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Saving across the World

Puzzles and Policies

Klaus Schmidt-Hebbel
Luis Servén

Recent World Bank Discussion Papers

Saving across the World

Puzzles and Policies

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FOREWORD

World saving rates have been falling and the gap between industrial-country and developing-country saving has widened since the 1970s. Within the developing world, the saving divergence has been dramatic: saving rates have doubled in East Asia, stagnated in Latin America, and collapsed in Sub-Saharan Africa. Saving disparities have been closely mirrored by growth performances: across countries, higher saving rates have been matched by higher income growth.

The coexistence of virtuous cycles of saving and prosperity in some developing countries with poverty traps of under-saving and stagnation in many others is a powerful reason for a closer look at the behavior of saving and its relation to growth. In addition to its direct growth impact, however, an adequate supply of saving is also a major policy concern because it contributes to reduce country vulnerability to unexpected shifts in international capital flows. In this way, high national saving helps ensure macroeconomic stability, itself a powerful growth factor.

Understanding the forces behind saving disparities across different countries and time periods, and identifying the role of specific policies that can contribute to a saving-growth take-off, are high on the World Bank's research agenda. This World Bank Discussion Paper is based on the research proposal on *Saving Across the World: Puzzles and Policies* that was recently approved by the World Bank Research Committee. The paper surveys broad saving trends in the world, summarizes current knowledge about saving and consumption, identifies major unresolved issues, and lays out the main policy-related questions to be addressed by the research. It also spells out the analytical and methodological framework of the different research components.

We expect that this research project will make a major contribution to improve our understanding of why people and institutions save -- and why they do not -- and to identify the policies that can get virtuous saving-growth cycles under way.

Lyn Squire, Director
Policy Research Department

ABSTRACT

Over the last three decades the developing world has witnessed a large and increasing divergence in saving rates: they have doubled in East Asia, stagnated in Latin America, and collapsed in Sub-Saharan Africa. These regional saving disparities have been closely reflected in the respective growth performances: across world regions, higher saving rates have come with higher income growth. Against such background, this paper lays out a research agenda to address three broad questions of direct policy relevance. First, why do saving rates differ so much across countries and time periods ? Second, how much do higher saving rates contribute to raising growth ? And third, what policy measures are the most effective to raise national saving ? The paper surveys broad saving trends across the world, reviews the current knowledge about consumption and saving, and identifies the main unresolved questions to be addressed by the research. The proposed agenda starts from the construction of an international database on saving and related macroeconomic variables, and includes work focused on specific policy issues that cut across a broad range of countries as well as research focused on regional and country experiences. The paper spells out in detail the analytical and methodological framework to be used by the different research components.

ACKNOWLEDGMENTS

This paper originated from the research proposal *Saving in the World: Puzzles and Policies*, presented to the World Bank Research Committee in 1996. The Committee generously agreed to fund virtually all of the research described here.

The paper is organized in two parts. Part I contains the general motivation and overview of the research, divided into three sections. The first one describes the broad stylized facts regarding saving in the world. The second summarizes the current theoretical knowledge about consumption and saving, focusing on their ability to explain the empirical facts. The third section lays out the main policy-relevant questions to be addressed by the research work. In turn, Part II contains a more detailed description of the analytical and methodological framework of the different components of the research.

We thank Sebastian Edwards and Lyn Squire for initial discussions when starting to think about this project and for subsequent comments on earlier drafts. The research proposal was prepared in close collaboration with the project's participants: Orazio Attanasio, Gerard Caprio, Angus Deaton, Cevdet Denizer, Ibrahim Elbadawi, Mark Gersovitz, Patrick Honohan, Aart Kraay, Norman Loayza, Alejandro Lopez, Ernesto May, Peter Montiel, Francis Mwega, Ijaz Nabi, Jonathan Ostry, Christina Paxson, Lucio Picci, Carmen Reinhart, Dani Rodrik, Andrew Samwick, Fabio Schiantarelli,Antonello Scorcu, Jonathan Skinner and Holger Wolf. Their respective contributions are acknowledged in Part II.

This paper has also benefitted from the collaboration of many individuals from within and outside the World Bank. We are particularly grateful to David Dollar, Bill Easterly, Peter Harrold, Ross Levine, Joanne Salop, Michael Walton, and participants at World Bank seminars and at the 1996 Latin American Meeting of the Econometric Society for comments on earlier drafts.We are also indebted to the members of the World Bank Research Committee and especially to four anonymous referees who provided extensive detailed comments and suggestions on the original research proposal.

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SUMMARY AND OVERVIEW

Over the last three decades the world has witnessed a large and increasing **divergence in saving rates**. World saving rates have been falling since the early 1970s and the gap between industrial-country and developing-country saving rates has widened since the mid-1970s. Within the developing world, the saving divergence has been dramatic: saving rates have doubled in East Asia, stagnated in Latin America, and collapsed in Sub-Saharan Africa. These saving disparities have been closely reflected in the respective growth performances: across world regions, higher saving rates have come with higher income growth.

From a theoretical viewpoint, there is in principle little reason to expect saving rates to behave similarly across countries. In an ideal first-best world, different saving rates could just be the result of optimal intertemporal consumption decisions when tastes, technology and/or other factors vary across countries. In the real second-best world, however, intertemporal choices are subject to a host of externalities, market failures and policy-induced distortions that in many countries are likely to cause saving to differ from its welfare-maximizing levels. Of course, the result need not be too low a level of saving. While some distortions -- such as too low government saving in a non-Ricardian world, or moral hazard leading to inadequate private savings for retirement in anticipation of public bailout of the old-age poor -- can result in socially insufficient saving, other types of market imperfection such as the absence of risk-sharing instruments, or policy-induced distortions such as forced saving schemes, can conceivably lead to saving above socially optimal levels.

Yet the very low saving ratios of many developing countries, particularly among poorer countries, strongly suggest that the prevailing situation is one of socially insufficient saving. Indeed, the direct association between saving ratios and growth rates across countries noted above hints at the existence of virtuous cycles of saving and prosperity along with poverty traps of under-saving and stagnation. In these circumstances, addressing the distortions that are at the root of under-saving can be key to higher long-run growth and welfare. In practice, however, the interpretation and policy implications of the saving-growth link still remain controversial.

Ensuring an adequate supply of saving is also a central policy objective for reasons other than its direct growth impact. A national saving ratio broadly in line with the economy's investment needs is a key ingredient to reduce countries' vulnerability to unexpected shifts in international capital flows. As illustrated by Mexico's recent experience, low domestic saving can exacerbate the likelihood and negative consequences of sudden capital outflows that may be driven by factors such as herd behavior or self-fulfilling expectations on the part of international investors. Under increasing international financial integration, high domestic saving contributes to ensure macroeconomic stability, itself a powerful growth factor.

However, a firm analytical and empirical basis to ground the choice of policy levers aimed at saving is still lacking. Little is known about the relative effectiveness of alternative policies in

encouraging saving. And this is so even in the case of policy measures that are often advocated on the basis of their positive saving impact -- like nowadays pension system reform or, in the past, financial sector liberalization.

Against this background, the purpose of this research project is to address **three broad questions**:

(1)   Why do saving rates differ so much across countries and time periods ?

(2)   How much do higher saving rates contribute to raising growth ?

(3)   What policy measures are the most effective to raise national saving ?

These questions are of direct policy relevance but correspond to different levels of the policy design process. The first question seeks to explain the massive and increasing differences in saving performance across countries and over time. Having a better understanding of the specific role of structural, external, and policy determinants in the behavior of savers is a first step in identifying the possible contributions of specific policy levers to saving. This requires going beyond the behavior of national saving, focusing specifically on the private sector and, to the extent possible, analyzing separately the saving decisions of households and firms.

Addressing the second question will improve our understanding of the saving-growth nexus and shed light on the role of saving vis-a-vis other factors in promoting higher sustainable growth. There is little doubt that saving, to the extent that it translates into physical capital accumulation, is a central ingredient for growth. However, recent research has underscored the reverse causation from growth to saving, with the implication that saving ratios themselves are in part a reflection of the economy's growth performance. In this context, disentangling and identifying quantitatively the relative importance of these two forces is a task of central relevance to the choice of target for growth-enhancing macroeconomic policy. If saving is a major growth determinant, the removal of distortions causing under-saving should be a central aspect of a policy framework aimed to overcome poverty traps. If, on the contrary, saving ratios are largely a consequence of the growth process, such a framework should target primarily the distortions hampering physical investment, human capital accumulation and/or technological advancement -- that is, the variables driving growth.

In turn, the third question refers to the optimal choice of saving policy instruments. The range of tools capable of affecting national saving levels is in principle quite broad: from changes in overall public saving, to specific tax and financial incentives to private saving, to broader institutional reforms such as the introduction of fully-funded pension systems. However, instrument selection should be governed by a systematic assessment of their respective effectiveness, which at present remains far from settled. In some cases, like pension reform, the lack of a conclusive evaluation reflects mostly the scarcity of empirical studies. By contrast, the effectiveness of specific tax incentives to private saving has attracted considerable empirical

attention in OECD countries although its results are still not conclusive, while no evidence is available for developing countries. In turn, the predominant view on the saving impact of financial system liberalization has been partially reversed in recent years, from the positive effect predicated in the past according to the 'financial repression' paradigm, to a possibly negative one -- although empirical support for the latter is still limited and confined to a few industrial countries. Finally, while few doubt the ability of public saving to affect national saving, empirical assessments of its impact in developing countries are scarce and quantitatively very different.

These three broad questions will be divided into specific researchable issues tackled by this project in individual papers. In order to address these issues effectively, **the research project is structured into five complementary components**:

A. Data
B. Saving across the world
C. Policy issues of worldwide importance
D. Lessons from international saving experiences
E. Project findings and policy implications

Chart 1 summarizes the project's five components and identifies specific issues that will be addressed in each component. Each issue in the chart will be analyzed in an individual paper within the project.

The first project component will tackle the construction of an international macroeconomic data base on saving and related variables. Availability of a large cross-country data set built with consistent criteria is an essential pre-requisite for conducting the research. The second component focuses on understanding both saving differences across space and time (the first broad question identified above) and the saving-growth link (the second broad question). Using new information from both national accounts and household surveys, the empirical research will shed light on the factors that drive (and inhibit) saving in the world, and on the relationship between saving and growth. The third component will focus on the effects of specific policies on saving (the third broad question), using a cross-country comparative approach. To complement the issue-oriented research of the second and third components, the fourth will assess in depth the saving performance of specific countries, country groups and world regions, to draw lessons from actual policy experiences. Finally, the fifth and last component will provide a policy-oriented synthesis of the main results and lessons from the research.

The **research methodology** will be based both on relatively narrow analytical frameworks explicitly derived from intertemporal optimization, and on broader models not derived from first principles but encompassing a number of alternative consumption/saving motives. Empirical implementation of the analytical models will make use of both micro and macroeconomic data. For the project's cross-country studies, the aggregate data will be drawn from the saving data base. The precise empirical models and the coverage of the data they use will vary across studies, depending on data availability and the need to tailor the samples to the specific questions under

investigation. Part I discusses the research content and organization of this proposal. Part II provides extensive details on the methodology to be used by each of the papers that will be prepared within the project.

The research project will have a **direct impact on World Bank Operations in four dimensions**. First, clarification of what drives saving and how saving relates to growth will be of direct assistance in policy diagnosis and the selection of policy targets -- that is, to determine the relative priorities in the overall country policy and lending strategy between saving-enhancing measures and measures targeted at investment (physical or human) or technological innovation. Second, the quantitative assessment of the relative effectiveness of saving-promoting policies will facilitate the rational selection of policy tools, clarifying which instruments are likely to have the biggest impact under what circumstances. Third, this in turn will help to determine the priority and sequencing of specific reform measures, providing analytical support to overall and sectoral adjustment operations, particularly in the areas of public expenditure and taxation, financial-sector reform, and pension-system reform. Finally, the development of empirically-validated saving functions with firm analytical foundations will enhance the formulation of country analyses, projections and strategies in operational work.

The **timing of this research** should also enhance its operational impact. The World Bank has not devoted a major research effort to the issue of saving in over a decade. In addition, several themes closely related to saving -- like the general trend towards fiscal orthodoxy or, more recently, the reform of pension systems -- have acquired a prominent role in its operational work. At the same time, concern with the causes and remedies of insufficient saving has resurfaced with the massive shifts in capital flows during the 1990s, and especially in the aftermath of the Mexico crisis. By improving our understanding of the determinants of private saving and bringing together the lessons from the international experience, the proposed research will help identify the saving consequences of alternative reform strategies, providing a firmer ground for the design of analytically-sound reform programs and the assessment of the sustainability of their overall macroeconomic framework.

CHART 1

SAVING ACROSS THE WORLD: PUZZLES AND POLICIES

A. DATA
World Data Base

B. SAVING ACROSS THE WORLD
• Saving and Policies
• Income Distribution
• Correlation & Causality
• Saving-Investment-Growth
• Household Saving

C. POLICY ISSUES
• Fiscal Policy
• Consumption Booms
• Tax Incentives
• Financial Liberalization
• Pension Reform

D. INTERNATIONAL EXPERIENCES
• Transition Economies
• Take-Off Experiences
• Sub-Saharan Africa
• China
• Colombia
• India
• Mexico
• Pakistan

E. PROJECT FINDINGS AND POLICY IMPLICATIONS

PART I: FACTS, THEORIES, AND RESEARCH ISSUES

This part places the proposed research in the context of the stylized facts concerning saving and the theories that attempt to explain them. It concludes with a detailed summary of the issues that will be addressed by the project.

1.   Saving: World Trends

The performance of saving in the world at large and in developing countries in particular has been characterized by a number of salient features during the last three decades. We look briefly at the evolution of world and regional saving rates and their correlation with selected economic variables. Unless specified otherwise, below we use regional unweighted averages of gross national saving rates, but the qualitative features described next also hold for alternative measures such as gross domestic saving rates and regional averages weighted by income levels. The data is from the World Bank BESD data base, based on U.N. and national sources for national-accounts information.

- *The world saving rate has been declining and the world real interest rate has increased since the 1970s*

The weighted average world saving rate rose slightly during the 1960s and early 1970s to a peak level of 25% in 1973 (see Figure 1). Subsequently world saving started declining continuously, to reach 19% in 1993-94. The average (ex-post) long-term real interest rate shows the opposite pattern: from a range of 2-3% in the 1960s it plunged briefly to negative levels after the 1973 oil shock, then quickly rose to high positive levels in the early 1980s and has remained close to 4% in recent years. According to the Group of Ten (1995), this reflects a trend increase in the real interest rate of around 100 basis points over the last 35 years.

The contemporaneous correlation between the average world saving rate (the average G-10 saving rate) and the long-term real interest rate is -0.61 (-0.56). The predominant interpretation of this empirical association is that the secular rise in the interest rate is due to lower world saving, which has outweighed a parallel reduction in desired world investment levels (Group of Ten 1995, IMF 1995).

- *Saving rates show divergent patterns across regions during the last three decades*

The trend decline in the world saving rate since 1974 conceals widely diverging regional saving patterns (Figure 2). OECD saving rates have been falling since the early 1970s, due mainly to lower public-sector saving (Group of Ten 1995, IMF 1995). Within developing

Figure 1

WORLD SAVING AND REAL INTEREST RATES
(Gross National Saving Rate Including Net Current Transfers, Ten-Year Government Bond Real Rates for G-10; Weighted Averages, 1965-1993)
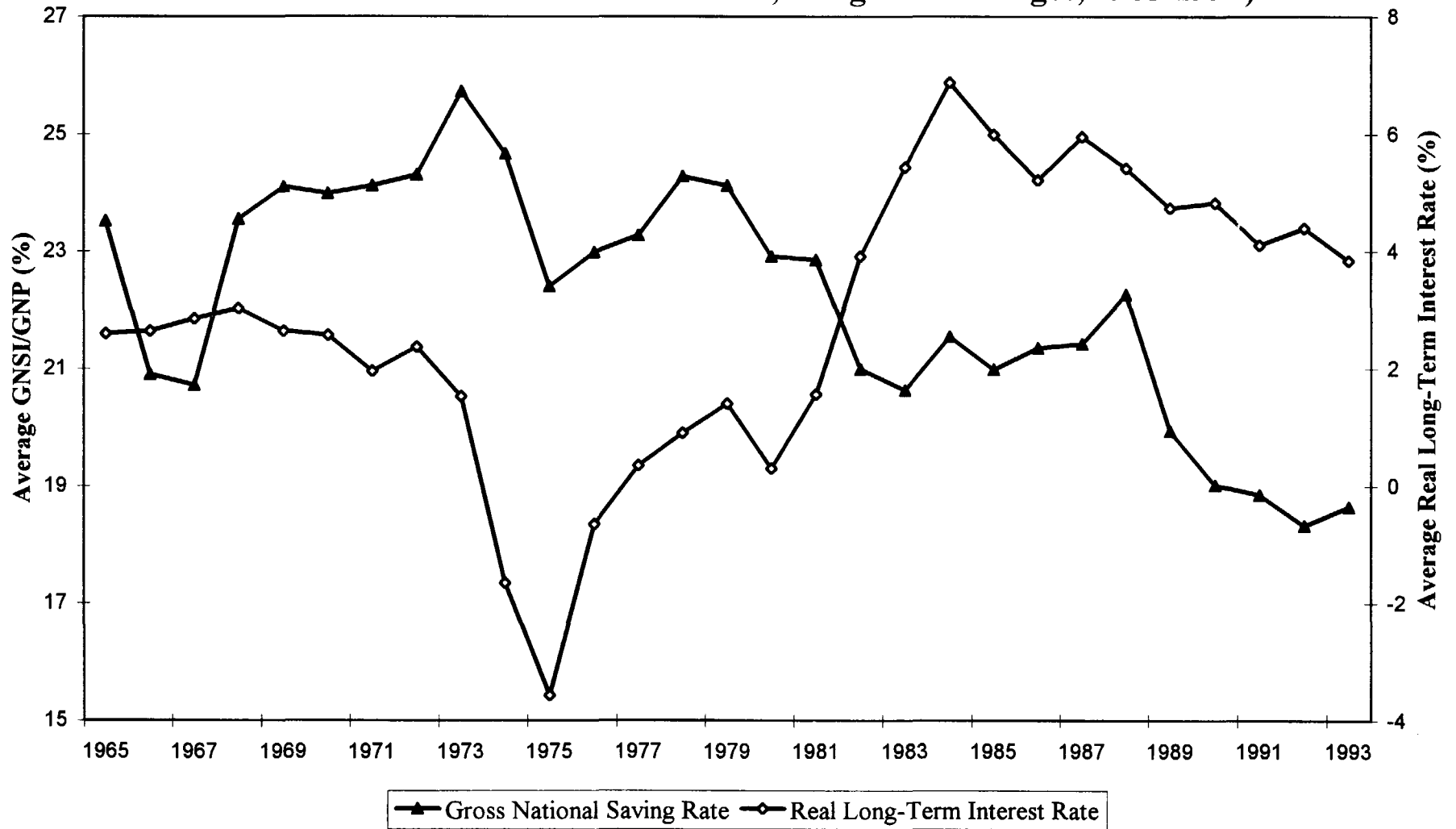
Figure 2

SAVING RATES BY WORLD REGIONS
(Gross National Saving Rate Including Net Current Transfers,
Unweighted Averages, 1965-1993)
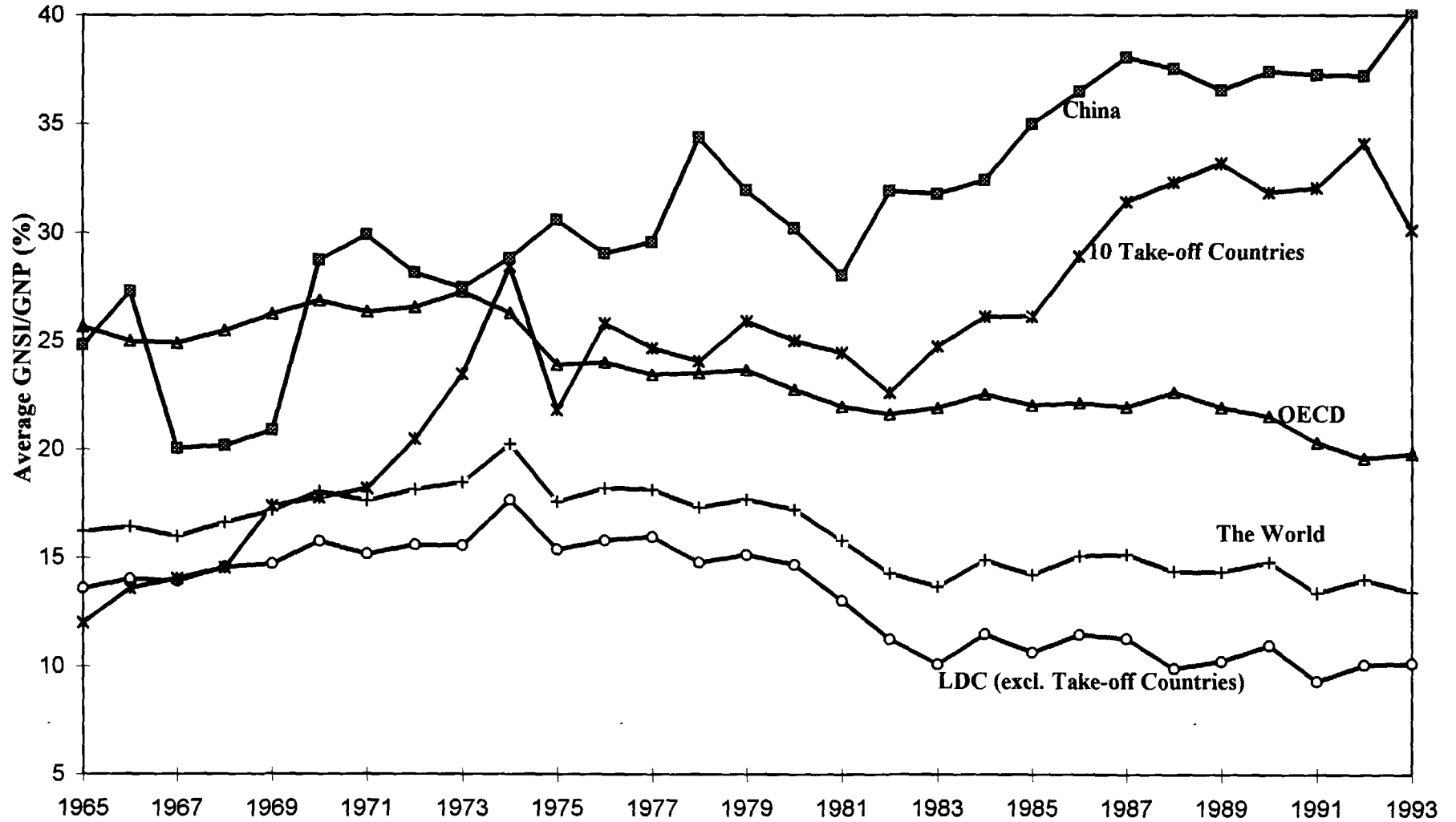
countries it is useful to distinguish between 11 take-off countries[1] (defined as those that have achieved high and sustained saving and growth rates during the last two decades) and all other developing countries, excluding former socialist economies (henceforth referred to as transition countries). The latter group shows a pattern of declining saving rates since the mid-1970s, similar to that observed in the OECD, but reaching a much lower average 10% since 1983. The take-off countries have been able to break through their historically low level of saving (and growth) since the 1970s. The ten market-economy take-off countries and territories have more than doubled their saving rates since the late 1960s, to reach an average 32% in the early 1990s. In turn, China started at rates close to 25% in the late 1960s, and has continuously raised its saving rate until becoming the world record-saver at 40% in the early 1990s.

Similar world and regional trends in national saving ratios to GNP are observed when regional averages are weighted by annual GNP levels (Figure 2a). The same is true when country populations are used as weights for regional averages -- with the obvious exception of the world saving rate which now, because of China's large share in world population, shows no downward trend from the 23% level reached in the late 1970s (Figure 2b). These results allow to return to unweighted averages in the following.

A large and increasing divergence of saving rates among developing country groups is also apparent when focusing on the World Bank's classification of developing regions (Figure 3). Saving ratios to GNP have risen from 18.3% during 1965-73 to 27.6% during 1984-93 in East Asia and the Pacific (denoted by EAP in Figure 3; all countries other than China), and from 25.3% to 36.8% in China. South Asia (SA) has been the only other developing region where saving rates have shown an increasing trend -- but from a very low 9.5% in 1965-73 to a still modest 15.3% in 1984-93. The Middle East and North Africa's (MENA) very high 29.0% saving rate during the period of high oil prices fell to 19.8% during 1984-93. In Latin American and the Caribbean (LAC), the modest saving rates of the 1960s and 1970s fell even further during the "lost decade" of the 1980s, to reach 13.6% in 1984-93. The most dramatic regional development is Sub-Saharan Africa's (SSA), where saving rates have been declining steadily from 10.5% in 1965-73 to reach an abysmally low level of 6.4% in 1984-93.

Saving rates also show a wide dispersion across countries and over time within any given developing-country region. In the case of LAC, for instance, while gross national saving rates shrunk in Mexico from 23% in 1980-87 to 19% in 1988-94 (thus contributing to Mexico's 1994-95 crisis), they grew in Chile from 13% in 1974-87 to 25% in 1988-94 (thus contributing to Chile's success).

Saving rates in transition economies have followed a declining trend since the onset of systemic transformation in the late 1980s (see Figure 4). In Russia saving rates have fallen to

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[1] This group includes China and ten market economies: Hong Kong, Indonesia, Korea, Malaysia, Singapore, Taiwan (China) and Thailand in East Asia; Botswana and Mauritius in Africa; and Chile in Latin America.

SAVING RATES BY WORLD REGIONS
(Gross National Saving Rate Including Net Current Transfers, Averages Weighted by GNP, 1965-1993)
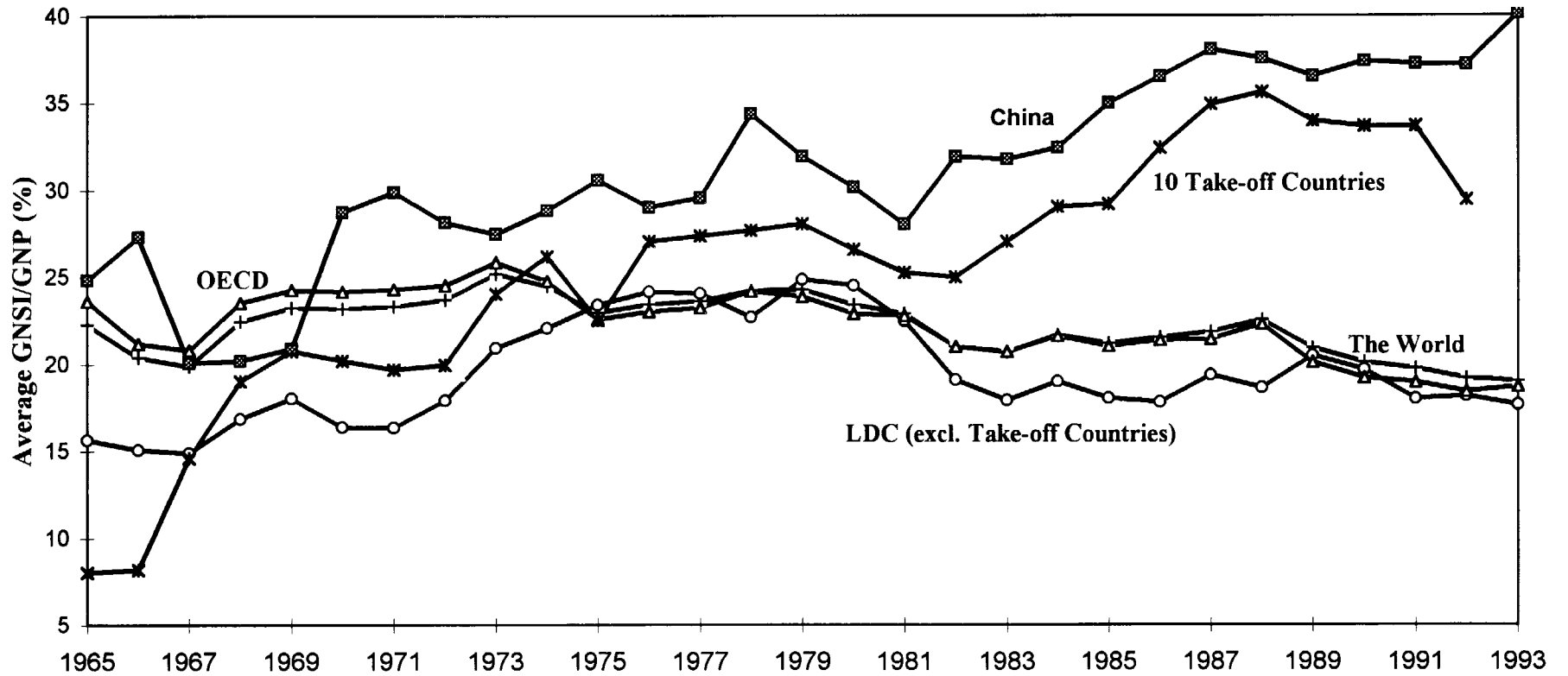
SAVING RATES BY WORLD REGIONS
(Gross National Saving Rate Including Net Current Transfers, Averages Weighted by Population, 1965-1993)
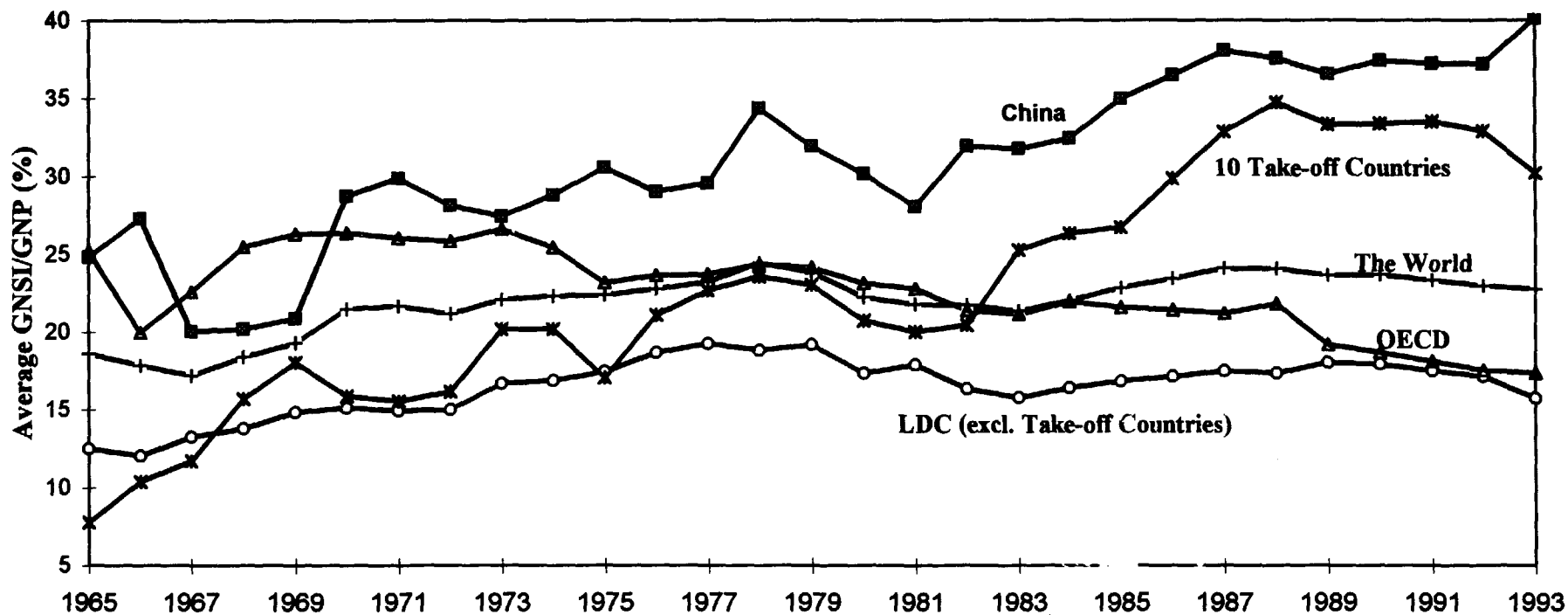
Figure 3

SAVING RATES BY DEVELOPING REGIONS
(Gross National Saving Rate Including Net Current
Transfers, Unweighted Averages, 1965-1993)
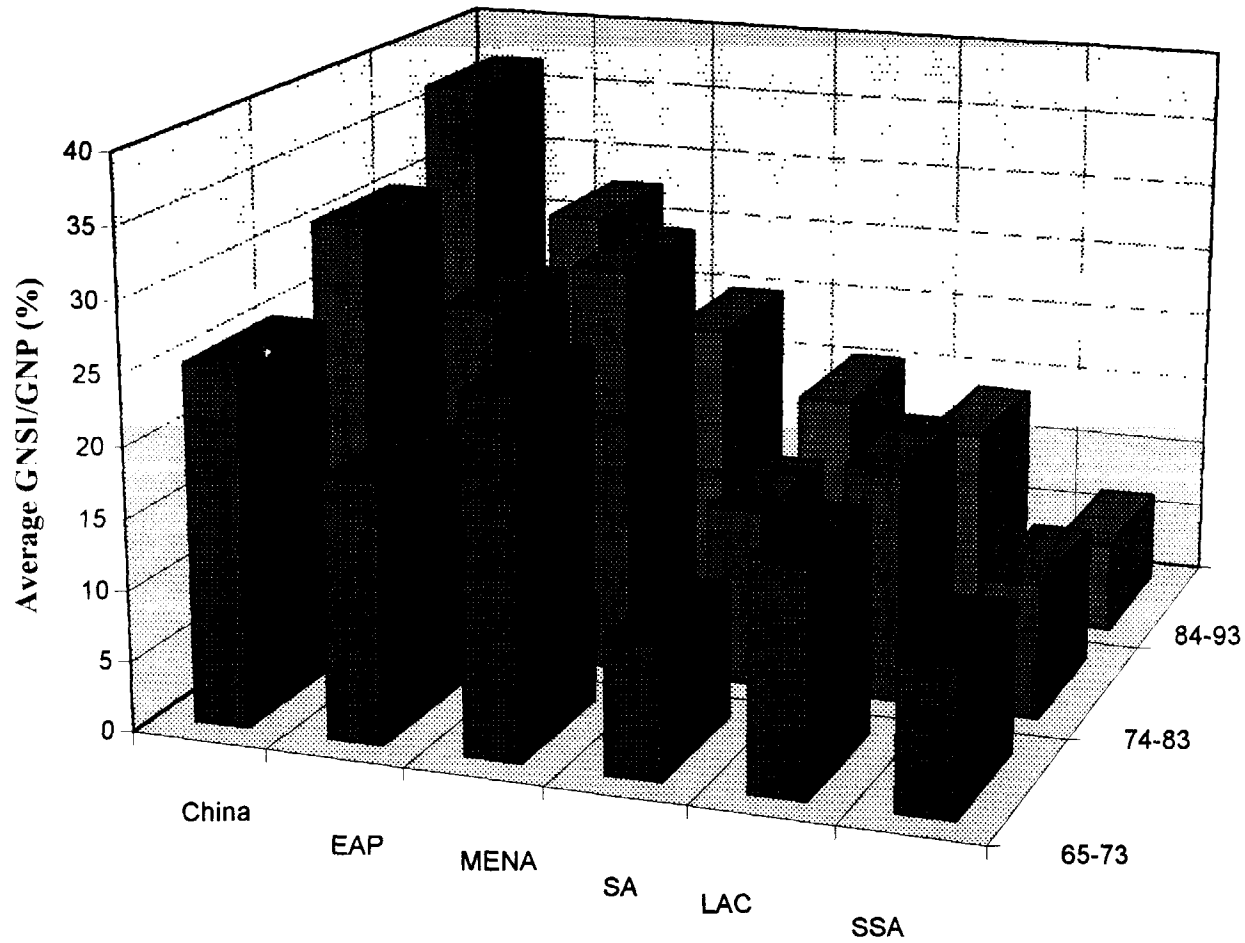
Figure 4

SAVING RATES IN TRANSITION ECONOMIES
(Gross Domestic Saving Rate, Unweighted Averages, 1989-1994)
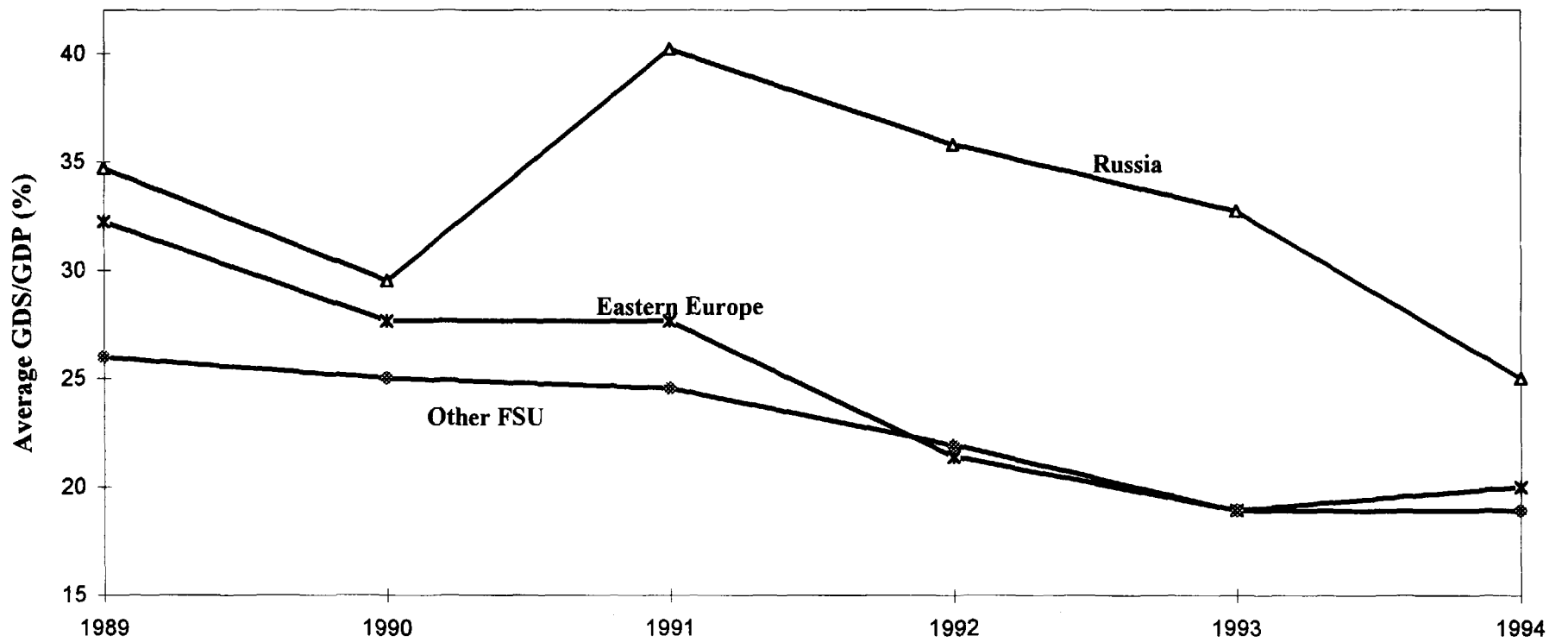
25%, while in Eastern European and other FSU countries average saving rates have declined to levels close to 20%.[2] The end of forced saving, declining income, higher expected future income, and stock-adjustment of consumer durables are among the possible explanations behind lower saving during systemic transition. However, the transition economies' 1993-94 saving rates are still remarkably high in comparison to the very depressed saving ratios often observed in developing market economies undergoing deep recessions.

