labor abundance and capital scarcity, labor-intensive industries are consistent with the comparative advantages determined by its endowment structure. Since labor-intensive businesses are usually smaller, they are more informationally opaque and require less amount of external finance than firms in capital-intensive industries. Lending to smaller businesses often requires banks to collect soft information on borrowers. Due to organizational complexity and the corresponding difficulty in communicating soft information, it is more difficult for large banks to effectively collect and utilize soft information about borrowers when making lending decisions. But smaller banks have advantages in monitoring small firms and satisfying their financial needs. Therefore, poor countries . . . should have smaller local banks play a dominant role in their banking sector.

As a result, proponents of this approach hold that there is an endogenously determined optimal financial structure at each stage of an economy's development. Measurement problems are a key challenge to empirically testing this approach to financial development. Case studies of individual countries lack sufficient variation in financial structure over time to permit formal hypothesis testing, and although cross-country financial indicators have come a long way in a short time, they remain relatively crude. Determining a country's optimal industrial structure and assessing the suitability of its financial structure using cross-country regressions alone would be a daunting task.

To foreshadow our main result, we find that firms grow more rapidly in countries with low levels of per capita income when the banking system is relatively well developed. We find no such results for other measures of the financial structure, including measures of stock market development. Moreover, we find no strong relationships between the financial structure and firm labor growth of countries with higher levels of per capita income, in line with previous findings in the literature (Levine 2002; Demirgüç-Kunt and Levine 2001). Our results are robust to the use of the instrumental variables method to address the potential endogeneity of our financial structure variables.

Previous studies have found that credit from suppliers (trade credit) can be an alternative source of funding for firms with limited access to bank loans. For example, small firms in the United States that lack an established relationship with a bank hold significantly higher levels of accounts payable than other firms (Petersen and Rajan 1997). More generally, using the regression methodology pioneered by Rajan and Zingales (1998), Fisman and Love (2003) show that firms in industries that are more dependent on trade credit financing grow relatively more rapidly in countries with relatively underdeveloped financial sectors. Because our focus is on developing and transitional economies, and as

a result of data constraints, we do not include trade credit in our analysis.[5] We note, however, that if trade credit naturally arises as a substitute for bank credit in less developed financial sectors, we would be less likely to find a significant relationship between banking sector development and firm growth. Because that relationship is only significant for the low-income subsample in our analysis, trade credit may not be an adequate substitute for bank credit in those environments. By contrast, trade credit could be a more effective substitute for bank credit in more advanced countries, which could help to explain why we do not find a significant relationship between banking sector development and firm labor growth for the sample of higher-income countries.

We also apply the Rajan and Zingales regression methodology to test whether firms in industries that rely heavily on external financing have higher labor growth rates in countries with relatively well-developed financial sectors. We find evidence consistent with that proposition, but only for firms in low-income countries with relatively well-developed banking sectors. Although the instrumental variables approach focuses on between-country differences, the Rajan and Zingales approach captures within-country, between-industry differences in labor growth rates. The fact that both approaches yield similar results supports the plausibility of our findings. Our confidence regarding the beneficial role of banks in poor countries is further bolstered by the finding that a more developed banking system is associated with higher investment rates, more employee training, and larger firm sizes *only* in poor countries, which suggests that banks spur both physical and human capital investments in addition to increasing job growth in these countries.

The WBES also contains a substantial amount of information on firm characteristics (size, industry, ownership structure, and legal status) that enables us to better identify the types of firms that benefit from a relatively well-developed banking system in countries that are at an early stage of development. Although our results seem to indicate that banks are the financial institutions that are best suited to serve firms in low-income countries, they do not appear to disproportionately serve the small-scale firms that characterize the early stages of economic development. In low-income countries, although labor growth increases with the size of the banking sector, large firms are the primary beneficiaries of this increase in labor growth.

The remainder of the paper is organized as follows. Section I describes the enterprise survey and financial structure data in greater detail and presents summary statistics. Section II describes the variables that we use as instruments

5. Fisman and Love (2003) use data from 37 industries in 43 countries to conduct their analysis. Industry-level trade credit financing in the United States is used to summarize the natural reliance on that form of financing in a frictionless financial sector. Most of those countries have higher per capita income levels than the countries that compose our sample (see table 1). Thus, the assumption that U.S. trade credit usage is a reasonable benchmark may be more applicable to higher-income countries than to those in our sample. In any event, we were unable to include a consistent measure of trade credit usage for a sufficiently wide set of countries in our OLS and instrumental variables regressions.

for our indicators of financial development in the firm growth regressions. Section III explains our estimation approach based on instrumental variables and the approach based on the Rajan and Zingales methodology and presents our main regression results. Section IV examines the types of firms that are most affected by the financial structure in high- and low-income countries. Section V provides a series of robustness checks for our main findings that incorporate measures of banking sector concentration and efficiency and the quality of the business environment. Section VI examines whether other firm characteristics and performance measures are related to financial development to better understand the potential mechanisms by which banking sector development fosters firm growth in low-income countries. Section VII concludes.

I. Data

Sampling from the universe of registered businesses and following a uniform stratified random sampling methodology, the core WBES employs a standardized survey instrument to benchmark the investment climate of individual economies across the world.[6] Table 1 lists the countries surveyed and the year and number of observations for each survey. The country list demonstrates that our focus is on developing and transitional economies. In the empirical analysis that follows, we often split the sample in half and, for ease of exposition, refer to these economies as the "poor" and "rich" subsamples. The split-sample tests roughly provide comparisons of firms in low- and middle-income countries. The survey contains sufficient information to allow for firm performance analyses and reports detailed information on firm employment, age, industry, ownership, legal status, and the number of establishments. Table 2 provides the definitions and sources of the key variables used in the analysis.

As noted above, our analysis is designed to explain the variation in firm labor growth. We use the percentage growth in the number of full-time employees over the two years prior to the survey as the dependent variable in our regressions because that information was asked of firms in a wider sample of countries than, for example, information about sales growth.[7] In addition, the information provided by firm owners regarding their number

6. A detailed description of the sample design and sample frame can be found at http://www.enterprisesurveys.org/documents/Sampling_Note.pdf.

7. We did, however, run regressions using both sales growth and a measure of total factor productivity as the dependent variable. We generally did not find strong links between those variables and our measures of financial sector structure. This is likely because the number of available observations was small for those variables. For example, the maximum number of observations for the sales growth variable was 41 countries in the rich subsample and 23 for the poor subsample. For total factor productivity, there were 36 countries in the rich subsample and 23 for the poor subsample. In comparison, there were 50 available rich countries and 43 poor ones for the labor growth variable. In the sales growth regressions for the low-income sample, the coefficient for private credit/GDP was positive in the OLS, GMM, and Rajan and Zingales regressions (described below), but it achieved significance only in the Rajan and Zingales regressions.

TABLE 1. List of Countries and Years of Each Survey with Sample Size

Country, year	Number of firms	Country, year	Number of firms	Country, year	Number of firms	Country, year	Number of firms	Country, year	Number of firms
Albania, 2002	163	Colombia, 2006	890	Hungary, 2005	583	Moldova, 2002	167	Slovenia, 2002	183
Albania, 2005	199	Costa Rica, 2005	316	India, 2002	919	Moldova, 2003	98	Slovenia, 2005	220
Angola, 2005	346	Croatia, 2002	176	Indonesia, 2003	67	Moldova, 2005	331	South Africa, 2006	831
Angola, 2006	342	Croatia, 2005	226	Ireland, 2005	492	Mongolia, 2004	160	Spain, 2005	597
Argentina, 2006	923	Czech Republic, 2002	256	Kazakhstan, 2002	244	Morocco, 2004	756	Sri Lanka, 2004	386
Armenia, 2002	164	Czech Republic, 2005	315	Kazakhstan, 2005	562	Mozambique, 2002	109	Swaziland, 2005	242
Armenia, 2005	347	Dominican Republic, 2005	123	Kenya, 2003	201	Namibia, 2006	293	Swaziland, 2006	240
Azerbaijan, 2002	154	Democratic Republic of Congo, 2005	340	Kenya, 2006	650	Namibia, 2005–2006	300	Syrian Arab Republic, 2003	466
Azerbaijan, 2005	339	Ecuador, 2003	392	Korea, Rep., 2005	573	Nicaragua, 2003	413	Tajikistan, 2002	171
Belarus, 2002	243	Egypt, Arab Rep., 2004	911	Kyrgyz Republic, 2002	160	Oman, 2003	317	Tajikistan, 2003	102
Belarus, 2005	313	Egypt, Arab Rep., 2006	943	Kyrgyz Republic, 2003	97	Panama, 2006	527	Tajikistan, 2005	189
Benin, 2004	170	El Salvador, 2003	415	Kyrgyz Republic, 2005	192	Paraguay, 2006	543	Tanzania, 2003	216
Bolivia, 2006	529	Estonia, 2002	159	Lao People's Dem. Rep., 2005	224	Peru, 2002	105	Tanzania, 2005	401
Bosnia and Herzegovina, 2002	172	Estonia, 2005	207	Latvia, 2002	169	Peru, 2006	574	Tanzania, 2006	395
Bosnia and Herzegovina, 2005	196	Ethiopia, 2002	351	Latvia, 2005	196	Philippines, 2003	607	Thailand, 2004	1,374
Botswana, 2005	311	Gambia, 2005	194	Lebanon, 2006	331	Poland, 2002	477	Uganda, 2003	240
Botswana, 2006	303	Gambia, 2006	192	Lesotho, 2003	42	Poland, 2003	96	Uganda, 2005	573
Brazil, 2003	1,547	Georgia, 2002	165	Lithuania, 2002	192	Poland, 2005	931	Uganda, 2006	570
Bulgaria, 2002	235	Georgia, 2005	194	Lithuania, 2004	206	Portugal, 2005	498	Zambia, 2006	491
Bulgaria, 2005	278	Germany, 2005	1,190	Lithuania, 2005	192	Romania, 2002	245		
Burkina Faso, 2006	45	Greece, 2005	537	Macedonia, Former Yugoslav Rep., 2002	162	Romania, 2005	559		
Burundi, 2006	289	Guatemala, 2003	435	Macedonia, Former Yugoslav Rep., 2005	191	Russian Federation, 2002	481		
Burundi, 2005–2006	292	Guinea-Bissau, 2005	179	Madagascar, 2005	226	Russian Federation, 2005	581		
Cambodia, 2003	24	Guinea-Bissau, 2006	175	Malawi, 2005	134	Rwanda, 2005	209		
Cameroon, 2006	113	Guinea, 2005–2006	244	Malaysia, 2002	839	Saudi Arabia, 2005	536		
Cape Verde, 2006	46	Guyana, 2004	144	Mali, 2003	125	Senegal, 2003	206		
Chile, 2004	903	Honduras, 2003	352	Mauritius, 2005	158	Slovak Republic, 2002	161		
China, 2002	2,374	Hungary, 2002	237	Mexico, 2006	1,251	Slovak Republic, 2005	205		