• *Long-term saving rates and growth rates are positively correlated*

Low long-term saving and growth rates in many countries coexist with high saving and growth levels in a few others. The three country groups depicted in Figure 5 (take-off developing countries, other developing countries, OECD economies) reflect distinct patterns. The take-off countries exhibit relatively high saving and growth rates during 1965-1994, while OECD economies show comparable long-term saving rates but much lower growth rates. The remaining (non-take-off and non-transition) developing countries show a wide dispersion but their average saving and growth record is much worse than that of the two preceding country groups. Across market economies, long-term saving and growth rates are positively related. The correlation coefficient is 0.47 for the world at large, and somewhat higher in developing than in OECD countries (see Table 1).

• *Long-term saving rates and income levels are positively correlated*

Long-term saving and income levels are also positively related across countries. But this seems to happen only up to an average per-capita income level of $ 17,000 (in 1987 US$) -- beyond that point, long-term saving rates tend to fall (Figure 6). The overall correlation coefficient between saving rates and per capita income levels is 0.51 for the (non-transition) world at large, and again somewhat higher in developing than in OECD countries (Table 1).

• *Long-term saving and investment ratios are strongly positively correlated*

This empirical fact, acknowledged since the work by Feldstein and Horioka (1980), is a robust finding for long-term saving and investment rates, and is also present in our data. In Figure 7, OECD and take-off countries are clustered closely together, and typically located above the 45 degree line in the figure (along which average national saving and domestic investment

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[2] Seven Eastern European countries (Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia, and Slovenia) and nine other FSU countries (Belarus, Estonia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Turkmenistan, Ukraine, and Uzbekistan) are included in the unweighted regional averages depicted in Figure 4. Source: World Bank data.

Figure 5

LONG-TERM WORLD SAVING AND GROWTH RATES
(Gross National Saving Rates Including Net Current Transfers and Real Per Capita GNP Growth Rates, 1965-1994 Averages by Countries)

$y = 2.9528x + 11.028$
$R^2 = 0.321$

Average GNSI/GNP (%)

Average Growth Rate of Real Per Capia GNP
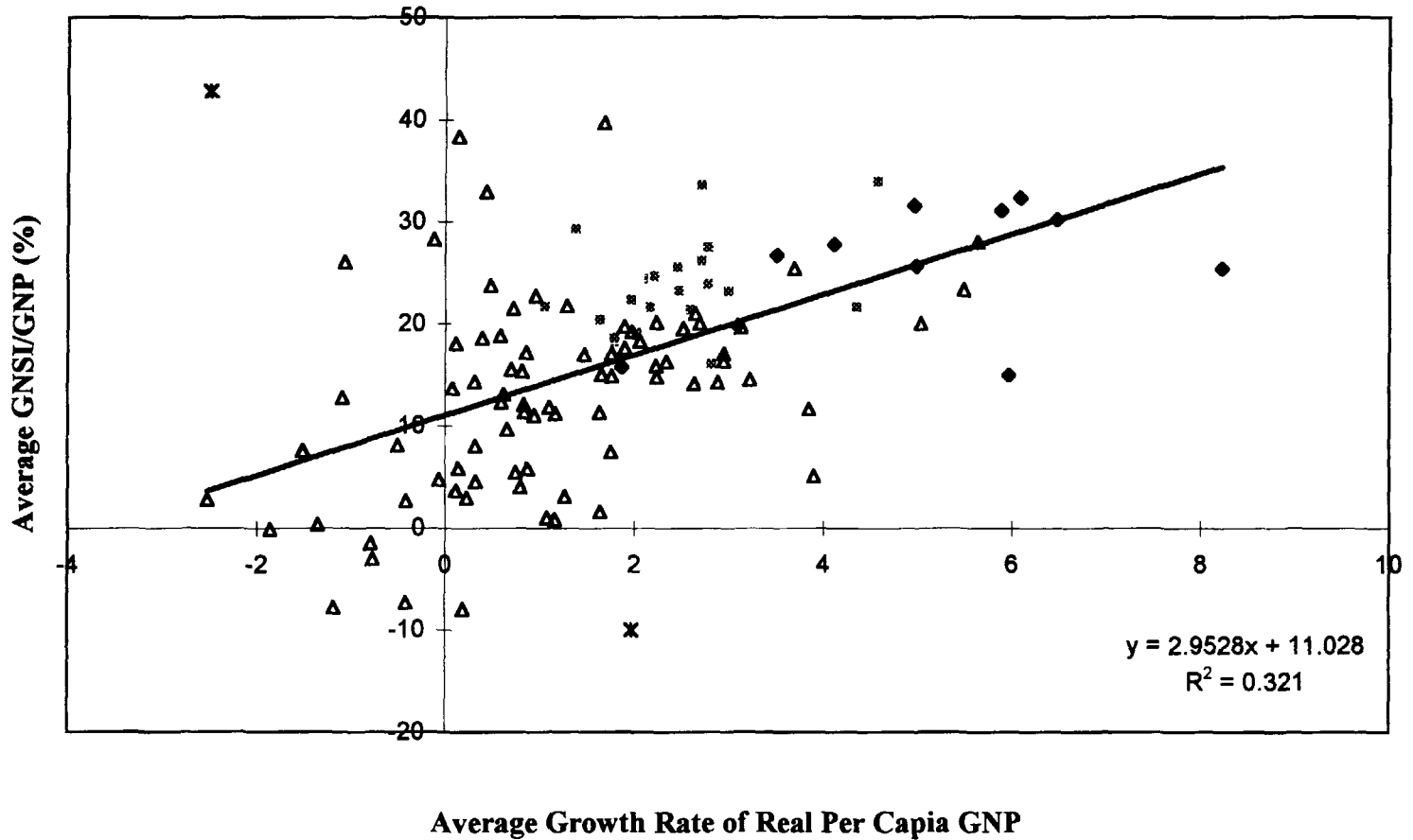
◆ Take-Off Countries ✻ OECD ▲ LDC (excl. Take-Off Countries and Outliers) ✖ LDC Outliers

Figure 6

LONG-TERM WORLD SAVING AND INCOME LEVELS
(Gross National Saving Rates Including Net Current Transfers and Real Per Capita GNP, 1965-94 Averages by Countries)

$y = -5E\text{-}08x^2 + 0.0018x + 11.706$

$R^2 = 0.2816$

Average Real Per Capita GNP (1987 Dollars)
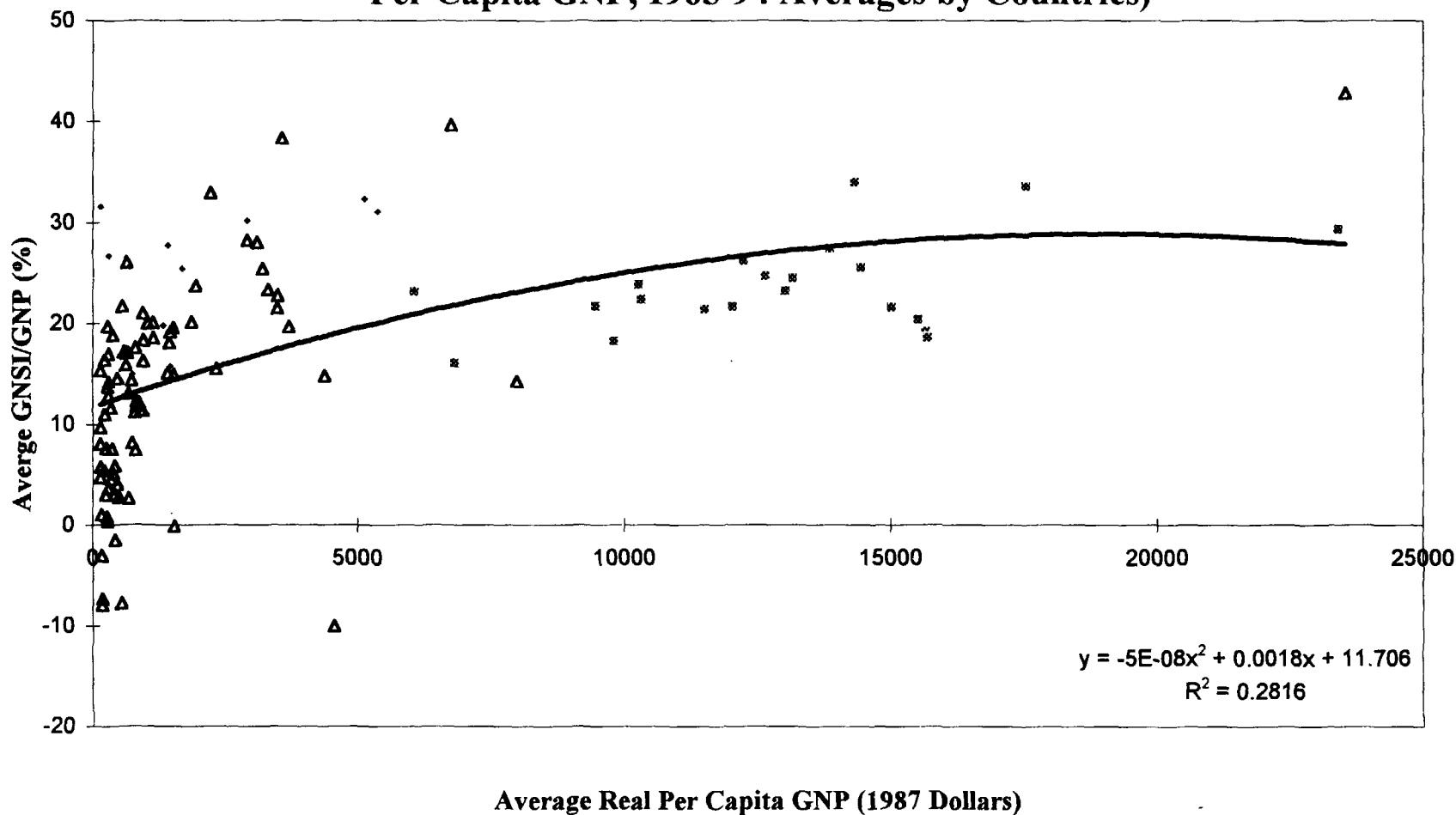
• Take-Off Countries ✳ OECD ▲ LDC (excl. Take-Off Countries)

Figure 7

LONG-TERM SAVING AND INVESTMENT RATES
(Gross National Saving Rates Including Net Current Transfers and Gross Domestic Investment Ratios, 1965-1994 Averages by Countries)

$y = 1.1092x - 8.4003$
$R^2 = 0.4049$

Average GNSI/GNP (%)

Average GDI/GNP (%)
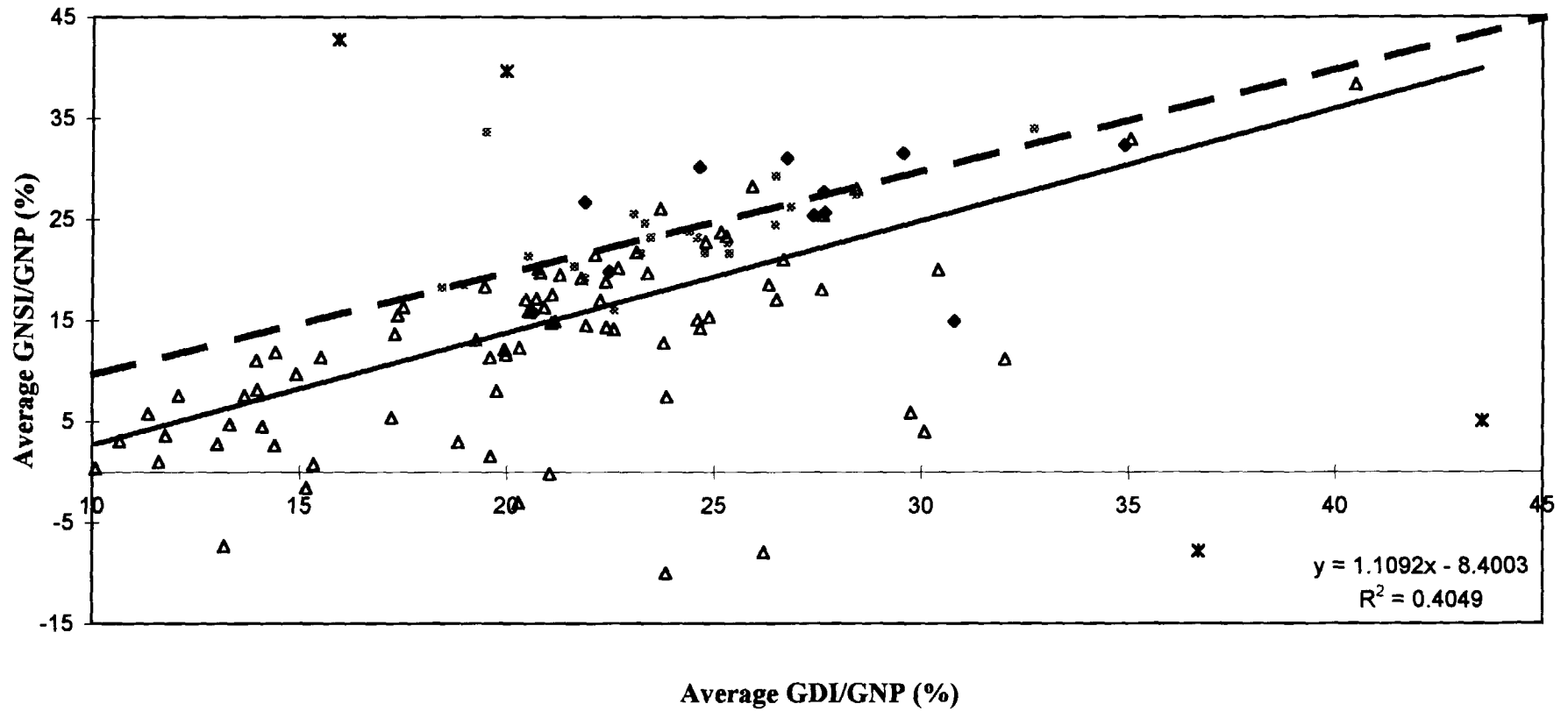
♦ Take-Off Countries ✳ OECD ▵ LDC (excl. Take-Off Countries and Outliers) ✕ LDC Outliers

Table 1			
CROSS-COUNTRY CORRELATION BETWEEN LONG-TERM SAVING RATES AND OTHER VARIABLES			
(1965-1994 Country Averages)			
	World	OECD Countries	Developing Countries
Correlation Coefficient between the Gross National Saving Rate and the following variables:			
Real GNP Growth Rate	0.47	0.33	0.45
Per Capita Real GNP Level	0.51	0.41	0.47
Gross Domestic Investment/GNP	0.42	0.55	0.40
Income Inequality (Gini Coeff.)	-0.34	-0.05	-0.20
Note: The standard errors of the correlations (except those involving the Gini coefficient) are 0.09 (0.14) for the world sample, 0.21 (0.22) for the OECD subsample, and 0.10 (0.18) for the developing country subsample.			
Source: Calculations using World Bank data and data from Deininger and Squire (1995).			

rates are equal), reflecting the fact that they typically export capital to LDCs -- most of the latter are located below the 45 degree line. The correlation coefficient between the long-term national saving ratio and the gross domestic investment ratio is 0.42 for the (non-transition) world at large -- in this case larger in OECD countries than in LDCs (Table 1).

• *There is no robust association between long-term saving rates and income inequality*

The pattern of correlation between long-term saving rates and income inequality is less clear-cut. The correlation between long-term saving rates and income concentration (measured by the Gini coefficient) is -0.34 at the world level, significantly different from zero. However, the association becomes weaker and statistically insignificant if industrial and developing countries

are considered separately (Figure 8 and Table 1).[3] Nevertheless, income inequality is on average higher in developing than in OECD economies, and income is typically less concentrated in the take-off countries.

2. Saving/Consumption Theories

To provide an analytical background for the proposed research, we now summarize briefly standard theories of consumption and saving and recent developments in this area, focusing on their consistency with the stylized facts and their ability to explain them.[4]

The point of departure for most modern research on consumption and saving is one of two dominant paradigms: the **permanent-income hypothesis**, focused on a representative infinitely-lived consumer (henceforth PIH) and the **life-cycle hypothesis** (LCH), derived from the aggregation of finitely-lived overlapping generations. We start by reviewing briefly the main accomplishments and shortcomings of these two polar theories and related sub-theories, and turn subsequently to other models that have taken recent research in new directions.

PIH abstracts from consumer heterogeneity by focusing on consumption of an infinitely-lived consumer or, equivalently, an infinite sequence of finitely-lived generations linked through inter-generational transfers (including bequests). Consumption is equal to permanent income -- the annuity value of the sum of non-human assets and human capital (the discounted value of labor income), net of the discounted value of taxes (see Friedman 1957, Hall 1978, and Flavin 1981 for the most popular formulations of PIH). As a variant of PIH, the **Ricardian-equivalence hypothesis** (REH), by making use of both the consumer's and the government's budget constraint, derives permanent income as net of the discounted value of government spending (Barro 1974).

While under the simple **Keynesian hypothesis** (KH) consumption is determined by current income, the forward-looking PIH consumer distinguishes between temporary and permanent income. PIH consumption is smoother than income: current temporary income gains are mostly saved while permanent income gains are consumed. In other words, if desired consumption is flat over the entire future horizon, current saving is equal to the discounted value of anticipated future reductions in income -- that is, saving is determined by future "rainy days" (Campbell 1987).

[3] Similar results apply to the correlation between long-term saving rates and the other measures of income distribution, such as the ratio between the income shares of the bottom 40 and the top 20 percent of the population.

[4] This section draws on recent surveys of consumption theory and evidence, in particular Deaton (1992, 1995), Honohan (1995), and Obstfeld (1995), and on surveys of the saving literature for developing countries, including Mikesell and Zinser (1973), Snyder (1974), Gersovitz (1988), Deaton (1990), Schmidt-Hebbel, Webb and Corsetti (1992), Srinivasan (1993), and Schmidt-Hebbel, Servén and Solimano (1996).

Figure 8

LONG-TERM WORLD SAVING RATES AND INCOME DISTRIBUTION
(Gross National Saving Rates Including Net Current Transfers and Gini Coefficient, 1965-94 Averages by Countries)

Average Gini Coefficient

◆ Take-Off Countries ✱ OECD ▲ LDC (excl. Take-Off Countries)
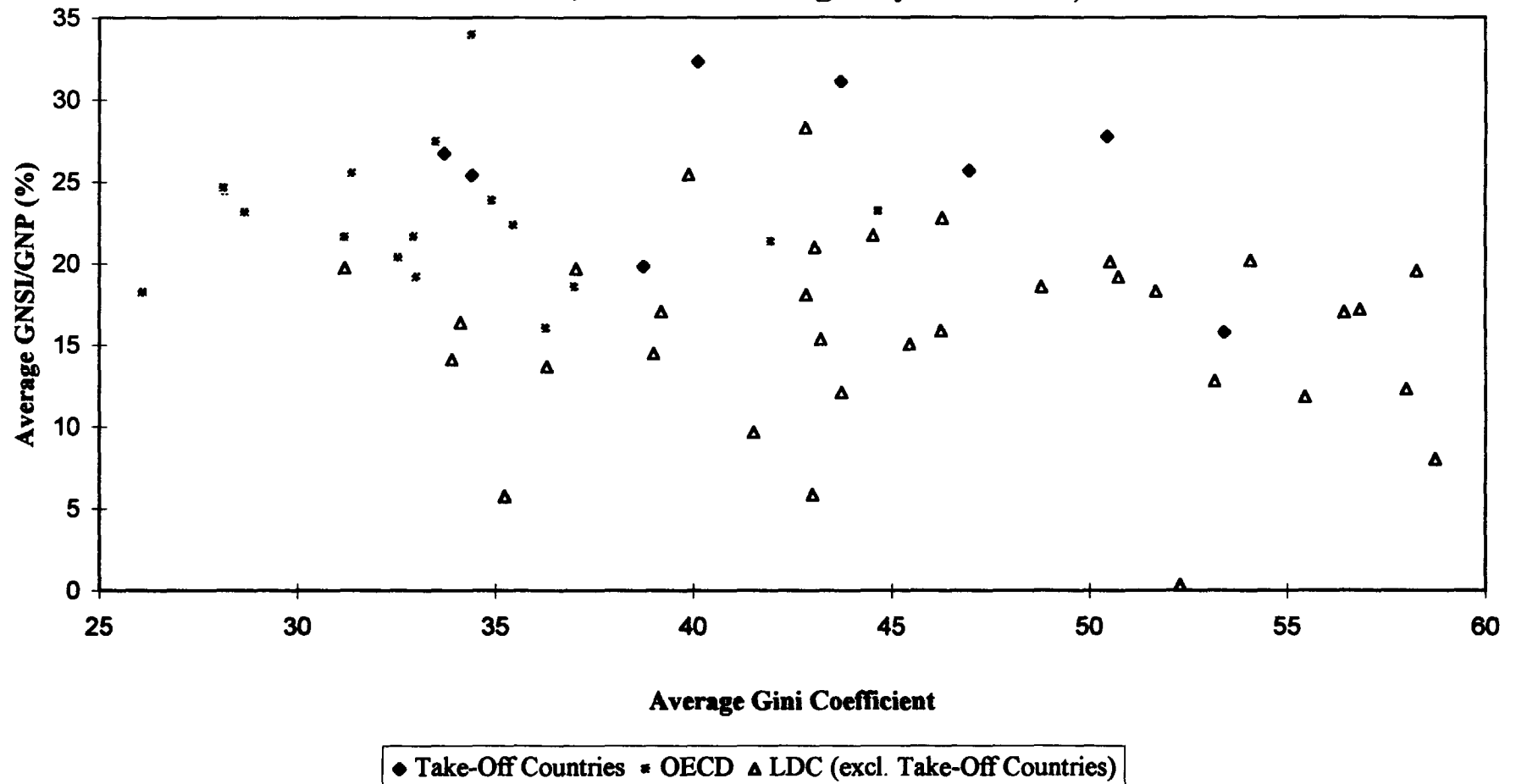
The rate of consumption growth -- or the intertemporal consumption profile -- reflects both consumer preferences for intertemporal consumption smoothing and the difference between the market interest rate and the consumer's subjective discount rate. A higher interest rate -- a larger reward for postponing current consumption -- tilts the consumption profile toward the future. But the effect of a higher interest rate on the level of current consumption (and hence on the level of current saving) is ambiguous, depending on the relative size of offsetting substitution, income, and human-wealth effects caused by an interest rate hike.

An important implication of PIH is that the change in consumption should be unpredictable, i.e., uncorrelated with any information known to consumers when the change takes place. Since the innovative papers by Hall (1978) and Flavin (1981), a large body of empirical work has shown that consumption exhibits "excess sensitivity", i.e., its change is correlated with predictable changes in other variables, typically contemporaneous or lagged income changes. This rejection of the standard PIH model was found initially in U.S. data, but has been extended to other OECD and developing economies. What are the reasons for excess sensitivity of consumption? The presence of either durable goods (Caballero 1990) or consumption habits (see below) makes consumption changes at least partly predictable. The same is true for borrowing constraints, that limit the ability of consumers to borrow against future income, as discussed below.

The PIH predicts that income growth -- i.e., the anticipated increase of future income relative to current income levels -- reduces current saving, as consumers raise current consumption in anticipation of higher future income. This prediction contradicts the positive saving-growth correlation documented in the previous section. Moreover, the assumption of homogeneous consumers portrayed by a representative agent who is closely linked to all future generations is a feature that makes PIH an implausible candidate to deal with real-world features that reflect consumer diversity along various dimensions, including age, income levels, and access to borrowing.

The LCH fathered by Modigliani and Brumberg (1954, 1979) -- the main competitor of PIH-REH theories -- introduces age-related consumer (or household) heterogeneity. Aggregate saving results from the addition of saving by different age-specific cohorts. Each cohort smooths consumption over a finite horizon, given lifetime resources that -- in the simple version of the LCH -- are not transferred across generations. Over the life cycle, saving and consumption follow hump-shaped patterns, with dissaving until early adult age, the peak of saving at mid-life, and dissaving during retirement as households run down their retirement assets. Saving is driven only by retirement needs. Hence saving propensities depend on age and differ systematically across cohorts.

A change in interest rates entails transfers among cohorts. Hence the net impact of a higher interest rate on aggregate consumption and saving -- already ambiguous at the level of each individual household -- is also ambiguous at the aggregate level, depending on the behavior and size of each cohort. Similarly ambiguous is the effect of growth on saving in the LCH

framework. Only in the particular case when growth takes place across generations (i.e., the younger cohorts' income levels are increased by more than those of the older generations) is aggregate saving likely to rise with income growth, because the mid-life saving of the active generations induced by growth is larger than the dissaving of the very young and the old retired cohorts.

However, LCH is not problem-free either when it comes to interpreting real-world saving behavior. First, there is not enough hump saving to account for the high level of aggregate wealth in modern economies (see Kotlikoff and Summers 1981). Second, household survey evidence for OECD countries suggests that changes in growth do not cause the cohort-specific differences in saving levels (see e.g. Bosworth, Burtless, and Sabelhaus 1991 for the U.S.) or in intertemporal consumption patterns (see Carroll and Summers 1991 and Deaton 1991b) predicted by the LCH. Third, a growing body of microeconomic evidence for OECD countries shows that old people save or at least do not dissave as much as predicted by the LCH (Deaton and Paxson 1994, and Poterba 1995), a finding which suggests that inter-generational bequests may be an important saving motive.

Bequests tend to undermine the distinction between the PIH and LCH, as the latter theory is based on the absence of close intergenerational links among households. One popular way to discriminate empirically between these two competing theories -- and hence to infer indirectly about the importance of bequests -- is to include population dependency measures (the ratios of the old and the young to the overall population) among other saving determinants in empirical saving equations. While many studies show that the proportion of old-age people reduces saving -- a finding that supports the LCH -- the evidence is controversial (see Gersovitz 1988 for a critical review) and may not be inconsistent with the micro evidence in support of bequests (Weil 1994).

More direct empirical evidence favoring the importance of the bequest motive is provided by both the older PIH literature and more recent household survey and aggregate cross-country studies. The older PIH literature concludes that bequests are a luxury good, reflected in elasticities of consumption to permanent income that are well below one. Menchik and David (1983) use U.S. household data to test directly whether the elasticity of bequests to lifetime resources is larger or smaller for the rich than for the other income groups and find that the marginal propensity to bequeath is unambiguously higher for the wealthy. Other household survey studies similarly find that saving rates are higher for lifetime richer consumers (e.g., Paxson 1992 for Thailand, and Deaton and Paxson 1994 for Taiwan). At the aggregate level, saving rates increase with the level of income (not its rate of growth) in cross-section or panel studies of developing countries (see Collins 1991 and Schmidt-Hebbel, Webb and Corsetti 1992), while growth (not income levels) contributes to raise saving in OECD countries (Modigliani 1992). These findings are consistent with the stylized fact on the positive correlation between saving ratios and income levels discussed in the previous section. The apparent implication is that bequests are a luxury good at low and middle levels of income but a normal good at high levels of income.

Uncertainty about the future leads to **precautionary saving** by risk-averse consumers: people set aside a certain amount of resources to face possible future changes in income levels, taxes, interest rates, or any other consumption determinant (Skinner 1988, Zeldes 1989). Higher uncertainty about the future reduces current consumption and hence raises saving. If very high consumer risk aversion is paired with high income uncertainty, consumption will follow closely income, so that aggregate consumption appears as if it were consistent with the simple KH. The general implication of uncertainty is that it raises saving beyond the level predicted by the standard PIH or LCH models without uncertainty. Uncertainty can explain in part why consumption follows income so closely (contradicting the simple PIH) in the case of young households that expect positive but uncertain future income growth: their risk aversion is at war with their impatience (Carroll 1991). Uncertainty can also explain in part why the retired save a positive amount or dissave little, as they face large uncertainty about their life length and health costs. It is also one of the reasons why the REH might fail, as a substitution of lower current taxes for higher future taxes reduces uncertainty of future income and hence lowers precautionary saving (Barsky, Mankiw and Zeldes 1986 and Kimball and Mankiw 1989).

One popular way to introduce risk aversion is by considering consumer preferences consistent with a marginal utility of consumption that declines with the level of consumption. For instance, under consumer preferences that satisfy constant relative risk aversion, the intertemporal elasticity of consumption substitution is equal to the inverse of the risk-aversion coefficient; both reflect the curvature of consumer preferences. This feature makes this model analytically tractable but conceptually and empirically somewhat limited. At the cost of additional complication, Epstein and Zin (1989) and Weil (1989, 1990) have proposed different ways to separate risk aversion from intertemporal substitution. A second noteworthy extension is Kimball's (1990) distinction between risk aversion (the concavity of the utility function) and prudence (the convexity of the marginal utility function). While both generalizations open promising avenues, little empirical research has been done to support their relevance.

Empirical tests of the representative-agent PIH model under uncertainty have focused mostly on the Euler equation (the first-order optimality condition for intertemporal allocation of consumption) relating the anticipated growth rate of consumption to the expected difference between interest and subjective discount rates, the covariance between consumption and interest rate, and the consumer's risk-aversion coefficient. Most tests for the U.S. economy, starting with Hansen and Singleton (1982), reject this version of PIH with uncertainty for reasonable values of risk-aversion coefficients; similar rejections are found for other OECD and developing countries. A variant of the Euler equation relates the expected consumption growth to the difference in expected yields of different assets, covariances between yield differences and consumption growth, and risk aversion. Large differences in yields (say, between stocks and treasury bills) are shown to be inconsistent with the rather smooth behavior of consumption -- another rejection of PIH under uncertainty termed the equity premium puzzle (Mehra and Prescott 1985, Hansen and Jagannathan 1991). These results, closely related to the excess-sensitivity of consumption discussed above, point toward the need of extending the PIH and LCH models to consider real-world features such as borrowing constraints and consumption habits.

Direct empirical tests of the precautionary saving motive have been hampered by the difficulty of obtaining estimable closed-form solutions to theoretically-plausible models of precautionary saving. As a consequence, its actual importance remains controversial. Nevertheless, some recent empirical estimates suggest that it may account for a substantial fraction of households' wealth (Carroll and Samwick, 1995b).

Borrowing constraints, that prevent consumers from borrowing for current consumption at going interest rates in financial markets, have been traditionally held against the predictions of the standard PIH or LCH. Borrowing constraints are a result of real-world financial market features, such as the fact that interest rates on loans cannot be expected to rise to clear financial markets because they raise default risks (Stiglitz and Weiss 1981), or the impossibility of using human capital (i.e. future labor income) as collateral (see Hayashi 1987).

One popular way to model the effect of borrowing constraints on consumption (introduced by Hall and Mishkin 1982) is by simply assuming that an exogenous fraction of consumers spend their entire income. But this hardly qualifies for a theory of borrowing constraints and does not apply symmetrically to an inability to save. In fact, when precautionary saving and borrowing constraints are taken together, it has been shown that risk-averse and forward-looking consumers *raise* their saving when they anticipate tighter constraints (Schechtman 1976, Bewley 1977, Schechtman and Escudero 1977, and Deaton 1991b, 1992). Consumers accumulate assets during good times in order to buffer consumption in bad times, when they will be unable to borrow from financial markets. These **buffer-stock** savings are not a form of long-term or retirement assets but are increased and run down over short periods. While income and consumption are separated by buffer saving at high-frequency observations (say, a few years), they still match closely each other at longer horizons.

The buffer-stock saving model offers insights into the behavior of many lower-income and rural households that use cash and durables to smoothen their consumption levels over the short run but accumulate little over the long term. Hence the approach is relevant for poor and rural households and countries (see Deaton 1991a, 1992) but appears to explain little of aggregate saving and asset-to-income ratios in middle and higher-income economies. In fact, simulations of buffer-stock models suggest that the buffer asset to output ratio is well below 1, possibly as low as 10% (Deaton 1995).

Saving for house purchases is analogous to saving for retirement, only that the former takes place at an earlier point in life. In the framework of the standard LCH model, **housing saving** can be considered as part of overall retirement saving, with asset build-up during active life and asset run-down during retirement. However, both preferences and financial-market features seem to be at odds with this simple prediction. There is very limited evidence that the elderly run down their housing assets during retirement through reverse-annuity mortgages or other schemes. Second, restrictions on mortgage availability (such as high down payments for mortgage loans) raise required levels of pre-purchase saving. Japelli and Pagano (1994) provide empirical evidence for OECD countries showing that down payment ratios raise aggregate saving rates. This

is exactly the opposite of the "financial repression" view (McKinnon 1973, 1991 and Shaw 1973), that predicted that financial liberalization would raise saving.

All models reviewed to this point share the assumption that intertemporal consumption decisions reflect preferences that are intertemporally separable, i.e., that the marginal rate of substitution of consumption between any two periods is independent of what happens in any other period. This assumption is lifted by **consumption habit** models, that allow for intertemporal dependencies by specifying consumer utility in any given period as a function of both consumption in that period and a "stock" of consumption habits. One form of habit is external habit formation (Abel 1990, Campbell and Cochrane 1994), where utility depends positively on the difference between each individual's consumption level and (possibly lagged) average per-capita consumption levels -- a preference structure in the spirit of Duesenberry's (1949) relative-income theory of "keeping up with the Joneses". An alternative specification is internal-habit formation (see Ferson and Constantinides 1991 for the U.S.), where utility depends on the difference between each individual's consumption level and her own lagged consumption level(s). In both cases, habits act as a drag on consumption levels.

Habit models seem to be consistent with various facts that are hard to explain in their absence. As opposed to the PIH and LCH models, habits imply that future consumption changes are partly predictable, because they reflect in part past consumption changes. This is consistent with the excess-sensitivity findings discussed above. Also, habits make consumption costlier for the young, because habits have to be fed for life, hence they tip consumption profiles away from the young and toward the old. Another implication of habits is that even anticipated increases in income growth can have a positive effect on saving -- which lasts as long as the drag of past consumption on current consumption holds; thereafter saving rates should fall to the levels predicted by models without habits. Nevertheless, habits are mentioned as one possible source of growth-to-saving causality that can contribute to explain the saving-growth correlation (Carroll and Weil 1994, Deaton and Paxson 1994).

An alternative preference hypothesis is that both consumption and wealth (or capital) are valued by consumers -- an idea advanced in different ways by "classical" economists from Smith and Marx to Keynes and Schumpeter, and that is resurfacing in recent literature (Cole, Mailath and Postlewaite 1992, Fershtman and Weiss 1993, Zou 1993). In this "capitalist spirit" model wealth is accumulated for its own sake, and higher wealth prompts further accumulation -- because consumption and wealth are gross substitutes in the agent's utility function.

A final question of interest is the impact of **poverty and income inequality** on aggregate saving. One way to model the consequences of poverty is through the use of consumer preferences embodying a *subsistence level* of consumption. Along the lines of the Stone-Geary specification, utility is a positive function of the difference between current consumption and an exogenously-given subsistence consumption level, below which no saving takes place (see Christiano 1989, Rebelo 1992). This notion has an old tradition in economics, exemplified in the "autonomous consumption" coefficient of conventional KH models. The key implication is that saving ratios rise

with income (or wealth) levels, in accordance with the positive correlation observed in the data. A variant of this model specifies the intertemporal elasticity of consumption substitution as an increasing function of wealth (Atkeson and Ogaki 1993) or of the distance between permanent income and subsistence consumption (Ogaki, Ostry and Reinhart 1995), so that the responsiveness of consumption substitution to the interest rate grows with the level of income. These latter studies present household and aggregate evidence, for both OECD and developing countries, in support of this view.

In turn, income inequality is another potentially important form of consumer heterogeneity ignored by representative-agent models. It played a prominent role in Post-Keynesian models of saving and growth (Lewis 1954, Kaldor 1957, and Pasinetti 1962), which focused on the *functional* distribution of income. These models stressed the notion that capitalists have lower propensities to consume than workers, so that income redistribution from wages to profits raises aggregate saving. This approach, however, does not say much about the links between saving and income inequality, because the association between the functional and personal distributions of income is empirically rather weak (Atkinson 1994). This explains the more recent resurgence of interest in the links between saving and the *personal* distribution of income. Empirical studies focusing on this issue typically use reduced-form (a-theoretical) consumption or saving specifications. For the most part, however, they find either no effects or, at best, a weak positive impact of inequality on aggregate saving (see Schmidt-Hebbel and Servén 1995b).

3.   Research Issues

Public policies have potentially significant effects on private and overall saving. Recent research on saving in OECD and developing countries has thrown light on some issues but many areas of disagreement remain. In some cases, the disagreement is rooted in the existence of competing theories; for instance, the Ricardian equivalence and life-cycle hypotheses offer strikingly different predictions about the effectiveness of fiscal policy. In other cases there is a lack of a well-established conceptual body to analyze the overall saving implications of certain structural reforms, such as financial liberalization and pension system reform. Finally, still in other cases a well-understood analytical framework does not prevent strong disagreements on the size of real-world effects; for instance, in the discussion of the saving effects of specific tax incentives in the U.S.

The general objective of all these policy interventions should be to counteract distortions that result in socially inefficient levels of saving. While there is a presumption that in many LDCs saving falls short of its welfare-maximizing level, this is by no means a necessary result, and any assessment of the positive effectiveness of saving-enhancing policies should keep in mind their welfare implications. Indeed, saving can surely exceed levels consistent with economic and social optimality. Recent economic history provides many examples of countries that saved and invested in excess, up to a point where rates of return on investment where close to zero or even negative. This was the case of many socialist countries where forced saving was the result of central plans

aimed at output targets and not consumer preferences -- the FSU during the Brezhnev era provides an extreme example. Excessive saving could also result in decentralized market economies, from binding regulations imposing forced saving or government policies encouraging over-saving. A mandatory fully-funded pension system is an example of a policy instrument that under the wrong conditions can lead to excessive saving, but under the right ones can raise it to optimal levels. It may contribute to higher saving by forcing certain population groups to save in excess of what they would voluntarily save, at the cost of reducing their welfare. But it may be an efficient second-best tool if, for instance, it mitigates existing distortions against saving, such as the expectation of government hand-outs to the old-age poor.

Nevertheless, the very low saving ratios of many LDCs, particularly among poorer countries, strongly suggest that the prevailing situation is one of socially insufficient saving. This may result from distorting policies, such as too low a level of government saving -- which in a world not characterized by Ricardian equivalence would lead to reduced national saving -- and/or from distortions due to other factors -- e.g., asymmetric information leading to imperfect policy credibility, under which reforms such as trade opening can distort consumers' intertemporal decisions leading to a saving collapse. In either case, saving-enhancing policies would be called for to offset the distortions.

Next we identify a limited number of policy-relevant research issues that are at the core of the saving experience and the policy discussion in developing, transition, and OECD economies. We state 12 policy questions that form the core of this research proposal -- but postpone a detailed discussion of each of them and how they will be tackled to Part II of the paper. Some of these questions -- like the first one on the list below -- are broad and cut across several of the proposed research components, while others are narrower and will be addressed by one specific component.

(1)   Does saving drive growth or does growth spur higher saving ?

While the world-wide experience shows a strong and positive correlation between saving rates and growth rates, what drives what is hotly debated. As already mentioned, this is not an abstract academic question, but rather has an enormous policy importance because its answer will determine the policy priorities for achieving high growth. If it is concluded that saving drives growth (through physical capital investment) or if causality runs in both directions, policies that encourage saving are called for. If instead investment drives growth and the latter determines saving, growth-oriented policies should primarily aim at raising investment. Finally, if the main causality runs from growth to saving and investment -- because human capital, technology and ideas, not physical investment, are the main growth determinants -- growth-promoting policies should focus on those three factors. Hence a closer look at the saving-investment-growth link and the pattern of causality in developing and OECD countries is warranted.

(2)   How does foreign saving -- and foreign aid in particular -- affect domestic saving ?

Foreign resource inflows involve both an external financing source and, in the case of grants and concessional loans, a unilateral transfer. In theory, their effects on investment and consumption (saving) depend on several factors: the relative importance of the grant element vis-a-vis the financing element, the recipient economy's access to world financial markets, the degree to which the inflows are permanent in time, and the extent to which they are fungible. For the most part, empirical studies analyzing whether foreign inflows crowd domestic saving in or out ignore these distinctions, and therefore the question remains largely unsettled.

(3)   Who does the saving -- and does it matter who saves?

While most consumption theory is developed for the individual consumer or household, a large share of aggregate saving is done by governments and firms. This opens up two issues. First, how large is saving by these three groups in developing countries? While for OECD countries there is reasonable data showing the sectoral breakdown of aggregate saving, there exists little data for developing countries -- and the little that exists is fairly unknown and unexploited. Putting together this data in a consistent way is an important first step. Second, does it matter who does the saving? It would not matter if households both "pierce the corporate veil" and behave according to the Ricardian equivalence hypotheses; in either case households would simply undo with their saving any change in saving undertaken by corporations and governments, respectively. That this offsetting by households is far from complete has been supported by much empirical research. With regard to the corporate-household saving dimension, this raises the question of how different corporate saving behavior (driven mostly by corporate investment) is from household saving. With regard to the public sector-private sector saving dimension, this leads to the next policy question.

(4)   How effective is public saving in raising national saving?

Fiscal adjustment is typically the centerpiece of stabilization programs. While there is a general trend in developing countries towards greater fiscal orthodoxy, its likely impact on national saving remains controversial. Not only the theories are split about the overall saving effects of raising public-sector saving; the existing empirical evidence is much too inconclusive to offer good policy advice. But a more accurate answer to this question is essential to assess the effectiveness of fiscal policy in raising aggregate saving, contributing to the economy's external equilibrium, and reducing its vulnerability to shocks such as abrupt changes in capital flows. Likewise, the effectiveness of alternative fiscal instruments (transfers, taxes, government consumption) -- is still poorly understood.

(5)   Do tax incentives raise private saving?

The previous question refers to the issue of how overall taxation affects saving. But how effective are specific tax incentives in raising saving, and how do they compare to each other? This question is relevant at a time when tax reforms in many industrial, developing and transition countries are changing the composition of taxation. Three main policy questions arise on saving and the structure of taxation. First, does a shift from corporate profit taxes to household income taxes affect overall private saving? Second, does a shift toward consumption taxation raise private saving? Finally, do specific saving incentives -- such as tax exemptions on retirement savings accounts -- encourage national saving, or do they simply induce a change in the composition of the private sector's savings portfolio?

(6)   What drives temporary consumption booms -- those that prove ex-post to be unsustainable -- in the wake of domestic liberalization, capital inflows, or terms-of-trade gains?

Recurrent episodes of high private consumption growth that prove unsustainable and lead to busts and painful corrections have been common throughout the world. Unsustainable over-spending associated to ample access to foreign borrowing was observed in the late 1970s and early 1980s in many developing countries and recurred in Mexico recently again. Commodity-led consumption booms were observed in Nigeria, Venezuela, Cote d'Ivoire and many other countries during the 1970s and 1980s. Spain and the U.K. showed large declines in private saving rates in the aftermath of financial liberalization during the 1980s. There has been ample speculation about the possible causes of these booms -- ranging from policy mistakes to lack of policy credibility, and from financial-sector problems to consumer myopia. However, a general understanding of the roots of private consumption booms is still lacking. In particular, a clear identification of the role played by policy mistakes and distortions in consumption booms under conditions of structural change and foreign resource inflows would help design macroeconomic policies able to reduce the frequency of recurrent cycles of boom and bust.

(7)   Does domestic financial liberalization raise or reduce private saving?

Since the 1970s and especially the 1980s, many industrial and developing countries have reformed their financial systems, allowing market forces more scope in determining interest rates, the allocation of credit, and the structure of private-sector asset portfolios. While financial liberalization has surely brought about microeconomic benefits, it has also been often associated to reductions in private saving rates. This decline in saving contrasts with earlier predictions of a positive saving flow response to deregulated (typically higher) interest rates and financial deepening. In particular, deregulation of consumer and housing mortgage lending has often led -- for instance in the U.K. during the 1980s and Mexico since the late 1980s -- to a significant expansion in these types of loans. In regard to interest liberalization, the world-wide empirical

evidence tends to show that saving is not very responsive to higher interest rates. But other questions are still waiting for answers. For instance, which are the features of domestic financial liberalization responsible for the frequently negative saving response -- and is this saving decline only temporary? Are market imperfections or policy mistakes to blame for the decline in private saving?

(8)   Is pension system reform conducive to higher saving?

Analysts and governments are becoming increasingly aware of the efficiency, distributive and fiscal-macroeconomic pitfalls of conventional pension systems based on pay-as-you-go transfers and state management. Since Chile's radical 1981 pension system reform, four Latin American countries, and Australia and Switzerland within the OECD, have adopted pension systems that provide a larger role to fully-funded and decentralized pension institutions. Many other developing, transition, and OECD countries are currently considering adoption of such a reform -- including Mexico in the aftermath of its crisis. Some of them -- including Mexico -- aim to raise their saving rates. Under certain conditions a shift from a pay-as-you-go to a fully-funded pension scheme could indeed contribute to higher saving. But both theory and the empirical evidence gathered to date are weak in predicting the magnitude and timing of such effects. While pension reform is justified on many grounds other than saving, reformers around the world would benefit significantly from a better understanding of the saving impact of the pension reforms they are considering.

(9)   Do poverty and income inequality affect saving?

One of the stylized facts of development is that saving rates tend to increase with living standards and per capita income levels. However, the evidence is much less conclusive regarding the association between aggregate saving and income inequality (for a given level of average per capita income). Yet a deeper understanding of that link is essential to assess the overall saving implications of government redistribution and transfer programs.

(10)   What drives saving in transition economies?

The depth and scale of the reforms involved in the systemic transformation of the so-called transition economies dwarf those undertaken in any other world region. Since 1981 in Eastern Europe, and 1991 in the FSU republics, structural reform and stabilization efforts have reached a scale unprecedented in modern economic history. In these economies, however, saving rates have fallen well below pre-reform levels, often in tandem with output levels. Does the decline in saving reflect the end of forced saving during socialism, the management of the transition process, or other standard factors such as fiscal imbalances, growing poverty, or consumption smoothing in the face of a transitional output drop and higher expected future income ? The

answer to this question will shed light on how permanent or temporary the saving decline is, and help elucidate if policy action is needed for to restore saving to levels more consistent with transition economies' investment needs.

(11)   What explains sustained saving-growth takeoffs?

Sustained saving and growth takeoffs have been the exception rather than the norm during the last four decades of development experience. A good understanding of how the saving-investment-growth process got started in these episodes, and what policies helped them (as well as what policy mistakes were avoided) is still missing. On the one hand, this requires revisiting the questions posed under issue No. 1, about the role of capital accumulation in growth and the causalities between saving, investment, and growth. On the other, a closer look at these success episodes is most important from the policy viewpoint, to identify the role of initial conditions and specific policy levers in getting a successful transition underway.

(12)   Why have saving and growth collapsed in Sub-Saharan Africa ?

Over the last three decades, Sub-Saharan Africa's has had both the lowest saving rates and the poorest growth performance among world regions. National saving rates have been declining steadily since the early 1970s -- in tandem with growth. The rising gap between domestic investment and national saving has been filled by foreign saving in general and foreign aid in particular. Low investment with poor productivity and abysmally low saving are at the core of Africa's growth collapse. While bad luck -- droughts, wars, and declining terms of trade -- has had its share in the region's dismal performance, inappropriate policies have certainly also contributed to this outcome. Which policy reforms would be the most effective in raising Africa's domestic saving levels and therefore make the region less dependent on foreign aid ?

Ultimately, the above policy-relevant issues all relate analytically to a broader, all-encompassing task that will not be undertaken in this project: a thorough characterization of the welfare analytics of saving involving an exhaustive description of the types of policy-induced and other distortions that lead to under-(or over-) saving. Tackling this issue in an analytically rigorous manner would require the construction of a general equilibrium model, encompassing alternative types of market failures and externalities, and possibly allowing for multiple equilibria, to characterize the equilibrium saving outcomes under different configurations of distortions. Such rather formidable task will not be attempted in this project.

PART II: PROPOSED RESEARCH

The main objective of this project is to explain differences in saving performance across countries and over time in order to identify policies that impact on saving. The research components, hypotheses and methods draw generally from the recent literature and, more specifically, from four background papers (Deaton 1995, Honohan 1995, Obstfeld 1995, Weil 1995) prepared for the project.

The research is structured into five major, closely inter-related, components:

A. Data base and panel estimation models
B. Saving across the world
C. Policy issues of worldwide importance
D. Lessons from international saving experiences
E. Project findings and policy implications

Chart 1 summarizes the project's five components and identifies the specific issues that will be addressed in each component. The first component addresses data and methodological aspects required for carrying out subsequent research. The construction of an international macroeconomic data base for saving and related variables built with consistent criteria is an essential pre-requisite for conducting the research. Part of the empirical research will be based on estimating relations based on combined cross-country time-series data -- hence recently developed panel data estimation techniques are summarized next. The second component of the research project focuses on understanding both saving differences across space and over time and the saving-growth link. Using new information from both National Accounts and household surveys, the research will shed light on the factors that drive saving in the world and on the relationship between saving and growth. The third component will focus on the effects of specific policies on saving, using a cross-country comparative approach. To complement the issue-oriented research of the second and third components, the fourth will assess in depth the saving performance of specific countries, country groups and world regions, to draw lessons from actual policy experiences. Finally, the fifth and last component will provide a policy-oriented synthesis of the main results and lessons from the research.

The research will be based both on relatively narrow analytical frameworks explicitly derived from intertemporal optimization, and on broader models not derived from first principles but encompassing a number of alternative consumption/saving motives. Empirical implementation of the analytical models will make use of both micro and macroeconomic data. For the project's cross-country studies, the aggregate data will be drawn from the saving data base. The precise empirical models and the coverage of the data they use will vary across studies, depending on data availability and the need to tailor the samples to the specific questions under investigation. The subsequent technical annexes, discussed within each research component, provide extensive details on the methodology to be used by each of the papers that will be prepared within the project.

A. DATA BASE AND PANEL ESTIMATION MODELS

In order to adequately carry out the subsequent research based on macroeconomic data, the first part of the project addresses important data and econometric estimation issues that arise in empirical cross-country work on saving.

Section A1 below describes the shortcomings of conventional macroeconomic saving data and proposes construction of a world data base that will overcome some of these limitations. Section A2 summarizes recently developed panel data estimation techniques that will be applied in estimating econometric relations based on combined cross-country time-series data.

A1.   A World Data Base of Aggregate Country Time Series

> "The distinction between current consumption and saving, or putting aside for the future, has been with us for ages. It was the basis for Joseph's solution to the seven lean years he foresaw (Gen. 41: 34-36) and for Aesop's fable of the ant and the grasshopper. Yet we still do not seem to have got it right, conceptually or empirically" (Lipsey and Tice, 1989, p.1).

The purpose of this research component is to assemble a large and more adequate international data base on saving and related macroeconomic variables. Empirical consumption and saving studies for both industrial and developing countries are often criticized because of their reliance on inadequate aggregate data. The criticisms stem partly from conceptual and empirical shortcomings of existing aggregate data and partly from inadequate use of the data by applied researchers.

Data on income, consumption, saving, and related aggregate variables from SNA (System of National Accounts) sources are maintained by various international organizations, including the UN, IMF, OECD, and the World Bank. These data suffer from inadequacies, inconsistencies and biases that have undoubtedly affected the quality of existing empirical work. The problems range from inadequate sector coverage, incomplete measurement and variable misclassification, to exclusion of capital gains and other sources of mismatches between saving flows and wealth changes. Other data related to saving, including public-finance and rate-of-return information, are also subject to measurement problems and are widely dispersed in different sources.

The implication of these data problems surely should not be to stop empirical research. The right inference is to correct some of the problems -- subject to reasonable cost limits -- and raise awareness of the remaining problems that could cause biases in future empirical work.

Therefore assembling a world data base of adequate aggregate time-series data for a

consistent set of variables and a large number of countries is a first priority for carrying out empirical research on saving. The construction of a world data base of country time series for consumption/saving flows and their main determinants, in the framework of this proposal, is justified on three grounds. First, it will extend sample coverage to a broader set of developing and industrial economies. Second, it will correct some of the main shortcomings of existing aggregate SNA data used in most empirical studies undertaken to date. Third, it will extend coverage to a significant number of saving/consumption determinants.

We focus subsequently on three data issues that are of fundamental importance for the construction of a world data base for this research project. First we survey briefly the existing data bases on saving and saving-related variables. Then we describe the main shortcomings of existing data and of their use in empirical research. Finally we discuss the main features and methodological improvements of the world data base for aggregate country time series that will be assembled to conduct much of the proposed research.

Brief Survey of Main Data Bases

SNA data from national sources are maintained at various data bases of international organizations. Four SNA data bases are accessible through the World Bank's BESD data base -- those of the United Nations, IMF, OECD, and the World Bank itself -- that differ in coverage (the UN's is the most detailed data base) and reported values.[5] Across countries there are major differences in the quality and coverage of data In addition, accounting practices reflected in the historical data bases differ from the revised standards set recently by the Inter-Secretariat Working Group on National Accounts (1993).

Government flow data at aggregate level are reported as part of the national-accounts data of the data bases mentioned above. More disaggregate government data are reported in "Government Financial Statistics" published by the IMF.[6] The latter source publishes data for the central or general government, relying on country sources that vary widely in accounting practices and data quality. Public investment levels are typically underestimated here and in the national-accounts data because much of investment by public corporations is excluded. Alternative data bases that correct public sector investment (as well as private investment) country data are Pfeffermann and Madarassy (1993) and Easterly and Rebelo (1993), covering a smaller number of countries.

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[5] A summary table on the availability of time-series data in the U.N. and World Bank data bases on income, consumption, saving, and related flow variables for all developing and OECD countries is available on request from the authors.

[6] A summary table on the availability of time-series data in the IMF's GFS on government budgetary flow variables for all developing and OECD countries is available on request from the authors.

As an alternative to the limited public sector coverage of the standard national-accounts and IFS data -- limited to the central or general government -- a recent research project at the World Bank has started to compile a data base for the consolidated non-financial public sector deficit. Using data from country sources, these data consolidate general-government deficit measures with those of the non-financial public-enterprise sector for 58 developing and OECD countries and the 1970-1990 period (Easterly and Schmidt-Hebbel 1994, Table A1).

External debt, disaggregated by public and private, are put together by the World Bank's annual "World Debt Tables". For public domestic debt stocks there is no systematic data base for developing countries but time series exist for individual countries in specialized country publications.

Time-series data on various rates of interest (bank deposit and loan rates, discount rates, money market rates, treasury bill rates, and government bond yields, by maturities) are compiled in the IMF's "International Financial Statistics".[7] IFC compiles a data base for stock market price indices and yields for a sample of emerging markets. The World Bank's PRDFP division has compiled time-series data on interest rates for a selected number of countries.

Other data on saving or consumption determinants -- including variables on demography, income distribution, financial-sector structure -- are gathered and/or published by the U.N., the World Bank, and the BIS.

Inadequacies of Existing Aggregate Data and their Use in Empirical Studies

Existing data and their use in applied research are affected by a host of inadequacies. We identify 17 limitations that affect income, consumption, saving and related flow variables, and 3 problems that affect rates of interest and return.

Available data and their use by applied researchers suffer from inadequacies, inconsistencies, and biases that undoubtedly have affected the quality of existing empirical work. Many of these problems have been identified in the sections on data discussion in Visaria (1980), Berry (1985), Fry (1988), Gersovitz (1988), Deaton (1989), Srinivasan (1993, 1994), OECD (1994), Schmidt-Hebbel, Serven, and Solimano (1995), and in the NBER volume on the measurement of saving, investment, and wealth edited by Lipsey and Tice (1989). For the purpose of this research project we summarize the following 17 major problems in the data and/or their use. Some of these difficulties reflect conceptual shortcomings (because of the gap between theoretical concepts and their empirical counterparts), others are due to inadequate measurement efforts, and a few reflect inadequate use of existing data by applied researchers.

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[7] A summary table on the availability of time-series data in the IMF's IFS on interest rates for all developing and OECD countries is available on request from the authors.

Problems of Income, Investment, and Consumption Data

(i) Income exclusion

Much of income and production is excluded from NIPA, in particular that of informal and illegal sectors, (subsistence) agriculture, and households. The omission of non-cash (more generally, non-recorded) components from both income and consumption overstates saving and investment ratios but not their levels, while the omission of non-cash investment from income understates both saving and investment ratios but not their levels.

(ii) Unrecorded capital flight

This particular form of income exclusion (involving under-reporting of net exports) implies an over-estimation of external saving. It implies either an over-estimation of gross domestic saving or an over-estimation of gross domestic investment.

(iii) International comparability of income levels (corrected by Summers and Heston)

Due to the lack of an international currency, income and consumption measures are only comparable across time within any given country. Summers and Heston (1990) denominated income and several expenditure categories in a common set of prices in a common currency, using the purchasing power adjusted conversion factors. The publicly-available Summers-Heston data base makes possible the comparison of income levels across countries and over time. However, it is also believed that the uniform valuation of national accounts ignores the systematic differences in the price structures of economies at different development stages, therefore narrowing excessively the income distances between richer and poorer countries. The purchasing-power-adjusted conversion factors are believed to include observed prices without adjustments for the large differences in product quality across countries. The gaps in Summers-Heston's coverage, quality, and timeliness of the basic survey data used in the calculation of conversion factors are also of concern.

(iv) Misclassification of consumer durables

Saving and investment are under-measured because purchases of consumer durables are misrecorded as consumption instead of investment. Theory suggests that a more adequate consumption measure should be based on the flow of services of currently-owned consumer durables and, possibly, part of the services rendered by human capital. Reclassifying private consumer durable spending as investment could raise saving ratios by 2 to 8 percentage points of GDP in OECD countries (OECD 1994).

(v) Misclassification of spending on human capital

Saving and investment are under-measured because expenditure on human-capital formation (education, health, training) is misrecorded as consumption or intermediate production instead of investment. For instance, reclassification of all education expenditures would raise saving ratios in OECD countries by 4-5 percentage points of GDP (OECD 1994). However, the difficulty in making this adjustment -- and similar adjustments for health and training spending -- is to identify the true investment and consumption shares of each of these spending categories.

(vi) Misclassification of spending on research and development (R&D)

Saving and investment are under-measured because expenditure on R&D is misrecorded as intermediate production instead of investment. For instance, reclassification of all R&D expenditure as investment would raise saving ratios in OECD countries by 1-2 percentage points of GDP (OECD 1994).

Problems of Investment Data

(vii) Estimation of aggregate and sector investment

Gross domestic investment (GDI) is often obtained as the additions to overall capital by capital categories: machinery and equipment, construction, and inventories. Gross investment in the public and private corporate sectors are independently estimated based on their reported accounts. However, public investment is typically underestimated by excluding all or significant parts of investment undertaken by decentralized public corporations, in particular those projects not financed with central or general government funds. Gross investment of the rest of the economy (households and unincorporated business) is a residual between GDI and corporate-sector investment.

(viii) Measurement of depreciation of physical assets

Depreciation of physical capital is subtracted from gross investment (and gross saving) to obtain net investment (and net saving). The world-wide average depreciation ratio is roughly 10 percent of GDP but shows significant country variation. Unfortunately, part of country differences are due to varying depreciation methods. Depreciation measures based on accounting principles (that vary across countries) often bear little resemblance to economic depreciation concepts. In addition, the distinction between inputs and capital goods in production sectors is often arbitrary.

(ix) Misrecording of maintenance expenditures on public capital

Maintenance of public-sector capital is typically misrecorded as recurrent expenditure, that is, government consumption. In the United States both public recurrent maintenance and public investment expenditures are misclassified as current spending.

(x) Measurement of environmental resources and misclassification of gross output

Conventional national-accounts measures do not account for the depletion of environmental capital and hence over-estimate true investment and output and income measures. While comprehensive SNA methods are being started in many OECD and some developing countries, no historical corrected time-series are available for most developing countries.

(xi) Capital heterogeneity

Intertemporal comparison of investment data is difficult because it involves comparing capital goods of different vintages and quality. This applies also to consumption, particularly durables (Berndt and Triplett 1990). In the spatial dimension it is difficult to compare and aggregate investment from different sectors of origin because of capital heterogeneity.

Problems of Consumption Data

(xii) Varying methods in computing private consumption

SNA estimates of public consumption of central and local governments are obtained from government sources. SNA estimates of private final consumption are based on three methods: (a) the expenditure method is based on direct information from household budget or expenditure surveys, (b) the commodity-flow method is based on direct information for prices and quantities of consumer goods, and (c) the residual approach that obtains private consumption as the residual balancing item of the income-expenditure identity.

A combination of the first and second approaches is the most satisfactory as it is based on direct household information, supplemented by production and foreign-trade information to allow for consistency checks. The third approach is the least satisfactory because private consumption reflects the measurement errors and biases in estimating output and all other expenditure variables.

Table A1 summarizes how countries are divided in applying the three methods to compute private consumption expenditure in their SNA data as compiled by the UN (Source: United Nations 1979). As shown there, OECD countries typically rely on a combination of the first and second methods, while the residual method is applied by a large number of Sub-African and Latin American countries.

Problems of Saving Data

(xiii) Computation of saving as a residual: inconsistencies between current and capital-account saving measures.

When private consumption is not obtained as a residual (i.e., not based on method (c) above), private (and national) saving is still measured as the residual difference between private (and national) income and consumption. Then saving reflects the measurement errors and biases of income and all expenditure variables. In addition, this current-account measure of saving is conceptually different from the capital-account measure of saving. The latter computes saving as the change in net wealth derived from flow of funds accounts (FFA) or each sector. Consumption theory is based on income and saving measures consistent with net wealth changes, that is, saving consistent with FFAs. Changes in net wealth differ conceptually from current-account saving by both net capital gains on asset and liability holdings resulting from revaluations (see point xv below) and capital transfers. Statistical differences between current and capital-account saving measures are due to net capital gains and measurement errors in both current and capital accounts. Empirical differences between the saving measures derived from the two accounts are often large and sometimes huge, even in OECD countries (Lipsey and Tice, 1989).

The conceptual consolidation of current-account and capital-account (or FFA) measures of saving is straightforward (see for instance Host-Madsen 1979, Lipsey and Tice 1989, Holloway (1989), Wilson et al. (1989), World Bank RMSM-X references, Inter-Secretariat Working Group 1993). FFA measures of saving and their integration into national accounts are pursued in many

OECD countries. For the U.S. in particular, there is a long literature on saving measures from both methods and their differences (see for instance Holloway 1989, Wilson et al. 1989, Hendershot and Peek 1989, and Boskin et al. 1989).

Few developing countries have pursued comparison and reconciliation of saving measures from the two methods, due to the absence of systematically constructed FFAs and their integration into national accounts. FFAs impose significant data requirements and costs, including detailed information on balance sheets of households, non-financial corporations, financial corporations, general government, and the rest of the world (the five sectors considered by the SNA). Reynolds and Camard (1989) compare saving measures from both methods for 5 Latin American countries, concluding that current-account measures typically underestimate FFA measures of saving. Unfortunately only one of the five countries -- Colombia -- continues to integrate its FFA into its national-accounts estimates (at both aggregate and sector levels, including households and corporations), and hence is the only Latin America country with continuous integrated saving measures from 1970 to date. A recent paper by Honohan and Attiyas (1989) presents saving data for 20 developing countries based on FFAs, but only for 8 countries the data on both the capital and financial accounts was available (see Honohan 1995 for additional discussion).

(xiv) Computation of saving as a double residual from the current account

When private consumption is obtained as a residual (method (c) in point (xi)), private (and national) saving is the ultimate, double residual and reflects all inaccuracies incurred in estimating income and expenditure.

(xv) Exclusion of net capital gains from current-account saving

As noted in point xii above, one of the differences between current and capital-account estimates of saving is due to the omission of revaluations from the former. Table A2 derives a simple reconciliation of current and capital-account saving measures by focusing on one important conceptual difference: net capital gains from revaluations of assets and liabilities due to inflation and changes in the real exchange rate. Other sources of capital gains -- such as changes in relative prices of equity and housing -- are not considered in Table A2 because of the lack of systematic data to engage in these corrections.

(xvi) Exclusion of changes in contingent and implicit sector liabilities from saving measures

Current-account measures of sector saving exclude typically -- and FFA measures of sector saving exclude often -- changes in implicit and in contingent sector liabilities, including pension rights issued by the government to households (through state-managed and typically pay-as-you-go pension systems) and government guarantees issued by the government to private institutions (such as loan guarantees and deposit insurance). Within the OECD, only for the U.S. there are consistent time series of sector saving and net worth levels that include household pension wealth (see Holloway 1989, Wilson et al. 1989, Henderson and Peek 1989, and McDermed et al. 1989). For developing countries no time series for private net worth and saving are available that comprise contingent and implicit public liabilities such as pension rights.

(xvii) Mismeasurement of sector income and saving data due to inadequate public sector coverage

Public and private saving and disposable income measures are distorted when they are based on a too narrow coverage of the public sector. The bias stemming from using general government (or, worse, central government) data is particularly significant in countries where large amounts of current and capital-account transactions occur between non-financial and financial public enterprises (including the central bank), one hand, and the domestic private or the external sectors, on the other. Examples of such transactions include loans by private domestic or foreign banks to public enterprises and subsidies to and bailouts of domestic private firms and households by the central bank.

(xviii) Inadequate use of income and saving data

A large number of empirical saving studies are based on inadequate saving data. They rely on to aggregate measures of saving -- ranging from gross domestic to national to private-sector saving -- when the relevant decision unit is the household or the individual. The problem of using a too aggregate saving measure is that it assumes that households offset exactly any (permanent) change in government saving and/or in corporate saving by a change in household saving in opposite direction and the same magnitude. However, such a perfect offsetting can only occur in a world of perfect Ricardian equivalence (for public-household saving offsets) and perfect household piercing of the corporate veil (for corporate-household offsets), that requires empirically implausible assumptions regarding capital-market efficiency and interdependence of current and future generations. Hence a wider use of more disaggregate saving data, particularly for households, should be given more weight.

Problems of Rate of Return Data

Most consumption and saving studies rely on interest rates paid on short-term deposits in banking institutions as the rate of return relevant for saving decisions. Exclusive reliance on these rates are inappropriate due to the following reasons.

(i)   Official deposit rates are not relevant under financial repression

When interest rates are fixed by governments -- a feature that was widespread in developing countries during much of the historical 1960-94 period -- they are almost irrelevant as a measure of the alternative cost of consumption. Better proxies for the latter include (typically unrecorded) interest rates charged in unofficial financial markets, (typically unrecorded) rates of return on investment, or the rates on foreign deposits corrected for the expected rate of exchange rate depreciation.

(ii) Deposit rates are not relevant for marginal saving decisions

When consumers face an array of financial savings alternatives, deposits are only one of the choices. Hence rates of return on alternative instruments -- including government and private bonds, foreign- currency deposits on or off-shore, and stock market returns -- or a weighted average of the relevant returns are better measures of the cost of future consumption.

(iii) Gross rates of return are not relevant for marginal saving decisions.

Few studies use net rates of return (gross rates minus relevant marginal capital income taxes). But changes in marginal tax rates -- due to changes in legislation or enforcement of tax compliance -- are frequent and hence the use of gross rates introduces a potentially serious measurement bias when estimating marginal saving decisions.

Construction of a World Data Base

Objectives

The implication of the preceding list of data problems surely should not be to stop empirical research. The right inference is to correct some of the problems -- subject to a reasonable cost limitation imposed on these corrections -- and raise awareness of the remaining problems that could cause irrelevance and biases in future empirical work.

The construction of a world data base of country time series for consumption/saving data and their determinants is justified on two grounds. First, it will extend coverage to a much broader sample of developing and industrial countries, both in space and in time. Second, it will correct some of the shortcomings of existing data and their use in most empirical studies.

Methodology

The sample will comprise annual data for all industrial (OECD) and developing countries for the 1960-1994 period. Saving and disposable income data will be disaggregated by sectors (public and private, and the latter between household and corporate sectors) according to data availability and the alternative definitions discussed below. The disaggregation of private saving and income by households and corporations will be possible for at least 19 OECD and 19 developing countries. The complete sample will be divided into smaller sub-samples according to data availability.

The world data base will not correct for problems that are inherent to the methodology of computing SNA data as this would involve a complete remaking of historical SNA data -- an impossible task in the framework of this project. This implies that most methodological shortcomings listed above will not be addressed here. Instead the focus will be in providing a comprehensive data base that will include alternative measures for those variables where they are recommended and feasible to be derived (particularly for saving and disposable income). The alternative series will present a few corrections that can both make a substantial improvement of existing data and be tackled at a realistic cost level.

Corrections of Income, Consumption, Saving, and Related Flow Data at National and Sector Levels

(a) Data inconsistencies in country time series in existing data bases

The data bases used as the basic sources for the world data base (United Nations, IMF, World Bank, and OECD) suffer from frequent inconsistencies and discontinuities in annual country time series data. Hence the first task will be to double-check the data bases with national sources and make appropriate corrections.

(b) Correction of public investment data

To correct for the narrow public sector coverage embedded in conventional sources for public investment (problem vii above), broad public sector investment data from Pfeffermann and Madarassy (1993) and Easterly and Rebelo (1993) will be used to derive adjusted public and private investment series.

(c) Correction of data for public saving, private saving, and private disposable income due to wider public sector coverage

To avoid the mismeasurement derived from using a too narrow government data coverage (problem xvii above), the consolidated non-financial public sector deficit data base of Easterly and Schmidt-Hebbel (1994) will be double-checked and expanded in time and in space. Making use of an adequate broad measure of public investment, this allows to derive public saving for the consolidated non-financial public sector. Given the latter, it is possible to derive residually a corrected measured for private saving and private disposable income (see equations (1) and (2), table A2).

(d) Correction of saving for capital gains and losses from inflation and real exchange rate devaluation

Revaluation of private (and household) net assets is one of the conceptual differences between FFA and current-account measures of saving (problems xii and xiv discussed above). The world data base will include both raw saving and disposable income measures derived from the current account and adjusted measures that add to the former the net capital gains due to revaluations of a limited number of net assets, leaving out other sources of FFA and current-account saving discrepancies.

The revaluations to be considered are reflected by the simple accounting framework in Table A2, that identifies three major categories of financial assets (domestic currency, domestic public debt held by the private sector, and net foreign debt issued by both public and private sectors). As shown there, adjusted private saving (and adjusted private disposable income) levels can be derived as the sum of conventional saving (and conventional disposable income) levels derived from the current account and net capital gains from inflation and real exchange rate depreciation (see equations (7) and (9) in Table A2). Analogous expressions can be derived for adjusted public and external saving levels.

While it is not anticipated that adjusted disposable income and saving levels will be derived for every developing country due to lack of data in some countries (particularly in regard to public domestic debt stocks), it is anticipated that available data will enable to derive these measures for most industrial countries and a large number of developing economies.

Rates of Return

The world data base will include appropriate information to deal with the three limitations of most previous studies discussed above. This information includes data series on interest rate caps (and floors), a broader set of rates of return on different financial instruments, and proxies for marginal capital income tax rates.

Coverage of Variables

The data base will be selective in terms of variable coverage by including only variables that either represent directly or are required to build final variables used as dependent variables (consumption, saving) or as regressors (income and wealth variables, government flow and debt variables, rates of return, and other regressors). In addition , the data base will include data for gross domestic investment and GDP growth rates, as well as the two latter main determinants.

Table A3 provides a summary of the core variables in the world data base. Income, consumption, investment, saving, and related flow variables will be corrected (C) for data inconsistencies and errors in the original sources. In addition, all saving, disposable income, and transfer and interest-payment components of foreign and public saving data will be presented in three versions: corrected (C), corrected and adjusted for public sector coverage (CAC), and corrected and adjusted for public sector coverage and revaluations of net assets (CACR), as discussed above. Finally, more complete information on rates of return will be included to address the shortcomings of previous studies discussed above.

Data Accessibility

The World Data Set will be stored on disk files and made accessible to outside users.

TABLE A1

MEASURES APPLIED TO DERIVE PRIVATE FINAL CONSUMPTION EXPENDITURE

	Private Final Consumption Approach
Argentina	Residual
Australia	Expenditure approach and commodity-flow approach
Austria	Commodity-flow and expenditure approach
Bolivia	Residual
Botswana	Residual
Brazil	Residual
Canada	Expenditure approach
Chile	Residual
Colombia	Residual
Cyprus	Commodity-flow approach
Denmark	Commodity-flow and expenditure approach
Dominican Republic	Residual
Egypt	Expenditure approach
El Salvador	Commodity-flow and expenditure approach
Ethiopia	Residual
Fiji	Commodity-flow approach
France	Expenditure approach and commodity-flow approach
Germany	Expenditure approach
Ghana	Residual
Greece	Expenditure approach and commodity-flow approach
Honduras	Residual
Hong Kong	Commodity-flow approach
India	Commodity-flow approach
Indonesia	Expenditure approach and commodity-flow approach

Table A.1 (continuation)	
Iran	Expenditure approach and commodity-flow approach
Iraq	Commodity-flow approach
Ireland	Commodity-flow approach
Israel	Commodity-flow approach and expenditure approach
Italy	Expenditure approach and commodity-flow approach
Japan	Expenditure approach
Jordan	Commodity-flow approach
Kenya	Residual
Lesotho	Expenditure approach
Liberia	Commodity-flow approach
Libyan Arab Jamahiriya	Commodity-flow approach & other
Malawi	Residual
Malaysia	Expenditure approach
Malta	Expenditure approach and commodity-flow approach
Mauritius	Commodity-flow approach and expenditure approach
Mexico	Residual
Netherlands	Commodity-flow approach and expenditure approach
Nigeria	Residual
Norway	Expenditure approach
Pakistan	Residual
Panama	Commodity-flow approach
Papua New Guinea	Expenditure approach
Paraguay	Residual
Philippines	Commodity-flow approach and income-elasticity approach
Portugal	Expenditure approach and commodity-flow approach
Puerto Rico	Expenditure approach and commodity-flow approach
Korea	Expenditure approach and commodity-flow approach

Table A.1 (concluded)	
Saudi Arabia	Commodity-flow approach
Sierra Leone	Expenditure approach and commodity-flow approach
Singapore	Expenditure approach and commodity-flow approach
South Africa	Expenditure approach
Southern Rhodesia	Residual
Spain	Expenditure approach and commodity-flow approach
Sri Lanka	Expenditure approach and commodity-flow approach
Sudan	Expenditure approach
Sweden	Expenditure approach and commodity-flow approach
Syria	Commodity-flow approach
Thailand	Commodity-flow approach supplemented by expenditure approach
Uganda	Residual
United Kingdom	Expenditure approach and commodity-flow approach
Tanzania	Expenditure approach and commodity-flow approach
The United States	Expenditure approach and commodity-flow approach
Uruguay	Commodity-flow approach
Venezuela	Commodity-flow approach
Zaire	Expenditure approach and commodity-flow approach
Zambia	Residual

Source: United Nations, 1979.

Note: country-specific details on the application of each approach to derive private final consumption expenditure (PFCE) are not provided in the above mentioned publication. However, the three approaches are generally applied as follows:

Expenditure Approach: PFCE is estimated directly from household budget or expenditure surveys, and other sources.

Commodity Approach: PFCE is estimated by: (i) adding distributive margins and indirect taxes to the value of goods produced domestically or imported, and (ii) multiplying estimated quantities purchased by consumers by appropriate average retail prices.

Residual approach: PFCE is estimated residually by deducting from GDP all other aggregate-demand components.

TABLE A2

SAVING AND INCOME MEASURES

Starting from the basic income-expenditure equation in current prices, the sum of private, public and foreign gross saving (in parentheses) is equal to the sum of private and public gross domestic investment:

$$
\begin{aligned}
(Y_p - C_p) + (TA - TR - i\, B_{-1} - E\, i^*\, F^*_{g,-1}) \\
+ (- NX - E\, TR^* + E\, i^*\, F^*_{p,-1} + E\, i^*\, F^*_{g,-1} + E\, ONFP^* = I_p + I_g)
\end{aligned}
\tag{1}
$$

where Y_p is private disposable income, Cp is private disposable income, TA is taxes paid by the private sector, TR is net transfers received by the private from the public sector, i is the nominal interest rate paid on public domestic debt B held by the private sector, E is the nominal exchange rate, i* is the foreign interest rate paid on foreign debt, F* is the net foreign debt of the public sector, NX is net exports, TR* is net transfers from the foreign to the domestic private sector, ONFP is other (non-interest) factor payments from the private to the foreign sector, and I is gross investment. Superscript * denotes foreign-currency values and superscripts p, g, and -1 denote the private sector, the public sector, and the preceding period, respectively. All stocks refer to the end of the corresponding period. Price variables, however, are average-period variables consistent with flow variables.[8]

Consistent with equation (1), private disposable income is defined as:

$$
Y_p = Y + i\, B_{-1} + TR + E\, TR^* - TA - E\, i^*\, F^*_{p,-1} - E\, ONFP^*
\tag{2}
$$

where Y is GDP.

Gross private saving is equal to the net (cash) accumulation of private assets, and the latter is equal to the increase in private sector wealth minus net capital gains:

$$
\begin{aligned}
S_p \equiv Y_p - C_p = (B - B_{-1}) - E\, (F^*_p - F^*_{p,-1}) + (H - H_{-1}) \\
\equiv P\, \Delta w_p - P\, ncg_p
\end{aligned}
\tag{3}
$$

---

[8] A more complete derivation would distinguish between average-period price variables for flow variables and end-of-period price variables relevant for stock variables, as in Khadr and Schmidt-Hebbel (1989).

TABLE A2 (continued)

where H is domestic base money held by the private sector, P is the private-consumption deflator, w_p is real net private wealth, and ncg_p is real net capital gains of the private sector. Real net private wealth -- the ratio of current-price net private wealth and the private consumption deflator -- is defined by its components as:

$$w_p \equiv b - f_p^* + h \tag{4}$$

Real net capital gains of the private sector -- the ratio of current-price net capital gains of the private sector and the private consumption deflator -- is defined as:
where small-case letters denote constant-price flows or stocks in domestic currency units (for instance $f_{-1} \equiv (E_{-1}/P_{-1}) F_{-1}^*$), and Greek letters denote rate of change of prices as follows: π is $(P-P_{-1})/P_{-1}$, π^* is $(P^*-P_{-1}^*)/P_{-1}^*$, and ϵ is $(EP^*/P -E_{-1} P_{-1}^*/P_{-1})/(E_{-1}P_{-1}^*/ P_{-1})$.

$$- ncg_p \equiv \left(\frac{\pi}{1+\pi}\right) b_{-1} - \left(\frac{\pi^*-\epsilon}{1+\pi^*}\right) f_{p,-1}^* + \left(\frac{\pi}{1+\pi}\right) h_{-1} \tag{5}$$

Note that similar equations for saving, wealth, and net capital gains can be derived for the public and foreign sectors.