TABLE 2. Variable Definitions and Sources

Variable name	Definitions
Lgrow (labor growth)	Firm-level employment growth rate, from Investment Climate Assessment data.
Private credit/GDP	Private Credit/GDP, from World Bank Financial Development and Structure Database (also available from *WDI*).
Stock market/GDP	Stock market capitalization/GDP, World Bank Financial Development and Structure Database.
Share of state banks	Share of banking sector assets held by government-owned banks, from Micco, Panizza, and Yanez (2007).
Share of foreign banks	Share of banking sector assets held by foreign-owned banks, from Claessens and Van Horen (2012).
$\text{Ln}(L_{t-2})$	Log(firm size in terms of the number of employees, twice-lagged), from Investment Climate Assessments.
Ln(firm age)	Log(firm age), from Investment Climate Assessments.
$\text{Ln}(\text{GDP per capita}_{t-2})$	Log(GDP per capita, twice-lagged), country-level, *WDI* data.

of employees is likely to be more accurate than information regarding their sales, especially for smaller firms that either do not maintain quality accounting records or are reluctant to fully report their sales (e.g., because of potential tax consequences). For the 89 countries represented by the firms considered in our regressions, the WBES were conducted at different points in time between 2002 and 2006.

We use three firm characteristics as controls in our firm growth regressions: age, size as measured by the number of employees two years prior to the survey, and the percentage of shares held by foreign owners. Both firm age and the number of employees enter the regressions in log form. We do not have strong priors regarding how these characteristics affect firms' labor growth, although if older firms are more likely to have reached their equilibrium size, they may have slower growth rates than younger firms. Percentage growth in employees may be greater for smaller firms because they begin from a low base of employees, but larger firms may have advantages, especially in terms of access to finance, that make hiring additional workers easier. It is also unclear whether firms with high shares of foreign ownership expand employment more or less quickly than firms with higher shares of domestic ownership. Better access to finance by foreign firms would allow for more rapid expansion, but a shorter-term focus on the part of those firms may limit firm expansion.

The key explanatory variables in our analysis are financial structure indicators drawn from the World Bank Database on Financial Development and Structure, which was updated in November 2010.[8] We rely on two primary variables that are intended to capture different aspects of each country's

8. More detailed descriptions of the dataset can be found in Beck, Demirgüç-Kunt, and Levine (2000, 2010). The permanent URL for accessing the dataset is http://go.worldbank.org/X23UD9QUX0.

financial structure: the ratio of private credit to GDP and the ratio of stock market capitalization to GDP. From previous research on the finance-growth nexus, we would expect growth in employment to be positively linked to both of these measures. However, new structural economics predicts that the association between firm growth and private credit relative to GDP, which is a bank-based measure of financial development, should be stronger for countries in early stages of development. We acknowledge, however, that this variable does not provide as direct a test of the predictions of new structural economics as we would like because it does not summarize the size distribution of banks, and small banks are the institutions that are hypothesized to best serve small-scale manufacturers in the early stages of development (as described above). By contrast, the relationship between employment growth and stock market capitalization (relative to GDP) is likely to be stronger for countries in more advanced stages of economic development.

Another aspect of financial structure that may affect firm growth is the nature of ownership—the extent to which the banking sector is state-owned or foreign. However, neither state nor foreign ownership of banks explains variation in labor growth in our sample (results not reported). The ratios of private credit to GDP and stock market capitalization to GDP are therefore the focus of the empirical analysis that follows.

Perhaps the first thing to notice from table 3, which provides summary statistics for our four indicators of financial development, is that country coverage is broader for the private credit measure, with 46 countries at or below the sample median for per capita income and 45 countries above the median. Broader coverage of countries is another reason that private credit is the primary financial indicator in our analysis. For stock market capitalization/GDP and the shares of banking sector assets held by state and foreign-owned banks, the sample is skewed in favor of high-income countries (37–41 country observations) as opposed to lower-income countries (19–22 observations). In part, this pattern of data availability may reflect the fact that stock markets and large shares of foreign bank participation are more likely to be features of the financial systems of advanced countries than of developing countries. However, this is not the case for the share of sector assets held by state-owned banks. The prevalence of observations from wealthier countries for that variable likely indicates the relative difficulty of collecting data that summarize financial development in low-income countries. In any event, for indicators other than private credit/GDP, the relatively small set of lower-income countries makes it more difficult to test hypotheses regarding the optimal financial structure based on predictions from new structural economics.[9]

9. The reason for a significantly higher likelihood of missing observations for our indicator of stock market development may be that when this variable is unobserved for poor countries, its true value is zero. Below, we examine how this consideration affects our results.

TABLE 3. Variations in Poor and Rich Countries

	For the poor region										
	N	Mean	SD	p10	p25	p50	p75	p90	CV	p75/p25	p90/p10
Labor growth	46.000	0.493	0.430	0.126	0.233	0.378	0.654	0.749	0.872	2.800	5.947
Private credit/GDP_{t-2}	46.000	0.195	0.196	0.047	0.071	0.142	0.263	0.427	1.007	3.729	9.129
Stock market cap./GDP_{t-2}	19.000	0.144	0.140	0.007	0.033	0.089	0.215	0.381	0.972	6.524	57.142
Investment rate	41.000	0.045	0.031	0.015	0.024	0.043	0.059	0.072	0.699	2.430	4.723
Training dummy	46.000	0.333	0.169	0.126	0.204	0.318	0.438	0.512	0.509	2.144	4.063
Ln($workers_{t-2}$)	46.000	3.002	0.811	1.714	2.617	3.031	3.447	4.133	0.270	1.317	2.411
State bank ownership share	22.000	0.204	0.252	0.000	0.000	0.083	0.315	0.688	1.238	.	.
Foreign bank ownership share	22.000	0.363	0.275	0.057	0.134	0.330	0.487	0.757	0.758	3.634	13.279
	For the rich region										
	N	Mean	SD	p10	p25	p50	p75	p90	CV	p75/p25	p90/p10
Labor growth	45.000	0.286	0.182	0.120	0.171	0.239	0.327	0.576	0.638	1.914	4.801
Private credit/GDP_{t-2}	45.000	0.515	0.405	0.169	0.195	0.391	0.765	1.153	0.786	3.917	6.823
Stock market cap./GDP_{t-2}	41.000	0.309	0.338	0.065	0.116	0.217	0.355	0.543	1.093	3.063	8.396
Investment rate	24.000	0.038	0.026	0.012	0.018	0.035	0.048	0.077	0.688	2.621	6.363
Training dummy	45.000	0.507	0.182	0.296	0.398	0.466	0.660	0.745	0.358	1.660	2.517
Ln($workers_{t-2}$)	45.000	3.120	0.548	2.602	2.808	3.082	3.283	3.913	0.176	1.169	1.504
State bank ownership share	37.000	0.162	0.199	0.000	0.010	0.096	0.203	0.452	1.230	20.300	.
Foreign bank ownership share	37.000	0.460	0.326	0.065	0.181	0.435	0.730	0.917	0.708	4.033	14.043

Notes: The poor and the rich samples each account for 50 percent of the (collapsed) country sample that deletes firms that have missing observations for labor growth and our base control variables. N represents the number of countries; SD represents the standard deviation; CV represents the coefficient of variation; p10, p25, p50, p75, and p90 represent the 10th, 25th, 50th, 75th, and 90th percentiles, respectively.