Substituting Fisher equations for domestic and foreign interest rates and after simple transformation, substitution of (2) into (3) yields the following equation for private gross saving:

$$S_p \equiv P_y\, y + TR + E\, TR^* - TA - E\, ONFP^* - Pc_p$$
$$+ P \left[r + \frac{\pi}{1+\pi}\right] b_{-1} - P \left[r^* + \frac{\pi^*}{1+\pi^*}\right] (1+\epsilon)\, f_{p,-1}^*$$
$$= P\, (b - b_{-1}) - P\, (f_p^* - f_{p,-1}^*) + P\, (h - h_{-1}) \tag{6}$$
$$+ P \left(\frac{\pi}{1+\pi}\right) b_{-1} - P \left(\frac{\pi^*-\epsilon}{1+\pi^*}\right) f_{p,-1}^* + P \left(\frac{\pi}{1+\pi}\right) h_{-1}$$

where P_y is the GDP deflator and y is real GDP.

TABLE A2 (concluded)

Dividing (5) by P allows obtaining "real" gross private saving defined as current-price gross private saving deflated by the private consumption deflator.

Adding private net capital gains (eq. (5)) to private saving (equation (6)) yields adjusted gross saving, i.e., a measure of saving that is consistent with wealth accumulation of the private sector:

$$
\begin{aligned}
S_P^A &\equiv P_y\, y + TR + E\, TR^* - TA - E\, ONFP^* - P\, c_p \\
&+ P\, r\, b_{-1} - P\, [r^*(1+\epsilon) + \epsilon]\, f_{p,-1}^* - P\left(\frac{\pi}{1+\pi}\right) h_{-1} \\
&= P\, (b - b_{-1}) - P\, (f_p^* - f_{p,-1}^*) + P\, (h - h_{-1})
\end{aligned}
\tag{7}
$$

Similarly, adding net capital gains to private disposable income yields Y_P^*, the adjusted measure of Y_p.

Summarizing:

$$
S_p^A - S_p \equiv Y_p^A - Y_p \equiv NCG_p
\tag{8}
$$

A constant-price measure of adjusted private disposable income is:

$$
\begin{aligned}
y_p^A &\equiv \frac{P_y}{P}\, y + \frac{TR}{P} + \frac{E}{P}\, TR^* - \frac{TA}{P} - \frac{E}{P}\, ONFP^* \\
&+ r\, b_{-1} - [r^*(1+\epsilon)+\epsilon]\, f_{p,-1}^* - \left(\frac{\pi}{1+\pi}\right) h_{-1}
\end{aligned}
\tag{9}
$$

Similar expressions can be derived for adjusted saving and adjusted disposable income (in constant and current prices) for the public and external sectors.

Source: Authors' calculations.

TABLE A3

MAIN VARIABLES INCLUDED IN WORLD DATA BASE

1. Income, Consumption, Investment, and Saving Flows (including Government Variables)[9]

Gross Domestic Product and Gross National Product (C)
Total, Private (Corporate and Household), and Public Consumption Expenditure (C)
Gross Domestic, Gross Private, and Gross Public Investment Expenditure (CAC)
Net Exports (C)
Gross Domestic Saving (C)
Gross National Saving and Gross Foreign Saving (C, CACR)
Gross Public and Gross Government Saving (C, CAC, CACR)
Gross Household and Gross Corporate Saving (C, CAC, CACR)
Private Disposable Income and Household Disposable Income (C, CAC, CACR)

Deflators for GDP, public and private consumption, public and private investment, exports, and imports

Transfer (taxes, transfers to households) and Interest Payment Components of Foreign Saving (C, CACR)
and Public Saving (C, CAC, CACR)

2. Wealth and Debt Stocks

Base money held by the private and household sectors
Net domestic public debt held by the private and household sectors
Net foreign debt issued by the private and public sectors
Private and public net worth

3. Rates of Return

Bank deposit and lending rates
Discount and money market rates
Government bond yields and Treasury bill rates
Stock market yields
Caps and floors on interest rates
Marginal tax rates on capital income

4. Other Consumption/Saving Determinants

Demographic indicators
Financial-sector structure and flow variables
Income-distribution measures

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[9] C is corrected, CAC is corrected and adjusted for coverage, CACR is corrected and adjusted for coverage and revaluations.

A2. Estimating Panel Data Models[10]

<u>Advantages of Panel Data Analysis</u>

A panel data set consists of multiple time series observations for a given sample of cross-sectional units. Compared to purely cross-sectional or time-series data sets, panel data sets have several major advantages. First, panel data sets provide researchers a larger number of data points than cross-sectional and time-series data do, thus increasing the degrees of freedom of the regression and improving the efficiency of econometric estimates.

Second, working with panel data allows us to control for unobserved individual-specific effects and/or time-specific effects. Cross-sectional modeling imposes quite restrictive assumptions on the model specification in the sense that although group-specific effects can be analyzed, unobserved individual-specific effects have to be ignored. Since individual-specific effects are correlated with other explanatory variables in most cases, the omission violates the orthogonality condition of the errors to the included explanatory variables. It thus results in biased least squares estimates unless instruments are available. If panel data are used, we can get rid of the individual-specific effects by first differencing the equation. By the same token, we can get rid of the time-specific effects by taking the deviation from the mean across individuals at a given time.

Third, working with panel data allows us the use of previous observations as instruments for the explanatory variables that are not strictly exogenous.

Fourth, for time-series data, multicollinearity among explanatory variables may be a serious problem. For example, in the estimation of a distributed-lag model:

$$y_t = \sum_{l=0}^{h} \beta_l x_{t-l} + u_t$$

where x_t is an exogenous variable and u_t is a random disturbance term. In general, x_t is highly correlated with x_{t-1} and $2x_{t-1} - x_{t-2}$. So very serious multicollinearity problem appears among the explanatory variables. Hence, there is not sufficient information to obtain precise estimates of any of the lag coefficients without specifying restrictions. If a panel data set is available, the differences in x across cross-sectional units can be used to reduce the collinearity and several restrictions can be dropped.

With these advantages of panel data in mind, we are now ready to discuss several estimation methods of panel data.

---

[10] Prepared by Wanhong Hu and Norman Loayza.

GMM Procedure for Dynamic Panel Data Models

Advantages:
- Accounts for individual-specific and time-specific effects.
- Relaxes the assumption of strict exogeneity of explanatory variables.

Disadvantages: Because it is based on time differencing, it
- Reduces the "signal" variance and may increase the "noise" variance.
- Eliminates purely cross-sectional information from the regression.

Consider the dynamic panel data model

$$y_{it} = \alpha y_{i,t-1} + \beta' x_{it} + \theta_e e_i + \mu_i + \xi_t + \varepsilon_{it} \qquad (1)$$

where x is a set of explanatory variables, e is the set of explanatory variables for which only cross-sectional data are available, μ_i and ξ_t are individual- and time-specific effects respectively. The data consist of N individual time series, each of them has T time periods.

To account for unobserved individual-specific effects, all variables in equation (1) are first-differenced. This eliminates not only the unobserved individual-specific effects but also all variables for which only cross-sectional information is available. After first-differencing, regression equation (1) becomes:

$$y_{it} - y_{i,t-1} = \alpha(y_{i,t-1} - y_{i,t-2}) + \beta'(x_{it} - x_{i,t-1}) + (\xi_t - \xi_{t-1}) + (\varepsilon_{it} - \varepsilon_{i,t-1}) \qquad (2)$$

Note that first-differencing introduces a correlation between the new error term and the differenced lagged dependent variable. Therefore, OLS estimation of equation (2) produces biased results, even when the set of variables x is strictly exogenous. Assuming that the ε_{it} are serially uncorrelated, that is, $E(\varepsilon_{it} \varepsilon_{is}) = 0$ for $t \neq s$, values of y lagged two periods or more are valid instruments in equation (2). Therefore, for $T \geq 3$, the model implies the following linear moment restrictions:

$$E[(\varepsilon_{it} - \varepsilon_{i,t-1}) y_{i,t-j}] = 0 \qquad (j=2,...,t-1; \; t=3,...,T) \qquad (3)$$

In the case that the problem of reverse causation applies to most variables in the set x, assuming that they are strictly exogenous would lead to inconsistent estimation. Assume, rather, that x are only weakly exogenous in the sense that $E(x_{it} \varepsilon_{is}) \neq 0$ for $s \leq t$ and $E(x_{it} \varepsilon_{is}) = 0$ otherwise. Values of x lagged two periods or more are valid instruments in equation (2). For $T \geq 3$, the model implies the following additional linear moment restrictions:

$$E[(\epsilon_{i,t} - \epsilon_{i,t-1})x_{i,t-j}] = 0 \qquad (j=2,\ldots,t-1; \ t=3,\ldots,T) \tag{4}$$

Hensen (1982) and White (1982) propose an optimal estimator, the Generalized Method of Moments (GMM) estimator, based only on moment restrictions, that is, in the absence of any other knowledge concerning initial conditions or the distributions of the error term and individual-specific effects. The moment restrictions equations in (3) and (4) can be written in vector form as $E[Z'_i v_i]=0$, where $v_i = ((\epsilon_{i,3} - \epsilon_{i,2}) \ldots (\epsilon_{i,T} - \epsilon_{i,T-1}))'$ and Z_i, is the instrument matrix of the form $Z_i = \text{diag} (y_{i,1} \ldots y_{i,s}, x_{i,1} \ldots x_{i,s})$, $(s = 1, \ldots, T-2)$. Note that the number of columns of Z_i, say M, is equal to the number of available instruments. Following Hansen (1982), the form of the GMM estimator of the $k \times 1$ coefficient vector $\theta = (\alpha \ \beta')'$ is given by

$$\hat{\theta} = \left(\bar{X}'ZA_N Z'\bar{X}\right)^{-1} \bar{X}'ZA_N Z'\bar{y}$$

where a bar above a variable denotes first differences. $\bar{X}$ is a stacked (T-2)N x k matrix of observations on $\bar{x}'_{i,t}$ and $\bar{y}'_{i,t-1}$; $\bar{y}$ is a stacked (T-2)N x 1 vector of $\bar{y}'_{i,t}$; $Z = (Z_1' \ldots Z_N')'$ is a (T-2) N x M matrix; and A_N is any M x M, symmetric, positive semi-definite matrix. Given the moment conditions being used, the estimated coefficients are the most efficient when $A_N = E[Z_i' v_i \ v_i' Z_i]$, that is, when the matrix A_N is equal to the variance-covariance matrix of the moment conditions. A two-step procedure has been suggested by Arellano and Bond (1991) to obtain the most efficient GMM estimator. The first step estimator is obtained by assuming

$$A_N = [N^{-1}\sum_i Z_i'HZ_i]^{-1}$$

where H is a (T-2) square matrix which has twos in the diagonal, negative ones in the first subdiagonals and zeros otherwise. Therefore A_N is positive semi-definite and the GMM estimator is consistent. In the second step, the residuals from the first step regression, $\hat{v}_i$, are used to construct the variance-covariance matrix of the moment conditions. The weight matrix is then

$$A_N = [N^{-1}\sum_i Z_i'\hat{v}_i\hat{v}_i'Z_i]^{-1}$$

Hence, the GMM estimator is the most efficient.

Chamberlain's Π-Matrix Estimation Procedure

Advantages:
- Accounts for individual-specific and time-specific effects.
- Does not reduce the "signal variance"

- Makes use of purely cross-sectional information.
- Eliminates the biases when the lagged dependent variable suffers from measurement error.

Disadvantages:
- Assumes that explanatory variables are strictly exogenous.

Consider the dynamic panel data model

$$y_{i,t} = \beta' x_{i,t} + (1+\gamma)y_{i,t-1} + \xi_t + \mu_i + \epsilon_{i,t} \tag{5}$$

The possibility of errors in variables is allowed regarding the dependent variable, y. To account for the time effects the data are processed by removing the time means from each variable. Thus the ξ_t's can be ignored and the regression can be fit without a constant.

Least squares estimation ignoring the individual-specific effects and the errors-in-variables problem produces biased estimators. In particular the estimate of $(1+\gamma)$ is biased in an unknown direction: the measurement error biases the estimate downwards, and the individual-specific effect tends to bias it upwards.

Using the within estimator (or any other panel-data estimator based on time-differencing) to correct for the individual-specific effects bias is inappropriate. The specific-effects bias disappears, but the measurement-error downward bias tends to worsen. This is due to the reduction in "signal" variance brought about by time-differencing. Furthermore, given the presence of a lagged dependent variable, time-difference estimators by construction create an additional downward bias. Therefore, in general the within and other time-difference methods underestimate $(1+\gamma)$.

Chamberlain (1984) proposes the Π-matrix estimation procedure which allows us to correct for both measurement-error and specific-effects biases. The procedure consists of writing both the lag dependent variable and the individual-specific effect in terms of the independent regressors and thus obtaining reduced-form regressions from which to obtain the coefficient estimates of interest. More specifically, the Π-matrix procedure consists of two steps. First, the parameters of the reduced-form regressions of the endogenous variable in each period in terms of the exogenous variables are estimated in all periods. Thus, we estimate a multivariate regression system with as many regressions as periods for the endogenous variables are available. Since group-wise heteroskedasticity and correlation between the errors of all regressions are allowed, the seemingly unrelated regression (SUR) estimator is used. As a result of this first step, we obtain estimates of the parameters of the reduced-form regressions (these are the elements of the Π matrix) and the robust (White's heteroskedasticity-consistent) variance-covariance matrix of such parameters.

Our working model may imply some restrictions on the elements of the Π matrix; or in other words, the parameters we are interested in are functions of the elements of the Π matrix. Then, in the second step of the procedure, the parameters of interest are estimated by means of a minimum

distance estimator, using the estimated robust variance-covariance of the estimated Π as the weight matrix:

$$Min(Vec\Pi - f(\psi))' \ \Omega \ (Vec\Pi - f(\psi))$$

where ψ is the set of parameters of interest, and Ω is the robust estimated variance-covariance of the Π matrix. Chamberlain (1982) shows that this procedure obtains asymptotically efficient estimates.

In order to use this method, we need to make explicit the restrictions that the working model imposes on the Π matrix. After removing the time means, equation (5) can be written as

$$y_{i,t} = \beta' x_{i,t} + (1+\gamma) y_{i,t-1} + \mu_i + \epsilon_{i,t}$$

$$E\left[\epsilon_{i,t} \mid x_{i,1}, \ldots, x_{i,T} = 0\right] \quad for \quad t = 1, \ldots, T$$

(6)

By recursive substitution of the y_{t-1} term in each regression equation, it is obtained

$$y_{i,0} = y_{i,0}$$

$$y_{i,1} = \beta' x_{i,1} + (1+\gamma) y_{i,0} + \mu_i + \omega_{i,1}$$

$$y_{i,2} = (1+\gamma)\beta' x_{i,1} + \beta' x_{i,2} + (1+\gamma)^2 y_{i,0} + [1+(1+\gamma)]\mu_i + \omega_{i,2}$$

$$y_{i,3} = (1+\gamma)^2 \beta' x_{i,1} + (1+\gamma)\beta' x_{i,2} + \beta' x_{i,3} + (1+\gamma)^3 y_{i,0} + [1+(1+\gamma)+(1+\gamma)^2]\mu_i + \omega_{i,3}$$

$$\cdot$$
$$\cdot$$
$$\cdot$$

$$y_{i,T} = (1+\gamma)^{T-1} \beta' x_{i,1} + \ldots + \beta' x_{i,T} + (1+\gamma)^T y_{i,0} + [1+(1+\gamma)+\ldots+(1+\gamma)^{T-1}]\mu_i + \omega_{i,T}$$

$$E^*\left[\omega_{i,t} \mid x_{i,1}, \ldots, x_{i,T}\right] = 0 \quad for \quad t = 1, \ldots, T \quad and \quad i = 1, \ldots, N$$

Chamberlain (1984) proposes to deal with the correlated individual-specific effect, μ_i, and the initial condition, $y_{i,0}$, by replacing them by their respective linear predictors (given in terms of the exogenous variables) and error terms, which by construction are uncorrelated with the exogenous variables. The linear predictors are given by

$$E^*(y_{i,0} \mid x_{i,1}, x_{i,2}, \dots x_{i,T}) = \lambda_1' x_{i,1} + \lambda_2' x_{i,2} + \dots + \lambda_T' x_{i,T}$$

$$E^*(\mu_i \mid x_{i,1}, x_{i,2}, \dots x_{i,T}) = \tau_1' x_{i,1} + \tau_2' x_{i,2} + \dots + \tau_T' x_{i,T}$$

As Chamberlain points out, assuming that the variances are finite and that the distribution of $(x_{i,1}, \dots, x_{i,T}, \mu_i)$ does not depend on i, using the linear predictors does not impose any additional restrictions.

Next we write the Π matrix implied by the working model. For instance, if the panel data consists of 5 cross section units for the exogenous variables x and 6 cross section units for the variable y, the additional cross section for y is given by the initial condition y_0. Thus, the multivariate regression implied by the working model is

$$
\begin{bmatrix} y_{i,0} \\ y_{i,1} \\ y_{i,2} \\ y_{i,3} \\ y_{i,4} \\ y_{i,5} \end{bmatrix}
= \Pi \cdot
\begin{bmatrix} x_{i,1} \\ x_{i,2} \\ x_{i,3} \\ x_{i,4} \\ x_{i,5} \end{bmatrix}
$$

$$\Pi = [B + \zeta \lambda' + \phi \tau']$$

where

$$
B =
\begin{bmatrix}
0 & 0 & 0 & 0 & 0 \\
\beta' & 0 & 0 & 0 & 0 \\
(1+\gamma)\beta' & \beta' & 0 & 0 & 0 \\
(1+\gamma)^2\beta' & (1+\gamma)\beta' & \beta' & 0 & 0 \\
(1+\gamma)^3\beta' & (1+\gamma)^2\beta' & (1+\gamma)\beta' & \beta' & 0 \\
(1+\gamma)^4\beta' & (1+\gamma)^3\beta' & (1+\gamma)^2\beta' & (1+\gamma)\beta' & \beta'
\end{bmatrix}
$$

$$\zeta\lambda' = \begin{bmatrix} 1 \\ (1+\gamma) \\ (1+\gamma)^2 \\ (1+\gamma)^3 \\ (1+\gamma)^4 \\ (1+\gamma)^5 \end{bmatrix} \cdot \begin{bmatrix} \lambda_1' & \lambda_2' & \lambda_3' & \lambda_4' & \lambda_5' \end{bmatrix}$$

$$\phi\tau' = \begin{bmatrix} 0 \\ 1 \\ 1+(1+\gamma) \\ 1+(1+\gamma)+(1+\gamma)^2 \\ 1+(1+\gamma)+(1+\gamma)^2+(1+\gamma)^3 \\ 1+(1+\gamma)+(1+\gamma)^2+(1+\gamma)^3+(1+\gamma)^4 \end{bmatrix} \cdot \begin{bmatrix} \tau_1' & \tau_2' & \tau_3' & \tau_4' & \tau_5' \end{bmatrix}$$

If we also consider the case in which some information as to one of the elements of the individual-specific factors is given, rewrite equation (6) as

$$y_{i,t} = \beta'x_{i,t} + (1+\gamma)y_{i,t-1} + \theta_e e_i + v_i + \epsilon_{i,t}$$

(7)

$$E[\epsilon_{i,t} \mid x_{i,1},...,x_{i,T}, e_i] = 0 \quad for \quad t = 1,...,T$$

where $\mu_i = \theta_e e_i + v_i$. In this case, the associated multivariate regression is very similar to the one where no information as to the individual-specific effects is available. Working with recursive substitution and the appropriate linear predictors, as in the previous case, the multivariate regression associated with equation (7) is the following

$$
\begin{bmatrix} y_{i,0} \\ y_{i,1} \\ y_{i,2} \\ y_{i,3} \\ y_{i,4} \\ y_{i,5} \end{bmatrix} = \Pi \cdot \begin{bmatrix} x_{i,1} \\ x_{i,2} \\ x_{i,3} \\ x_{i,4} \\ x_{i,5} \\ e_i \end{bmatrix}
$$

$$
\Pi = [B + \zeta\lambda' + \phi\tau']
$$

where

$$
B = \begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 \\
\beta' & 0 & 0 & 0 & 0 & 0 \\
(1+\gamma)\beta' & \beta' & 0 & 0 & 0 & 0 \\
(1+\gamma)^2\beta' & (1+\gamma)\beta' & \beta' & 0 & 0 & 0 \\
(1+\gamma)^3\beta' & (1+\gamma)^2\beta' & (1+\gamma)\beta' & \beta' & 0 & 0 \\
(1+\gamma)^4\beta' & (1+\gamma)^3\beta' & (1+\gamma)^2\beta' & (1+\gamma)\beta' & \beta' & 0
\end{bmatrix}
$$

$$
\zeta\lambda' = \begin{bmatrix}
1 \\
(1+\gamma) \\
(1+\gamma)^2 \\
(1+\gamma)^3 \\
(1+\gamma)^4 \\
(1+\gamma)^5
\end{bmatrix} \cdot \begin{bmatrix} \lambda_1' & \lambda_2' & \lambda_3' & \lambda_4' & \lambda_5' & \lambda_e \end{bmatrix}
$$

$$\phi\tau' = \begin{bmatrix} 0 \\ 1 \\ 1+(1+\gamma) \\ 1+(1+\gamma)+(1+\gamma)^2 \\ 1+(1+\gamma)+(1+\gamma)^2+(1+\gamma)^3 \\ 1+(1+\gamma)+(1+\gamma)^2+(1+\gamma)^3+(1+\gamma)^4 \end{bmatrix} \cdot \begin{bmatrix} \tau_1' & \tau_2' & \tau_3' & \tau_4' & \tau_5' & (\tau_e+\theta_e) \end{bmatrix}$$

From the implied restrictions on the Π matrix (in particular those related to the coefficients on e_i), note that τ_e cannot be separated from θ : only ($\tau + \theta$) is identified. Therefore, even though this elements of the individual-specific effects help condition for the individual-specific factor, its precise effect on the dependent variable is not identified without further restrictions.

Panel Data Estimation using the Bayesian Shrinkage Estimator

Advantages:
- Accounts for parameter heterogeneity and homogeneity.
- Increases efficiency of estimation when the true model has parameter heterogeneity.

Disadvantages:
- Complicates the calculation by iteration.

The most common approach to the analysis of panel data is to pool the observations, with or without separate intercept terms, and assume that the slope coefficients do not vary across cross-sectional units or over time. The separate intercepts are either fixed or random. Therefore these models account for heterogeneity in the intercept term only. But there are cases in which there are changing economic structures or different socioeconomic and demographic background factors that imply that the slope coefficients may be varying over time and/or may be different for different cross-sectional units. For the purpose here, we shall focus on the cross-sectional heterogeneity. In that case a separate time series model may be chosen to estimate the parameters for each cross-section units. But this ignores any similarities among individual units. Instead of choosing between the pooled model and the unpooled model as two exclusive alternatives, one could consider a compromise between the two, by assuming that the parameters in the different cross-sectional units are not all the same but not all completely different either. One model that can achieve such purpose is the random coefficient model.

Several estimation methods are proposed for the random coefficient model. Among them, the iterative Bayesian estimator is the most efficient one, as demonstrated by simulation studies. The functional form of the iterative Bayesian estimator is

$$\beta_i^* = \left(\frac{1}{\hat{\sigma}_i^2} X_i'X_i + \Sigma^{*-1} \right)^{-1} \left(\frac{1}{\hat{\sigma}_i^2} X_i'X_i \hat{\beta}_i + \Sigma^{*-1} \mu^* \right)$$

where

$$\mu^* = \frac{1}{N} \sum_{i=1}^{N} \beta_i^*$$

$$\Sigma^* = \frac{1}{N-k-1} + \left[R + \sum_{i=1}^{N} (\beta^* - \mu^*)(\beta^* - \mu^*)' \right]$$

This iterative Bayesian estimator is the weighted average of the estimates of the individual cross-section parameters and their overall mean with the weights equal to the inverse of their variances. When the parameter heterogeneity is true, the variance of the overall mean is large, so that a larger weight is given to the estimates of the individual cross-sectional parameters. Therefore it emphasizes the parameter heterogeneity. On the other hand, if the individual parameters are homogenous in the true model, a larger weight is given to the overall mean. So parameter homogeneity is emphasized. It is called the shrinkage estimator because the estimates of the individual cross-sectional parameters are shrunk towards their weighted average.

When the true model incorporates parameter heterogeneity, it is not appropriate to estimate the panel data model using fixed or random effects models. It is shown in simulation studies that the above Bayesian shrinkage estimator outperforms the estimator for the time series model for individual cross-sections, the estimator for the fixed effect model, the estimator for aggregate time series model, the estimator for aggregate cross-section model, the within-group estimator and the Stein-rule estimator by having the smallest root mean squared errors.

B. SAVING ACROSS THE WORLD

Saving rates display considerable variation across countries and, in addition, they are strongly associated with growth performance. The objective of this part of the research is to improve our understanding of these two phenomena, by addressing two main questions: first, why do saving ratios diverge so much across countries ? Second, what are the analytical underpinnings and the quantitative importance of the saving-growth link ?

This part of the research will consist of three components. First, the implementation of empirical aggregate models of saving using the world data base. Second, an empirical analysis of the links between saving, investment and growth in a general-equilibrium setting. Third, an empirical investigation of household saving behavior using an international set of time-series of household surveys. We provide here a brief overview of the proposed research, and then turn to the detailed description of each component.

To assess the chief forces behind saving, the **first** component will implement empirical aggregate models of saving based on a partial-equilibrium setting. There is a substantial literature estimating the behavior of consumption (or saving), including its responsiveness to growth, in a reduced-form framework. For the most part, however, it is quite uneven in data and econometric quality. Further, it says little about whether the main factors behind saving are similar for industrial and developing countries, and, perhaps most important, for households and firms.

The proposed research will address these issues. Using the best available cross-country time-series data (from the project's saving data base already described) and applying adequate econometric techniques, it will provide a systematic account of what the international data say on saving determinants, paying close attention to the estimated magnitude of the impact of key saving determinants, such as income growth -- both over time, across countries, and in LDCs compared to industrial countries -- to check their consistency with the effects predicted by the theoretical models reviewed in Part I above. By separating (for a smaller sample) firm and household data, it will analyze the extent to which firm decisions differ from household behavior. This distinction is central in many countries: corporate saving is a large fraction of aggregate saving and, since it is mostly geared to finance firms' investment, it could account for the bulk of the observed saving-growth correlation (under the plausible assumption that households fail to pierce the 'corporate veil').

The empirical work will be reflected in two papers devoted to the estimation of consumption and saving equations based on mutually complementary approaches. The first one, described in detail in section B1 below, will implement standard reduced-form saving/consumption equations, investigating the empirical determinants of private saving/consumption rates and the differences between aggregate household and firm saving behavior, as well as the differences between industrial and developing countries. The second paper, summarized in section B2 below, will focus on identifying the effects of income inequality on aggregate saving, using a structural approach.

The **second** research component will focus on improving our analytical understanding and quantitative assessment of the relationship between saving and growth. Clarifying the reasons that explain the strong empirical association between saving ratios and growth rates is a task with extremely important policy implications. If the observed correlation reflects the fact that saving is a major *cause* of growth, the consequence is that overcoming poverty requires a policy framework oriented to encouraging saving. If, on the contrary, the positive correlation is primarily due to the fact that higher saving rates are the *result* of faster income growth, the policy framework should target instead the forces driving growth -- investment in physical and human capital and/or technological advancement. Of course, these two explanations are not mutually exclusive (or even exhaustive).

The recent literature has shed some light, and raised new questions, on the saving-growth link. Work by Carroll and Weil (1994) presents empirical evidence that saving appears to follow growth, rather than preceding it; they conclude that the observed correlation reflects, at least in part, reverse causation from growth to saving. In fact, this direction of causation is implicit in the large number of cross-country empirical studies of saving that, since Modigliani (1970), include income growth among saving determinants. Most find a positive and highly significant effect of growth on saving rates (see Masson *et. al.* 1995 and Edwards 1995a for recent examples), a result -- as noted above -- hard to explain in the framework of conventional consumption theory.

The alternative, saving-to-growth view has a long tradition in development economics. It is grounded on two key propositions (see Schmidt-Hebbel, Servén and Solimano 1996 for an extensive discussion): first, national saving is fully reflected in domestic physical investment. Second, investment is a (or the) centerpiece of the growth process. In theory, the first proposition need not hold in the open economy, where national saving can be devoted to financing investment abroad. In practice, however, the well-known finding by Feldstein and Horioka (1980) -- recently corroborated by Feldstein and Bacchetta (1991) -- indicates that national saving and domestic investment ratios move closely together also in the open economy.

While this has been argued (by Feldstein and Horioka 1980, Feldstein 1994) to be proof of capital immobility, with the implication that saving increases crowd-in domestic investment (albeit through unspecified mechanisms), a number of alternative interpretations have underscored various common factors that can move saving and investment in the same direction (see Obstfeld 1994 for an overview): restrictions on countries' current account imbalances, imposed explicitly by world financial markets, or implicitly by governments' current account targeting (Summers 1988);[11] the economy's long-run budget constraint, which also prevents long-run saving and investment from showing large divergences;[12] relative price and demographic variables affecting both saving and investment (Taylor 1994); and, finally, *domestic* capital immobility reflected by the importance of retained earnings (i.e., firm saving) as a source of investment financing in most countries -- a hypothesis especially relevant for LDCs, where capital market imperfections are widespread and borrowing constraints are the norm.

Consider now the investment-growth link. While in the conventional neoclassical growth model physical investment only affects growth in the transition to the steady state -- in which growth is driven by exogenous technical progress --, the 'new' growth literature attaches a more prominent role to capital accumulation as a determinant of long-run growth, in particular by emphasizing the close links between physical investment and technical progress (e.g., Romer 1986, 1987, among many

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[11] Some empirical support for this view has been recently provided by Argimon and Roldan (1994), who show in particular that in countries enforcing capital controls saving appears to precede investment, according to Granger causality tests.

[12] Coakley *et. al.* (1995) provide some empirical evidence in support of this argument. They argue that solvency requires the current account balance to follow a stationary process. This in turn requires saving and investment to co-integrate with a unit coefficient, a requirement which is validated in their data.

others), a notion that dates back to the "vintage capital" extension of the neoclassical model (Phelps 1962, Bliss 1968). In any case, the strong correlation between investment and growth rates is a well-established empirical fact (see e.g. Levine and Renelt 1992), and recent work by Alwyn Young (1994, 1995) has underscored the central role of capital accumulation in East Asia's stellar growth performance. In turn, the correlation between investment and technical progress has also been documented (e.g., DeLong and Summers 1993).

An extreme, albeit popular, interpretation of these empirical facts is the 'capital fundamentalism' view, according to which physical investment is the *only* prerequisite for growth (see King and Levine 1994 for a critical discussion). This notion contrasts with the increasing attention paid by the recent growth literature to the role of human capital and technological innovation in the growth process. Indeed, it has been argued that the co-movement of investment ratios and growth rates may largely reflect the action of third factors -- such as technological innovation -- driving both capital accumulation and output expansion (Benhabib and Jovanovic 1991, King and Levine 1994). In an extreme view, physical investment would just be a *consequence*, rather than a cause, of the growth process, itself driven by human capital, technology and ideas. In this vein, Blomstrom *et. al.* (1993) argue that empirically growth Granger-causes investment, and not conversely.

From the policy viewpoint, the upshot of all this literature is that, in spite of the close empirical association between saving and growth, the extent to which saving-enhancing policies can contribute to raise growth remains unsettled. Thus, the objective of the second research component is to help clarify the empirical relevance and the analytical underpinnings of the saving-investment-growth link, to assist in the overall design of growth-enhancing policies. The component includes two papers. The first one, described in Section B3 below, is essentially empirical, and its purpose is to provide a systematic account of the observed regularities concerning the saving-investment-growth links, which at present is unavailable in the literature. By contrast, the second paper (summarized in Section B4) will focus on the analytical foundations of those links, by constructing and simulating a structural model of saving, investment, and growth derived from first principles.

Finally, to complement the above research based on macroeconomic data, the **third** component of this part of the research will investigate the determinants of household saving using time-series of cross-section household surveys from a set of diverse countries. It will focus on two issues: the role of life-cycle patterns in household saving rates, and the role of habits, the acquisition of durable goods and other non-life-cycle determinants of saving behavior. As discussed in Part I, these two types of factors are capable of generating a positive effect of growth on saving, although through rather different channels. The life-cycle effect of growth on saving (Modigliani 1970) is an aggregation phenomenon that comes from changing the "weights" of different age groups within the population in favor of the young, who (according to the theory) save more than the old, with the implication that aggregate saving rates rise. By contrast, the habit effect operates at the level of the individual household. As stated above, the basic idea of the consumption habit model (Carroll and Weil 1994; Carroll, Overland and Weil 1994; Deaton 1995) is that the marginal value of consumption depends on a stock of habits (perhaps embodied in a stock of durable goods) accumulated in the past; consumption responds to earnings innovations more slowly than in the standard permanent income

model, and therefore the result of earnings growth is higher saving, at least temporarily -- i.e., until stocks of habits adjust to higher levels.

The research will consist of two separate papers respectively exploring these two sets of issues. As described in more detail in Section B5 below, both papers will use a common data base, which will consist of time series of cross-sectional household income and expenditure surveys from a range of countries. These data can be used to track the earnings, income, consumption and saving experiences of *birth cohorts* over time.

B1.   Saving and Policies across the World

This study will identify the empirical regularities of saving/consumption and their sensitivity to their main determinants over time and across countries. The paper will make use of a reduced-form set-up for consumption/saving in the vein of the empirical saving studies by Schmidt-Hebbel, Webb and Corsetti (1992), Masson, Bayoumi and Samiei (1995), and Edwards (1995a). However, this paper will aggregate value on the existing literature in five dimensions, by allowing for:

- *A larger set of dependent variables.* The equations will be specified and estimated separately for constant-price private consumption ratios and current-price national, private, household, and corporate saving ratios. Alternative definitions and measures for saving, as discussed in Section A1 and reflected in the project's saving data base, will be considered.

- *A broader set of consumption/saving determinants.* The specification will include a broad set of categories of regressors: income measures (in levels and rates of growth), consumer asset levels, rates of return, public-finance variables, demographic variables, income inequality indexes, consumer uncertainty measures, etc.

- *More flexible specifications.* Functional specifications will allow for nonlinear effects (for example, in real per-capita income and interest rates) and interaction terms (e.g., between inequality indicators and income levels).

- *Use of the project's large Saving Data Base.*

- *Adequate treatment of econometrics issues.* The empirical study of saving and its determinants will be based on panel-data econometrics techniques (see Section A2 for details). Estimation based on panel data (which consists of multiple time-series observations for a sample of cross-sectional units) offers several major advantages. First, given that panel data have a larger number of observations than either cross-sectional or time-series data do, their econometrics estimates are more efficient, that is, their associated standard errors are smaller. Second, working with panel data allows to control for unobserved individual (e.g., country) and time heterogeneity. Since individual-specific and time-specific effects are correlated with other explanatory variables in most cases, omitting them results in biased ordinary-least-squares estimates. Using panel data, the time-specific effects can be eliminated

by taking the deviation from the mean across individuals at a given point in time. By the same token, individual-specific effects can be eliminated by time-differencing the regression equation (Anderson and Hsiao 1982). Given that we will, in all likelihood, estimate dynamic models (e.g., with lagged-dependent variables), time-differencing introduces a correlation between the error term and the differenced explanatory variables. In this case ordinary least squares is inappropriate, and instruments, usually based on previous observations of the dependent variable, must be used (Chamberlain 1984.) Third, panel-data estimation allows to solve, at least partially, the problem of joint endogeneity of the explanatory variables. Searching for appropriate instruments is difficult, particularly when the dependent variable is a multi-faceted variable such as the saving rate or the growth rate. Panel-data provides a simple way to obtain such instruments, namely, instruments based on previous observations of each of the jointly endogenous explanatory variables (Arellano and Bond 1991 and Holtz-Eakin, Newey, and Rosen 1988). And, fourth, given that the time dimension of the available sample for this project is large (at least 35 annual data points), panel-data estimation can accommodate heterogenous parameters not only across time periods but also across cross-sectional units (e.g., countries) without ignoring the similarities among individual units. This can be accomplished by implementing a random coefficients model through an iterative Bayesian estimator (Maddala 1991 and Hu and Maddala 1995). On the other hand, the large time dimension of the sample will force to also consider the question of stationarity and cointegration among the variables of interest (Pesaran and Smith 1995), an issue safely ignored when dealing with the usual panels of short time series.

B2. Does Income Distribution Affect Saving? [13]

The relationship between income distribution and saving has received comparatively little attention in the theoretical and empirical literature. While age-related heterogeneity among savers has been stressed in life-cycle models, income inequality is another real-world dimension of heterogeneity that until recently has remained relatively unexplored. In theory, there are a number of scenarios in which income distribution can have an effect on aggregate consumption and saving -- for example, if rich and poor consumers possess different preferences, have differential access to borrowing or to insurance against idiosyncratic risks, or if the elasticity of lifetime consumption to lifetime resources differs from unity.

Whether inequality matters for saving has obvious policy implications. For example, budget-neutral fiscal policies that redistribute resources from rich to poor consumers can raise or lower aggregate saving depending on the sign of the saving-inequality link. While most empirical studies using microeconomic data suggest that saving propensities are higher for richer consumers (e.g., Menchik and David 1983, Bunting 1991), the link between inequality measures and aggregate saving appears empirically rather weak, at least on the basis of reduced-form empirical saving equations (see Schmidt-Hebbel and Servén 1995b).

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[13] Prepared in collaboration with Jonathan Ostry and Carmen Reinhart.

An alternative, structural approach recently employed by Ogaki, Ostry and Reinhart (1995) conjectures that the neglect of income inequality may be responsible for the failure of empirical studies to identify any significant effects of interest rate changes on saving (e.g., Giovannini 1985). As is well known, the sensitivity of private saving to changes in real interest rates is crucial to determine the likely effects of a broad range of exogenous and policy-induced shocks that affect interest rates and/or the price of consumption in the future relative to its current level -- e.g., financial liberalization, fiscal policy changes, changes in the intertemporal profile of tariffs and taxes, and so on. Under the plausible assumption that intertemporal considerations only play a role in consumption behavior once a "subsistence" level of consumption has been achieved (in the spirit of Stone-Geary preferences), Ogaki, Ostry and Reinhart argue that the intertemporal elasticity of substitution, and therefore the interest sensitivity of saving, would be close to zero for poorer consumers, and higher for richer ones.

The empirical support for this hypothesis in Ogaki, Ostry, and Reinhart is based on macroeconomic data for a sample of countries with diverse income levels to estimate a structural model allowing the intertemporal elasticity of substitution to vary with the level of "permanent income". The model can explain quite well the marked differences in saving and the interest rate sensitivity of saving among low- and middle-income countries, but it is less satisfactory in accounting for the large observed differences among countries with similar income levels. One likely reason is that the model does not take into account that income distribution varies markedly across countries and that, despite similar income levels, the country with the more skewed distribution has a greater proportion of its population at or near subsistence levels.

The proposed research will explore the role of income distribution in determining the interest-rate sensitivity of saving. It will build on the previous work by Ogaki, Ostry, and Reinhart (1995) by accommodating the cross-country diversity in income distribution through disaggregation of each country's households across income categories, allowing their preferences to differ accordingly. The aggregate parameters for the country will then be a weighted average of the parameters of the various groups. Such a specification will capture behavioral differences for countries with similar income levels but dissimilar income distribution. For example, the country with the more skewed distribution would have a lower aggregate intertemporal elasticity of substitution (IES), since the aggregation attaches a higher weight to the near-zero IES of the population at or near subsistence levels. The estimated parameters will be used to calculate, in the context of a simple endogenous growth model, the elasticity of saving with respect to changes in the real rate of interest, and to assess if income distribution can account in some measure for the differences in saving rates between the rapidly-growing economies of South-East Asia and lower-saving economies, such as those of Latin America, with similar per capita income levels.