As expected, higher-income countries have more developed financial sectors in terms of their average private credit/GDP, stock market capitalization/GDP, and the share of assets held by foreign-owned banks (table 3).[10] The average share of sector assets held by state-owned banks is slightly skewed in favor of lower-income countries (0.20 vs. 0.16 for higher-income countries), although the median state-owned bank asset share is almost identical for the two groups.

At least two other features of the summary statistics for the financial indicators stand out. First, although higher-income countries tend to have more developed financial sectors, there is an overlap in the distributions of the financial indicators between higher- and lower-income countries. For example, among lower-income countries, those in the top 10th percentile have private credit/GDP ratios of 42.7 percent or higher, which ranks them above the median for higher-income countries. A second feature is that within the group of low- (or high-) income countries, there is substantial variation in all financial development indicators despite the relatively small sample sizes. For example, the ratio of stock market capitalization to GDP runs from 1 percent at the 10th percentile to 38.1 percent at the 90th percentile for countries in the lower-income sample. On the one hand, this pattern suggests that if there is an optimal financial structure that varies with the stage of development as reflected in per capita income levels, a sizable fraction of the countries in our sample are not achieving it. On the other hand, and perhaps more practically, the substantial variation in financial structures within both the high- and low-income samples enables us to test whether certain structures yield better outcomes in terms of employment growth and whether those structures differ depending on a country's income level.

II. Instruments

Endogeneity poses the primary challenge to identifying a causal relationship between financial structure and firm growth at different stages of economic development. Therefore, we use instrumental variable estimation techniques. A brief description of the specific variables that we consider and the motivation for their inclusion as instruments are presented below.

Commodities, Natural Resources

Engerman and Sokoloff (1997) argue that the land endowments of Latin America were amenable to commodities that featured economies of scale in production (sugar cane, rice, silver) and thus the use of a large share of slave and indigenous labor. Power was historically concentrated in the hands of the plantation and mining elite, and the institutional structure that arose and persisted offered economic opportunity only to a small group. In contrast, the

10. The difference is statistically significant for private credit/GDP and stock market capitalization/GDP at conventional levels but less so for the share of assets held by foreign-owned banks (with a p value of 12 percent).

endowments of North America lent themselves to commodities grown on family farms (particularly wheat and maize), which fostered the growth of a relatively large middle class in which power was widely distributed. The institutions that arose and persisted came to reflect this relative equality of economic opportunity. These factors help to account for the disparity in per capita income between North America and Latin America. Therefore, we include dummy variables to indicate whether any of a given commodity is grown in each country as potential instruments. Corn, maize, and wheat growth are our proxies for the egalitarian institutions emphasized by Engerman and Sokoloff, which we expect to be positively linked to financial development.

A related body of literature examines whether natural resource endowments, particularly oil, are associated with lower levels of economic development. The existence of a so-called resource curse has been extensively analyzed and debated (Sachs and Warner 1995, 2001; Lederman and Maloney 2008). We therefore include a measure of an economy's dependence on oil, the net exports of petroleum per worker, in the set of potential instruments. We expect that variable to be negatively associated with the financial development indicators.[11]

Settler Mortality

Another influential strand of the literature on the effects of endowments on institutional development and growth trajectories focuses on rates of settler mortality (Acemoglu, Johnson, and Robinson 2001, 2002). In climates and environments that were inhospitable to development, as reflected by high rates of settler mortality, Europeans created states and institutions that enabled elites to extract wealth from the colonies, usually in the form of minerals and cash crops. By contrast, in more hospitable environments, settler colonies emerged in which institutions were created to protect property rights and to foster more broad-based economic opportunity. Acemoglu, Johnson, and Robinson (2001) find robust evidence that settler mortality has a pervasive influence on a series of key property rights institutions, such as protection against expropriation by the government, constraints on the executive, and the establishment of democracy. Because relatively widespread access to financial services is likely to be reflective of the more egalitarian institutions that emerged in settler colonies, we include the logarithm of annualized deaths per thousand European soldiers in the set of potential instruments, which we expect to be negatively associated with the financial development indicators.

Fractionalization and Trust

Trust, which arises as a manifestation of the social and institutional environment, may help to facilitate financial intermediation. A higher level of trust, for

11. A key advantage of using this measure is that it is available for most countries. Moreover, Lederman and Maloney (2008) show that measures based on net exports are more closely linked to actual natural resource reserves than other trade-based endowment measures.

instance, may reduce the information asymmetry between lenders and borrowers; it may also facilitate the social norm of not defaulting on debts. For example, Guiso, Sapienza, and Zingales (2004) find that in Italy, social capital development has a positive effect on the use of formal financial services, including credit. Therefore, we include the average level of trust in a country from 1981 to 2006 among the potential instruments, and we expect it to be positively linked to the financial development indicators.[12]

We also include measures of ethnic and linguistic fractionalization among the set of potential instruments. We expect them to be negatively linked to the financial development indicators.

Legal Origin

La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998) first documented that the legal protection of outside investors was stronger in common law countries (of English legal origin) than in civil law countries rooted in Roman legal traditions, particularly those of French legal origin. Their interpretation was that English common law traditions evolved to protect private property and support private market outcomes, whereas French civil law tended to unify the legal system and cement state control of the judicial system, often to the detriment of private market development. Because the legal traditions in most countries were introduced by outside colonizers, LaPorta et al. argued that legal origin could be treated as exogenous in regressions explaining financial development and growth. Using legal origin as an instrument for investor protection, they demonstrated a strong link between those protections and measures of financial development. We therefore include dummy variables for English and French legal origins in the set of potential instruments. We expect English (French) legal origin to be positively (negatively) linked to financial development.

We ran a series of exploratory regressions (unreported) of financial development on firm characteristics and potential instruments, each added separately to the regression. The strongest relationships were the negative ones between settler mortality and both key measures of financial development (private credit/GDP; stock market capitalization/GDP), a positive correlation between private credit/GDP and interpersonal trust, and a negative correlation between net petroleum exports per capita and private credit/GDP. Surprisingly, the legal origins, the commodities-based endowment measures, and the ethnic

12. As described in Knack and Keefer (1997) and Zak and Knack (2001), our measure of trust is based on data from the World Values Survey first conducted in 1981. Specifically, the measure is the percentage of respondents in each country agreeing that "most people can be trusted" against the alternative that "you can't be too careful in dealing with people." We use the average from 1981 to 2006 (rather than from the actual year of the WBES survey) because data on trust are available for distinct years for different countries, and relying on the survey year would lead to too many missing values for trust for our countries. Averaging also has the benefit of smoothing the measurement errors for the trust variable.

fractionalization measures were not significantly associated with our measures of financial development in these regressions.

Settler mortality does not appear in the first stage results in table 6 despite its strong association with financial development. This is because the instrument set does not pass the Hansen's J test of overidentifying restrictions when settler mortality is included (results unreported). For the exclusion restrictions to be satisfied, the instruments should affect labor growth only through their effects on financial development. Because settler mortality has been shown to be strongly linked to broad measures of institutional and economic development (Acemoglu, Johnson, and Robinson 2001, 2002)—for instance, we can conceivably see how settler mortality may directly affect local infrastructure and labor regulations, both of which may directly affect firm growth (Xu 2011)—it is not surprising that its inclusion results in the failure of the overidentification restriction test (i.e., Hansen's J test). We note, however, that its inclusion does not change the relationships between financial structure and labor growth highlighted below.[13]

Because trust may have a strong influence on contractual arrangements, we find it more plausible that its effects on labor growth may work largely through its positive impact on private credit levels. Similarly, the strong negative relationships between the measures of countries' reliance on oil exports and various measures of financial development recently documented in Beck (2011) indicate that widespread access to financial services, particularly credit, is rare in resource-based economies. Therefore, the notion that net oil exports primarily affect labor growth through their effects on financial development and structure also seems plausible. In the Generalized Method of Moments (GMM) regressions that follow, we will show that the test of overidentifying restrictions is passed when trust and net oil exports are used as instruments in most cases, and we will offer additional estimation approaches in the few cases in which the test is not passed.

III. Regressions

We present our results in several steps, first ignoring the potential endogeneity of financial structure and then addressing this potential endogeneity with either the instrumental variables or the Rajan and Zingales approach.

Ordinary Least Squares

We estimate the following base regression:

$$\Delta L_{ij} = \alpha + \beta FIRM_{ij} + \gamma FIN_j + \varepsilon_{ij} \tag{1}$$

where ΔL is the percentage change in the number of workers employed by firm i in country j over the two years prior to the enterprise survey, as described above. *FIRM* represents the three firm characteristics that we use as controls:

13. Results are not reported here but are available from the authors.

age, size measured in (the logarithm of) total workers, and the share of foreign ownership.[14] As described in section II, we expect that labor growth would be slower for older, better established firms. We have no strong priors regarding how firm size or the share of foreign ownership affect labor growth. *FIN* represents the indicators of financial development and structure that are the focus of the analysis. Because the dependent variable measures labor growth over the two years prior to each survey, the financial structure variables and firm size are also measured two years prior to the survey (denoted by the subscript "t-2" in the tables).

We begin with ordinary least squares (OLS) regressions describing the associations between the financial development indicators and labor growth. We present results for the full sample of countries and for high- and low-income subsamples. We divide the countries into high- and low-income categories based on the median per capita income level for the 91 countries for which we have private credit/GDP figures, as we did for the summary statistics in table 3. Standard errors are clustered at the country level in all models to avoid exaggerating the precision in firm-level regressions with country-level variables (Moulton 1990).

The OLS regressions suggest relationships between the financial indicators and firm labor growth that are consistent with predictions of new structural economics (table 4). For example, private credit/GDP is only significantly positively associated with labor growth in the sample of low-income countries, whereas stock market development/GDP is positively associated with labor growth among the high-income group. The magnitudes of those coefficients are also large. For example, a one-standard-deviation increase in private credit/GDP in the low-income group yields an approximately 20 percentage-point increase in labor growth compared to a mean labor growth rate of 49.3 percent (37.8 percent median) for that sample.[15] A one-standard-deviation increase in stock market capitalization/GDP in the high-income group is associated with a 7.3 percentage point increase in labor growth compared to the 29 percent mean (24 percent median) growth rate for that sample. Coefficients for the stock market capitalization and private credit variables are similar to those from the respective subsamples when we interact them with the dummy variables for poor and rich regions (see model 4).[16]

14. In unreported specifications, we include industry dummy variables. The qualitative results are similar to those presented here.

15. Bear in mind that all labor growth rates are based on a two-year period.

16. Because the number of firms differs across countries in table 1, one might be concerned that countries with more firms are weighted too heavily in the regressions. We therefore reran our regressions weighting each firm by 1/(number of firms surveyed in that country). We also ran regressions weighted by the ratio of the nonagricultural population to the average firm size in each country (larger firm size in a country decreases the weight given to its firms; greater nonagricultural population increases those weights). Because the results for the financial structure variables are quite similar in the weighted regressions to those from our unweighted specifications, we do not present the weighted regressions in the paper.

TABLE 4. OLS Regressions of Labor Growth on Financial Structure: Pooled, Poor, and Rich Samples

	Pooled				Poor			Rich		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ln(workers$_{t-2}$)	−0.060***	−0.050***	−0.054***	−0.065***	−0.074***	−0.024	−0.056***	−0.067***	−0.068***	−0.070***
	(−4.742)	(−2.919)	(−4.475)	(−7.688)	(−5.095)	(−0.791)	(−3.409)	(−7.739)	(−7.557)	(−8.137)
Ln(firm age)	−0.119***	−0.120***	−0.110***	−0.108***	−0.112***	−0.119***	−0.113***	−0.106***	−0.111***	−0.102***
	(−8.333)	(−10.278)	(−8.853)	(−11.221)	(−9.249)	(−5.643)	(−8.038)	(−10.058)	(−9.267)	(−8.842)
Foreign ownership	0.088*	0.062	0.070*	0.115***	0.144***	0.065*	0.142***	0.119***	0.116***	0.120***
	(1.913)	(1.103)	(1.700)	(5.863)	(3.634)	(1.777)	(4.568)	(5.918)	(5.243)	(6.005)
Private credit$_{t-2}$	0.030		0.230		0.798***		1.256***	−0.101**		−0.218***
	(0.223)		(1.018)		(6.875)		(10.486)	(−1.972)		(−2.758)
Stock mkt. cap./GDP$_{t-2}$		−0.036	−0.119			0.513	−0.915***		0.013	0.216***
		(−0.421)	(−0.617)			(1.160)	(−3.795)		(0.268)	(4.142)
Private credit$_{t-2}$ × Poor				1.100***						
				(8.414)						
Private credit$_{t-2}$ × Rich				−0.165*						
				(−1.943)						
Stock mkt. cap./GDP$_{t-2}$ × Poor				−1.151***						
				(−4.216)						
Stock mkt. cap./GDP$_{t-2}$ × Rich				0.220***						
				(4.086)						
Ln(GDP per capita$_{t-2}$)			−0.105**	−0.040			−0.117***			−0.026
			(−2.514)	(−1.491)			(−2.922)			(−0.625)
Intercept	1.018***	1.042***	1.761***	1.299***	0.898***	0.952***	1.668***	1.062***	1.028***	1.233***
	(15.253)	(14.504)	(6.703)	(8.264)	(14.347)	(14.527)	(7.167)	(10.289)	(9.740)	(4.268)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	50,114	40,443	40,443	40,443	21,581	12,542	12,542	28,533	27,901	27,901
Adjusted R^2	0.079	0.089	0.112	0.170	0.147	0.114	0.243	0.102	0.100	0.110

Note: Standard errors clustered at the country level. *, **, and *** represent significance at the 10, 5, and 1 percent levels; *t* statistics are in parentheses.

In the low-income sample, the coefficient for stock market capitalization is positive in one specification (model 6) but does not achieve statistical significance. In model 7, that coefficient is negative and significant.[17] In the high-income sample, the coefficient for private credit/GDP is negative and significant in model 10, but this result may be due to the high correlation between the private credit and stock market capitalization indicators. Among the group of 61 countries in our regressions that have values for both of those indicators (which is biased toward higher-income countries because many low-income countries lack information on stock market capitalization), the correlation is 0.66. However, when the stock market capitalization variable is dropped, the private credit variable remains significant in the high-income sample (model 8), although it is much smaller (in absolute value). Overall, the associations between private credit and labor growth are strong in the low- income sample, whereas stock market capitalization is not positively related to labor growth. The reverse is true among the high-income countries.

Among the control variables, there is a strong negative relationship between firm age and labor growth across both high- and low-income countries. There is also a significant negative association between firm size and labor growth. The share of foreign ownership in a firm is positively associated with labor growth in each sample. Because we split the sample by the level of per capita income, there is less of a need to include that variable in the labor growth regressions. However, in the regressions that pool all countries, that variable is negative and significant, indicating that labor growth is slower in countries with high incomes (table 4, model 3). For the subsample regressions, the coefficient for per capita income is also negative, and it is significant in the low-income sample. Perhaps more important, its inclusion does not qualitatively change the results obtained for the other variables (table 4, models 7 and 10).

Instrumental Variable Regressions

Because labor growth is as likely to affect financial structure (or omitted factors may drive both high labor growth and financial development), it is important to investigate whether the associations between financial structure and firm labor growth in table 4 are plausibly causal. To address concerns

17. The reason for a significantly higher likelihood of missing observations for our indicator for stock market development may be that its true value is zero when it is unobserved for poor countries. To consider this possibility, in a sensitivity check (not reported in the tables), we set the stock market indicator to zero when it is missing for the low-income sample. The results for the low-income sample remain similar: private credit/GDP remains positive and significant even when stock market development is controlled for; stock market capitalization is insignificant when it is included alone or with private credit/GDP.

regarding the endogeneity of the financial structure variables, we present GMM estimates in table 5.[18] As described above, we use the average level of interpersonal trust from 1981 to 2006 and net petroleum exports per worker as instruments. Both are measured at the country level. The first-stage F statistics for the excluded instruments and Shea's adjusted partial R^2 statistics indicate that the instruments are strong predictors of financial development in the poor subsample (see also the first-stage regressions in table 6). They also perform reasonably well for the full sample and for the rich subsample when private credit/GDP is the endogenous variable. They do not perform well when stock market capitalization is treated as endogenous for the full and rich-country samples. The instruments' inability to explain stock market capitalization is not surprising because, as mentioned above, trust levels and net petroleum exports are not strongly correlated with stock market capitalization.

The main finding from the GMM regressions in table 5 is that private credit/GDP remains positively associated with labor growth in the sample of low-income countries (see models 5 and 7), and the coefficient is similar to those from the OLS regressions in table 5. We view this finding as evidence consistent with predictions from new structural economics and Gerschenkron (1962): in the early stages of economic development, banks are better able to foster firm growth than are stock markets. The p values for Hansen's J test of overidentifying restrictions are far larger than the critical values for those regressions, providing additional support for the validity of our instruments.

Stock market capitalization/GDP is not significantly linked to labor growth in the sample of high-income countries, in contrast to the OLS regressions. The first-stage F statistics for the excluded instruments are small whenever stock market capitalization is the endogenous financial structure variable in the GMM regressions for that subsample. Moreover, recall that our sample of "high- income" countries is closer to a sample of middle-income countries. Were we to include firms from industrialized countries, results for the market capitalization variable might differ because those countries tend to have the most advanced securities markets in the world. Finally, the instruments do not pass Hansen's J test of overidentifying restrictions when stock market capitalization appears in the GMM regressions for the low-income subsample, indicating that trust and net petroleum exports are not likely to affect labor growth through their effects on market capitalization alone.[19] Overall, the GMM

18. We choose GMM over two-stage least squares because GMM can account for the heteroskedasticity of an unknown form (Wooldridge 2002). In practice, the two-stage least squares results were qualitatively similar to the GMM results presented here.

19. We derive similar results when we use Limited Information Maximum Likelihood estimation, which is more amenable to weak instruments. For the private credit variable, the results are very similar across the GMM and Limited Information Maximum Likelihood estimations. The Limited Information Maximum Likelihood regressions are available upon request from the authors.