Analytical Framework

We begin by describing the maximization problem faced by a representative household in a given country. As in Ostry and Reinhart (1992), we adopt a two-good framework that distinguishes between traded and nontraded goods. As argued in that paper, it is important to estimate the intertemporal elasticity of substitution with a two-good model in order to avoid bias when the relative

price of traded and nontraded goods (the real exchange rate) varies considerably through time. We allow for cross-country variation in both the intratemporal elasticity of substitution between traded and nontraded goods and the intertemporal elasticity of substitution. The assumption is that the latter varies systematically with the level of wealth. We begin by describing, in equations (1)-(7) below, the optimization problem at the *national* level.[14]

There is an infinitely-lived representative household whose objective is to choose a consumption stream that maximizes:

$$[\sigma/(\sigma-1)]E_0 \sum_{t=0}^{\infty} \beta^t \, [am_t^{1-1/\epsilon} + n_t^{1-1/\epsilon}]^{\frac{1-1/\sigma}{1-1/\epsilon}},$$

(1)

$$a, \, \beta, \, \epsilon, \, \sigma > 0, \quad \beta < 1,$$

subject to the series of budget constraints:

$$p_t \, m_t + q_t \, n_t = p_t \, \overline{m}_t + q_t \, \overline{n}_t + \overline{x}_t + B_t - (1/R_{t-1}^*)B_{t-1}, \quad \forall t \geq 0,$$

(2)

and the transversality condition:

$$\lim_{t \to \infty} \prod_{i=0}^{t} (1/R_i^*)B_t = 0,$$

(3)

where E_0 is the expectations operator conditional on information available at time 0; B_t denotes the real level of debt carried from period t to period t+1 with B_{t-1} given; $(1/R_t^*)-1 = r_t^*$ is the real interest rate (in terms of the numeraire) on the debt so R_t^* is the associated world real discount factor; m (n) denotes consumption of importables (nontradables) and p (q) denoted the relative price of m (n) in terms of the numeraire; bars over m, n, and x denote the fixed endowments of imports, nontraded goods, and exports, respectively; β is the subjective discount factor; and ϵ (σ) denotes the intratemporal (intertemporal) elasticity of substitution.[15] An intratemporal elasticity of substitution greater (less) than one implies gross substitutability (complementarity) between traded and nontraded goods; a value of unity corresponds to the logarithmic utility case. The intertemporal elasticity of substitution reflects the sensitivity of consumption (and therefore saving) to changes in intertemporal prices (i.e. the consumption rates of interest), with higher values indicating greater sensitivity.

The problem of the representative consumer in a given country is to choose an optimal sequence $\{m_t, n_t, B_t\}$ that maximizes (1) subject to (2) and (3). The first order necessary conditions for an optimum are:

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[14] For a fuller discussion of the underlying model at the national level, see Ostry and Reinhart (1992).

[15] Notice that the estimation allows for differences in σ across households.

$$E_t \left\{ \frac{p_t}{R_t^* p_{t+1}} \left[\frac{am_{t+1}^{1-1/\epsilon} + n_{t+1}^{1-1/\epsilon}}{am_t^{1-1/\epsilon} + n_t^{1-1/\epsilon}} \right]^{\frac{\sigma-\epsilon}{\sigma(\epsilon-1)}} \left[\frac{m_{t+1}}{m_t} \right]^{-\frac{1}{\epsilon}} \right\} = \frac{1}{\beta}, \tag{4}$$

$$E_t \left\{ \frac{q_t}{R_t^* q_{t+1}} \left[\frac{am_{t+1}^{1-1/\epsilon} + n_{t+1}^{1-1/\epsilon}}{am_t^{1-1/\epsilon} + n_t^{1-1/\epsilon}} \right]^{\frac{\sigma-\epsilon}{\sigma(\epsilon-1)}} \left[\frac{n_{t+1}}{n_t} \right]^{-\frac{1}{\epsilon}} \right\} = \frac{1}{\beta}, \tag{5}$$

$$a(n_t/m_t)^{1/\epsilon} = p_t/q_t \tag{6}$$

Equation (4) is the intertemporal Euler equation associated with importables consumption in two consecutive periods; it states that the marginal utility cost of giving up one unit of m at time t should be equated to the expected utility gain from consuming one more unit of m at t+1. Equation (5) is the analogous condition relating the marginal rate of substitution between consumption of good n at t and t+1 to the relevant intertemporal relative price. Finally, equation (6) is the nonstochastic first order condition equating the intratemporal marginal rate of substitution between importables and nontradables to the corresponding relative price ratio. It can be verified that equations (4)-(6) are not independent. Specifically, combining equation (6) with either of the two remaining equations yields the third. Therefore, given that the nonstochastic first order condition holds, equations (4) and (5) do not provide independent restrictions on the evolution of consumption through time.

Given time series data on importables and nontradables consumption, and on interest rates, and import, export, and nontradables prices, it is possible to estimate the system consisting of (4)-(6) and recover the main parameters of interest. Since (6) must hold identically (in the absence of measurement error), and since (4) and (5) are not independent given that (6) holds, we can eliminate (4) or (5) from the estimation. The restrictions on the joint behavior of consumption of importables and nontradables, the terms of trade, and the relevant rate of return, implied by the maximization of the expected utility function given by (1) subject to the constraints given in (2) and (3), are summarized in equation (4). In addition, given the assumption of rational expectations, we can use equation (4) to define the disturbance:

$$u_t = \left\{ \frac{p_t}{R_t^* p_{t+1}} \left[\frac{am_{t+1}^{1-1/\epsilon} + n_{t+1}^{1-1/\epsilon}}{am_t^{1-1/\epsilon} + n_t^{1-1/\epsilon}} \right]^{\frac{\sigma-\epsilon}{\sigma(\epsilon-1)}} \left[\frac{m_{t+1}}{m_t} \right]^{-\frac{1}{\epsilon}} \right\} - \frac{1}{\beta}, \tag{7}$$

where u_t must be uncorrelated with any variable that is in the information set of agents at time t.

With the optimization problem of a representative household in a given country fully described, it remains to be specified how intertemporal parameters governing saving behavior vary systematically across countries. In what follows, we take a particularly simple approach motivated

by a Stone-Geary preference specification (as described, for example, by Rebelo (1992)). We adopt a specification in which the intertemporal elasticity of substitution is an increasing function of the gap between permanent income and the subsistence level of consumption, viz:

$$\sigma_{ik} = \sigma(1 - \frac{\gamma}{y_{ik}^p})$$

(8)

where σ_{ik} denotes the intertemporal elasticity of substitution in country i for income class k; y_i is a measure of permanent income in country i for that income group; and γ is a constant which reflects subsistence consumption. Clearly, equation (8) is similar to the Stone-Geary preference specification but with permanent income replacing consumption. Conceptually, we focus on income rather than consumption in order to make transparent the connection between the intertemporal elasticity of substitution and the level of development (i.e., income per capita). There are five income groups per country. Equation (8) shows that, with this specification of preferences, saving will be zero until subsistence is achieved. In addition, the interest sensitivity of aggregate consumption will be lower as the ratio, γ/y_i, approaches unity and wealth is only sufficient to support a subsistence level of consumption.

Parameter Estimates and Numerical Exercises

The model will be implemented on cross country data using the largest available sample, which in practice will be determined by the existence of suitable income distribution data. Empirical estimates of ϵ and σ will be obtained from Ogaki, Ostry, and Reinhart (1995), Atkeson and Ogaki (1994), and econometric estimates for those countries where consumption data by income level are available. The intertemporal elasticity of substitution for each income group σ_{ik}.in each country can then be calculated using its average income level. The aggregate IES for each country, σ_i, will be constructed as a weighted sum of the elasticities of the different income groups, for a broad spectrum of countries with different per capita incomes. The results will then compared to the Ogaki, Ostry, and Reinhart benchmark to assess to what extent income distribution can play a role in altering aggregate consumption/saving patterns and the responsiveness of saving to changes in the rate of return.

The estimates will also be used, in the context of a simple general equilibrium model, to assess if income distribution can account in some measure for the differences in saving rates between the rapidly growing economies of southeast Asia and Latin American countries with similar per capita income levels.

B3. Saving, Investment and Growth in the World: Correlation and Causality [16]

A number of recent empirical studies have analyzed the relationship between saving and growth, saving and investment and capital formation and growth. Particular attention has been devoted to the dynamic relationships that link these variables (Carroll and Weil 1994, King and Levine 1994, Blomstrom *et.al.* 1993). The more or less explicit aim of most exercises is to establish causal links in an attempt to discriminate among different models. While the answers to the questions posed are obviously important, both from the scientific and the policy points of view, no consensus has emerged. The interrelations between saving, investment and growth are far from being established, and are believed to change over time and across countries. Several methodologies have been employed and different, at times contradictory, results have been found, sometimes at odds with the established theoretical model, so that they are often referred to as *puzzles*. An accurate study of a consistent data set spanning a large number of countries and a long time period can therefore be very useful, if nothing else to establish which are the facts that theoretical models need to explain.

The main aim of this paper is to describe with a variety of econometric techniques a large data set containing data on consumption, income, investment and saving from a large number of countries and a relatively long time period. While the thrust of the paper is empirical and descriptive, some basic economic models will loom on the background and inform the analysis at several levels. The scope of the paper, however, is not to discriminate among different and sometimes conflicting models (even though some insights in this direction can be gained) but rather to use them as a framework to organize and analyze the data.

The study will focus on measuring the correlations between saving, investment and growth. It will consider simultaneously the relationships between the three variables both in the long and in the short run. To study the long run relationships, it will use both cross sectional regressions of long run averages and the estimation of multivariate error correction models. From the estimates of the latter models, the short run dynamics can also be inferred.

The paper has two components. The main goal of the first part is to review and establish the main correlations among saving, growth and investment and determine how they vary in different time periods, at different frequencies, in different groups of countries, with the introduction of several controls and at different levels of disaggregation. The second part of the analysis will focus on time precedence and, loosely speaking, on causation; more generally, it will examine the dynamics of the relationships between the relevant variables. Particular care will be devoted to the choice of the appropriate econometric technique.

The analysis is obviously not original. The study of the cross-country correlation between saving and growth can be traced to the work of Modigliani (1970), while analysis of the co-movement of investment and saving was pioneered by Feldstein and Horioka (1980). More recent papers that have looked at these problems are those by Carroll and Weil (1994), King and Levine (1994),

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Blomstrom, Lipsey and Zejan (1993), Obstfeld (1994), Deaton (1995), Schmidt-Hebbel, Servén and Solimano (1996).

The paper will build on the existing literature to extend it in three directions. First, the rigorous analysis of a comprehensive and consistent data set should provide a definitive description of the main correlations present in the data and of their changes in recent years. A systematic account of what the international data do and do not say, which now is not available in the literature, should be very useful, if nothing else to establish the stylized facts that theoretical models need to explain. The availability of data on a large number of countries should also allow exploring differences across groups of countries characterized by different observable features, such as economic development, population, development of financial markets and so on. In addition, to the extent the data permit, the analysis will be performed at several levels of disaggregation, with saving, for example, divided among the household, corporate and government sectors.

Second, the analysis will consider simultaneously the relationships between the three variables of interest (saving, investment and growth) both in the long and in the short run. This trivariate setting provides an encompassing framework in which the findings of earlier literature focusing on a subset of these variables in a bivariate framework can be assessed and reinterpreted.

Third, the study of the dynamic relations between saving, investment and growth will take into consideration a number of methodological issues that arise in earlier studies, devoting particular care to the choice of the appropriate econometric techniques (we return to this below). Further, unlike most of the previous literature, the analysis will not be limited to the study of the cross-section dimension of the available data, or its representation in terms of long-term time averages. The availability of a relatively long panel allows the use of more powerful and efficient techniques which exploit both the cross sectional and the time series variability. An empirical analysis of saving and growth that wants to go beyond the long run relationships identified by studies of cross sections of long run averages, should use statistical models that allow for differences between short run and long run coefficients.

Theoretical Considerations

(i) The relationship between saving and growth: life cycle and other models

Most of the cross section analysis of the relation between growth and saving has focused on long-run relations. Modigliani's classic discussion of the relationship between (productivity and population) growth and saving implied by the life cycle model is based on steady state considerations. According to a simple version of the life cycle model,an optimizing individual accumulates wealth during the first part of her life and decumulates in the last in order to keep consumption constant when income drops after retirement. If there is either population and/or productivity growth, in the steady state the saving of the young will exceed the dissaving of the old, therefore implying the presence of aggregate saving. An increase in productivity growth will then cause aggregate saving to rise in the steady state, as it increases the difference in lifetime resources between old and young generations.

In more realistic and sophisticated versions of the model, the relationship between aggregate saving and growth is not that straightforward. In principle, one has to consider how growth is distributed among individuals of different ages and among factors of production, the shape of the utility function, the relationship between interest rates and discount factors, the possibility that optimal consumption is hump-shaped because of changing needs linked to changes in family composition, the strength of the precautionary saving motive, general equilibrium effects that will modify, at least for large closed economies, the equilibrium interest rate, and so on. Even though for some of these factors it is possible to sign the direction in which they push the relationship, their weight and their interplay is essentially an empirical matter. For instance, if labor income profiles are quite steep, young consumers will want to borrow, and then repay their debts and accumulate wealth for retirement during middle age. Strong productivity growth across generations might imply, in this case, a *negative* relationship between saving and growth as the dissaving of the young might more than compensate the saving of the middle aged.[17] The complexity of the problem implies that, even in the long run, the relationship between saving rates and growth is ambiguous. Which of the various factors will prevail is essentially an empirical issue. While some idea about their relative importance can be obtained from simulation exercises, the matter can be solved only empirically.

In the short run, the relationship between saving growth is much more complicated. Even in the simplest version of the model, the short run dynamics can be quite involved. Essentially, to establish the effect that a change in growth has on saving rates, one has to be precise about the nature of the short run movements. Unexpected shifts to the rate of productivity growth that are perceived to be permanent can easily have negative effects on aggregate saving as all individuals alive at the time the shock occurs adjust their consumption plans upwards. Younger individuals, who will enjoy the increased productivity growth for a longer period, increase their consumption more. While the exact pattern of aggregate saving depends on the way the aggregate productivity shock is distributed among generations and among factors of production, it is likely that in the short run aggregate saving declines to recover on the transition path to a new (higher) steady state.[18]

Simple simulation models that have this property can be easily constructed. Attanasio and Weber (1994), for instance, calibrate a simple overlapping-generations model with several generations, where an unexpected increase in productivity growth causes aggregate saving to decline in the short run, as all generations, but especially younger cohorts, adjust their consumption plans.

These considerations should make clear that simple correlations between saving and growth will not be able to establish whether the life-cycle model is empirically rejected. The life-cycle model, however, can constitute a useful framework within which one can interpret these correlations. In

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[17] Here we are ignoring general equilibrium effects on the interest rate, which is likely to change in such a situation.

[18] As stressed above, even the long run effect can be negative.

addition, one can single out the most important modifications that have to be made to the textbook version of the model to make it fit the data.

The two questions that need to be answered are the following: first, is the life cycle model, in a more or less sophisticated version which might include substantial modifications of the simple textbook model, an adequate representation of reality ? Second, does the life cycle model explain the observed correlation between saving and growth or does this require other factors (liquidity constraints, habit formation, bequests, irrational behavior) ? Of course the answers to the two questions are related. The modifications needed for the life cycle model to fit observed consumption and saving behavior will have implications for the relationship between saving and growth. While the paper will not address these problems explicitly, it can be useful to gain insights especially to the second of these questions.

(ii) The relationship between investment and growth: the neoclassical growth model and recent developments

The empirical finding of a positive correlation between saving and growth can be justified by a mechanism quite different from the one suggested by the life cycle model and its refinements, namely through a mechanism in which saving crucially affects growth via investment. This approach, that can be tracked back to "capital fundamentalism", [19] stresses the role of investment in promoting sustained growth. According to some of its proponents, capital accumulation is the main factor that ignites growth.

Even though the strong causal link between (fixed) capital accumulation[20] and growth is not always accepted,[21] physical capital remains crucial in most growth models. Even in Solow's neoclassical growth model, only in the steady state is growth independent of the rate of capital accumulation. During transition periods the former is affected by the latter. Moreover, some recent versions of the traditional (exogenous) growth model (Mankiw, Romer, Weil, 1992) stress the fact that physical capital accumulation might approximate also the accumulation of the stock of human capital, which is more difficult to measure.

The relationship between investment and growth is even stronger in many recent endogenous growth models (originated from Romer, 1986). These models and some related empirical evidence suggest the presence of a strong link between investment and the equilibrium rate of growth not only

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[19] See the discussion and the evaluation of capital fundamentalism in the recent paper by King and Levine (1994).

[20] Either through total fixed investment or, more specifically, by means of equipment investment, as suggested by De Long and Summers (1991).

[21] An opposite view would hold that growth precedes investment. While this seems a bit extreme (although in the short run booming output could boost investment via the accelerator mechanism), some empirical evidence supporting such view has been presented by Blomstrom, Lipsey and Zejan (1993).

in the short but also in the long run. Capital accumulation complements and proxies for other important sources of growth, such as human capital accumulation and technological innovation embodied in new investment. These elements are likely to have a strong external effect on the growth process, even though they are not easily observable, especially with aggregate data.

From a theoretical point of view, a further level of analysis should also consider the effects that changes in aggregate saving have on the marginal product of capital and on the equilibrium returns of available assets. The analysis should obviously distinguish between small open economies and large closed ones. It is therefore worthwhile to have another look at these correlations and, in particular, at their dynamic dimension. This further step would link the traditional analysis that focuses on the relationship between growth and saving rates, to that of the relationship between saving and investment and that between investment and growth. Once again, we stress the importance of analyzing the three main variable of interest simultaneously.

(iii) Saving and investment

An important piece of the empirical evidence available on the relationship between saving, investment and growth, is the positive correlation between saving and investment. Feldstein and Horioka (1980) were the first to present this result and interpreted it as an indication of a low degree of international capital mobility. They, and the related literature, use cross-country regressions of the following type:

$$(I/Y)_i = a + b\ (S/Y)_i$$

in which country variables are averaged over long time periods in order to eliminate short run variability. If investment depends only upon the interest rate differential (zero in the case of perfect mobility) and other factors not related to saving, any association between the investment rate and the saving rate is due to lack of capital mobility. With immobile capital the correlation between saving and growth should be perfect. The coefficient b could then be interpreted as a measure of the degree of capital mobility. It is likely that the degree of mobility and integration of actual capital markets is somewhere in the middle between the two extreme of perfect mobility and immobility. Empirically, this coefficient turns out positive and slightly less than one.

An extensive body of literature scrutinizes this result, that has proven to be robust to instrumental variable estimation (which allows for the simultaneity problems caused by the presence of common shocks, when S and I are part of a larger model - see Feldstein, 1983, Dooley, Frankel, Mathieson, 1987) or to omitted variables problems (see Amirkhalkhali, Dar, 1993, who estimated a random coefficient model).

Feldstein and Horioka's interpretation, however, remains controversial. From an empirical point of view, it contrasts with other pieces of evidence (for instance those derived from the analysis of interest rate differentials) that point out to the existence of fairly integrated capital markets. From a theoretical point of view, several explanations of the observed correlations have been supplied that

are not necessarily in conflict with integrated capital markets. (See, for instance, Frankel, 1992 and Obsfeld, 1994).

The saving investment-correlation poses some interesting questions for the understanding of the growth process, with important policy implications: if growth is promoted by capital accumulation and capital is internationally immobile, saving-enhancing measures are an important part of a growth-oriented policy framework. On the other hand, in the case of a highly integrated international capital market, saving policies would be powerless to promote investment and thereby growth.

Our large data set will allow to analyze several aspects of the correlation between saving and investment. One, for instance, is the possibility of differences in the correlations between private saving and private investment, and the corresponding variables at the national level. The differences might be due to the stabilizing behavior of the public sector, whose policy goal is to avoid current imbalances. If this is the case, the cross section correlation between saving and investment should be stronger for the private sector variables than for the national ones.

Related to this, one of the explanations that have been suggested for the observed correlation between saving and investment is the fact that, in many countries, the bulk of investment is financed through retained earnings. If household 'fail to pierce the corporate veil' , one could conceivably observe a correlation between saving and investment due to the association between corporate saving and investment alone. Saving data disaggregated between the corporate and household sectors, available in this study's database, will be useful to test this hypothesis. Likewise, the correlation between saving and investment is likely to be different among various groups of countries (e.g., LDCs are likely to have a significantly lower degree of capital market integration than OECD countries). Therefore, the analysis will be performed for different groups of countries, according for example to their per capita income levels.

Another relevant issue concerns the appropriate definition of saving and investment. If the only component of investment crucial for growth is fixed investment, one could run "approximate" Feldstein and Horioka regressions, to evaluate different sectoral correlations (see Bayoumi, 1990). Definitional issues might also arise for savings, since national accounting saving measures do not correct for capital gain/losses. Alternative saving measures will be tried in the empirical experiments, in order to check the robustness of the results.

Finally, the appropriateness of the time aggregation procedure used by Feldstein-Horioka and the related literature has been recently challenged by Sinn (1992). Sinn argues that the intertemporal national budget constraint implies *per se* a strong link between I and S over long periods of time. Therefore it seems possible to gain some insights considering the temporal dimension explicitly.

Empirical Considerations

As stressed in the introduction, the paper will start with a description of the main correlations in the dataset, with particular reference to output growth, savings, investments and consumption.

Unlike most of the literature, which has looked only at pairwise correlations, the paper will consider the three relevant variables and their interactions simultaneously.

The analysis will start with static models and explore both short run relations, estimated using data at relatively high frequency, and long run ones, studied by cross sectional regressions of averages over long periods. Different sets of conditioning variables will be considered. Particular emphasis will be given to the issue of structural breaks and robustness (relative to controls, level of disaggregation and definitions) of the results. Structural breaks are likely to be extremely important, given the widespread view that financial markets have become much more interdependent and connected after the process of financial liberalization which took place in many countries during the 1980s (and that is bound to be important in itself for the relationships between saving, growth and investment). Different testing techniques will be used for this purpose, possibly also trying to assess the presence of structural breaks without imposing their dates.

Next, the paper will turn to dynamic models. It will use VAR systems, which will allow to explicitly analyze and link the short run and long run dynamics of the relevant variables. Once again, the analysis will allow for the presence of several controls and consider the possibility of structural breaks. However, the methodology traditionally used to estimate VARs has to be modified to take into account both the time and the cross section dimension of the dataset at hand. The starting point of the analysis will be the techniques proposed by Holtz-Eakin, Newey and Rosen (1988), Arellano and Bond (1991) and Arellano and Bover (1995). These methods yield consistent and efficient estimates even when the T dimension of the panel is relatively small. Exploiting only the cross sectional variation in the data (and some identification assumptions) this approach has the advantage of being able to safely ignore the issue of non-stationarity in the time series dimension.

The availability of a relatively long panel, however, allows the use of more powerful and efficient techniques which exploit both the cross sectional and the time series variability. In principle, for instance, one could estimate a single process for each of the countries considered.[22] More generally, a long panel allows estimation of models that would be unidentified in a shorter one. Just to give an example, it is well known that the presence of autocorrelation in the residuals induces biases that cannot be eliminated when only a short T is available. When T is large enough, however, one can condition on enough lags, so to make autocorrelation a negligible problem. Another important example, that of coefficient heterogeneity across countries, is discussed below. In general, however, dynamic models to be estimated with panel data should be approached with care. Pesaran and Smith (1995) show that several commonly used pooling techniques yield inconsistent results and propose some useful techniques.

The consideration of dynamic models will lead to the analysis of the issue of causation. In a recent paper, Carroll and Weil (1994) run Granger causality tests between growth and saving. The basic regressions they use to test the hypothesis of Granger causality are the following:

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[22] In this context, however, non stationarity in the time series dimension obviously becomes an issue to consider.

$$s_{t,i} = a^s{}_i + b^s s_{t-1,i} + g^s g_{t-1,i} + u^s{}_{t,i}$$

(1)

$$g_{t,i} = a^g{}_i + b^g s_{t-1,i} + g^g g_{t-1,i} + u^g{}_{t,i}$$

(2)

Carroll and Weil estimate equations (1) and (2) by OLS, and because of the biases caused by the presence of fixed effects in short panels,[23] in first differences using twice lagged instruments. They run their tests on five-year non overlapping averages so that the time dimension of their sample is quite short. They find that growth Granger-causes saving (with a positive sign) but not viceversa.

The proposed analysis will improve on Carroll and Weil's in four dimensions. First, it will consider Granger causality tests not only between saving and growth, but also between growth and investment, as in Blomstrom, Lipsey and Zejan (1993) and investment and saving as in Argimon and Roldan (1994),[24] using all three variables simultaneously.

Second, in the short-panel context, it will employ more efficient techniques to test for Granger causality, in particular the GMM techniques described in Holtz-Eakin, Newey and Rosen (1988, 1989) and, more recently, in Arellano and Bover (1995). The latter paper, in particular, stresses the advantages of considering explicitly all the orthogonality conditions implied by the statistical assumptions and using them to construct an efficient GMM estimator which allows for heteroscedasticity of unknown form. Given the nature of the problem, believe efficiency is crucial to identify any relationship with relatively small samples.

Third, the analysis will not be confined to the 5-year or 10-year averages popular in the literature. It will use a long panel and analyze the data at the highest frequency available. The short run dynamics can be quite useful in uncovering relationships between the variables under study. An issue that the *large T* of our sample allows to tackle is that of the possible presence of parameter heterogeneity across countries, that is, heterogeneity that cannot be dealt with with (semi) differencing the data. Again, Pesaran and Smith (1995) give useful indications about how to deal with this problem in the context of dynamic panel data. Considering and estimating country specific coefficients, besides being appropriate from a methodological point of view, can provide useful insights about the plausibility of different theoretical models, and therefore prove extremely valuable.

Fourth, the data set used in these tests will contain quality information on a variety of variables which allow controlling for other factors likely to be important for the relationship between saving and growth and saving and investment -- countries' overall level of development, financial

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[23] Given the presence of country specific fixed effects, using OLS in levels is equivalent to running the equations as deviations from the mean. This procedure is well known to cause biases.

[24] These authors do not use panel and perform only single country causality tests.

openness, and so on . Any conclusion regarding the issue of causation should be explicit about the information set upon which it is drawn.

Of course, tests of Granger causality should always be interpreted with caution, especially when they involve variables which are likely to be determined by forward-looking behavior, such as saving and investment. Obviously, one would not want to conclude that Christmas cards cause Christmas! Yet such procedures can be informative if carefully used, and are likely to be particularly useful here given that they very directly confront the key issue of interest -- the direction of causation between saving, investment and growth.

Several methods have been proposed in the literature to discriminate between the long- and the short-run components of the data. One technique that could be useful to discriminate between the two dynamic dimensions of the data is the "common trends-common cycle" approach of Vahid and Engle (1993). In that paper, the authors combine cointegration techniques with the concept of 'common features analysis' The two concepts together allow a rigorous distinction between short and long run dynamics in a multivariate dataset. It would be interesting to see whether their contribution could be used in the present context where, instead of a simple VAR, we have a panel-VAR. The Pesaran and Smith paper, by explicitly considering cointegration in dynamic models for panel-data, could also be relevant for this purpose.

In general, the identification of the permanent and cyclical components of the data, and of their reciprocal interplay, could provide useful insights for the descriptive purposes of this paper, by simply adding more information on the nature of the stochastic processes generating the data. The study of the relationship between the different (permanent or transitory) factors that generate the data could provide useful insights on the relevance of the theoretical models discussed above.

B4.   Saving-Investment-Growth Links

The objective of this research component is to provide an analytical framework, derived from first principles, capable of addressing three major stylized facts: the correlation between saving and growth (documented, for example, by Carroll and Weil 1994), the saving-investment correlation (Feldstein and Horioka 1980, Feldstein and Bacchetta 1991), and the physical investment-growth correlation (sometimes referred to as "capital fundamentalism"). The purpose of the exercise is to assess the co-movement between those three variables under alterative assumptions about the structure of the economy and the nature of the shocks affecting it.

In order to do this, the research will be guided by a formal model. The model needs to be both analytically rich, in the sense of generating well-defined short-run, transition, and steady-state relationships between variables, and empirically relevant, in the sense of encompassing real-world determinants of saving, investment, and growth. To achieve these two requirements, a two-stage approach is followed for deriving structural equations for the three fundamental variables (consumption/output ratio, investment/output ratio, and real GDP growth rate):

(i) Derivation of a "core" model with well-specified dynamic equilibrium paths and transition equations that depend on relevant initial conditions and the paths of pre-determined variables.

(ii) Model extensions.

The Core Model

The proposed core model is based on the Lucas-Uzawa two-sector growth model (Uzawa 1965, Lucas 1988), encompassing both physical and human capital. The latter can also be interpreted more broadly as "non-physical" capital, an aggregate of human capital and knowledge. The basic model uses a two-sector framework in which production of the single final output uses both kinds of capital, while the accumulation of human (or non-physical) capital is carried out by the education sector and requires no physical capital. On the consumption side, preferences are time-separable and display a constant elasticity of intertemporal substitution and a constant rate of discount. Finally, population grows at an exogenously given rate. Under the assumption of constant returns to scale in both sectors of production, in a closed-economy setting the model displays endogenous balanced growth.

The core model extends this basic framework in three respects: (i) consumption inertia is added through the introduction of "consumption habits", in order to allow the model to generate a positive association between saving and growth due to consumption inertia; (ii) the model is adapted to a small open-economy setting; and (iii) convex adjustment costs to physical investment are assumed, to rule out unrealistic transition paths involving instantaneous jumps in the physical capital stock (matched by jumps in the opposite direction in the foreign asset stock). In turn, jumps in the human capital stock are automatically ruled out by the assumption that its production technology uses only human capital.

The analytics of the basic model, in a closed-economy setting, have been examined by Barro and Sala-i-Martin (1995) and Caballe and Santos (1993). Below we outline the derivation of the extended model's equilibrium. For simplicity, we can assume that households own the firms and make all production, consumption, and capital accumulation decisions. At every instant, the representative household must decide how to divide the use of its human capital between final goods production and human capital accumulation. In addition, it must also decide on the levels of consumption and physical capital accumulation. We assume that accumulation of physical capital at a rate different from that of human capital incurs convex adjustment costs; this formulation is particularly convenient because adjustment costs vanish in the steady-state, when both kinds of capital grow at the same rate.

Letting n denote the exogenous rate of population growth and ρ the rate of time preference, and expressing all variables in per-capita terms, the representative household's objective is to maximize the utility functional:

$$\int_{t}^{\infty} e^{-(\rho - n) s} \frac{\left(\dfrac{c}{z^{1-\gamma}}\right)^{1-\theta}}{1 - \theta} \, ds \tag{1}$$

subject to

$$y \le A k^{\alpha} (uh)^{1-\alpha} \tag{2a}$$

$$\dot{f} \le y - I - \frac{\theta}{2} k \left[\frac{I}{k} - (\delta_k + n) - \left\{ \frac{B(1-u)h - (\delta_h + n)h}{h} \right\} \right]^2 - C + tr + (r - n)f \tag{2b}$$

$$\dot{k} \le I - (\delta_k + n)k \tag{2c}$$

$$\dot{h} \le B(1-u)h - (\delta_h + n)h \tag{2d}$$

$$\lim_{\tau \to \infty} e^{-(\rho - n)\tau} f \ge 0 \tag{2e}$$

Here z denotes the stock of consumption habits, and the parameter $0 \le \gamma \le 1$ measures (the reciprocal of) its importance in the instantaneous utility function. If γ equals 1, only current consumption matters, while if γ equals zero utility depends only on consumption relative to the habit stock. In turn, u is the fraction of human capital used in goods production, δ_j is the depreciation rate of type-j capital, A, B and ϕ are positive parameters, f denotes the foreign asset stock, tr are foreign transfers (assumed to equal an exogenously given fraction of output y), and r is the real interest rate on foreign lending and borrowing. Equation (2a) describes the production technology for final goods, while (2b) describes the household's current account balance, with adjustment costs assumed quadratic for analytical simplicity. (2c) and (2d) describe the accumulation of the two kinds of capital, while (2e) has to be imposed to avoid Ponzi schemes of unbounded foreign borrowing.

Consumption habits are assumed to be "external" -- i.e., the habit stock z reflects past per-capita consumption levels of all households in the economy, and the representative household views the evolution of z as exogenous. Its time path is given by

$$\dot{z} = \eta(c - z) \tag{2f}$$

where the parameter η measures the persistence of habits -- the smaller η, the lesser the influence of current consumption on the habit stock (see Carroll, Overland and Weil 1994, and Ryder and Heal 1973).

The household's control variables are c, u and I. It is convenient to let λ, λq and λp respectively denote the shadow values of foreign assets, physical and human capital. Then, ignoring for the moment (2f), and replacing (2a) into (2b), after some manipulation the first-order conditions of this problem can be shown to include:

$$\frac{\dot{c}}{c} = \frac{1}{\theta}(r-\rho) + (1-\gamma)\ (1-\frac{1}{\theta})\ \frac{\dot{z}}{z} \tag{3a}$$

$$(1-\alpha)\ A[\frac{k}{uh}]^{\alpha} = pB + \frac{k}{n}(q-1) \tag{3b}$$

$$\frac{\dot{k}}{k} = \frac{q-1}{\Phi} + B(1-u) - (\delta_h + n) \tag{3c}$$

$$\frac{\dot{h}}{h} = B\ (1-u) - (\delta_h + n) \tag{3d}$$

$$\dot{f} - (r-n)f = Ak^{\alpha}(uh)^{1-\alpha} - k\ [\frac{q-1}{\Phi} + \delta_k - \delta_h + B(1-u)] - \frac{(q-1)^2}{2\Phi}\ k - C + tr \tag{3e}$$

$$\dot{q} = (r + \delta_k) q - \left[\alpha A \left(\frac{uh}{k} \right)^{1-\alpha} + \left(\frac{q-1}{\phi} \right) \left\{ \frac{q-1}{2} + \delta_K - \delta_h + B(1-u) \right\} \right] \qquad (3f)$$

$$\dot{p} = [r + \delta_H - B] p + u \frac{k}{h} (q - 1) \qquad (3g)$$

Using (3b) to replace u into the other equations, and taking into consideration (2f), the model's equilibrium dynamics can be summarized by seven differential equations describing the time paths of c, k, h, f, z and the shadow prices q and p. Forward integration of the arbitrage equation (3f), subject to the transversality condition preventing q from exploding, would show that q equals the present value of the marginal product of physical capital, augmented by the contribution of capital to reducing marginal adjustment costs, and discounted at the rate $r+\delta_k$.

Steady state - It may be useful to consider first the closed-economy case, which is the one commonly explored in the literature. If the economy is closed, then the left-hand side of (3e) must equal zero at all times, and this in turn determines the equilibrium real interest rate.

At the steady state, the ratio of physical to human capital, and the fraction of the latter allocated to each activity, must both be constant. It can be seen that (3c) and (3d) imply that the ratio of physical to human capital will be changing as long as q is different from unity. Thus, at the steady state q = 1, which from (3f) implies that the marginal product of physical capital, net of depreciation, must equal the real interest rate. To prevent p from exploding, (3g) then requires that $B= r+\delta_h$, or, in words, that the marginal product of human capital (net of depreciation) in the production of human capital equal the real interest rate. Since B and δ_h are given, this in fact determines the steady-state real interest rate. From (2f) and (3a) we can then obtain the common steady-state growth rate of c, z, k, h and y, which equals

$$[\theta\gamma + 1-\gamma]^{-1} (B - \rho - \delta_h)$$

If $\gamma = 1$, so that habits are irrelevant, this is the standard result derived, for example, by Barro and Sala-i-Martin (1995). Otherwise, if $\gamma < 1$, consumption habits affect the long-run growth rate (note, however, that the latter is independent of the degree of habit persistence as measured by η). Finally, (2f) and (3e) can be used to determine the steady-state consumption/habit stock and consumption/output ratios.

Consider now the small open economy case, in which the domestic good is a perfect substitute for foreign goods, the economy can borrow and lend at the world real interest rate r*, and the foreign asset stock f is endogenously determined. Under perfect capital mobility and perfect asset substitutability, r* is given by world asset markets. It follows from the above discussion that a balanced-growth steady-state can exist only if r* = $B-\delta_h$, the closed-economy equilibrium interest

rate. [This is analogous to the requirement that r* equals the rate of time preference ρ for a steady state to exist in open-economy exogenous-growth models].

Thus, balanced growth rules out *permanent* deviations of the real interest rate from B-δ_h, but *temporary* deviations can be allowed for by suitable extension of the model. The simplest way to do so is to rule out either perfect capital mobility or perfect asset substitutability (an alternative would be to allow for a time-varying technology, involving a changing B). The consequences of removing the first assumption have been explored by Barro, Mankiw and Sala-i-Martin (1992) in the context of an exogenous-growth model with borrowing constraints. With a binding foreign borrowing constraint (in the form of a floor for the foreign asset/output ratio, for example), the model eventually reverts to the closed-economy case, albeit with a non-zero foreign asset stock. An obvious alternative is to impose imperfect asset substitutability by assuming that the relevant interest rate for the country's aggregate borrowing and lending abroad is a negative function of the foreign asset/GDP ratio:

$$r \quad = \quad r^* \quad - \quad \varphi(\frac{f}{k}) \qquad\qquad (4)$$

where $\varphi' > 0$ and r* now denotes a "base" international interest rate. The model consisting of (3)-(4) is, in principle, capable of generating balanced long-run growth: if the f/y ratio is changing, as it would under unbalanced growth, the real interest rate would also be changing over time, thereby altering the growth rates of the endogenous variables. A steady state would again be characterized by r = B-δ_h; from (4), this would yield the equilibrium foreign asset/output ratio, and the steady state c/y ratio could be then derived from (3e).

Model Extensions

Although the core model extends in several respects the existing literature, it still remains highly stylized. To enhance its realism, some further extensions can be introduced.

Heterogeneity - A key extension is to remove the assumption of identical intertemporally-optimizing agents, to allow for some heterogeneity in consumption and investment behavior. This can be done along the lines of Schmidt-Hebbel and Serven (1994, 1995). In the case of consumption, assume that only a fraction $0 < \upsilon < 1$ of households base their consumption decisions on intertemporal optimization; the remaining households are either myopic or impatient and liquidity-constrained, and devote their entire income to consumption:

$$c \quad = \quad \gamma \, c_u \quad + \quad (1 \, - \, \upsilon) \, [y \, + \, tr] \qquad\qquad (5)$$

where c_u is consumption by unconstrained, intertemporally-optimizing households, and its rate of growth is given by (3a) above. This extended formulation allows the model to replicate the "excess

sensitivity" of consumption to income encountered in empirical studies (see e.g. Campbell and Mankiw 1991).

A similar specification can be used to introduce liquidity constraints or myopia in investment decisions. Empirically, investment has been found to be significantly affected by firms' current cash flows, a likely indication of liquidity constraints (see e.g. Fazzari, Hubbard and Petersen, 1988). To take account of this fact, we can again assume that only a fraction $0<\mu<1$ of investment is geared to intertemporal optimization, with the remainder being determined by current profits, in turn given by the marginal product of physical capital times the capital stock:

$$I = \mu\, I_u + (1 - \mu)\,(1 - \alpha)\, y \tag{6}$$

where I_u is the intertemporally-optimizing investment rule derived earlier. Equations (5) and (6) do not alter the model's capability to generate endogenous steady-state growth, but will generally affect the economy's steady-state configuration as well as its dynamics outside the steady state.

Adjustment costs of human capital accumulation - In reality, the accumulation of human capital is arguably much slower than that of physical capital. In order to replicate this fact, the above formulation involving adjustment costs of changing the physical/human capital ratio could be replaced with the assumption of convex adjustment costs to changes in k and h, separately. However, unless such costs are specified so that they vanish in the steady state, the model's long-run solution will be greatly complicated. A perhaps preferable option to achieve the same objective would be to retain the above formulation and add convex costs of labor reallocation -- i.e., costs of changing u.

Relative prices - The formulation above assumes implicitly that the final good produced by the domestic economy is a perfect substitute for foreign goods, and the relative price of investment goods in terms of consumption goods is unity. It would be straightforward to modify this specification to allow for imperfect substitutability between domestic goods and imports (retaining, however, the small country assumption that their relative price is exogenously determined), and for different import contents of consumption and investment (a highly realistic feature for LDCs). Adequate consideration of the relative prices of the latter has been shown by Taylor (1994) to be an important element in helping explain the Feldstein-Horioka puzzle.

Implementing the Model

To implement the model it is useful to keep in mind the relationship of its aggregates with those in the National Accounts. The latter record only a limited portion of human capital accumulation (excluding, for example, the value of the time foregone by students), so that measured GDP is probably broader than the model's y but falls short of the theoretically correct aggregate that would include also human capital investment. Moreover, recorded expenditures on human capital formation are typically classified as consumption rather than investment, so that the consumption aggregate of the National Accounts includes not only the theoretically correct c in the model, but also

some fraction of human capital investment. Thus the National Accounts understate output, saving and investment, and overstate consumption expenditures.

The model brings out different channels of transmission between consumption (or saving), investment and growth. The latter is determined by "broad" investment, i.e., the accumulation of both physical and human capital. Since correctly-measured saving includes human capital accumulation, growth is in fact driven by "broad" saving, but the co-movement of the latter with "broad" investment depends on the external financing regime and on the type of shocks affecting the economy -- and the same applies to conventionally-measured saving and investment. In turn, with consumption habits, consumption of goods depends on its past history and on current and future anticipated income. Depending on the force of consumption habits, anticipated output growth may raise or reduce conventionally-measured saving. Finally, anticipated output growth -- brought about, for example, by exogenous productivity improvements -- raises the profitability of investment and encourages capital accumulation -- human, physical, or both.

Model Simulation

An analytical solution to equations (3)-(6) is in general not available. Instead, the model will be simulated to explore its properties, focusing on the co-movement of saving, investment and growth along the adjustment path to the steady-state and, in particular, on their response to disturbances. The simulations will investigate the consequences of alternative assumptions regarding the external financing regime, the degree of consumption inertia, and the proportion of myopic agents in the economy, along the lines of Schmidt-Hebbel and Serven (1994, 1995). This framework allows exploring, for example, the degree of consumption inertia necessary to replicate a persistent co-movement between saving ratios and growth rates of the magnitude observed in East Asian countries over the last two decades.

Parameterization - The model will be parameterized for a "representative" developing economy. Estimates of the parameters of the goods production function are widely available in the literature. In turn, estimates of the parameters of the utility function with consumption habits are more scarce, and different values will be explored. Estimates of B, the technology parameter in the production of human capital, are not directly available. However, a rough estimate can be obtained from the steady-state condition $r = B - \delta_h$, using a plausible value for δ_h. Likewise, estimates of the adjustment cost parameter ϕ are also available, although they are based on the standard specification of adjustment costs involving only physical investment and would need to be transformed to fit our framework.

Capital stock estimates are available for a number of developing economies. In turn, the stock of human capital will be obtained from the data base recently developed by Nehru *et. al.* (1995), or approximated by measures of educational attainment. From these estimates we will derive initial values for the k and h ratios.

Simulation method - The simulations will explore the impact of disturbances, distinguishing between their instantaneous, transition, and steady-state effects on the endogenous variables. In simulating

the model it is important to keep in mind that f, k, h and z are state variables, while c, p and q are not. The latter can jump at a point in time in response to new information about the current and/or future paths of the exogenous variables. Given initial conditions for f, k and h, solving the model essentially amounts to finding initial values for the jumpers so that the model will converge to its steady-state equilibrium.

Since the simulations will be concerned with dynamic trajectories originating possibly very far from the steady-state, a linearized solution procedure can be inaccurate and provide misleading results. To prevent this, the full non-linear model will be solved. This will also allow the identification of any significant non-linearities arising in the model's response to disturbances (see below). To solve the model we will use the method outlined in Schmidt-Hebbel and Serven (1994), which combines multiple shooting (see Lipton et. al., 1982) with Fair and Taylor's (1983) extended-path approach.

Simulation scenarios - Three main types of simulation exercises will be undertaken. Under alternative assumptions about the external borrowing regime and the extent of liquidity constraints in consumption and investment, the simulations will respectively explore:

(i) the economy's adjustment path starting from alternative initial values of the physical/human capital ratio. In the closed-economy model without adjustment costs and habits, the patterns of consumption, investment and growth along the transition path depend only on whether this ratio is above or below its steady-state level . The simulations will examine if this continues to be the case once consumption habits, adjustment costs and external borrowing are brought in, and will focus also on their effects on the speed of adjustment and on the saving-investment-growth co-movement along the transition path.

(ii) the response to changes in foreign transfers (as a fraction of GDP). As noted earlier, in the above formulation these are equivalent to terms-of-trade changes. Their impact on consumption, saving and growth will be examined, distinguishing between permanent and transitory, anticipated and unanticipated disturbances.

(iii) the response to productivity changes in the production of goods (as measured by the parameter A above).

B5.   What Determines Saving at the Household Level?[25]

This research component will investigate the determinants of household saving using time-series of cross-section household surveys from a set of diverse countries. It will focus on two issues: the role of life-cycle patterns in household saving rates, and the role of habits, the acquisition of durable goods and other non-life-cycle determinants of saving behavior.

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[25] Prepared by Angus Deaton and Christina Paxson.

As already discussed, there is a large body of cross-country evidence that economic growth rates and aggregate saving rates are positively correlated, see for example Modigliani (1970), Maddison (1992), Bosworth (1993), and Carroll and Weil (1993). However, as we noted above, the direction of causality -- from growth to saving, or from saving to growth--is not well-understood. There are several economic theories that predict a correlation between saving and growth, but with very different implications for causality. First, growth models imply that an increase in a country's aggregate saving rate will increase the rate of economic growth, either in the short-run as the country moves to a new steady state, as in neoclassical growth models, or in the long-run, as in many endogenous growth models such as Romer (1986) and Lucas (1988). Second, Modigliani's classic life-cycle model predicts a correlation between savings and growth, but with the direction of causality reversed. As economic growth increases, the life-time resources of the young increase relative to the old, and since (according to the theory) the young save more than the old, aggregate savings rates increase. Third, models of habit formation imply that individuals who experience unexpected growth in incomes will save more in current and future periods. The basic idea of these models is that the marginal value of consumption depends on a stock of habits (perhaps embodied in a stock of durable goods) accumulated in the past. Habit stocks cause consumption to respond more slowly to earnings innovations than is implied by standard permanent income models, see Carroll and Weil (1993) and Deaton (1995). The result of earnings growth is therefore higher saving, at least in the short run, until stocks of habits adjust to higher levels.

Note that although the second and third of these mechanisms have similar implications for the effect of growth on saving, they operate quite differently. The life-cycle effect of growth on saving is an aggregation phenomenon that comes from changing the "weights" of different age groups within the population. By contrast, the habit effect, whereby consumption drags behind income changes, operates for individual households over time.

These three explanations of the link between saving and growth have quite different policy implications. The first implies that policies designed to increase aggregate saving rates, such as mandatory retirement saving plans or the introduction of tax-free savings vehicles, will result in higher growth at least in the short run, and higher standards of living. The second and third explanations do not have this implication, since higher saving is the *result* rather than the cause of growth. Of course, these three explanations for the link between saving and growth are not mutually exclusive (or even exhaustive), and few would argue that a link from saving to growth does not exist. However, to better assess the usefulness of policies that promote saving, it is desirable to know how much of the correlation between saving to growth can be accounted for by life-cycle theory and models of habit formation.

We propose to investigate the effects of growth on saving using time-series of cross-sections of household surveys from a set of diverse countries. The plan is to write two papers, one that examines life-cycle patterns in saving rates, and a second that examines non-life-cycle determinants of saving, including the role of habits and the acquisition of durable goods in saving behavior. Both of these papers will use a common data base, which will consist of time-series of cross-sectional household income and expenditure surveys from a range of countries. These data can be used to track the earnings, income, consumption and saving experiences of *birth cohorts* over time. For example,

if a country has conducted income and expenditure surveys annually since 1980, these can be used to construct averages (and medians) of income, consumption, and saving in each survey year for each group of people born in the same year. It is then possible to examine the evolution of income, consumption and saving for each birth cohort. Birth cohorts can be defined over individuals, or over households, using the age of the head of the household to determine cohort membership.

There are several advantages to working with cohort data. First, they are much richer than standard aggregate time series, since they follow a large number of aggregates, and they can be used to better understand the underlying sources of time-series fluctuations in national aggregates. Second, cohort data are well-suited to the analysis of the life-cycle and habit formation models discussed above. Since the cohort data are more dissaggregated than national time series, they can be used to analyze what are essentially micro theories of household behavior. At the same time, the use of cohort means (or medians) reduces the amount of measurement error and noise that characterize micro and panel data. Third, cohort techniques can be used to track other features of the data, such as medians or other percentiles, as well as higher moments. In general, the cohort data can be tailored to the analysis. For example, it is as easy to compute the averages or medians of logs as of levels, and we can control the selection criteria for inclusion, so that the aggregates correspond as closely as possible to the theoretical magnitudes.

A good deal of this data assembly has already been done, at least for some countries. Funded by the National Institute of Aging to look at saving and inequality among the elderly, Deaton and Paxson have assembled (or are assembling) time-series of cross-sections of data from Taiwan (17 surveys), Britain (21 surveys), the US (12 surveys), Thailand (6 surveys), Indonesia (4 surveys), Malaysia (4 surveys), and Singapore (2 surveys). We would like to expand the list of countries to include Korea, Colombia and the Philippines, and are in the process of gathering information on the characteristics and accessibility of data from these countries.

The analysis of the cohort data will be broken into two separate papers. The first paper will examine life-cycle patterns in income, consumption, and saving, and will focus on the effect of growth on saving via the life-cycle mechanism. It will contain the following components:

- The first step will be to identify age and cohort effects in income, consumption, and saving profiles. This is essentially done by regressing the variables of interest on sets of age and cohort dummy variables, with the possible inclusion of controls for household size and composition that may affect both preferences for consumption as well as the earnings potential of households.

- The estimates of the age profiles of consumption and income will be compared within and across countries. As is pointed out by Carroll and Summers (1991), life-cycle theory indicates that the age profile of consumption is determined solely by tastes and interest rates. If these factors do not vary greatly across countries, and provided that differences across countries in household size and composition have been controlled for, then the estimated age profiles in consumption should be similar. Preliminary work on the US, Britain, Taiwan, and Thailand in Paxson (1995) suggests that age profiles differ substantially across countries. An alternative

to standard life-cycle theory, that consumption tracks income over time within cohorts, can be assessed by examining the coherence of the age profiles of income and consumption. A finding of "tracking" supports the idea that people buffer their consumption from income fluctuations over the short-run but not the long-term, as is predicted by buffering models (see Deaton, 1992, for a review.)

- The decomposition analysis described above will be done for medians, means, and other percentiles of the variables of interest. For magnitudes that are positively skewed, like income and saving, means may be heavily influenced by a few large observations. Medians provide a useful alternative. In addition, if wealthy people are life-cycle smoothers, and poorer people are not, consumption and income profiles should show greater synchronization for lower than higher quantiles. The data can also be used to assess the relationship between bequests and wealth. Bequests imply that life-time consumption is less than life-time income, and if bequests are a luxury good than the share of life-time resources that are unspent will increase with wealth. This can be addressed by comparing the saving behavior of wealthy and less-wealthy members of the same cohort, as well as comparing saving behavior across wealthy and less-wealthy cohorts.

- The last part of the analysis will use the estimates of age profiles of income, consumption, and saving to quantify the effect of growth on aggregate saving rates. These calculations will be provided for a variety of specific assumptions about the effects of growth on age-income profiles. For example, given age-specific saving rates, the effects on the aggregate saving rate of growth that shifts up age-income profiles without changing their shapes can be computed. Of course, it is also possible that growth will steepen age-income profiles, with different implications for aggregate saving. For countries with time-series of data long enough to span a "high growth" and "low-growth" period, the actual effect of growth on age-income profiles can be assessed, and this will give us a handle on which of the estimated effects of growth on saving is most reliable. A major aim of this section will be to see how much of the observed cross-country correlation between saving and growth can be accounted for by the effects of growth on saving predicted by life-cycle theory.

The second paper will examine non-life-cycle determinants of saving within cohorts, and will focus on the role of habits and the acquisition of durable goods in saving behavior. There are three major components to the analysis. The third of these is large enough so that it may be split off into a separate paper.

- The first section will use the cohort data to estimate the effect that the past earnings growth of a cohort has on its current savings rate. The basic method will be to regress savings rates on lags of earnings growth rates, including controls for age and cohort effects as well as other factors (such as family size and composition) that may affect saving rates. This has been done for Taiwan (Deaton and Paxson, 1994) and the US, the UK, and Thailand (Paxson, 1995), with the finding that although cohorts that have experienced faster earnings growth have higher subsequent saving rates, the effect of growth on saving is small relative to the

correlation between growth and saving observed in cross-country data. This analysis will be repeated for the other countries for which we have data.

- Models of habit formation imply that expected versus unexpected earnings growth will have different effects on savings. Earnings growth over the life-cycle that is *predicted* by consumers need not produce higher savings, unless consumers are myopic. Unexpected earnings growth will, however, result in higher current and subsequent saving, since habits slow the adjustment of consumption to earnings innovations. Testing these ideas formally requires that one distinguish between expected and unexpected income growth, something that is quite difficult to do. However, useful information on this issue may be gleaned by comparing the response of saving to growth across countries with different growth histories, and across time periods within countries. For example, the theory predicts that, all else equal, the effects of growth on saving will be larger in countries whose higher growth rates are more recent phenomena. Comparisons of countries such as Thailand and Indonesia with countries like Taiwan and Korea, whose high growth rates have persisted over longer periods of time, will provide information on whether higher savings rates are likely to be a short-run or long-run response to increases in growth rates.

- The third section will examine other non-life-cycle reasons why saving may respond to economic growth. One possible reason concerns liquidity constraints. Consumers who cannot borrow against future income to acquire durables (including housing) may "save up" for these purchases. This process can produce a link between growth and saving that is similar to the standard life-cycle mechanism: growth increases the demand for durable goods and housing among younger consumers (with higher life-time wealth), and therefore leads to more "saving-up" behavior. A policy-relevant implication is that credit market imperfections that prevent individuals from borrowing against future income may actually increase saving, especially in high growth economies. Support for the hypothesis comes from Jappelli and Pagano (1994), who show that countries with higher minimum down-payment requirements for house purchases have, other things equal, higher saving rates.

- The relationships between liquidity constraints, durable goods, and growth will be investigated in the following ways. First, differential restrictions on the availability of home mortgages will distort the age profile of consumption in predictable ways that are different across countries. With cohort data from several countries with different restrictions, and with some idea of the ratio of house prices to income, these propositions can be readily tested. Second, many household income and expenditure surveys have information on the ownership of specific durable goods, such as vehicles, major appliances, and homes. These can be used to determine age and cohort effects in ownership, and the relationship between ownership and saving behavior. Similar work has been done by Besley and Levenson (1994) in the context of Taiwan, and can be done in other countries, such as Thailand, where suitable data are available. It will be of particular interest to compare patterns of saving and housing purchases across countries with different compulsory saving plans in place. In Singapore, for example, funds from compulsory saving accounts can be used to finance the housing purchases,

whereas in Malaysia the funds are not available for this purpose, and these different institutional features have different implications for age profiles of household saving.

Data

The raw data used for these analyses will consist of time-series of cross-sections of household income and expenditure data. Our goal is to obtain data from as diverse a group of developing countries as is possible. Suitable data sets exist for Taiwan, Thailand, Malaysia, Singapore, Korea, and possibly for Colombia and the Philippines. Unfortunately, we have been unable to identify suitable data from any African country. Data from the United States and Britain will also be used, so that we can examine differences and similarities across more and less developed countries. The following four data sets are currently available at Princeton, and have been used by Deaton and Paxson to do preliminary work on several of the topics discussed above:

(1) *Taiwan*

The *Personal Income Distribution Surveys* of Taiwan have been conducted annually since 1976. We have all surveys up to and including 1992; the 1993 survey should be available shortly. These are large surveys, covering between 11,000 and 15,000 households per year. They contain information on earnings from employment and self-employment both at the household level and at the level of the individual, information on property income and transfers, and detailed information on consumption expenditures in the year before the survey. There is also information on ownership of durable goods, housing characteristics, and very limited information on wealth changes during the survey year. In addition, the surveys contain basic socio-demographic information, such as the numbers, ages, sexes, and education levels of household members.

(2) *Thailand*

The *Socio-Economic Surveys* of Thailand have been conducted in 1975/6, 1981, 1986, 1988, 1990 and 1992, and each of these data sets is available at Princeton. Like the Taiwanese surveys, these are large cross-sectional income and expenditure surveys, with between 11,000 and 13,500 households surveyed per year. The Thai surveys are quite detailed. Because a large fraction of household income is from farming, the survey asked details about farm revenues and costs, and this information is used to measure farm profits. Information is on earnings, rents received (both in cash and in-kind), and income from financial assets was also collected. Consumption includes both home-produced and purchased items. The reference period for income is a year. The reference period for consumption items differs across items. Food consumption had a reference period of a week, other small expenditure items (such as clothing, personal supplies, and entertainment) had a reference period of a month, and major expenditure items (such as bicycles and major appliances) had an annual reference period. Information on standard socio-economic variables, household ownership of durable goods and housing, and changes in real and financial assets in the month before the survey are included.

(3) *United States*

The US data are from the *Consumer Expenditure Surveys* (CEX) from 1980 to 1992. The CEX is a "rolling panel" that interviews approximately 7000 households per year. Each household is interviewed 5 times, once each quarter, with different households beginning their series of interviews in different quarters. The results of the 2nd through 5th interviews are made available. Not all household complete the full series of surveys, however, and the number of quarterly observations ranges from 15,613 to 20,716 per year. The information on each household in each quarter consists of detailed expenditure measures in the 4 months preceding the interview. Information on income was collected only at the 2nd and 5th survey (unless a job change was experienced between the 2nd and 4th survey), and refers to income in the previous year. The income figures for households in their 3rd and 4th interview refer to the 2nd-interview income figure. The US data are perhaps of lower quality than the Taiwanese and Thai data, and several researchers have questioned its accuracy and comparability to National Accounts figures (see Bosworth et. al., 1991, and Attanasio, 1994.) Top coding is a problem, particularly for income. The upper limit on specific income categories (e.g. self-employment income, salary income, etc.) was $100,000 by 1992, but was more severe in the early 1980's. Top coding may affect the accuracy of cohort averages, but should not affect the calculations of medians and all but the highest quantiles of income.

(4) *Britain*

Britain conducts an annual *Family Expenditure Survey* (FES), and data from 1969 to 1992 are available at Princeton. The survey was begun in 1954, and it may be possible to extend our series back to this date. The sample is representative of Great Britain, which is the United Kingdom excluding Northern Ireland. Approximately 7000 households are surveyed per year. Like the CEX, the FES is done on a quarterly basis, but households are not interviewed more than once, so that there are fewer observations over which to compute cohort means and medians. The FES's questions regarding income and expenditure are somewhat different than those from other surveys. The earnings measure (which is used when constructing income) is based on a question about "normal weekly earnings." Consumption also has a weekly reference period.

In addition to these four surveys, we are in the process of assembling data from Indonesia, Malaysia and Singapore. Of these countries, the Indonesian data are most complete. We have permission to use the SUSENAS surveys, provided we can obtain the data from researchers within the US who have already obtained it. We have already assembled files for income, expenditure, and basic household demographic information from 1980, 1984 and 1990 (provided to us by Mark Pitt of Brown University.) Income and expenditure surveys were also conducted in 1987 and 1992, and these data sets can be purchased from Biro Pusat Statistik.

We currently have data from Malaysian Household Income Surveys conducted in 1973, 1984, 1987 and 1989. Unfortunately, only the 1973 survey collected information on the expenditure items necessary for our work, and the consumption items are not included in the data which we have access to. The 1973 consumption information was used by Pravin Visaria at the World Bank, and we are trying to locate this data set (which we have permission to use). The Malaysians conducted an

expenditure survey in 1993/4, which has just recently been processed. Although our discussions with people in the Economic Planning Unit indicate that these data will not be released from the country for some time, they have agreed to construct cohort data for us. Data from Singapore will be available with similar restrictions: information from the two household income and expenditure surveys are not publicly available, but researchers within the Statistical Office will process cohort data sets. We are also in the process of identifying other countries with suitable data. Korea has conducted Family Income and Expenditure Surveys since 1983, and it may be possible to either obtain the surveys or have researchers within Korea process them for us. Colombia and the Philippines are two other possible countries, but we currently have very little information on whether these data sets are suitable or accessible.

Methods

Similar methods will be used to construct and analyze cohort data for each of the available data sources. For each country, two data sets will be constructed. The first will consist of cohort means, medians, and other summary statistics of variables of interest, where "cohort membership" is defined according to the year of birth of the head of household. The second will be similar to the first, except cohort membership will be defined according to the birth year of each individual. These two types of data sets are complementary. The first can be used to track the evolution of total household income, consumption, and saving over time; the second can be used to examine the effects of growth on age-earnings profiles of individuals. A basic problem with the use of cohort data to analyze *household* behavior is selection into and out of household headship. The implicit assumption made when tracking cohorts defined according to the age of the household head is that the underlying population of household heads is constant over time. This will not be true if there is selection into and out of headship, caused by household formation and dissolution, marriage, divorce, and death. This is a special problem in economies such as Taiwan and Thailand, where elderly adults often co-reside with adult children. Selection into and out of headship may result in biased estimates of age profiles of income, consumption, and saving if, for example, poorer elderly individuals are more likely to move in with children (thereby ceasing to be household heads.) The cohort data sets based on individuals can be used to some extent to cross-check our results on households, although selection problems must be continually kept in mind when interpreting the results.

The first paper, on the life-cycle effects of growth on aggregate saving rates, will make use of extremely simple and flexible nonparametric methods. The starting point of this work is a simple version of the life-cycle model with no uncertainty. Consumption for a consumer i aged a and born in year b is a function of life-time wealth W_{ib} and preferences $f_i(a)$ is specified as:

$$c_{iab} = f_i(a) W_{ib}. \tag{1}$$

The function $f_i(a)$ determines how fixed life-time resources W_{ib} are allocated to consumption over the life-cycle, and in the "textbook" life-cycle model would be a constant. There is no reason, however, to believe that tastes for consumption do not vary with age, especially when (1) is applied to *household* rather than *individual* consumption . The advantage of specifying consumption as the product of life-time wealth and a "preference" function $f_i(a)$ is that the logarithm of consumption

can be expressed as the sum of an age-specific component and a fixed life-time wealth component. This linear expression can be averaged over all individuals aged a and born in year b, to obtain:

$$\overline{\ln(c_{ab})} = \overline{f(a)} + \overline{\ln(W_b)},\tag{2}$$

which can be estimated by regressing the average logarithm of consumption for each cohort-age cell on a set of age and birth-year dummy variables. Life-cycle theory implies that the estimated age effects measure life-cycle preferences for consumption, and the cohort effects reflect the effects of economic growth of the life-time wealth of each cohort. Equation (3) can be further modified to include cohort-age averages of other variables, such as the numbers of children and adults in the household, that may affect consumption regardless of age. Additionally, year effects can be included to account for common macro shocks to consumption, although the colinearity of age, year of birth, and time necessitates that restrictions be imposed on year effects, see Deaton and Paxson (1994) for details. Equations similar to (2) can be estimated for the average logarithm of income and average saving rates, as well as for medians and other percentiles of these variables. As discussed in Section 1, the estimates of age effects in these variables will be compared across countries and within countries, and will also be used to quantify the effects of growth on saving.

To illustrate how these calculations can be done, consider the exercise of computing the effect of growth on the aggregate saving rate, when growth has the effect of shifting up age-income profiles without changing their age profiles. The income of a cohort aged a in year t can then be expressed as:

$$y_{at} = e^{h(a)}(1+g)^{t-a},\tag{3}$$

where the function $h(a)$ measures age effects in the logarithm of income, and the term $(1+g)^{t-a}$ measures the effect of growth on income on cohorts born in year $t-a$. The fraction of aggregate income earned by those aged a can be expressed as:

where η_α is the fraction of households aged α. Notice that the assumption that growth does not

$$y_{at}^s = \frac{e^{h(a)}(1+g)^{-a}}{\displaystyle\sum_{\alpha=1}^{A} e^{h(\alpha)}(1+g)^{-\alpha}\eta_\alpha}\tag{4}$$

change the shape of age-income profiles implies that the share of income earned by each age group is independent of time. Likewise, the aggregate saving rate (s/y) is independent of time, and can be expressed as:

where $s(a)$ is the age-specific saving rate. Equation (5) can be used to derive the partial effect of changes in the growth rate g on the aggregate saving rate.

$$(s/y) = \frac{\sum_{a=1}^{A} s(a) e^{h(a)} (1+g)^{-a} \eta_a}{\sum_{a=1}^{A} e^{h(a)} (1+g)^{-a} \eta_a} \tag{5}$$

$$\frac{\partial(s/y)}{\partial g} = \frac{1}{(1+g)} \frac{\sum_{a=1}^{A} (s/y - s(a)) e^{h(a)} (1+g)^{-a} \eta_a}{\sum_{a=1}^{A} e^{h(a)} (1+g)^{-a} \eta_a}. \tag{6}$$

Information on the age profiles of income and savings rates can be used to fill in for $s(a)$ and $h(a)$ in (5) and (6) for various growth rates. Similar calculations can be done for growth that affects both the levels and shapes of age-income profiles, although for these calculations the age effects in consumption rather than saving rates must be used in the formulae (since age-specific saving rates will change with growth.)

The second paper, that examine non-life-cycle effects of growth on saving, will make use of similar methods. The first part of the analysis, which examine the effects of previous growth on current saving, will consist of regressions of the following form:

$$(s/y)_{at} = \beta_0 + \sum_{j=1}^{K} \beta_j \Delta \ln(e_{a,t-j}) + \epsilon_{at}, \tag{7}$$

where (s/y) is the saving rate of cohorts aged a in year t. The term $\Delta \ln(e_{a,t-j})$ is the change in earnings between $t-j$ and $t-j-1$. Controls for age and cohort effects, as well as variables that measure household size and composition, will be also be included. Equation (7) will be estimated for each country separately, and for different time periods within countries. The second part of the analysis, which examines saving, growth, and the acquisition of durable goods and housing, will make use of cohort-level data on ownership of durables and housing, and will use nonparametric methods to identify age and cohort effects in these variables. These will then be related to age and cohort patterns in saving rates of each country, to examine whether the "saving up"models is plausible, and will also be compared across countries with different credit market characteristics.

C.   POLICY ISSUES OF WORLDWIDE IMPORTANCE

This component of the research will focus on the consequences of specific government policies and reforms on private and national saving levels. This will provide a much-needed set of empirical results to assess the relative importance of policies that intendedly or unintendedly affect saving levels. The focus below is on both stabilization and structural reform measures, including fiscal policies, trade and financial liberalization, tax and financial saving incentive schemes, and pension system reform. In addition, the response of private saving to foreign capital flows and terms-of-trade shocks will be identified.

C1.   How Effective is Fiscal Policy in Raising National Saving?

While fiscal deficits have been rising since the late 1980s in OECD countries and transition economies, the opposite trend -- towards greater fiscal orthodoxy -- is observed in developing countries (IMF 1995). Fiscal adjustment is the cornerstone of macroeconomic stabilization -- but the impact of lower public deficits on national saving and the current account remains both theoretically and empirically controversial. However, responding to this question is essential for assessing the effectiveness of fiscal policy in raising aggregate saving, contributing to the economy's external equilibrium, and reducing its vulnerability to external shocks such as abrupt changes in terms of trade and capital inflows. Likewise, the effectiveness of alternative fiscal instruments (taxes, government consumption, transfers) is still poorly understood.

An inference from the review of consumption theories in Part I is that the most popular consumption models offer strikingly different predictions on the effects of fiscal policy on national saving. While only current levels of taxation matter for consumption under the simple Keynesian hypothesis, both current and future taxes -- over an infinite horizon -- matter for consumption under the permanent-income hypothesis. This, in turn, is rejected by the Ricardian equivalence proposition, that states that only permanent (non-capital[26]) government expenditure matters for private consumption decisions, implying that alternative ways of financing a given level of government spending -- taxation, inflation, or debt -- affect neither private consumption nor national saving. According to the no-bequest life-cycle hypothesis, fiscal policy affects national saving as long as it shifts income across different generations -- which it typically does. If consumers face binding borrowing constraints, they will react to higher current taxes by cutting consumption, as if they were Keynesian or myopic. Finally, private consumers will react differently when they perceive public consumption or transfers payments as substitutes or complements to their own consumption spending (Bailey 1971). In sum, theoretical predictions

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[26] Whether only current public expenditure, or also public investment, is relevant in this regard depends on the perceived productivity of the latter. If public and private investment are indistinguishable, the assertion in the text is correct. At the other extreme, if public investment is viewed as essentially identical to public current expenditure, the variable relevant for private consumption decisions in a Ricardian world would be total public expenditure.

on the effectiveness of public saving in raising national saving range between nil and high, depending on the underlying framework. In addition, the quantitative impact of fiscal policy will depend on the type of fiscal instrument, its horizon of application, its inter-generational impact, and the extent of binding borrowing constraints among consumers.

What does the empirical evidence show on the effectiveness of fiscal policy in raising national saving? Most surveys of the evidence for OECD countries reject the Ricardian ineffectiveness proposition (Hayashi 1985, Hubbard and Judd 1986, Bernheim 1987, Leiderman and Blejer 1988; the notable exception is Seater 1993 who concludes that Ricardian equivalence holds approximately). Recent studies for developing countries also reject the Ricardian notion in its pure form but conclude that some offsetting of public saving by private savers does occur (Haque and Montiel 1989, Corbo and Schmidt-Hebbel 1991, Easterly, Rodríguez and Schmidt-Hebbel 1994, Edwards 1995a, Masson, Bayoumi and Samiei 1995).

Existing estimates of offset coefficients for developing countries are few, differ from each other, and are based on widely differing saving definitions, model specifications and empirical samples. For example, Corbo and Schmidt-Hebbel (1991) develop a nested-hypothesis framework that distinguishes between Keynesian, permanent-income and Ricardian consumption hypotheses and apply it to a panel data sample of 13 developing countries, rejecting each of these three simple hypotheses in their pure forms. In the overall sample, they find a public-private saving offset coefficient of 0.47; this result, however, conceals a large variation in individual-country offset coefficients. For two larger samples of LDCs, Edwards (1995a) obtains offset coefficients that vary between 0.36 and 0.65, and Masson, Bayoumi and Samiei (1995) report an offset coefficient of 0.62. The implication is that public saving is a useful tool in raising national saving -- but researchers and policy makers are still far from sure of how effective are specific fiscal tools.

To contribute to a more precise and systematic understanding of the effects of fiscal policy on national saving, a new framework will be applied to developing-country and OECD data to assess the quantitative effects of specific fiscal instruments on private consumption, and hence on national saving. This study will aggregate value on the existing literature by allowing for:

- *Use of a new encompassing model.* In order to consider the different mechanisms through which public expenditure and revenue affect private consumption and saving, a model that aggregates over heterogeneous consumer groups is derived from first principles. Three distinct consumer groups share common preferences but differ in the restrictions they face in solving their intertemporal optimization problem. The first group is unable to optimize intertemporally because of a binding borrowing constraint, the second is comprised by permanent-income optimizers who do not face borrowing constraints, and the third group is Ricardian in the sense that it takes into account the government's intertemporal budget constraint. Consumer preferences embody the possibility of finite lifetimes (as in Blanchard 1985) and public/private consumption substitutability or complementarity (as in Bailey 1971). Therefore the aggregate consumption model nests five hypotheses that can be tested against each other and imply strikingly different policy implications: Keynesian or binding borrowing

constraints, permanent-income over infinite lives, permanent income over finite lives, Ricardian equivalence, and private/public consumption substitutability. This set-up generalizes previous consumption estimations for developing countries, that nest some of these hypotheses, such as Haque and Montiel 1989 (for the first, third and fourth hypothesis), Corbo and Schmidt-Hebbel 1991 (for the first, second and fourth), and Karras 1994 (for the fifth hypothesis).

• *Flexible model application.* In order to identify the effectiveness of specific fiscal instruments, the model application will distinguish between broad categories of fiscal revenue (taxes, non-tax revenue) and current government spending (government consumption, transfers). In addition, alternative forms of the model will be applied to deal with unobserved variables that are discounted sums over the future horizon, including expressions involving lagged terms and long-term moving averages.

• *Use of the project's Saving Data Base.* One of the main strengths of the saving data base is its inclusion of raw and adjusted data for public sector revenue and expenditure, and for private-sector disposable income (see Section A1). This makes it ideally suited for an empirical implementation of the model to the cross-country time-series sample of OECD and (non-transition) developing economies.

• *Adequate treatment of econometrics issues.* In order to deal adequately with lagged dependent and independent variables in a panel data context, the estimation will be based on dynamic-panel techniques, as discussed in Section A2 above.

The Model

The objective of this model is to provide a framework, derived from first principles, to address the effects of fiscal policy on private saving and hence on national saving. In doing this, we will allow for different mechanisms through which public expenditure and revenue decisions may affect private consumption or saving levels. The only tractable way to allow simultaneously for the operation of different mechanisms is by introducing heterogeneous consumer groups that differ in their reaction to fiscal policy, as considered previously by Haque and Montiel (1989) and Corbo and Schmidt-Hebbel (1992). As opposed to the latter, however, the heterogeneous consumer groups share common preferences but differ in the restrictions they face in solving their intertemporal optimization problem.

Intertemporal preferences over are given by a standard constant-elasticity function while intratemporal preferences allow for substitutability (or complementarity) between private consumption and public consumption expenditure. Consumer utility is maximized over an infinite horizon but lives are finite as each individual faces a constant probability of death in each period. Three consumer groups are considered here, each of them represented by a "representative" consumer. Consumer 1 is unable to optimize intertemporally because of a binding borrowing constraint that forces him to save a fixed share of her current disposable income. Consumer 2 is a

permanent-income life-cycle (PILC) optimizer who does not face borrowing constraints (BC) but does not either take into account the government's intertemporal budget constraint. Consumer 3 is an intertemporal Ricardian (R) optimizer who does not face borrowing constraints but substitutes the government's intertemporal budget constraint into her own.

This set-up combines therefore finite lifetimes (as in Blanchard 1985 and applied to LDC consumption function estimations by Haque and Montiel 1989) with a distinction between BC and R consumers (as in Haque and Montiel 1989 and Corbo and Schmidt-Hebbel 1992), with a distinction between PILC and R consumers (as in Corbo and Schmidt-Hebbel 1992), and with private/public consumption substitutability (as in Bailey 1971 and applied to LDC and OECD consumption functions by Karras 1994).

The optimization problem for consumer i (i=1,2,3) will be performed for an open economy with constant domestic interest rates (equal to long-term external interest rates) and no uncertainty. Consumer i maximizes lifetime happiness given by the following standard time-separable intertemporal utility function:

$$U_{it} = \sum_{s=t}^{\infty} \left(\frac{1}{1+\rho}\right)^{s-t} u\left(c_{is}^{*}\right)$$

(1)

where U is the present discounted value of current and future utility streams, u is a concave utility function of effective consumption c^{*}, ρ is the subjective discount rate, subindex i denotes consumer i, and sunindeces s, t denote time periods.

Maximization of (1) is subject to the following five constraints:

$$p_t y_{it} + rb_{it-1} + e_t tr_{it}^{*} - tt_{it} - \left(\frac{\pi_t}{1+\pi_t}\right) h_{it-1}$$

$$- \left[r_t^{*}(1+\varepsilon_t) + \varepsilon_t\right] f_{it-1}^{*} - c_{it}$$

$$= (h_{it} - h_{it-1}) + (b_{it} - b_{it-1}) - e_t f_{it}^{*} - e_{t-1} f_{it-1}^{*}$$

(2)

$$\equiv w_{it} - w_{it-1}$$

$$u\left(c_i^{*}\right) = \frac{\left(c_i^{*}\right)^{1-\theta} - 1}{1-\theta}$$

(3)

$$c_{it}^{*} = c_{it} + \delta g_{it}$$

(4)

$$w_{it} - w_{it-1} \equiv dy_{it} - c_{it} \geq (1 - \beta)\, dy_{it} \tag{5}$$

$$\lim_{s \to \infty} (\gamma R)^s\, (-w_s) = 0 \tag{6}$$

where p is the relative price of output (GDP) in units of private consumption, y is GDP, r is the domestic real interest rate, b is the domestic public debt held by the domestic private sector, e is the real exchange rate (the domestic nominal exchange rate times the foreign price level divided by the domestic price level), tr^* is foreign unrequited transfers to the private sector, tt is total tax and non-tax payments by the private to the public sector net of public transfers to the private sector, π is domestic inflation (percentage rate of change of the deflator of private consumption expenditure), h is domestic base money held by the private sector, r^* is the foreign interest rate, ϵ is the real exchange rate depreciation (percentage rate of change of e), f^* is the foreign debt of the private sector, c is private consumption, w is total private wealth, g is public consumption, dy is private disposable income as defined in the left-hand side of equation (2), and R is the gross discount factor defined as $(1+r)^{-1}$.

Equation (2) represents the intra-period budget constraint written such that adjusted saving (the left-hand side in 2) is equal to the change in real private wealth. This formulation is consistent with the definition for adjusted saving that will be used in constructing the project's macroeconomic data base as discussed in Section A1 above. Equation (3) defines the standard utility function characterized by constant relative risk-aversion with risk aversion coefficient θ, that is undistinguishable from the inverse of the constant intertemporal elasticity of substitution $(1/\theta)$.

Equation (4) defines effective consumption as an aggregate of private consumption and public consumption, similar to the equation defined in Bailey (1971) and Barro (1981), and a particular form of the slightly more general formulation by Christiano and Eichenbaum (1988) and Barro (1989). The formulation here is also very similar to that used in the empirical studies by Kormendi (1983) and Aschauer (1985) for the U.S., Ahmed (1986) for the UK, and Karras (1994) for a large sample of countries. The only difference of our formulation with those found in the preceding literature is that we specify a relation between private consumption of individual i and a part of overall government consumption (g_i) that corresponds to public goods enjoyed by consumer i (the relation of the latter to overall g is defined below). This formulation -- as the ones in the preceding literature -- assumes perfect substitutability (or complementarity) between private and public consumption. If the substitution parameter δ is negative (positive) government consumption substitutes for (complements) private consumption.[27]

Equation (5) reflects the borrowing constraint, that will be binding when private consumption reaches a share β of private disposable income. Finally, equation (6) defines the condition that rules out a Ponzi scheme of unlimited net debt accumulation by the private sector. Note that this condition

---

[27] Substitutability and complementarity are used here in the sense of rivalry, not in the Hicks-Allen sense. (For a further discussion see Karras 1994, footnote 1.)

requires that in the long term the gross rate of growth of net debt can not exceed the gross rate of interest (1+r) divided by the rate of survival, γ. The latter is equal to 1 (the rate of survival under infinite lifetime) minus the time and age-independent probability of death faced by each consumer in every period (Blanchard 1985). Hence an increase in the probability of death raises the consumer's effective discount factor γR.