TABLE 5. GMM Estimates of Determinants of Labor Growth: The Pooled, Poor, and Rich Samples

	Pooled sample				Poor subsample				Rich subsample			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Ln(GDP per capita$_{t-2}$)			−0.104	−0.458			−0.041	−0.040			0.104	−0.311
			(−1.494)	(−0.241)			(−0.961)	(−0.508)			(0.773)	(−0.748)
Ln(workers$_{t-2}$)	−0.076***	−0.080	−0.069***	−0.099	−0.077***	−0.072***	−0.075***	−0.060***	−0.066***	−0.084***	−0.061***	−0.097**
	(−7.396)	(−1.461)	(−7.537)	(−0.462)	(−5.106)	(−2.739)	(−5.222)	(−2.578)	(−6.967)	(−4.258)	(−4.512)	(−2.551)
Ln(firm age)	−0.129***	−0.165	−0.109***	−0.106**	−0.113***	−0.094***	−0.112***	−0.090***	−0.089***	−0.143***	−0.098***	−0.102***
	(−4.994)	(−1.575)	(−7.885)	(−2.454)	(−9.534)	(−5.338)	(−9.275)	(−5.461)	(−4.515)	(−3.216)	(−6.702)	(−4.179)
Foreign ownership	0.122***	0.070	0.113***	0.091	0.150***	0.109***	0.149***	0.103***	0.140***	0.050	0.138***	0.068
	(4.215)	(0.543)	(3.557)	(0.444)	(4.015)	(2.867)	(4.004)	(2.693)	(4.161)	(0.477)	(4.114)	(0.659)
Private credit$_{t-2}$	0.342		0.363		0.871***		0.889***		−0.471		−0.603	
	(0.750)		(0.886)		(5.801)		(5.537)		(−1.290)		(−1.253)	
Stock mkt. cap./GDP$_{t-2}$		2.635		3.834		1.381*		0.216		1.591		2.103
		(0.533)		(0.212)		(1.703)		(0.275)		(0.737)		(0.628)
Intercept	0.980***	0.370	1.662***	3.312	0.898***	0.912***	1.139***	1.254***	1.179***	0.524	0.414	2.737
	(9.407)	(0.307)	(4.137)	(0.360)	(14.928)	(9.795)	(3.978)	(2.851)	(8.031)	(0.611)	(0.455)	(1.363)
Number of observations	49,910	40,285	49,910	40,285	21,535	12,542	21,535	12,542	28,375	27,743	28,375	27,743
Adjusted R^2	0.047	.	0.087	.	0.148	0.088	0.149	0.091	0.051	.	0.020	.
First-stage F-statistics for excluded instruments	2.388	0.177	3.468	0.017	8.295	9.631	8.053	12.835	0.963	0.137	3.094	0.170
Shea's adj. partial R^2	0.151	0.003	0.144	0.0002	0.473	0.219	0.444	0.266	0.050	0.001	0.021	0.010
p value, Hansen's J	0.225	0.843	0.134	0.599	0.942	0.057	0.760	0.020	0.722	0.872	0.923	0.418

Note: Standard errors are clustered at the country level. *, **, and *** represent significance at the 10, 5, and 1 percent levels; t statistics are in parentheses.

The two financial variables (private credit/GDP and stock market capitalization/GDP) are considered endogenous. The instruments are petroleum net exports per capita (lagged) and average trust 1981–2006.

TABLE 6. First-Stage Results from GMM Estimates in Table 5

	Pooled				Poor				Rich			
	Private $credit_{t-2}$ coef./t	Stock market/ GDP_{t-2} coef./t	Private $credit_{t-2}$ coef./t	Stock market/ GDP_{t-2} coef./t	Private $credit_{t-2}$ coef./t	Stock market/ GDP_{t-2} coef./t	Private $credit_{t-2}$ coef./t	Stock market/ GDP_{t-2} coef./t	Private $credit_{t-2}$ coef./t	Stock market/ GDP_{t-2} coef./t	Private $credit_{t-2}$ coef./t	Stock market/ GDP_{t-2} coef./t
Ln(firm age)	0.044***	0.019*	0.016*	0.002	0.005	0.001	0.004	−0.002	0.048**	0.018	0.011	−0.003
	(3.028)	(1.755)	(1.677)	(0.232)	(0.545)	(0.196)	(0.446)	(−0.556)	(2.350)	(1.320)	(0.826)	(−0.296)
Foreign ownership	−0.005	0.016	0.008	0.011	−0.034**	−0.013	−0.033**	−0.020	0.048	0.039	0.032	0.031
	(−0.131)	(0.523)	(0.230)	(0.402)	(−2.492)	(−1.401)	(−2.045)	(−1.349)	(0.900)	(1.036)	(0.674)	(0.943)
Ln($workers_{t-2}$)	0.017*	0.010	0.010	0.012	0.019***	0.007*	0.016***	0.006*	0.003	0.008	0.015	0.014
	(1.736)	(1.151)	(1.367)	(1.530)	(2.650)	(1.904)	(2.586)	(1.839)	(0.230)	(0.719)	(1.121)	(1.264)
Trust	0.015**	0.001	0.013*	−0.000	0.018***	0.001	0.017***	−0.002	0.012	−0.001	0.005	−0.005
	(2.162)	(0.252)	(1.818)	(−0.023)	(3.513)	(0.336)	(3.294)	(−0.558)	(1.056)	(−0.095)	(0.480)	(−0.515)
Petroleum net export per worker	−0.076*	0.007	−0.080***	0.005	−0.303**	−0.387***	−0.339*	−0.458***	−0.069	0.015	−0.055	0.025
	(−1.720)	(0.205)	(−2.608)	(0.157)	(−1.985)	(−2.811)	(−1.937)	(−3.284)	(−1.357)	(0.359)	(−1.295)	(0.580)
Ln(GDP per $capita_{t-2}$)			0.142***	0.105***			0.055	0.072			0.243***	0.144**
			(4.289)	(3.298)			(1.410)	(1.528)			(3.273)	(2.561)
Intercept	−0.121	0.206*	−1.013***	−0.510***	−0.210**	0.071	−0.518**	−0.338	0.077	0.360**	−1.706***	−0.696*
	(−1.030)	(1.657)	(−6.042)	(−3.298)	(−2.162)	(1.479)	(−2.239)	(−1.248)	(0.357)	(1.977)	(−3.729)	(−1.716)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	49,910	40,285	49,910	40,285	21,535	12,542	21,535	12,542	28,375	27,743	28,375	27,743
Adjusted R^2	0.250	0.042	0.430	0.162	0.675	0.597	0.687	0.643	0.135	0.050	0.278	0.118

regressions do not provide support for a causal link between stock market capitalization and labor growth among firms in high-income countries.[20]

Rajan and Zingales Methodology

Another widely used method for identifying a causal link between financial sector development and growth comes from Rajan and Zingales (1998), who focus on how industry-level growth rates vary with both dependence on external sources of financing and the level of financial sector development in a country.[21] The key identifying assumption is that capital markets in the United States are relatively frictionless; thus, an industry's reliance on external finance in that country is a reliable indication of its true technological demand for external financing. Industry-level dependence on external finance computed from U.S. data is therefore the key exogenous source of variation in their analysis.

The equation that we estimate is as follows:

$$\Delta L_{ijk} = \alpha + \beta_j + \gamma_k + \delta EXTDEP_j + \theta EXTDEP_j * \mathrm{FIN_k} + \varepsilon_{\mathrm{ijk}} \tag{2}$$

where ΔL is the percentage change in the number of workers employed by firm i in industry j in country k over the two years prior to the enterprise survey, as described above. Dummy variables for each industry are represented by βj, and γ_k represents dummies for each country. *EXTDEP* is the industry-level dependence on external finance based on U.S. data, which is equal to external finance (capital expenditures minus cash flow from operations) divided by capital expenditures, as defined in Rajan and Zingales (1998). We interact that variable with *FIN*, which represents our indicators of financial development (private credit/GDP and stock market capitalization/GDP) in each country. A positive, significant coefficient for that interaction term is supportive of the notion that the labor growth of firms in externally dependent industries is faster than other industries in countries with relatively well-developed financial sectors. Because our aggregate variable now varies at the country-industry level, we cluster our standard errors at that level.

Because this approach focuses on within-industry, between-country differences in labor growth, it is complementary to our instrumental variable regressions (which focus on cross-country differences). Moreover, the inclusion of country and industry dummy variables makes this approach less susceptible to criticisms regarding omitted variable bias and model misspecification than more traditional

20. When we replace the stock market capitalization variable with the value of shares traded in the stock market (divided by GDP), we do not find a significant positive link with labor growth in the high-income sample. We do, however, continue to find a positive relationship between private credit/GDP and labor growth in the low-income sample when the stock market turnover variable replaces the market capitalization variable in our regressions (results not reported).

21. See, for example, Fisman and Love (2007) and Kroszner, Laeven, and Klingebiel (2007) for applications of this method and Xu (2011) for a summary of the use of this method in identifying the effects of the business environment in general.

cross-country regressions. Rajan and Zingales relied on industry-level data because these were the most disaggregated comprehensive data on growth at that time. In contrast, our surveys enable us to examine firm-level growth in a consistent manner across countries. Finer disaggregation should improve the precision of our estimates relative to industry-level approaches.