Consumer 1 faces a binding borrowing constraint. Hence equation (5) holds with equality, implying that her consumption level is simply equal to:

$$c_{1t} = \beta dy_{it} \tag{7}$$

For borrowing-unconstrained consumers 2 and 3 equation (5) is not binding. The intertemporal budget constraint of consumer 2 is derived by combining equations (2), (3), (4), and (6):

$$\sum_{s=t}^{\infty} (\gamma R)^{s-t} c_{2s}^{*} = w_{2t} + \sum_{s=t}^{\infty} (\gamma R)^{s-t} \left(p_s y_{2s} - tt_{2s} + e_s tr_{2s}^{*} \right)$$
$$- pvihb_{2t} + \sum_{s=t}^{\infty} (\gamma R)^{s-t} \delta g_{2s} \tag{8}$$

Maximization of (1) subject to (8) yields the standard Euler equation for the ratio of future and current effective consumption levels:

$$\frac{c_{2t+1}^{*}}{c_{2t}^{*}} = \left(\frac{1+r}{1+\rho} \right)^{\frac{1}{\theta}} \tag{9}$$

Using equations (4), (6), (8), and (9) it is possible to derive the following expression for current-period consumption of consumer 2:

$$c_{2t} = [\gamma, \rho, r] \left\{ w_{2t} + \sum_{s=t}^{\infty} (\gamma R)^{s-t} (p_s y_{2s} - tt_{2s} + e_s tr_{2s}^{*}) \right.$$
$$\left. - pvihb_{2t} + \sum_{s=t}^{\infty} (\gamma R)^{s-t} \delta g_{2s} \right\} - \delta g_{2t} \tag{10}$$

where pvihb is the present value of interest costs incurred by holding base money (see Schmidt-Hebbel and Serven 1995) and the equilibrium discount factor [γ, ρ, r] is defined as:

$$[\gamma,\rho,r] \equiv \frac{(1+\rho)^{\frac{1}{\theta}}(1+r)^{1-\frac{1}{\theta}} - \gamma}{(1+\rho)^{\frac{1}{\theta}}(1+r)^{1-\frac{1}{\theta}}} \tag{11}$$

Note that (10) reflects that consumption is equal to permanent income, and the latter is the product of the equilibrium discount factor defined above and consumer net wealth. The equilibrium discount factor collapses to the simplified form $\rho/(1+\rho)$ when both the intertemporal elasticity of substitution is 1 and the survival probability are unitary.

The flow budget constraint of the consolidated public sector is given by:

$$tt_t + \left(\frac{\pi_t}{1+\pi_t}\right)h_{t-1} - rb_{t-1} - \left[r_t^*(1+\varepsilon_t)+\varepsilon_t\right]fg_{t-1}^* - g_t$$

$$= -\left(h_t - h_{t-1}\right) - \left(b_t - b_{t-1}\right) - \left(e_t fg_t^* - e_{t-1}fg_{t-1}^*\right) \tag{12}$$

where fg^* is net foreign public debt.

Now turn to consumer 3 who internalizes the government budget constraint. Define λ_i (i=1,2,3; the sum of the λ_i is 1) as the share of consumer i in public-private flows and stock holdings (assumed constant across different flows and stocks for each consumer i). Let's replace each public-private flow or stock holding related to consumer i, say x_i, by consumer i's share in overall x, that is λ_i x. Then the intertemporal budget constraint of consumer 3 can be derived by combining equations (2), (3), (4), (6) and the intertemporal version of the government budget constraint (12), as given by:

$$\sum_{s=t}^{\infty}(\gamma R)^{s-t}c_{3s}^* = -e_t\left(f_{3t}^* + \lambda_s fg_t^*\right) + \sum_{s=t}^{\infty}(\gamma R)^{s-t}\left(p_s y_{3s} - e_s tr_{3s}^*\right)$$

$$- \sum_{s=t}^{\infty}(\gamma R)^{s-t}\lambda_3 g_s + \sum_{s=t}^{\infty}(\gamma R)^{s-t}\delta g_{3s} \tag{13}$$

Maximization of (1) subject to (13) yields an analogous expression to the Euler equation derived for consumer 2 in (9). Using equations (4), (6), (13), and (9) it is possible to derive the following expression for current-period consumption of consumer 3:

$$c_{3t} = [\gamma,\rho,r]\left\{e_t\left(f_{3t}^* + \lambda_3 fg_t^*\right) + \sum_{s=t}^{\infty}(\gamma R)^{s-t}\left(p_s y_{3s} - e_s tr_{3s}^*\right)\right.$$

$$\left. - \sum_{s=t}^{\infty}(\gamma R)^{s-t}\left(\lambda_3 g_s - \delta g_{3s}\right)\right\} - \delta g_{3t} \tag{14}$$

Aggregate private consumption is simply defined by:

$$c_t = c_{1t} + c_{2t} + c_{3t}$$

(15)

Substituting (7), (10), and (14) into (15), and making use of the λ_i shares, yields the following expression for aggregate private consumption:

$$
\begin{aligned}
c_t = {} & \lambda_1 \beta \left\{ p_t y_t + rb_{t-1} + e_t tr_t^* - tt_t - \left(\frac{\pi_t}{1+\pi_t} \right) h_{t-1} - \left[r_t^* (1+\varepsilon_t) + \varepsilon_t \right] f_{t-1}^* \right\} \\
& + (\lambda_2 + \lambda_3) \, [\gamma, \rho, r] \left\{ \sum_{s=t}^{\infty} (\gamma R)^{s-t} \, [p_s y_s - e_s tr_s^*] - e_t f_t^* \right\} \\
& - \lambda_2 \, [\gamma, \rho, r] \left\{ \sum_{s=t}^{\infty} (\gamma R)^{s-t} tt_s + pvihb_t - h_t - b_t \right\} \\
& - \lambda_3 [\gamma, \rho, r] \left\{ \sum_{s=t}^{\infty} (\gamma R)^{s-t} g_s + fg_t^* \right\} \\
& + \delta (\lambda_2 + \lambda_3) \left\{ [\gamma, \rho, r] \sum_{s=t}^{\infty} (\gamma R)^{s-t} g_s - g_t \right\}
\end{aligned}
$$

(16)

Note that equation (16) nests various null hypotheses for aggregate consumption behavior:

(i)   Keynesian (or borrowing-constraints) hypothesis: $\lambda_1 = 1$, $\lambda_2 = \lambda_3 = 0$;

(ii) Permanent income - infinite lifes hypothesis: $\lambda_1 = \lambda_3 = 0$, $\lambda_2 = \gamma = 1$;

(iii) Permanent income - finite lifetimes: $\lambda_1 = \lambda_3 = 0$, $\lambda_2 = 1$, $\gamma < 1$;

(iv) Ricardian equivalence: $\lambda_1 = \lambda_2 = 0$, $\lambda_3 = \gamma = 1$;

(v)   Public/private consumption substitutability or complementarity: $\delta \neq 0$.

With regard to the latter hypothesis, note that private consumption is only affected by public consumption (if the null under (v) is true) when current and average future public consumption differ.

Equation (16) is not readily estimable because of unobserved variables that are sums over the infinite future horizon. Hence we propose two implementable variants for (16): one using lagged terms and the other estimated long-term averages.

Model Application

Consumption using Lagged Terms

First we go back to the individual consumer's optimal consumption equations (7), (10) and (14). Exploiting a relation between current and past expectations of future variables and subtracting $(1+r)/\gamma\ c_{it-1}$ (for i=2,3) from equations (10) and (14), and adding two the latter transformations equation (7), it is possible to derive the following expression for aggregate private consumption involving lagged terms:

$$
\begin{aligned}
c_t = \lambda_1\beta & \left[p_t\ y_t + rb_{t-1} + e_t\ tr_t^* - tt_t - \left(\frac{\pi_t}{1+\pi_t}\right) h_{t-1} - \left[r_t^*(1+\varepsilon_t) + \varepsilon_t\right] f_{t-1}^* \right] \\
& + (\lambda_2 + \lambda_3) \left[\frac{(1+r)/\gamma}{1+[\gamma,\rho,r]}\right] c_{t-1} \\
& + (\lambda_2 + \lambda_3) \left[\frac{[\gamma,\rho,r]}{1+[\gamma,\rho,r]}\right] \left[\left[p_t y_t - \left(\frac{1+r}{\gamma}\right) p_{t-1} y_{t-1}\right] + \left[e_t tr_t^* - \left(\frac{1+r}{\gamma}\right) e_{t-1} tr_{t-1}^*\right]\right] \\
& - \lambda_2 \left[\frac{[\gamma,\rho,r]}{1+[\gamma,\rho,r]}\right] \left[tt_t - \left(\frac{1+r}{\gamma}\right) tt_{t-1}\right] \\
& - \lambda_3 \left[\frac{[\gamma,\rho,r]}{1+[\gamma,\rho,r]}\right] \left[g_t - \left(\frac{1+r}{\gamma}\right) g_{t-1}\right] \\
& - \delta(\lambda_2 + \lambda_3) \left[\left[\frac{[\gamma,\rho,r]}{1+[\gamma,\rho,r]}\right] \left(\frac{1+r}{\gamma}\right) g_{t-1} + \left[\frac{1}{1+[\gamma,\rho,r]}\right] \left[g_t - \left(\frac{1+r}{\gamma}\right) g_{t-1}\right]\right]
\end{aligned}
\tag{17}
$$

Consumption using Estimated Long-term Averages

Define gy_s , gross consumer income, and gp , gross payments of the private sector to the government, and if g_s , interest payments on the foreign debt of the government as:

$$
gy_s \equiv p_s y_s + e_s tr_s^* - \left[r_s^*(1 + \varepsilon_s) + \varepsilon_s\right] f_{s-1}^*
\tag{18}
$$

$$
gp_s \equiv tt_s + \left(\frac{\pi_s}{1 + \pi_s}\right) h_{s-1} - rb_{s-1}
\tag{19}
$$

$$tfgs \equiv \left[r_s^* \left(1 + \varepsilon_s\right) + \varepsilon_s \right] fg_{s-1}^* \tag{20}$$

Note the appropriately defined estimated long-term average for any variable by a bar symbol over the corresponding variable. Then the aggregation of equation (7) and appropriately modified forms of equations (10) and (14) yield the following expression for aggregate private consumption involving estimated long-term averages:

$$
\begin{aligned}
c_t &= \lambda_1 \beta (gy_t - gp_t) \\
&+ (\lambda_2 + \lambda_3) \left[[\gamma, \rho, r] \left(\frac{1+r}{1+r-\gamma} \right) \right] \overline{gy}_t \\
&- \lambda_2 \left[[\gamma, \rho, r] \left(\frac{1+r}{1+r-\gamma} \right) \right] \overline{gp}_t \\
&- \lambda_3 \left[[\gamma, \rho, r] \left(\frac{1+r}{1+r-\gamma} \right) \right] \left(\overline{tfg}_t + \overline{g}_t \right) \\
&+ \delta(\lambda_2 + \lambda_3) \left[[\gamma, \rho, r] \left(\frac{1+r}{1+r-\gamma} \right) \overline{g}_t - g_t \right]
\end{aligned} \tag{21}
$$

Further Issues on the Empirical Application of the Model

In order to identify the effectiveness of specific fiscal instruments, the model application will distinguish between broad categories of fiscal revenue (taxes, non-tax revenue) and current government spending (government consumption, transfers).

The model will be applied to the data of the Saving Project's World Data Base. One of the main strengths of the World Data Base is its inclusion of raw and adjusted data for public sector revenue and expenditure, and for private-sector disposable income. This makes it ideally suited for an empirical implementation of the model to the cross-country time-series sample of OECD and (non-transition) developing economies.

In order to deal adequately with lagged dependent and independent variables, the estimation will be based on dynamic-panel techniques, as discussed in Section A2 above.

C2.   What Drives Consumption Booms ?[28]

Consumption booms are sustained periods of rapid growth in private consumption, during which the share of private consumption in GDP increases. Consumption boom episodes have been common in developing countries, and have been associated with a variety of exogenous events, including episodes of stabilization from high inflation, surges in capital inflows, the implementation of market-oriented structural reforms (especially including trade and financial liberalization), and favorable movements in the external terms of trade. The emergence of a consumption boom is often perceived as a policy problem due to its effects on demand for home and traded goods, and on the resources available for investment. In the case of inflation stabilizations, for example, the emergence of a consumption boom puts upward pressure on the prices of home goods and tends to undermine the stabilization objective. Brazil's Cruzado plan is perhaps the best-known example. Consumption booms that have emerged in the context of capital-inflow episodes have resulted in current account deficits that have undermined the credibility of the prevailing exchange rate and contributed to capital-flow reversals. The recent example of Mexico has now become notorious, but similar, if somewhat muted, boom episodes have characterized several other capital-importing countries in Latin America.[29]

Causes of Consumption Booms

In spite of the episodic importance of consumption booms in developing countries and their implications for short-run macroeconomic management, systematic study of the factors that explain the emergence of booms has only recently been undertaken. By and large, analysis of the causes of consumption booms has been confined to speculation based on casual empiricism in descriptive studies focusing on other issues (e.g., stabilization episodes, surges in capital inflows, etc.). In these contexts, several competing hypotheses have been offered to explain the emergence of booms, attributing the phenomenon to changes in alternative determinants of aggregate consumption expenditure. The leading ones are:

a. A redistribution of income from capital to labor in the form of increases in the real wage. Since wage earners as a group are more likely to be liquidity-constrained than recipients of capital income, aggregate consumption may rise in response. This mechanism has been cited, for example, as an explanation of the short-term booms that were associated with the populist economic programs of Salvador Allende in Chile in the early seventies, as well as of Alan Garcia in Peru during the late eighties.

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[28] Prepared by Peter Montiel.

[29] Another aspect of consumption booms that has recently become of concern is that, in the context of tax systems that emphasize expenditure taxes, the emergence of a consumption boom may cause recorded data to overstate the sustainable extent of fiscal adjustment, due to the favorable effect of the boom on government revenues (see Talvi (1994) and Calvo (1995).

b. A reduction in real interest rates associated with exchange-rate based stabilization programs. With high capital mobility, using the exchange rate as a nominal anchor reduces domestic nominal interest rates. If expectations of inflation remain high, however, the domestic real interest rate falls, triggering an increase in consumption expenditure. Rodriguez (1982) used such a model to interpret the macroeconomic dynamics associated with the Argentine "tablita" experiment in the late seventies.

c. A generalized easing of credit conditions in the context of financial liberalization. An easing of terms and increase in availability of funds to finance consumer expenditure may trigger a boom. This can be given a positive interpretation if artificial liquidity constraints are removed when financial repression is eliminated, facilitating consumer borrowing on secured terms (e.g., housing mortgage credit), or a negative one if financial liberalization takes place without adequate prudential supervision of banks, creating moral hazard problems for bank stockholders and their agents, the bank managers. Such a situation could promote high-risk lending at high real interest rates. Several observers have recently emphasized this phenomenon as a potential trigger for the recent Mexican consumption boom.

d. Lack of credibility in the sustainability of reforms. In the context of inflation stabilization, for example, a stabilization which is temporarily effective, but not expected to last, will lower the nominal interest rate for a short period. If money reduces the costs of economic transactions, current consumption will be cheap relative to future consumption, because low current nominal interest rates will lower the opportunity cost of holding the money balances required to effect current transactions. As a result, households will shift consumption to the present. In the context of a trade liberalization, an "incredible reform" (Calvo 1987) will generate the expectation of a future tariff increase, making imported durables temporarily cheap and causing an increase in consumer expenditure on such items. Argentina under the Austral plan, and Brazil under the Cruzado plan, are likely examples of this mechanism (Reinhart and Vegh (1995)).

e. Finally, booms may be triggered by a "euphoria" factor. If there are favorable movements in the external terms of trade, or structural reforms take place and are perceived to be so productive as to substantially increase the permanent incomes of households, then a boom in consumption represents an optimizing response on their part. Alternatively, if households are Ricardian and they anticipate a reduction in permanent future taxes (perhaps because of a permanent reduction in government consumption) the perceived increase in private wealth may arise from an intersectoral transfer, rather than an improvement in aggregate productivity. This story has been told in a variety of settings. It has been applied to the Chilean "tablita" during the late seventies, as well as to Argentina, Mexico, and other large recipients of foreign capital inflows during the early nineties.

It is clear that consumption booms arising from each of these disparate factors will have different policy implications, so identifying the causes of consumption booms in specific episodes becomes a matter of policy interest. Obviously, different consumption boom episodes may have different causes, and more than one of the driving factors listed above may be operative in any particular boom episode.

Research Methodology

Stylized Facts

The research proposed here will have two different objectives. The first objective is to attempt to narrow the scope of potential explanations for the emergence of boom episodes by establishing a set of stylized facts. This will be done by examining a broad range (across countries and over time) of both developing and industrial country data to obtain the broadest possible sample of consumption boom episodes. The identification of episodes will rely on an objective set of criteria based on the definition given above. For each identified episode, the potential roles of each of the factors identified above will be examined, through what amounts to a correlation analysis. The question to be addressed in this part of the work is whether macroeconomic phenomena associated with the boom were such as to allow scope for each of the hypotheses proposed above to explain the emergence of the boom during the period identified. In particular:

a. Was the boom accompanied by a major functional redistribution of income? Is there evidence for the country in question that aggregate consumption is affected by the functional distribution of income?

b. Did domestic real interest rates fall at the inception of the boom? Is there evidence that consumption expenditure is sensitive to changes in the real interest rate in the country in question? What light can the behavior of other components of absorption shed on the potential role of this variable?

c. Were there changes in the domestic financial system or in household access to external financial markets consistent with a finance-induced boom? This would involve not just financial liberalization but, as indicated above, an approach to liberalization which may have encouraged imprudent behavior on the part of lenders.

d. If the boom accompanied a stabilization effort, was the stabilization strategy the same across countries -- i.e., did booms tend to be associated only with exchange-rate based stabilizations, or have money-based stabilizations also produced booms? If the stabilization strategy has indeed been important, was the emergence of the boom associated with a fall in the nominal exchange rate? Is there independent evidence that the change in the nominal exchange rate was expected to be transitory?

e. Did the boom accompany a major program of structural reform, a large change in the terms of trade, or some other event that could plausibly be related to a revision of expectations of future income on the part of households? Is there independent evidence, say from the behavior of asset prices or from external capital flows, that future income prospects in the country looked more favorable?

If booms tend to be associated with one or more of the macroeconomic factors listed above, then other episodes in which similar changes in these macroeconomic factors were observed, but in

which a boom did <u>not</u> materialize, will be examined to identify possible reasons for the emergence of booms in some cases and not in others. The results of this phase of the research should be a set of stylized facts about consumption booms in developing countries, as well as a narrowing and sharpening of the hypotheses listed above about the causes of booms.

Analysis of Specific Episodes

The second phase of the research will present a more rigorous analysis of the determinants of one or more important recent consumption booms. The experience of Mexico during 1989-94 is the prime candidate if a single episode is considered. If more than one, then the contemporaneous consumption booms in Argentina and Brazil could also be examined. An alternative criterion for choosing other episodes to study in detail would be the availability of data on the components of consumption expenditures -- i.e., durables and non-durables (including services). The weight given to this criterion would depend on whether evidence emerges from the stylized facts of systematic differences in the behavior of durables and nondurables during booms. If this distinction appears to be important in the episodes reviewed, then countries that publish data on the composition of private consumption would be prime candidates for the more in-depth analysis.

Methodologically, the most straightforward way of approaching the second part of the research would consist in the estimation of decision rules for consumer expenditure and the construction of counterfactual simulations. Since all of the potential explanations of consumption booms involve the effects of major changes in policy regimes, however, Lucas critique considerations render this approach problematic.

Instead, a more promising approach involves simulations of optimal consumer behavior based on "deep" parameters. The parameters required depend on the specification of the model. While the literature offers a number of options, the precise form of the model to be simulated cannot be determined until the first part of the research is complete. The reason is that the specification chosen must be able to encompass the subset of the hypotheses listed above that appear, at least in principle, capable of explaining the behavior of consumption during the episode in question. Thus the precise form of the model must be determined after this subset of hypotheses has been determined in the light of the data.

In broad terms, however, it is likely that a model that will prove useful for the purpose at hand will feature two goods (domestic and foreign), a transactions-cost motivation for the holding of money, and binding liquidity constraints affecting some subset of consumers. In this case, the parameters estimates required are for both the intertemporal and intratemporal elasticities of substitution, the parameters of the transactions technology, and the incidence of liquidity constraints. Ideally, these parameters would be estimated within a consistent framework based on data drawn from the consumption boom to be studied. Alternatively, some subset of them would be imposed based on results already in the literature. The question posed would be whether, given realistic values of such parameters, observed changes in relevant variables exogenous to households are capable of generating the observed pattern of consumer behavior.

Work along these lines has recently been undertaken by Reinhart and Vegh (1995), as well as by Rebelo and Vegh (1995). Reinhart and Vegh adopted a partial-equilibrium approach to assessing the potential relevance of the "credibility" hypothesis in explaining the time path of consumption expenditure in several episodes of exchange-rate based stabilization. Using a standard constant relative risk aversion specification of utility, they derived a closed-form solution for consumption and simulated the effects on consumption of temporary reductions in the nominal interest rate of the magnitude observed in the stabilization episodes. Their work focused specifically on whether movements in nominal interest rates in these episodes were of sufficient magnitude as to explain movements in private consumption, given the estimated values of intertemporal substitution elasticities and parameters of the money demand function, holding constant the other determinants of consumption. They found that the "credibility" hypothesis was more successful in the case of the "heterodox" stabilization programs of the mid-eighties than in that of the "tablita" programs of the late seventies.

Rebelo and Vegh (1995), on the other hand, applied the simulation methodology at the opposite extreme of generality. They specified and calibrated a general-equilibrium model, subjecting it to alternative "stabilization shocks" meant to capture competing hypotheses attempting to explain the macroeconomic dynamics associated with exchange-rate based stabilizations, including consumption booms. They found that nominal wage rigidity, combined with the supply-side effects of disinflation, proved best able to generate a configuration of outcomes consistent with the stylized facts.

The research proposed here adopts a methodology that is less ambitious than that of Rebelo and Vegh, but more general than that of Reinhart and Vegh. Since the focus is on accounting for consumption booms only (not the other stylized facts associated with exchange-rate based stabilization), and doing so in contexts that may be more general than just that of exchange-rate based stabilization, general-equilibrium simulation will not be adopted, and the variables that affect household consumption choices will be taken as exogenous. In that sense, the approach is more partial-equilibrium in nature than that of Rebelo and Vegh. On the other hand, it can be viewed as a generalization of Reinhart and Vegh.

To clarify the distinction between the proposed research and what was done by Reinhart and Vegh, consider, for example, the potential role of the "euphoria" hypothesis in the Reinhart-Vegh analysis. Their simulations are based on an analytical closed-form consumption equation of the form:

$$c_t = \bar{y} \frac{\left[\sum_{t=0} \left(\frac{1}{1+r} \right)^t \frac{r/(1+r)}{[p(I_t)]^p} \right]^{-1}}{[p(I_t)]^p}$$

where c is real private consumption, ybar is permanent income (consisting of the annuity value of financial assets and capitalized labor income), r is the real interest rate, I is the opportunity cost of holding money (I = i/1+i), with i denoting the nominal interest rate), p is the effective price of

consumption (including transactions costs), and ρ is the intertemporal elasticity of substitution. Reinhart and Vegh simulate changes in c_t as I changes, holding ybar constant, and compare actual to predicted extreme values of c_t, their objective being to establish the empirical plausibility of the "credibility" hypothesis.

While their procedure is well suited for that purpose, if the purpose is instead that which motivates the research proposed here -- i.e., to explain what has driven a particular consumption boom -- it is necessary to go further. Without knowing how well the equation above tracks consumption using actual values of all the right-hand side variables, we cannot draw conclusions about the extent to which the boom in question can be explained by each one of the candidates listed above. Consider the potential role of 'euphoria", for example. Changes in household wealth arising from revised expectations of future income can be estimated from observed changes in stock market and real estate price indices, together with VARs for labor income. In the Reinhart-Vegh model, such changes would be reflected in ybar -- holding other variables constant -- may well also explain a substantial part of the variation in consumption expenditure. If so, then the "credibility" hypothesis may have explained too much, since the combined effects of changes in ybar and I may conceivably overpredict the boom. In this case, the original specification of the consumption function above would be called into question.

To avoid this potential problem, the work on specific booms proposed here would extend the Reinhart-Vegh analysis in two directions:

a. First, the model used in the simulations of private consumption will encompass the different hypotheses listed earlier, with the objective of identifying the relative contributions made by the relevant subset of them in a particular application.

b. Second, the model's parameters will be chosen so as to track the actual behavior of private consumption, to ensure that the simulations yield decompositions that are consistent.

Thus, rather than asking whether any single hypothesis is capable of explaining the facts in the context of a maintained consumption theory, the objective would is to develop an encompassing structural consumption model for the episode in question which fits the facts, and then assess the roles of the different hypotheses in the context of that model. This will, for example, permit simulations of consumption behavior based on models derived from first principles to assess the extent to which an observed "boom" reflects consumption tilting toward the present (perhaps attributable to the "credibility" hypothesis), as opposed to a level change in the path of consumption (which would arise under the "euphoria" hypothesis).

C3. Do Tax Incentives Raise Private Saving?

There is a long-standing debate about the impact of taxation on saving and capital accumulation. In one view, taxes are a serious impediment to saving and investment both because high statutory tax rates imply high tax rates in practice and because savers respond to these

disincentives. In turn, taxes reduce capital and output growth, with potentially serious long-term consequences for living standards and economic development. In another view, taxes have little impact on saving and investment decisions. Aggregate saving and investment are determined primarily by other factors such as the riskiness of returns to saving, the sophistication of the financial system, and life-cycle factors such as social security and retirement income. In this alternative view, financially savvy savers are able to avoid paying the statutory tax rate through careful tax planning and because tax enforcement is lax. Attempts to increase saving through government tax incentives could be frustrated by high-income taxpayers shuffling assets from taxable to non-taxable forms, leading to windfall tax breaks to these taxpayers with no corresponding impact on aggregate saving.

Disentangling which of these views is correct is clearly crucial for determining public policy toward saving in developing countries. This paper will consider both the theoretical and empirical evidence on these two divergent views. For example, recent theoretical models of endogenous growth suggest a strong role for taxation in affecting long-term income growth. By contrast, other research using U.S. tax data have considered how the tax code affects saving behavior, and found little or no evidence that taxes affect aggregate saving behavior. Understanding where there is agreement about the effect of taxation on saving and where disagreement still exists is one of the first priorities of any survey of saving and taxation.

The paper will rely on existing empirical and theoretical studies, and sets as its goals providing:

(i) a framework for evaluating taxation and saving in developing countries,
(ii) an evaluation of the existing body of literature within that framework, and
(iii) policy lessons on taxes and tax incentives for developing countries.

The paper will begin with a discussion of the main theoretical determinants of saving and then proceed to consider the theoretical effects of taxation implied by the different models. For instance, if people save primarily to guard against future income downturns such as crop failures, tax policy could have much different effects on their saving behavior than if the primary motive for saving is retirement income. In developing countries, further institutional issues need consideration, such as the role of the extended family, owner-operated businesses, imperfections in financial markets including such prominent institutions as tontines (ROSCAS), and emigrant remittances.

A distinction between saving at the individual and at the national level is crucial. While understanding the saving behavior of, say, the bottom four quintiles of the income distribution is important in assessing their own financial security, the level of aggregate saving will be determined largely by individual saving of the top quintile of the income distribution and joint saving-investment decisions of businesses. For wealthy individuals, issues of legal tax avoidance and illegal tax evasion should play an important role, especially in developing countries where tax codes may contain many loopholes and enforcement is lax. Because businesses often make saving and investment decisions jointly, understanding how the tax code affects investment decisions is of importance as well. Here the study will rely on a number of studies (Auerbach 1993, Mintz 1993) for developing countries that calculate effective tax rates and illustrate the many and varied investment incentives and tax holidays

available in developing countries. This will be complemented by primary material from the authors' own participation in tax missions to Cameroon, Egypt, Ghana, and Guyana and elsewhere.

Beyond assessing the different theoretical models in terms of their implications, especially those for tax policy, the paper will examine how they fare relative to the empirical findings, especially those on developing countries. Here there has been much recent work including that associated with Deaton (1990, 1991b), Paxson (1988) and Udry (1994), among others. One natural division in the studies is between those that report only on the determinants of saving, with the effects of taxation to be inferred, and those that report directly on the effects of taxation usually based on time series. For the latter type there will be relatively more reliance on the OECD countries. To the extent possible, however, evidence will also be drawn from both middle-income countries, such as South Korea and Chile, and low-income countries, such as African or South Asian ones. These groups of countries will face different issues attendant on their different degrees of development. For instance, the better-off countries with longer life spans and perhaps a less family-oriented social structure should evidence a more important role for retirement saving. This observation is just one example of a general principle, namely that it is less a question of a contest between theories of saving for universal applicability than one of relative importance in different contexts.

Analysis of theoretical issues should illuminate a more difficult question: for the purpose of policy, what is the social value of encouraging more saving? Is the social value of increased capital accumulation sufficiently high to justify the loss in revenue that could be used for other worthy purposes or the diversion of resources from the private sector (and perhaps private saving)? Furthermore, how does one evaluate this hypothetical saving program if the benefits are received by different groups in the income distribution? These are thorny theoretical issues that must be considered in the design of any government program to encourage saving.

Another important theoretical and policy question is, if the government seeks to encourage saving, how to do it? There are two basic approaches: global incentives and targeted incentives. Global incentives include sweeping changes in the tax code, such as a switch from an income-based to a consumption-based individual tax, a business cash-flow tax, or greater reliance on a value-added tax. Such reforms require many changes in the tax code, including transitional provisions. Alternatively, targeted saving incentives, such as individual retirement accounts or salary reduction plans, cause less disruption to the existing tax code but may also encourage large-scale tax avoidance through such methods as transferring assets from taxable forms to tax-sheltered forms without any overall change in saving.

C4. Does Financial Reform Raise or Reduce Saving?[30]

Since the 1970s and especially in the 1980s, many industrial and developing countries have reformed their financial systems and have allowed market forces more scope in determining interest

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[30] Prepared by Gerard Caprio and Fabio Schiantarelli.

rates and in allocating credit (Caprio, Atiyas, and Hanson 1994). At the same time, there has been a notable decline in saving rates, in particular in those countries, such as the United States, where financial markets appear to be least regulated. Following McKinnon (1973) and Shaw (1973), some observers had expected that higher real interest rates, a likely feature of the post-reform environment, would yield an increase in saving, notwithstanding the possibility that income and substitution effects would offset one another.

However, a variety of studies suggest that any effects on interest rate changes on saving will be quite small. Yet little systematic investigation of a second channel, namely the extent to which a relaxation of credit constraints on consumers is part of reform and negatively affects saving, has occurred. More specifically, higher access to consumer credit, consumer durables and housing mortgage credit may reduce saving as it relaxes a binding credit constraint (Jappelli and Pagano 1994, Muellbauer and Murphy 1990, Attanasio and Weber 1994; see also Rossi 1988 on cross-country evidence on interest rates, credit constraints and consumption). Finally, improved access to financial markets may reduce precautionary or buffer-stock saving under conditions of uncertainty. (See Deaton 1990, 1995; see also Honohan 1995 for a comprehensive survey of these and other channels).

This paper will address these issues by examining several financial reform efforts in LDCs, drawn from cases such as Korea, Malaysia, Indonesia, Chile, Mexico, Ghana, Turkey, and Zimbabwe, in order to analyze how saving evolved in the aftermath of reforms. The study will also consider, for purpose of comparison, the impact on saving of financial reforms in a few OECD countries such as Italy, the UK, and Norway).

In each of the cases a dynamic model of saving will be estimated using pre- and post-reform aggregate data, with the explicit goal of testing for structural breaks. Empirical tests will start with the appropriate Euler equation for consumption (or saving) derived from first principles, allowing for borrowing constraints of different forms (exogenous ceiling on borrowing, borrowing related to income, wealth or other macroeconomic or structural variables) and test whether the degree of misspecification of the equation changes over time. This could result from the share of constrained consumers changing over the years in relation to business cycle conditions, structural changes in financial markets (the focus of our investigation), and other policy changes.

One way to test for misspecification is to add to the Euler equation for consumption that would hold under the assumption of perfect capital markets a set of additional variables that should only matter in the presence of financial constraints (past income, income volatility, etc.) and check whether they are significant or not and whether their significance changes between the pre-reform and post reform period. Different measures of financial liberalization will be developed, and their significance will be assessed as additional explanatory variables in the consumption (saving) equation.

The study will also try to document the extent to which any changes in saving were linked to precise features of reform. For example, discussing the Italian experience, where saving rates remain high and consumer credit -- especially for mortgages -- remains in relatively short supply, Jappelli and Pagano (1994) and others have speculated that the practice of requiring a 50% down payment for

housing finance provides a boost to saving.[31] Thus it would be useful to see if those countries with some degree of financial reform and still high saving (such as Korea, Indonesia, Malaysia, and recently Chile) also feature continuing constraints of consumer credit, and whether those countries with a post-reform decline saw a greater response in consumer lending.

In order to pursue this investigation, reform experiences will have to be analyzed and their commencement points dated. Fortunately, Caprio, Atiyas, and Hanson (1994) have analyzed many of the above episodes. That analysis could be pushed further by measuring the degree of reform by comparing average pre-reform interest rates with those generated by uncovered interest parity, and/or by estimating the percent of their portfolio over which banks have full control (i.e., that portion not preempted by reserve requirements, portfolio requirements, or directed credit).

This analysis requires only standard (mainly aggregate) data sources and some familiarity with the historical experiences. The team will augment their knowledge by drawing on Bank and country collaborators. An attempt will be made to analyze deviations in saving rates to see if other country characteristics, such as the level of development or history of inflation stability, influence the response of savings to reform dynamics. Also, to the extent that panel data sets or even surveys of consumers can be obtained for reforming countries, the investigation would also include an attempt to assess from micro data if there was a change in the proportion of consumers who were constrained by the lack of credit availability pre-and post-reform. In terms of econometrics implementation, both single-country and panel-data estimation techniques will be used.

This research will prove beneficial in advising on financial reform, in particular when post-reform programs are dependent on domestic saving.

The Approach

In analyzing the linkage between financial reform and saving, the analysis will focus on a subset of mostly developing economies (and potentially some industrial economies, such as Italy), for which significant information is available on the process by which the financial system was liberalized. The analysis will begin with a largely descriptive exercise, reviewing briefly the reform process based on published studies (Caprio et. al. 1994) and various Bank sources for up to 8 countries. This part of the study will also include an estimation of pooled cross-country, time-series saving equations along the lines proposed for the wide cross-country empirical studies in the project, but with financial variables spelled out in greater detail. The relatively concentrated country focus will permit the gathering of more variables related to financial reform, such as a wider array of rates of return (including interest rates on loans and stock market returns), the degree to which government

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[31] Interestingly, despite financial reforms there, greater competition has not changed this constraint, and it appears to be linked to the inefficiency of the judicial process: since foreclosure is so difficult, mortgage lenders require a significant down payment to reduce the inclination of borrowers to walk away from their obligation.

involvement in credit decisions has changed, and the share of credit going to consumer and mortgage finance. The purpose of this part of the exercise is largely descriptive.

Next, we derive and illustrate a formal test of the effect of financial reform on consumption, through its impact on the extent of liquidity constraints. The basic idea is that financial reform determines the fraction of consumers that are liquidity constrained. This can be seen as an extension of Campbell and Mankiw (1991).

Aggregate consumption, c_t is the sum of consumption by financially unconstrained consumers, c^u_t, out by financially constrained consumers, c^c_t:

$$c_t = c^u_t + c^c_t \tag{1}$$

Under quadratic utility, the Euler equation for consumption implies that for unconstrained consumers

$$c^u_t = c^u_{t-1} + \epsilon_t \tag{2}$$

Where ϵ_t is a forecast error. Assume that constrained consumers consume a proportion γ of income, y^c_t $(0 < \gamma \le 1)$:

$$c^c_t = \gamma y^c_t + \bar{\omega}_t \tag{3}$$

Denote the fraction of aggregate income that goes to constrained consumers by λ_t

$$y^c_t = \lambda_t y_t \tag{4}$$

Substituting (2), (3) and (4) into(1) we obtain:

$$c_t = c_{t-1}^u + \gamma \lambda_t y_t + \epsilon_t + \bar{\omega}_t \tag{5}$$

Using (1) and (4) lagged once in order to replace the unobservable value of c^u_{t-1}, we obtain, after adding and subtracting $\lambda_t y_t$:

$$\Delta c_t = \gamma \lambda_{t-1} \Delta y_t + \gamma (\lambda_t - \lambda_{t-1}) y_t + v_t \tag{6}$$

where $v_t = [\epsilon_t + \bar{\omega}_t - \bar{\omega}_{t-1}]$

We well assume that λ_t is a function of a set of variables x that capture financial liberalization:

$$\lambda_t = \alpha + \delta' x_t \tag{7}$$

Then (6) can be written as:

$$\Delta c_t = \gamma \alpha \Delta y_t + \gamma \delta' x_{t-1} \Delta y_t + \gamma \delta' y_t \Delta x_t + v_t \qquad (8)$$

The simplest option for estimation is to assume that x_t is a dummy variable that equals one in the post reform period and zero otherwise. In this case a test for the (lack of) effect of reform on consumption, through its effect on the proportion of consumers that are liquidity constrained, is simply a test on the hypothesis that δ equals zero. This implies that the coefficient on the change in income is constant through time.

In order to account for the presence of the third regressor in (8), the easiest option, although not necessarily the most efficient, is to include an additive dummy variable for the year in which financial reform was introduced (in all the other periods the dummy is zero).

This framework can be further developed by allowing for more complicated versions of the utility function for unconstrained consumers, for a more complex consumption rule for the constrained consumers, and for a more detailed modeling of financial reform.

C5.   Is Pension System Reform Conducive to Higher Saving?[32]

Over the last fifteen years, many countries at various stages of economic development have implemented or proposed substantial reforms to their public pension systems. As discussed in World Bank (1994) and Arrau and Schmidt-Hebbel (1994), recent reforms involve a transition from an unfunded pay-as-you-go (PAYG) system to a mandatory contribution scheme that is by design fully-funded (FF). Because the public pension system within a country may have important effects on capital formation and welfare, and because these reform proposals have become so widespread, a considerable literature has developed that simulates the effect of reforms on saving and welfare. The post-reform economic performance of Chile, which began its privatization in 1981 and is the only country for which there are many post-reform years to observe, has also generated a sizable literature.[33]

The approach taken in this study complements the existing literatures by providing empirical evidence on the actual importance of the benefit and tax features of mandatory PAYG and FF pension systems on aggregate private consumption. Below we develop the theoretical and empirical framework that will be used to ascertain the degree to which features of the public pension system account for the variation of consumption levels and growth in a panel of countries.

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[32] Prepared by Andrew Samwick.

[33] Corsetti and Schmidt-Hebbel (1995) (and others cited therein) discuss the simulation methods, and Diamond (1994) provides a recent overview of the Chilean reforms.