Our main finding is that the interaction between industry-level dependence on external finance and private credit/GDP is significantly positively linked to labor growth in the sample of low-income countries (table 7). By contrast, there is no significant relationship between labor growth and the interaction between stock market development and dependence on external finance in the sample of low-income countries. This same pattern is obtained in our instrumental variable regressions. Our finding indicates that when evaluated at the median industry level of external finance (0.24), a country at the 90th percentile of banking development would have a labor growth rate that is higher by 11.9 percentage points than a country at the 10th percentile of banking development.[22] This increase in the labor growth rate is equivalent to 28 percent of the standard deviation of labor growth for the poor country sample.

As in our instrumental variable regressions, we find no significant relationship between labor growth and the interaction between industry-level dependence on external finance and indicators of financial development within the sample of high-income countries. Although neither the instrumental variables nor the Rajan and Zingales approaches can definitively establish a causal link between banking sector development and labor growth in the early stages of development, both approaches yield similar results and are similar to the baseline OLS results. At a minimum, we consider the persistent contrasts in the correlations between the high- and low-income samples across estimation methods to be noteworthy.

IV. Interactions Between Firm Characteristics and Financial Structure

In the previous section, we presented evidence consistent with a positive relationship between private credit/GDP and firm growth in poorer countries. To obtain a better idea of what types of firms are likely to benefit from bank finance in these poorer countries,[23] we interact the financial structure variables with firm characteristics using the following equation:

$$\Delta L_{ij} = \alpha + \beta FIRM_{ij} + \gamma FIN_j + \delta FIRM_{ij} FIN_j + \varepsilon_{ij}. \tag{3}$$

The notation is the same as in equation (1). We focus first on the relationship between firm size, financial structure, and firm growth. Small firms are defined

22. That is, $1.302 \times 0.24 \times (0.427 - 0.047)$.
23. We do not find strong and consistent patterns for the rich subsample.

TABLE 7. Rajan and Zingales Approach: The Effect of Financial Development on Labor Growth by Dependence on External Finance

	Poor				Rich			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\text{Ln}(L_{t-2})$	−0.070***	−0.024	−0.074***	−0.044***	−0.080***	−0.081***	−0.080***	−0.081***
	(−3.126)	(−0.708)	(−7.172)	(−3.444)	(−7.664)	(−7.535)	(−16.897)	(−16.722)
Ln(firm age)	−0.115***	−0.127***	−0.117***	−0.122***	−0.111***	−0.111***	−0.111***	−0.111***
	(−10.236)	(−7.602)	(−13.317)	(−10.889)	(−8.526)	(−8.368)	(−14.904)	(−14.565)
Foreign ownership	0.145**	0.063	0.139***	0.045	0.154***	0.150***	0.134***	0.134***
	(2.508)	(1.326)	(4.844)	(1.412)	(5.714)	(5.438)	(6.781)	(6.693)
$\text{Ln(GDP per capita}_{t-2})$	0.011	0.161	0.005	0.508***	−0.030	−0.032	−0.085***	−0.088***
	(0.203)	(1.263)	(0.052)	(3.871)	(−0.730)	(−0.753)	(−5.467)	(−5.622)
External dependence	−0.379***	−0.075			−0.007	−0.070**		
	(−3.534)	(−0.687)			(−0.202)	(−2.568)		
$\text{Private credit}^{*}_{t-2}\text{Ext. Dep.}$	1.199***		1.302***		−0.066		−0.037	
	(5.623)		(5.604)		(−0.982)		(−1.140)	
$\text{Stock market cap.}^{*}_{t-2}\text{Ext.}$		0.367		−0.926		0.038		−0.006
Dep.		(0.701)		(−1.489)		(0.677)		(−0.195)
Country dummies	No	No	Yes	Yes	No	No	Yes	Yes
Industry dummies	No	No	Yes	Yes	No	No	Yes	Yes
Number of observations	14,910	9,153	14,910	9,153	19,124	18,758	19,124	18,758
Adjusted R^2	0.130	0.129	0.194	0.229	0.109	0.110	0.147	0.149

Notes: The table shows OLS regressions; standard errors are clustered at the country-industry level. *, **, and *** represent significance at the 10, 5, and 1 percent levels; *t* statistics are in parentheses. External dependence is the industry-level dependence on external finance based on U.S. data, which is equal to external finance (capital expenditures minus cash flow from operations) divided by capital expenditures, as defined in Rajan and Zingales (1998). The industry classifications in our dataset (and the correspondence with the industry classifications in the Rajan and Zingales paper) are as follows: 1, textiles (same); 2, leather (same); 3, garments (same); 5, food (same); 7, metals and machinery (metal products); 8, electronics (electric machinery, which contains electronic components); 9, chemicals and pharmaceutics (average of "drugs" and "other chemicals"); 11, wood and furniture (same); 12, nonmetallic and plastic materials (plastic products); 15, auto and auto components (motor vehicles); 16, other manufacturing (other industries); 23, construction or transportation (transportation equipment).

The following industries (mostly services) in our data are coded as missing because external financial dependence measures are not available for them in Rajan and Zingales (1998): other unclassified, telecommunications, accounting and finance, advertising and marketing, other services, retail and wholesale trade, hotels and restaurants, real estate and rental services, and mining and quarrying.

as those with 10 or fewer workers; medium-sized firms have from 11 to 50 workers; and large firms have more than 50 workers. Note that our definitions of size cutoffs are somewhat smaller than those in many studies of mature economies, reflecting the fact that our sample is composed of developing and transitional countries, which generally feature more firms than mature economies.

In models in which private credit/GDP is the financial structure variable, the coefficients for medium- and large-size are negative and significant, indicating that the growth rates of small firms are higher than for others.[24] The negative coefficients for medium- and large-size are offset, however, by the positive coefficients on the interactions between firm size and private credit/GDP (table 8).[25] Those coefficients imply that the labor growth rates for large firms in the low-income sample only begin to exceed those for small firms when private credit reaches 30–38 percent of GDP. Within the low-income sample, only approximately one-fifth of the countries meets or exceeds that standard.

This finding suggests that the positive relationships between private credit/GDP and labor growth for the poorer countries reported in the previous section were driven by large firms in a small set of countries with well-developed credit markets. This pattern would seem to be at odds with the predictions of new structural economics in which banks are hypothesized to be well positioned to aid small-scale entrepreneurs in the earliest stages of development.[26]

We next divide the firms by age, with old, middle-age, and young corresponding to the top, middle, and bottom thirds of the age distribution in our sample (table 8). In the low-income sample, labor growth declines with firm age, indicating that better-established firms are less likely to be in an expansionary phase that requires the hiring of new workers.[27] Moreover, because we compute labor growth on a percentage basis as incremental gains in employment affect small firms to a much greater extent than they do large ones. Within the low-income sample, the beneficial effects of private credit development on the labor growth of firms appear to be largely independent of firm age. The coefficients on all of the interactions between firm age and private credit in both the OLS and GMM regressions are positive, significant, and of almost identical magnitude. A similar pattern emerges when we divide the firms into high-, mid-, and low-capital intensity, corresponding to the top, middle, and bottom thirds of the sample as measured by the ratio of capital to labor at the industry level. Within the sample

24. These coefficients are not shown in table 8 but are discussed in the table notes.

25. In the GMM estimation, the interaction terms of financial structure variables with firm characteristics are considered endogenous. The instruments consist of the interaction of our old instrumental variables with firm characteristics.

26. We acknowledge that well-developed banks might have enabled these firms to grow from small to large over time.

27. See Table 8 notes for the coefficients of the old and middle-aged dummy variables. The same pattern is also evident for the high-income sample, though results for that sample are not shown in table 8.

TABLE 8. Private Credit and Labor Growth by Firm Characteristics, Poor Subsample

	OLS	GMM
Private credit by firm size		
Priv. × Small (≤ 10 workers)	0.533***	0.557
	(2.823)	(1.511)
Priv. × Medium (11–50 workers)	0.795***	0.918***
	(5.857)	(6.097)
Priv. × Large (> 50 workers)	0.942***	1.041***
	(10.173)	(8.592)
Private credit by firm age		
Priv. × Young	0.830***	0.812***
	(7.113)	(4.878)
Priv. × Middle-aged	0.850***	0.900***
	(6.870)	(5.531)
Priv. × Old	0.797***	0.870***
	(6.074)	(5.919)
Private credit by firm capital intensity		
Priv. × Low	0.808***	0.827***
	(5.621)	(4.961)
Priv. × Medium	0.875***	0.876***
	(7.195)	(7.090)
Priv. × High	0.810***	0.761***
	(7.324)	(3.814)

Notes: This table shows regression coefficients for the interaction between private credit/GDP (twice-lagged) and various firm characteristics (twice-lagged size, age, and capital intensity). The interaction terms for each characteristic are included in separate regressions. In addition to the firm characteristics, the regressions also control for the share of foreign ownership in the firm and the logarithm of GDP per capita in each country. Standard errors are clustered at the country level. *, **, and *** represent significance at the 10, 5, and 1 percent levels. Firm characteristics enter the regressions not only as part of an interaction with private credit but also on their own.

For reference, the coefficients for the medium and large firm dummies for the OLS regression described in the top third of the table are −0.244*** and −0.359***, respectively. The coefficients for the middle-aged and old dummies for the OLS regression described in the middle third of the table are −0.107*** and −0.184***, respectively. The coefficients for the medium and high capital intensity dummies for the OLS regression described in the bottom third of the table are −0.018 and −0.106**, respectively.

of lower-income countries, neither young nor less capital-intensive firms appear to benefit from banking sector development to a greater extent than others in terms of labor growth.

To summarize, contrary to predictions from new structural economics that banks should disproportionately benefit small-scale entrepreneurs and manufacturers in the early stages of economic development, our results indicate that the labor growth rates of larger firms are increasing in the level of private credit to GDP. Although banks appear to be more important than stock markets for generating firm growth in low-income economies, they do not seem to target the clients that new structural economics predicts would be the most natural. However, we cannot rule out the possibility that banks enabled a

subset of small firms to grow over time. Of course, it remains an open question why only a subset of firms would have benefited from bank finance.

V. Additional Robustness Checks

In table 9, we present OLS regressions that control for additional country-level variables to assess the robustness of our findings regarding financial development and firm labor growth. Because job growth likely depends on the quality of the institutional environment and the general level of stability, we include two variables: an index of adherence to the rule of law and another measuring political stability. Certain industries may have experienced more rapid job growth during the period in which our surveys were conducted; thus, we also include variables that measure the shares of GDP attributable to agriculture, manufacturing, and services (the omitted category) in our analysis. Finally, we control for the stringency of labor regulations by including a measure of the costs of firing an employee. Higher costs would likely be associated with slower labor growth. Although these control variables are occasionally significant, their inclusion does not change our main finding: private credit/GDP remains significantly positively linked to labor growth within the low-income sample. Although stock market capitalization/GDP remains positively linked to labor growth in the high-income sample, the inclusion of the additional controls renders its coefficient insignificant.

Banking sector structure, competition, and efficiency may also help to determine the labor growth rates of firms. For example, it may be that labor growth in low-income countries is more closely related to the levels of competition and concentration in the banking sector than to banking sector depth (as measured by private credit/GDP). The inclusion of the banking sector concentration variable may also provide a more direct test of the predictions of new structural economics because that variable provides some information on the size distribution of banks. To examine these possibilities, we include two variables: the share of banking sector assets held by the three largest banks as a measure of concentration and the ratio of banking sector costs to income as a proxy for efficiency. Neither of these variables is significant in the regression, and the private credit variable remains significant and of similar magnitude as in our base regressions. To conserve space, we do not present these results here.

VI. Mechanisms Through Which Bank Finance Spurs Firm Development

As a final empirical exercise and to further assess the plausibility of our main finding, we examine the relationships between our indicators of financial development and other firm-level performance variables (table 10). Within the sample of low-income countries, we find that private credit/GDP is positively and significantly associated with firms' investment rates, which indicates that

TABLE 9. Sensitivity Checks, Industry Controls, Rule of Law, Political Stability, and Firing Costs

	Poor						Rich					
	coef./t	coef./t	coef./t	coef./t	coef./t	coef./t	coef./t	coef./t	coef./t	coef./t	coef./t	coef./t
Ln(Workers$_{t-2}$)	−0.073***	−0.036	−0.078***	−0.022	−0.076***	−0.028	−0.067***	−0.068***	−0.072***	−0.073***	−0.062***	−0.062***
	(−5.235)	(−1.504)	(−4.774)	(−0.806)	(−5.062)	(−0.948)	(−7.035)	(−6.745)	(−8.429)	(−8.359)	(−7.435)	(−7.445)
Ln(firm age)	−0.113***	−0.106***	−0.118***	−0.110***	−0.114***	−0.130***	−0.103***	−0.108***	−0.103***	−0.107***	−0.113***	−0.119***
	(−9.493)	(−7.541)	(−9.818)	(−6.676)	(−9.428)	(−5.593)	(−10.391)	(−9.821)	(−9.681)	(−9.249)	(−10.714)	(−9.991)
Foreign ownership	0.142***	0.024	0.173***	0.075**	0.143***	0.063*	0.127***	0.123***	0.139***	0.138***	0.100***	0.097***
	(3.524)	(0.397)	(3.759)	(2.258)	(3.568)	(1.686)	(6.059)	(5.522)	(6.324)	(5.921)	(5.026)	(4.623)
Private credit$_{t-2}$	0.825***		0.859***		0.798***		−0.089		−0.095*		−0.103*	
	(6.949)		(7.683)		(6.135)		(−1.457)		(−1.789)		(−1.807)	
Stock/GDP$_{t-2}$		0.107		0.614**		0.329		0.051		0.007		0.015
		(0.189)		(1.962)		(0.785)		(0.866)		(0.112)		(0.265)
Agri./GDP$_{t-2}$	0.347*	0.860*					0.410	0.779				
	(1.658)	(1.734)					(0.712)	(1.274)				
Manufacture/ GDP$_{t-2}$	0.002	0.026					0.001	−0.001				
	(0.446)	(1.568)					(0.421)	(−0.312)				
Rule of law$_{t-2}$			0.060	0.231					−0.043	−0.027		
			(1.101)	(1.623)					(−1.573)	(−0.818)		
Political stability$_{t-2}$			−0.082	−0.014					−0.063*	−0.079**		
			(−1.357)	(−0.145)					(−1.885)	(−2.457)		
Firing costs$_{t-2}$					0.000	0.002*					0.001	0.001
					(0.001)	(1.710)					(1.543)	(1.007)
Intercept	0.785***	0.432	0.868***	0.793***	0.912***	0.845***	0.992***	0.959***	1.053***	1.004***	1.025***	1.008***
	(10.101)	(1.644)	(11.580)	(7.082)	(10.717)	(7.874)	(9.634)	(9.561)	(9.622)	(9.341)	(9.160)	(8.858)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	21,490	12,542	17,859	11,417	20,729	12,542	28,052	27,420	27,826	27,390	25,740	25,108
Adjusted R^2	0.152	0.158	0.175	0.144	0.148	0.127	0.104	0.104	0.108	0.106	0.110	0.107

Note: The table reports OLS regressions of labor growth on indicators of financial development, firm characteristics, and country-level controls. Standard errors are clustered at the country level. *, **, and *** represent significance at the 10, 5, and 1 percent levels; *t* statistics are in parentheses.

TABLE 10. Potential Mechanisms through which Financial Development Spurs Firm Development

	Dependent variable		
Explanatory variable	Investment rate	Training	Firm Size
Private credit			
Poor subsample	0.048***	0.417***	1.035***
	(3.698)	(4.099)	(3.959)
Rich subsample	0.001	−0.108*	0.238
	(0.063)	(−1.691)	(1.488)
Stock market capitalization			
Poor subsample	−0.073*	−0.502	0.495
	(−1.813)	(−1.403)	(0.390)
Rich subsample	−0.008	−0.088	0.316
	(−1.380)	(−1.030)	(1.586)

Notes: This table shows coefficients for indicators of financial development from OLS regressions of firm outcomes (investment rate, training, and firm size) on financial indicators and other controls. Each coefficient in the table comes from a separate regression. Those regressions also control for firm characteristics (twice-lagged number of workers, age, and share of foreign ownership in the firm) and per capita income in each country; in the case of firm size as the dependent variable, we do not control for lagged firm size. Standard errors are clustered at the country level. *, **, and *** represent significance at the 10, 5, and 1 percent levels. Training is a dummy variable indicating whether the firm offers training to its employees. Firm size is measured by (the log of) total workers.

the labor growth associated with banking sector development is accompanied by capital investment. Similarly, private credit/GDP is positively associated with a dummy variable indicating that the firm provides training to its employees. This result suggests that bank finance is associated not only with an increasing number of workers at firms in low-income countries but also with the development of their human capital, presumably to achieve productivity gains. Finally, in low-income countries, private credit is positively associated with firm size measured by the number of employees. One concern was that our measure of labor growth focused on a short time horizon (two years). The positive and significant relationship between private credit and firm size is consistent with the notion that bank finance sustains firms over longer periods, enabling them to expand over time.

In contrast, neither private credit nor stock market capitalization is significantly associated with investment rates, firm size, or employee training within the sample of high-income countries. Furthermore, there is not a strong relationship between stock market capitalization and the other firm outcome variables within the sample of low-income countries. These patterns mimic those found for labor growth and thus are consistent with the beneficial effects of banking sector development in lower-income countries.

VII. Conclusions

We have combined data from detailed firm surveys with indicators of financial development and structure that cover a broader set of countries than those in previous studies to analyze the relationships between firm growth, financial structure, and the stage of economic development. In low-income countries, we find evidence that labor growth is swifter in countries with a higher level of private credit/GDP, consistent with the predictions of new structural economics. This conclusion holds under two well-established estimation approaches: instrumental variable regressions and the Rajan and Zingales regression methodology. The plausibility of the finding of the beneficial role of banks in poorer countries is further supported by our finding that a more developed banking system is associated with higher investment rates, more employee training, and larger firm sizes only in poor countries, suggesting that banks spur both physical and human capital investments in addition to increasing job growth in such countries. In high-income countries, we find that labor growth rates increase with the level of stock market capitalization using OLS regressions, which may be seen as consistent with predictions from new structural economics. However, we are unable to reproduce those results using the two additional estimation methods described above.

Moreover, when we examine the types of firms that appear to benefit from well-developed private credit markets in low-income countries, we find no evidence that the small-scale firms benefit most. Rather, labor growth rates increase with the level of private credit market development for larger firms. This pattern is consistent with arguments rooted in political economy that banking systems in low-income countries serve the interests of the elite rather than providing broad-based access to financial services.

We acknowledge that our approach comes with caveats and highlights the gaps in our knowledge regarding the effects of financial structure. For example, our inability to find a suitable instrument for stock market development makes it difficult to study whether market capitalization enables firms to grow more quickly in high-income countries. Again, our results using the Rajan and Zingales methodology fail to reveal any evidence of a positive link between stock market development and the labor growth of firms in industries that depend heavily on external finance. We also acknowledge that our indicators of financial structure do not provide as direct a test of the predictions of new structural economics as we would like because they do not summarize the size distribution of banks, and small banks are the institutions that are hypothesized to best serve small-scale manufacturers in the early stages of development. It is possible, therefore, that alternative financial structure variables would yield different results regarding labor growth.

Deriving policy implications from our findings is not straightforward. For example, we are reluctant to recommend that governments actively attempt to shape the size composition of banks, with the exception of allowing sufficient

entry to facilitate competition in the provision of financial services (see Barth, Caprio, and Levine 2006 on the downside of rigid entry restrictions). Moreover, we are mindful of the fact that careful empirical studies of bank branching in the United States show that it led not only to larger banks, intensified competition, and improved bank performance but also to substantial increases in the incomes of the less affluent by increasing the relative wage rates and working hours of unskilled workers.[28] Although these were indirect benefits to the less well off, it is not clear whether those benefits were smaller than those that would have been generated by relationship lending to small businesses via smaller banks.

Rather than focusing on policy advice regarding the size distribution of financial institutions in a country, a better route might be to focus on the features of the environment that make the provision of financial services possible (such as adherence to the rule of law, property rights protection, effective dispute resolution mechanisms, and credit and collateral registries). Multiple studies have demonstrated that the entry rate and growth of new firms are positively associated with financial development. These effects are especially strong for small firms, which report being more constrained by financial obstacles than others.[29] A focus on the enabling environment might therefore be the most effective way to support the growth and entry of small firms.

Finally, although the enterprise surveys that we use offer rich information across a wide range of countries, our labor growth rates can only be computed over a two-year window. We therefore rely on a snapshot of firm growth to draw inferences. Case studies of firm financing patterns and financial development in low-income countries over longer periods are likely to offer a more complete picture of how firms grow. To the extent that some low-income countries have been better able to achieve financial inclusion, these case studies may shed light on how banks can foster growth across a broader spectrum of firms during the early stages of development. However, to the extent that the political economic incentives that limit the inclusiveness of financial systems in low-income countries cannot be overcome, it would be wise to explore how alternative policies and intermediaries could better achieve that aim.

References

Acemoglu, D., S. Johnson, and J.A. Robinson. 2001. "The Colonial Origins of Comparative Development: An Empirical Investigation." *American Economic Review* 91 (5): 1369–1401.

———. 2002. "Reversal of Fortunes: Geography and Institutions in the Making of the Modern World Income Distribution." *Quarterly Journal of Economics* 117 (4): 1231–94.

28. See Jayaratne and Strahan (1998) and Beck, Levine, and Levkov (2010).

29. See Beck, Demirgüç-Kunt, and Maksimovic (2005); Beck, Demirgüç-Kunt, Laeven, and Maksimovic (2006); Klapper, Laeven, and Rajan (2006); and Laeven (2003).

Barth, J.R., G. Caprio Jr., and R. Levine. 2006. *Rethinking Bank Regulation: Till Angels Govern*. New York: Cambridge University Press.

Beck, T. 2011. "Finance and Oil: Is There s Resource Curse in Financial Development?" European Banking Center Discussion Paper 2011-004. Tilburg University, Tilburg, the Netherlands.

Beck, T., A. Demirgüç-Kunt, L. Laeven, and V. Maksimovic. 2006. "The Determinants of Financing Obstacles." *Journal of International Money and Finance* 25 (6): 932–52.

Beck, T., A. Demirgüç-Kunt, and R. Levine. 2000. "A New Database on Financial Development and Structure." *World Bank Economic Review* 14 (3): 597–605.

———. 2010. "Financial Institutions and Markets Across Countries and over Time: The Updated Financial Development and Structure Database." *World Bank Economic Review* 24 (1): 77–92.

Beck, T., A. Demirgüç-Kunt, and V. Maksimovic. 2005. "Financial and Legal Constraints to Firm Growth: Does Firm Size Matter?" *Journal of Finance* 60 (1): 137–77.

Beck, T., R. Levine, and A. Levkov. 2010. "Big Bad Banks? The Winners and Losers from Bank Deregulation in the United States." *Journal of Finance* 65 (5): 1637–67.

Claessens, S., and N. van Horen. 2012. "Being a Foreigner among Domestic Banks: Asset or Liability?" *Journal of Banking & Finance* 36 (5): 1276–1290.

Demirgüç-Kunt, A., E. Feyen, and R. Levine. 2011. "Optimal Financial Structures and Development: The Evolving Importance of Banks and Markets." World Bank, mimeo.

Demirgüç-Kunt, A., and R. Levine. 2001. *Financial Structure and Economic Growth: A Cross-Country Comparison of Banks, Markets, and Development*. Cambridge, MA: MIT Press.

Engerman, S., and K. Sokoloff. 1997. "Factor Endowments, Institutions, and Differential Paths of Growth among New World Economies: A View from Economic Historians of the United States." In Stephen H. Haber, ed., *How Latin America Fell Behind*, 260–304. Stanford, CA: Stanford University Press.

Fisman, R., and I. Love. 2007. "Financial Development and Growth Revisited." *Journal of the European Economic Association* 5 (2–3): 470–79.

———. 2003. "Trade Credit, Financial Intermediary Development, and Industry Growth." *Journal of Finance* 58 (1): 353–74.

Gerschenkron, A. 1962. *Economic Backwardness in Historical Perspective, a Book of Essays*. Cambridge, MA: Harvard University Press.

Guiso, L., P. Sapienzia, and L. Zinglales. 2004. "The Role of Social Capital in Financial Development." *American Economic Review* 94 (3): 526–56.

Klapper, L., L. Laeven, and R. Rajan. 2006. "Entry Regulation as a Barrier to Entrepreneurship." *Journal of Financial Economics* 82 (3): 591–629.

Knack, S., and P. Keefer. 1997. "Does Social Capital Have an economic Payoff? A Cross-Country Investigation." *Quarterly Journal of Economics* 112 (4): 1252–88.

Kroszner, R.S., L. Laeven, and D. Klingebiel. 2007. "Banking Crises, Financial Dependence, and Growth." *Journal of Financial Economics* 84 (1): 187–228.

Jayaratne, J., and P.E. Strahan. 1998. "Entry Restrictions, Industry Evolution and Dynamic Efficiency: Evidence from Commercial Banking." *Journal of Law and Economics* 41 (1): 239–74.

Laeven, L. 2003. "Does Financial Liberalization Reduce Financing Constraints?" *Financial Management 2003* (Spring): 5–34.

La Porta, R., F. Lopez-de-Silanes, A. Shleifer, and R.W. Vishny. 1998. "Law and Finance." *Journal of Political Economy* 106 (6): 1131–50.

Lederman, D., and W.F. Maloney. 2008. "In Search of the Missing Resource Curse." Economía 9 (1): 1–58.

Levine, R. 2002. "Bank-Based or Market-Based Financial Systems: Which is Better?" *Journal of Financial Intermediation* 11 (4): 398–428.

Lin, J. 2010. "New Structural Economics: A Framework for Rethinking Development." World Bank Policy Research Working Paper 5197. Washington, DC.

Lin, J.Y., X. Sun, and H.X. Wu. 2012. "Banking Structure, Labor Intensity, and Industrial Growth: Evidence from China." World Bank, mimeo.

Micco, A., U. Panizza, and M. Yanez. 2007. "Bank Ownership and Performance. Does Politics Matter?" *Journal of Banking and Finance* 31 (1): 219–41.

Moulton, B. 1990. "An Illustration of a Pitfall in Estimating the Effects of Aggregate Variables on Micro Units." *Review of Economics and Statistics* 72 (3): 334–38.

Petersen, M.A., and R.G. Rajan. 1997. "Trade Credit: Theories and Evidence." *Review of Financial Studies* 10 (3): 661–91.

Rajan, R.G., and L. Zingales. 1998. "Financial Dependence and Growth." *American Economic Review* 88 (3): 559–86.

Sachs, J.D., and A. Warner. 1995. "Natural Resource Abundance and Economic Growth." National Bureau of Economic Research Working Paper 5398. National Bureau of Economic Research, Cambridge, MA.

———. 2001. "The Curse of Natural Resources." *European Economic Review* 45 (4–6): 827–38.

Xu, L.C. 2011. "The Effects of Business Environments on Development: A Survey of New Firm-Level Evidence," *World Bank Research Observer* 26 (2): 310–40.

Wooldridge, J.M. 2002. *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: The MIT Press.

Zak, P.J., and S. Knack. 2001. "Trust and Growth." *Economic Journal* 111 (April): 295–321.

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