The Model

The standard intertemporal consumption problem under uncertainty posits a consumer maximizing the expected present discounted utility subject to a budget constraint:

$$\max_{C_{t+j}} E_t\left[\sum_{j=0}^{T-t}\left(1+\delta\right)^{-j} U\!\left(C_{t+1}\right)\right]$$

$$s.t.$$

$$A_{t+j+1} = \left(1+r\right)A_{t+j} + Y_{t+j} - C_{t+j}$$
$$A_t \ given$$
$$A_{T+1} \geq 0$$

(1)

where C_t, A_t, and Y_t are consumption, assets, and income in year t, respectively; r is the interest rate; and δ is the rate of time preference. The main source of uncertainty in the model is assumed to be labor income uncertainty. The first-order condition for consumption in adjacent periods (with j = 0) is given by the Euler equation:

$$\left(\frac{1+r}{1+\delta}\right)E_t\left[U'\!\left(C_{t+1}\right)\right] = U'\!\left(C_t\right)$$

(2)

As in Dynan (1993), a second-order Taylor approximation of $U'(C_{t+1})$ around C_t allows the Euler equation to be rewritten as:

$$E_t\left[\frac{C_{t+1} - C_t}{C_t}\right] = \frac{1}{\xi}\left(\frac{r-\delta}{1+r}\right) + \frac{\rho}{2}E_t\left[\left(\frac{C_{t+1} - C_t}{C_t}\right)^2\right]$$

(3)

where $\xi = -C_t\,(U''/U')$ is the coefficient of relative risk aversion and $\rho = -C_t\,(U'''/U'')$ is the coefficient of relative prudence.[34] The Euler equation shows that expected consumption growth is the result of two primary motivations. The first term represents the consumer's desire to intertemporally smooth consumption when confronted by an interest rate that need not equal his rate of time preference. If the interest rate is higher (lower) than the rate of time preference, then the consumer will want to shift

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[34] Kimball (1990) introduces the concept of "prudence" to characterize economic behavior under uncertainty.

consumption into later (earlier) periods, which will increase (decrease) expected consumption growth. The higher is the consumer's intertemporal elasticity of substitution, ξ^{-1}, the stronger this effect will be. The second term represents the consumer's desire to buffer his consumption against uncertain income shocks. The larger the impact of income uncertainty on the variance of consumption growth and the larger the consumer's coefficient of relative prudence, ρ, the stronger this effect will be.

Rewritten as an econometric specification, the approximation in Equation (3) is:

$$\Delta \ln(C_{t+1}) = \frac{1}{\xi}\left(\frac{r-\delta}{1+r}\right) + \frac{\rho}{2} var(\Delta \ln(C_{t+1})) + \epsilon_{t+1} \tag{4}$$

Note that equation (4) simplifies to Hall's (1978) specification of $C_{t+1} = C_t + \epsilon_{t+1}$ under the assumptions that utility is quadratic (i.e. certainty equivalent) and that the interest rate is equal to the rate of time preference. In general, however, we should expect that both intertemporal substitution and precautionary saving should play a role in consumption growth.[35]

Because pension reforms typically involve transitions to steady-states in which the tax burden on current income is changed, accounting for liquidity constraints is important in this analysis. Equation (4) accounts for the potential effects of future, but not current, liquidity constraints on expected consumption growth because such constraints will amplify the variance of future consumption growth. If liquidity constraints in the current period are binding, then consumption will equal the amount of resources that are currently available rather than the value specified by equation (4). The model shows that the impact of any pension reform on consumption growth will occur by affecting the market rates of interest, the variability of consumption growth, or the degree to which consumers are liquidity constrained. The consumer's response to those changes will be determined by the values of his underlying preference parameters (δ, ξ, and ρ).

The consumer's optimization problem specified in equation (4) also has a first-order condition that if the shadow value of current assets is positive, then the intertemporal budget constraint must be satisfied. One of the most important consequences of a pension reform is that it changes the amount of resources that will be available to current generations of consumers over their life-time. In the theoretical framework of equation (1), such a shift in available resources is analogous to changing A_t. Because equation (4) describes only the growth of consumption given a fixed budget constraint, an additional equation must be specified to identify the *initial* level of consumption that results after the pension reform is implemented. This second equation may be specified with the level

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[35] Dynan (1993) estimated ρ in household level data and found it to be economically small. Carroll (1994) provides other evidence that future income uncertainty does affect current consumption in a manner consistent with this framework. Carroll and Samwick (1995a, b) estimate that households that face more income uncertainty hold more wealth and summarize the empirical literature on precautionary saving.

of consumption or the ratio of consumption to income as the dependent variable and will be discussed further below.

Estimation

The model in the previous section applies directly to consumption decisions made at the household level. Ideally, the model would be estimated on individual consumers over a time period that included a pension reform. The effect of the reform could then be inferred from the consumption responses of individuals whose budget sets were differentially affected by the reform.[36] In reality, such data do not exist, and as a result, the primary source of identifying information must come at the aggregate level by comparing the consumption patterns of countries that have different degrees of pension liability funding and institutional frameworks in their public systems.

The data for this project will be drawn from the World Data Base discussed in Section A1. and ongoing World Bank studies of pension reform in many countries.[37] Consistent with data availability, the sample of countries will be chosen to include a wide variety of country experiences and pension regimes in order to more precisely identify the effect of the public pension system on saving. At a minimum, the selected countries will include those with a large degree of pension-liability funding, such as Chile, Malaysia, Singapore, and Trinidad and Tobago; those with mature or nearly-mature PAYG systems, such as Mexico, Uruguay, and the United States; and those with no mandatory pensions, such as Australia and South Korea.[38] The sample will consist of both OECD and LDC countries, including those such as Argentina, Peru, and Colombia that have recently reformed their systems and countries such as Bolivia, Costa Rica, Hungary, France, and Italy that are actively considering reform. It is anticipated that data availability and quality will be better in the OECD than the LDC countries in the sample.

One complication that arises when equation (4) is not estimated using household level data is that the population must be sorted into a few representative groups. Because country-level datasets do not typically contain separate measures of consumption and other variables disaggregated by groups, special assumptions are necessary to relate the (unobserved) group consumption amounts into the aggregate consumption value.[39]

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[36] There is a vast literature on the effects of Social Security and private pensions on household saving. See Gale (1995) for a recent review.

[37] See, for example, Schmidt-Hebbel (1995) on Colombia's recent reforms and World Bank (1994) for a more general overview.

[38] Both of these countries did introduce public pensions toward the end of the probable sample period, Korea in 1988 and Australia in 1986-1992.

[39] Corbo and Schmidt-Hebbel (1991) aggregate over constrained and unconstrained consumers in deriving their econometric specification.

Recent research on precautionary saving suggests that consumers be classified into two groups based on a criterion that determines whether they are actively saving for retirement. Carroll [1992] shows that in an infinite horizon model, consumers whose expected consumption growth rate (the right-hand side of equation (3)) is exceeded by their income growth rate will seek to maintain a target wealth-to-income ratio. Consumers' prudence will prevent wealth from falling too low, and their impatience (a high value of δ relative to r) will prevent it from rising too high. Carroll and Samwick [1995a] show that in a life-cycle model with an income drop at retirement, this "buffer-stock" behavior will persist until retirement is about fifteen years away. Samwick [1995] further shows that while consumers are engaged in buffer-stock behavior, they do not offset changes in their expected retirement wealth by adjusting their discretionary wealth holdings.[40] Consumers who are not engaged in buffer-stock behavior (i.e. those whose expected consumption growth rate exceeds their income growth rate) are actively saving for retirement in this model and, therefore, will have a savings response to pension reform. For completeness, these consumers will be described as engaging in "life-cycle" behavior.

Based on the theoretical framework, the fraction of the population engaged in life-cycle behavior will be an important determinant of the effect of pension reform on saving. Aggregate consumption growth is equal to:

$$\Delta \ln(C_{t+1}) = \lambda^L_t \Delta \ln(C^L_{t+1}) + \lambda^B_t \Delta \ln(C^B_{t+1})$$
$$= \lambda^L_t \Delta \ln(C^L_{t+1})$$

(5)

where λ denotes the share of the respective groups of consumers in total consumption and the groups are denoted by L (life-cycle) and B (buffer-stock). Since the consumption of the latter group is on average constant, aggregate consumption growth is the product of two factors: the share of consumption accounted for by life-cycle group and the consumption growth rate for that group. The proper specification for equation (5) is to specify consumption (and all other aggregate flows that appear as exogenous variables) in per-capita terms.

Equation (5) suggests two categories of variables that will be relevant in a reduced-form specification for aggregate consumption growth. The first category is comprised of variables that determine the consumption growth rate for those engaged in life-cycle behavior. The intertemporal substitution motive (the first term in equation (4)) requires the inclusion of an interest rate that reflects the opportunity cost consumption for these consumers. That is more likely to a home-equity loan or savings account rate than a credit card rate for those who are actively saving for retirement. The precautionary saving motive requires the inclusion of variables that affect the degree of income uncertainty and the extent to which capital markets can efficiently insure individuals against that risk. Carroll and Samwick (1995a, b) show that approximately 15 percent of the variation in income uncertainty at the household level is attributable to demographic variables such as age, education, and

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[40] Gourinchas and Parker (1995) extend Carroll's (1992) theoretical framework in a similar fashion.

family composition and characteristics of employment such as self-employment, occupation, and industry. The reduced form should therefore include the variables describing the distribution of these characteristics across the population. King and Levine (1993) examine the relationship between measures of financial market development and economic growth in a cross-country study that includes all of the countries that have proposed pension reform. These measures should also be included as independent variables.[41] Denote all of these variables in country i at time t by X_{it}.

The second category is comprised of variables that determine the fraction of the population engaged in life-cycle behavior. Since this ratio is just the fraction for whom expected consumption growth exceeds income growth, all of the variables from the first category are potentially relevant here, too. Additionally, variables relevant to the growth rate of income facing both buffer-stock and life-cycle consumers must be included. One important variable will be the average retirement age from full-time and part-time work, since the transition from buffer-stock to life-cycle saving is determined largely by how close the consumer is to retirement. Additionally, measures of openness to international trade and productivity growth across sectors should be included to proxy for pre-retirement income growth. Denote all of these variables in country i at time t by Z_{it}.

Since λ is constrained to be between 0 and 1, an econometric specification of the form:

$$\Delta \ln(C_{i,t+1}) = \frac{e^{Z_{i,t}\gamma}}{1 + e^{Z_{i,t}\gamma}}\left(X_{i,t}\beta + \mu_i + \nu_t + \epsilon_{i,t}\right) \tag{6}$$

will be used to estimate the parameters of the reduced-form model, where μ_i and ν_t are country and time dummies, respectively.

As discussed above, the consumption growth equation holds only for a given pension regime and must therefore be complemented by an equation that determines the level of initial consumption as a function of the characteristics of the pension regime. The most naturally starting point for such a specification is Feldstein's (1974, 1995) study of the effects of social security on aggregate consumption for the United States in which an aggregate measure of Social Security Wealth (SSW) was constructed for each year in the sample period. SSW is simply the expected present value of all promised benefits to workers and retirees covered by the system in a given year.

Although calculating SSW for every country in every sample year may be infeasible due to data limitations, there are several characteristics of the public pension system that are important to

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[41] The measures used in their study are: 1) the ratio of liquid liabilities to GDP, 2) the ratio of deposit money bank domestic assets to deposit money bank assets plus central bank domestic assets, 3) the ratio of claims on the nonfinancial private sector to total domestic credit, and 4) the ratio of claims on the nonfinancial private sector to GDP. Levine and Renelt (1992) consider a broader array of financial development indicators.

the determination of SSW that can be included as proxies. Regardless of the type of public pension (FF, PAYG, or mixed), the average retirement date, life expectancy at retirement, fraction of the population in the workforce, and dependency-ratio will be important determinants of expected pension benefits. For PAYG systems that promise benefits according to a formula, the legislated early and normal retirement dates, historical and legislated retirement income replacement rates, provisions for post-retirement indexation of benefits, and political or legal guarantees of pension benefit payments will be important. For systems that are structured as defined contribution pensions (including all FF systems), expected pension wealth will depend on average cumulative savings at retirement, minimum and maximum contribution rates, provisions for lump sum withdrawal and pre-retirement borrowing, restrictions on portfolio allocation (including requirements that funds be allocated to government liabilities) and government guarantees to supplement contributions for low income workers. The extent to which the pension liabilities have been funded should also be included as a continuous variable to allow for different effects of funded versus unfunded systems on consumption.

Denoting all of the pension variables by P_{it}, the specification of the consumption equation is:

$$C_{i,t} = \alpha_0 + \alpha_1 HW_{i,t} + \alpha_2 W_{i,t} + P_{i,t}\theta + \eta_i + \phi_t + \omega_{i,t} \tag{7}$$

where C_{it} is consumption, HW_{it} is the expected present value of after-tax labor income, W is the aggregate stock of household wealth, and all three are measured in real, per-capita terms. Since some of the variables are likely to be missing for some countries over the sample period, a variety of specifications of equation (7) will be estimated with different subsets of variables comprising P_{it}. This basic specification may also be augmented to allow for direct liquidity constraints as in Corbo and Schmidt-Hebbel (1991) by including measures of aggregate consumer credit or to allow for buffer-stock behavior by introducing a factor analogous to λ in equations (5) and (6).

As they are written, equations (6) and (7) constitute a system of equations that must be estimated jointly (to allow for potentially correlated errors) using panel data techniques, including non-linear methods to account for the need to predict the share of life-cycle savers in (6). The methods employed will be based on the three estimation procedures for panel data developed in Section A2 above.

Prediction

The estimates of the parameters from equations (6) and (7) will then be used to simulate the aggregate consumption response to various types of pension reforms. The explanatory variables in these equations can be classified into four groups based on how they will change during the pension reform. The first group will be directly affected by the reform, such as those included in P_{it} that characterize the public system. The second group will be largely unaffected by the pension reform. The age distribution and life expectancy of the population are examples of this group. The third

group includes variables such as per-capita disposable income that will change differentially according to how the transition is financed. The magnitude of these changes will be based on simulations of OLG models of pension reform found elsewhere in the literature.[42] The fourth group consists of variables such as labor force participation that may also change directly as part of the reform in a way that has been omitted from the model presented above. Because little is known about other behavioral responses to pension reform, a broad range of possible responses will be simulated.

D.   LESSONS FROM INTERNATIONAL SAVING EXPERIENCES

The preceding research component follows an issue-oriented approach that focuses on specific policy instruments and cuts across developing regions. To complement that approach, this component will examine the overall saving experiences of specific countries and country groups. Its objective is to assess their saving record and saving-related policy framework as a whole, in order to learn form countries' actual experiences to draw lessons for the design and implementation of saving policies.

This component will include four tasks. First, an analysis of saving patterns in economies undergoing systemic transition, focusing on the causes of the sharp decline in their saving rates since the onset of transition. Second, a study of the policies that were instrumental for the success of take-off countries across the world in jumping to a path of high saving and rapid growth. Third, an analysis of the causes of the collapse of saving in Sub-Saharan Africa, with an assessment of the policies needed to reverse it. And finally, a set of five country studies sharing a common methodological framework, analyzing in depth consumption/saving behavior and saving policies in selected countries.

D1.   How Does Saving Behave under Systemic Transition ?[43]

The scope for recovery and growth in the transition economies (TE) depends crucially on adequate volumes of efficient investment. While net international capital flows to those economies are increasing, the evidence is unambiguous that in the near future their investment will have to be primarily financed by national savings. However, one striking aspect of the transition from socialism to capitalism has been the marked decline in saving rates, from levels above 30 -- and in some cases above 40 -- percent to levels around 20 percent (see Table D.1). Of course, there is ample reason to place wider than usual confidence intervals around saving rate estimates in transition economies, reflecting data problems affecting both the measurement of the saving level and the measurement of income -- in particular unrecorded income from the emerging private (or informal) sector. Nevertheless, the generalized saving decline across a broad cross section of transition countries clearly has the status of a stylized fact.

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[42] See, for example, Arrau and Schmidt-Hebbel (1993).

[43] Prepared in collaboration with Cevdet Denizer and Holger Wolf.

The decline in saving can be conceptually decomposed into two parts, roughly corresponding to the disequilibrium and equilibrium components. Under central planning, saving was residually determined given the investment demands implied by the plan's growth targets and assumed ICORs. There is some evidence that the implied saving rates -- averaging around 33 percent during the 1970s and 1980s -- amply exceeded desired saving, until the onset of liberalization loosened the rigidity of binding consumption constraints (Kornai 1959, 1980, 1992; Welfe 1989; Quandt 1989). To the degree that consumption indeed was below its desired level, the transition caused a welfare-increasing decline in saving from disequilibrium to equilibrium levels.

Table D.1						
Gross Domestic Saving in Selected Transition Countries (percent of GDP)						
	1989	1990	1991	1992	1993	1994
Bulgaria	31.4	22.0	35.8	22.9	16.7	20
Czech Republic	30.6	29.9	36.7	25.3	20.1	22
Hungary	29.9	28.0	19.4	15.7	10.7	12
Poland	42.7	36.0	21.9	16.5	15.9	17
Romania	29.5	20.8	24.1	23.4	21.7	21
Slovakia	28.5	24.2	28.2	19.8	22.4	23
Slovenia	33.0	32.6	27.4	26.2	25.0	25
Belarus	37.4	30.2	32.9	32.7	33.2	29
Estonia	25.9	22.3	30.1	17.1	25.0	25
Kazakhstan	22.3	25.9	9.5	23.7	14.0	16
Kyrgyzstan	13.2	12.9	14.0	12.0	10.0	11
Latvia	37.9	38.8	27.0	24.0	24.4	25
Lithuania	25.8	25.5	31.5	20.4	10.6	12
Russia	34.7	29.5	40.2	35.8	32.7	25
Turkmenistan	26.0	27.2	33.4	25.0	20.0	18
Ukraine	27.3	25.5	16.5	11.8	7.9	10
Uzbekistan	17.8	16.7	25.9	30.5	25.0	20
Vietnam	4.7	6.1	16.5	20.2	16.0	17
Mongolia	13.1	15.2	8.0	7.6	16.1	18
Source: World Bank data.						

The second component of the decline reflects changes in equilibrium saving largely brought about by the impact of transition on standard determinants of saving. The latter can in turn be divided into a component common to the collapse of central planning and the transition itself, and another component reflecting the particular implementation of the transition process in each country -- including the choice between big bang and gradualism and the choice of reform sequencing, which have been shown to be major determinants of inflation and output performance in transition economies (De Melo et al 1995).

The objective of this paper is to assess the relative empirical importance of these three factors -- the move towards equilibrium saving and the impact of common versus idiosyncratic elements on equilibrium saving -- in the observed evolution of saving rates in transition economies. Until recently, a systematic assessment has been hampered by the limited number of observations available to researchers.

For this purpose, the paper will first compute a rough estimate of the pre-reform level of disequilibrium saving by calculating the level of saving in the year immediately preceding the initiation of reforms (1989 for most of Eastern Europe, and 1991 for the former Soviet Union) that would have been observed if the (then socialist) economies had behaved like market economies. The calculation will be based on the predicted values from cross-country saving regressions on a standard set of determinants. This procedure will be checked against other cross-country saving regressions estimated for market economies in the context of the Saving Project. This will yield a range of estimates of pre-reform "equilibrium" saving rates and, by extension, of the empirical relevance of the shift from disequilibrium to equilibrium saving in explaining the observed decline in saving rates.

Next, the paper will turn to the estimation of the impact of the transition itself on equilibrium saving, using standard intertemporal consumption models as an organizing framework. Such models predict that the evolution of saving depends on three major factors. First, on the disaggregated level, the unconstrained optimal consumption path is a function of the expected income profile. Second, whether this optimal consumption profile can be attained depends on the ability of consumers to smooth consumption and thus on the development of the financial sector. Finally, the demographic composition of the population determines aggregate saving rates given individual constrained choices.

While demographics arguably are -- at least to a first approximation -- exogenous to the transition process, both the evolution of income, as well as consumers' ability to borrow against unexpected current declines and expected future rises in income, are directly affected by the transition process. Thus, the impact of transition can be conceptually decomposed in two parts. The first, "quasi-exogenous", component reflects the shocks to income profiles (such as terms of trade shocks) and demographic developments which are, to a first approximation, independent of the particular transition strategy selected by each country. The second component captures the effects of deliberate policy choices about the nature and speed of the transition, which vary across the different countries.

Policy choices involve multiple dimensions, which renders an exhaustive analysis impossible given the limited degrees of freedom available. Following Balcerowiz and Gelb (1994) and De Melo et al (1995), transition policies will instead be grouped into three core categories: macroeconomic

stabilization (proxied by inflation), microeconomic liberalization, and institutional restructuring. The latter two categories are proxied by a set of annual liberalization indices developed by de Melo et al. (1995) as well as a set of indices for institutional reform developed by European Bank for Reconstruction and Development (EBRD 1995). This allows both comparisons across countries and over time of the progress of individual countries along the three core dimensions of reform.

To implement empirically this approach, the paper will use panel regressions of saving rates on a set of determinants, including both the familiar set of saving determinants -- dependency ratios, income controls, terms of trade, and so on -- henceforth labeled X --, and the liberalization indices, henceforth labeled L. Depending upon the issue of interest, the regressions will be run in levels or first differences. The data on transition economies will predominantly come from the World Bank's ANDREX and World Debt Tables databases, and the 1996 World Development Report, augmented by terms of trade variables from Tarr (1994) and the liberalization indices from De Melo et al. (1995) and EBRD (1995).

As a first step, the analysis will examine to what extent the variables in X can be explained by the variables in L, taking account of both linear and non-linear relations. By projecting the X variables onto the L variables, the former can be split into a component orthogonal to L, say X1, and a component dependent on L, say X2.

The second step will involve the estimation of empirical saving equations with X1, X2 and L as regressors. This will allow to isolate and quantify separately the *direct* (i.e., acting through the L variables) and *indirect* (through X2) impacts of transition policies on the observed evolution of saving rates, distinguishing it from that of the policy-invariant saving determinants X1.

Thus, these regressions will allow us to examine a range of questions, including:

- the importance of linear and non-linear policy actions captured by changes in the standard determinants of saving;

- the importance of linear and non-linear policy actions not captured by changes in the standard determinants of saving;

- the differential importance of policy changes in different areas on saving behavior;

- the overall importance of policy-induced versus policy-invariant features of the transition in determining changes in equilibrium saving rates.

The data used in the study will cover 27 transition economies and span the years 1985 to 1994. The sample includes the following countries:

- *Eastern and Central Europe:* Slovenia, Poland, Hungary, Czech Republic, Slovak Republic, Bulgaria, Croatia, FYR Macedonia, Romania, and Albania.

- *Baltics:* Estonia, Lithuania, and Latvia.

- *Former Soviet Union:* Russia, Kyrgyz Republic, Moldova, Kazakhstan, Uzbekistan, Belarus, Ukraine, Turkmenistan, Armenia, Georgia, Azerbaijan, andTajikistan.

- *Asia:* Mongolia, Vietnam.

D2. Saving and Growth Take-off: What Breeds Success ?[44]

Sustained saving and growth takeoffs have been the exception rather than the norm during the last four decades of development experience. Only a small (but significant) group of LDCs has accomplished the transition from a low saving-investment-growth trap to a high saving-investment-growth path in recent decades. Most of these 11 countries are in East Asia: Korea, Singapore, Taiwan, Hong Kong, China, Thailand, Malaysia, and Indonesia. The other three countries are Chile, Botswana, and Mauritius (see Table D.2).[45]

A good understanding of how the saving-investment-growth processes got started in these exceptional experiences, and the policies that helped them (as well as the policy mistakes that were avoided) is still missing. This requires revisiting in part the role of capital accumulation in growth and the causalities between saving, investment, and growth. For observers and policy makers alike it is most important to identify the role of specific structural conditions and policy levers in getting started a successful transition. Hence the objective of this study is to identify analytically and empirically the policy and structural triggers that caused the structural break in the small group of countries that "have made it".

<u>Issues</u>

The study will address two sets of issues that are crucial in understanding the take-off experiences. One refers to the causality between saving, investment, and growth; the second set is about the role of specific policies and structural features in contributing to the structural break of saving, investment, and growth.

Causality

- Does saving drive growth (through investment) or is higher saving mostly a consequence of higher growth (either directly or as a reflection of expanding investment) in take-off

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[44] Prepared in collaboration with Dani Rodrik.

[45] There are other countries that have achieved large increases in their saving rates between the 1960s and the late 1980s and early 1990s, such as Congo, Papua New Guinea, Malta, Pakistan, and Turkey. But none of them has achieved both high investment rates and high per capita growth rates, as opposed to all 11 sample countries.

experiences? This issue is hotly debated both world wide and within the context of the take-off countries (see Deaton 1995 and Schmidt-Hebbel, Serven and Solimano 1996 for recent reviews of the discussion). On one side of the controversy are those that argue that saving drives growth or, more directly, that investment drives growth ("capital fundamentalism") while on the other side are those that argue that growth (based on factors other than physical capital accumulation, such as education or technological progress) drives saving (Carroll and Weil 1994) or investment (King and Levine 1994). For the case of two East-Asian take-off countries (Korea and Taiwan), Rodrik (1994) argues that investment is the force behind growth. Sorting out the main causality is essential for discriminating between policy levers targeted at saving, investment, or productivity growth.

- Does foreign saving play an important role in the take-off experiences? Is foreign saving endogenous or exogenous to national saving and domestic investment decisions?

- There are two dimensions to causality: the time precedence (Granger-causality) of one variable regarding the other(s), and the identification of the role played by the main independent determinants that have contributed to the take-off of saving, investment, and growth. To this second dimension we turn next.

Role of Policies in Saving, Investment, and Growth

- How much have policies contributed to the take-off experiences? Addressing this question requires understanding and modeling the behavior of saving, investment, and growth, and how this behavior changes during take-off. This allows identifying the relative weight of policy instruments as compared to structural/initial conditions and external (non-policy) shocks.

- Potential policy levers affecting saving, investment, and growth range from direct interventions and incentives (such as mandatory pensions, public investment, tax incentives for saving, investment, education, R&D) to providing an enabling environment (a stable macroeconomic framework, stable and low government-induced distortions, adequate protection of property rights, adequate regulation) and, lastly, to the choice of a specific development mode. Regarding the latter, interestingly the take-off sample includes countries where government policy has been more active (as in Korea, Singapore, Taiwan; see Rodrik 1994) and others where it has been more passive (as in Hong Kong, Chile), as well as a country that is transiting from rigid central planning to a market economy with strong state intervention (China).

Methodology

In order to disentangle time-precedence from causal determination, it seems sensible to follow a two-stage strategy to understand the interrelations between saving, investment, and growth during take-off.

Time Precedence

Understanding "what comes first" is a useful first indication of causality. One way to do this is by performing Granger-causality tests between national saving, domestic investment, and growth. These tests will be performed at the country level and for the whole sample. But time precedence is not identical to causation -- hence the central next step.

Assessing the role of policies: modeling and estimating behavioral equations for saving, investment, and growth

Functional forms for saving, investment and growth will be derived in a two-stage way. First, a set of core equations will be derived or taken from a standard stylized dynamic new-growth model (see e.g. Section B4 above, Caballe and Santos 1993 or Barro and Sala-i-Martin 1995). Second, the model will be extended by adding a vector of additional relevant regressors (as in the reduced-form saving equations used, for instance, by Edwards 1995 and Masson, Bayoumi and Samiei 1995).

For the specification of private saving, and in addition to standard consumption determinants, the following policy determinants will be considered: public saving (to test for Ricardian crowding-out), tax incentives for and mandatory saving requirements imposed on corporations and households, the degree of financial liberalization (measured for example by consumer and housing credit flows), and the extent of mandatory fully-funded or pay-as-you-go pension systems.

Estimation will be performed for individual country time series or for a panel of cross-country and time-series observations.

Data

The core data for the dependent variables (gross domestic, national, and private saving; private consumption, gross domestic and private investment; GDP, GNP and private disposable income), and for some regressors, for the time series (1960-94) and 11 countries will be provided by the central data base of the Saving Project. Data for additional independent variables will be collected by the study author.

Inference and Policy Conclusions

Shedding light on both the interrelations between saving, investment, and growth and their ultimate determinants -- foremost policy levers -- in the small sample of LDCs who "are making it" will make a significant contribution to the understanding of development. In particular, it will be helpful to disentangle which policy changes may help, which are irrelevant, and which may hurt the prospects of take-off in the large majority of developing countries that have not yet made it. Such inference will be based on the empirical findings proposed above, allowing for a quantification of the contribution of specific policies to take-offs.

Table D.2

Ranking of Take-off Countries by Changes in Saving, Investment, and Growth Rates
(Levels by Sub-Periods, in Percent)

Gross Domestic Saving/GDP	1960-73	1974-83	1984-93
More Than 30% Increase			
Botswana	12.49	20.73	39.76
Singapore	12.40	36.28	43.87
20 to 30% Increase			
Indonesia	10.62	29.60	31.63
Korea	10.93	25.20	35.10
10 to 20% Increase			
China	24.25	30.44	36.65
Mauritius	13.63	19.83	24.07
Malaysia	24.44	31.62	34.67
Thailand	19.67	22.77	31.07
5 to 10% Increase			
Chile	16.44	17.08	25.19
Hong Kong	24.90	31.69	34.51
Taiwan	21.80	31.99	31.57

Gross National Saving/GNP	1965-73	1974-83	1984-93
More than 30% Increase			
Botswana	-2.49	17.15	33.85
20 to 30% Increase			
Singapore	18.76	34.51	43.48
10 to 20% Increase			
China	25.26	30.59	36.82
Indonesia	13.34	27.37	28.55
Korea	16.77	24.14	34.39
Mauritius	13.87	19.61	25.35
5 to 10% Increase			
Chile	12.45	13.84	18.96
Hong Kong	27.26	31.69	34.60
Malaysia	22.09	28.34	30.71
Thailand	21.73	22.53	30.12
Taiwan	25.81	31.69	32.91

Gross Domestic Investment/GDP	1960-73	1974-83	1984-93
More Than 15% Increase			
Indonesia	12.45	25.14	28.68
10 to 15% Increase			
China	23.42	30.11	36.27
Korea	20.07	29.78	32.94
Mauritius	15.69	25.68	27.10

Table D.2 (Concluded)

Gross Domestic Investment/GDP	1960-73	1974-83	1984-93
Singapore	25.40	43.31	40.16
Thailand	21.69	27.49	34.19
5 to 10% Increase			
Chile	17.17	18.95	22.66
Malaysia	20.37	30.16	30.20
Less Than 5% Increase			
Botswana	25.91	38.56	29.77
Hong Kong	25.25	29.02	26.23
Taiwan	22.84	30.17	22.00

GNP Growth Rate	1960-73	1974-83	1984-93
More Than 3%			
Chile	1.33	-1.45	5.95
China	2.26	5.41	8.23
Mauritius	1.96	1.58	6.16
More Than 0%			
Botswana	5.22	6.72	5.37
Indonesia	2.28	4.63	4.43
Korea	6.99	11.90	7.73
Thailand	4.64	4.10	7.18
Less Than 0%			
Hong Kong	7.01	6.20	5.17
Malaysia	4.20	4.20	4.05
Singapore	6.80	6.77	5.50
Taiwan	7.43	6.60	4.73

GDP Growth Rate	1960-73	1974-83	1984-93
More Than 3%			
Chile	1.28	-0.16	5.31
China	2.26	5.41	8.25
Mauritius	1.95	2.03	5.84
More Than 0%			
Indonesia	2.27	4.37	4.16
Korea	6.93	6.51	7.52
Thailand	4.61	4.37	7.23
Less Than 0%			
Botswana	6.24	6.78	4.58
Hong Kong	7.01	6.20	5.17
Malaysia	4.14	4.46	3.76
Singapore	7.13	6.49	5.56
Taiwan	7.44	6.60	4.74

Source: World Bank data.

D3.   Can Africa's Saving Collapse Be Reverted ?[46]

Sub-Saharan Africa's growth performance during the last three decades has been described as a tragedy (Easterly and Levine 1994, Schmidt-Hebbel 1994, Hadjimichael and Ghura 1995). Africa's per capita real GNP growth rate has declined steadily since the 1960s, reaching on average negative valuest since the early 1980s (see Figure 9). Declining growth combined with low investment reflects Africa's serious trend decline in investment productivity.

National saving rates have been falling steadily since the early 1970s -- in tandem with growth. Africa's average gross national saving ratio to GNP fell from 10.5% during 1965-73 to an abysmally low 6.4% in 1984-93. The rising gap between domestic investment and national saving has been filled by foreign saving in general and foreign aid in particular. Overall foreign saving ratios have doubled, from 6% of GNP in the late 1960s to more than 12% of GNP since the late 1970s.

Hence declining investment productivity and low saving are at the core of Africa's growth collapse. While bad luck -- droughts, wars, and declining terms of trade -- has had its share in the region's dismal performance, inappropriate policies have certainly also contributed to this outcome.

In a recent paper, Mwega (1995) has investigated empirically the factors that influence the private saving rate in a sample of less developed and OECD countries, with particular emphasis on Sub-Saharan African countries. From cross-country time-series regressions, he found that Africa shift dummies are negative and highly significant, suggesting that Sub-Saharan Africa has a lower private saving rate than other regions even after controlling for a wide range of economic factors. Research shall be undertaken to unravel the factors behind this differential behavior.

The purpose of this paper is to shed light on Sub-Saharan Africa's dismal saving behavior with the ultimate aim to identify specific policies that could contribute to reversing the region's saving decline. While raising saving is not sufficient for achieving sustained growth, it does appear to be a necessary condition for higher growth. In fact, identifying the policies that support saving (and the policy distortions that inhibit saving) is essential in times as these, when serious cutbacks in foreign aid -- of which the region is the one that benefits most at a global scale -- can be anticipated.

Issues

This study will address two inter-related sets of issues. The first set refers to the links between national saving, foreign saving (particularly aid), investment, and growth in Sub-Saharan
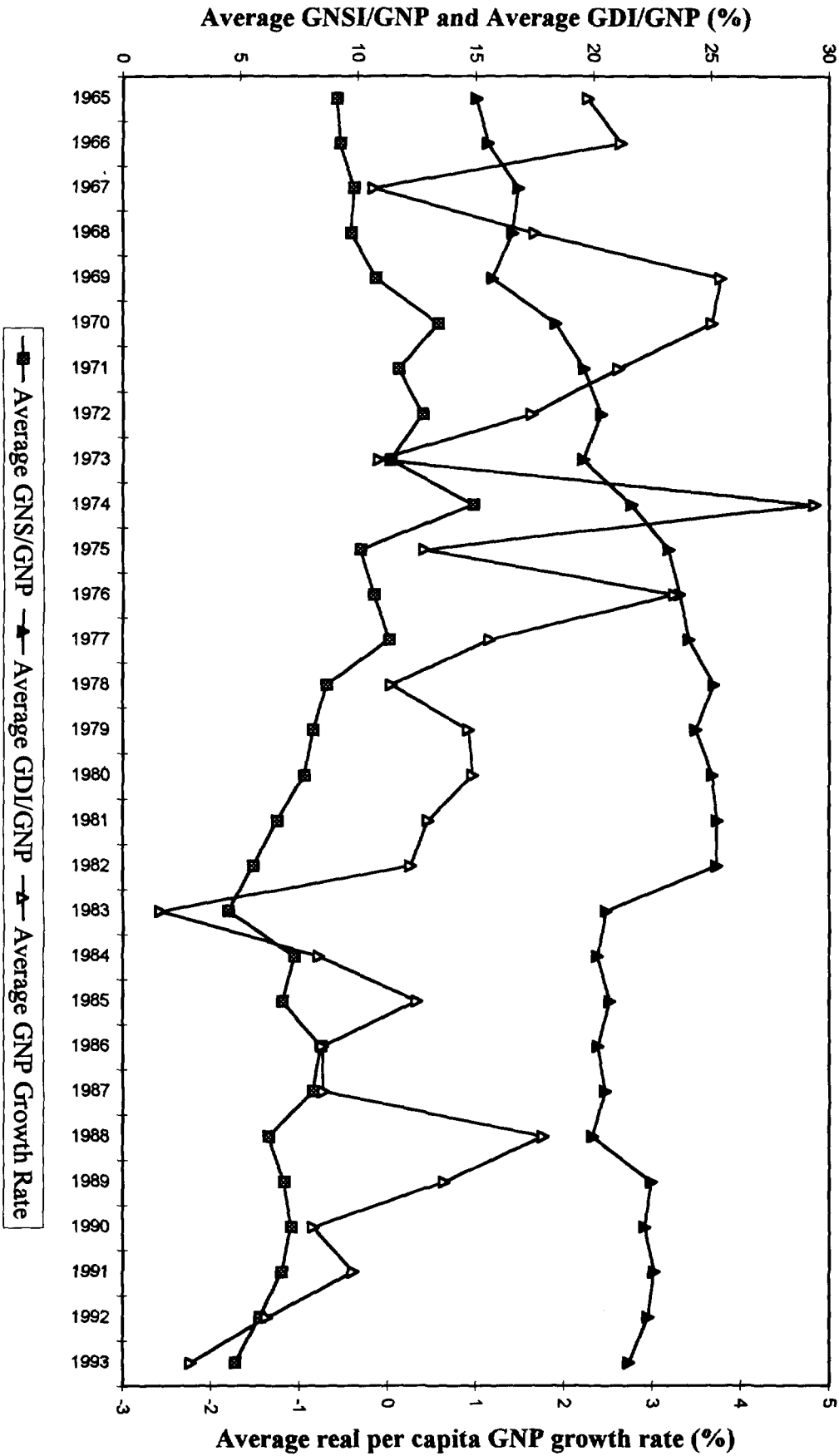
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[46] Prepared in collaboration with Ibrahim Elbadawi and Francis Mwega.

Figure 9

SAVING, INVESTMENT AND GROWTH RATES IN SUB-SAHARAN AFRICA

Africa. The second concerns the impact of key behavioral determinants and government policies on saving. Among the main issues for Africa that will be covered in this study are the following:

1. Links and time precedence between saving, investment and growth

- Are national saving and domestic investment strongly correlated? (See Feldstein and Horioka 1980 and the subsequent literature surveyed in Schmidt-Hebbel, Serven and Solimano 1996). The growing gap between both variables observed in Africa since the 1960s suggests that -- as opposed to other regions -- have not been closely associated during the last three decades.
- Does growth follow investment or does investment follow growth? (See King and Levine 1994)
- Does saving follow income per capita -- or its rate of growth -- or is the opposite pattern observed? (See Deaton 1995, Carroll and Weil 1994).
- Does foreign saving in general (and foreign aid in particular) crows or domestic saving or is foreign saving endogenous to domestic saving and investment decisions?

2. Saving and foreign aid

- A recently resurgent literature on the macroeconomic effects of foreign aid has found that higher aid is translated mostly into consumption, not investment (Boone 1994, Obstfeld 1995). For Africa, as the world's main aid recipient relative to GNP, addressing this issue is of utmost importance to both the donor community and African policy makers. Hence when foreign aid is adequately measured (comprising transfers, grants, and the grant component of concessional lending), does Boone's (1994) result -- that aid mostly finances consumption -- still hold for Sub-Saharan Africa?

3. Terms of trade, cyclical income, and overall uncertainty

- How does saving respond to terms of trade shocks? Have temporary commodity booms financed public and private consumption in similar magnitudes?
- How strongly pro-cyclical is saving?
- Does macroeconomic instability in particular affect saving, as shown for the case of Africa's growth decline? (Schmidt-Hebbel 1994).
- How important is overall uncertainty in inducing precautionary or buffer-stock saving in Africa?

4. Fiscal policy and saving

- By how much does private saving offset changes in public saving? More specifically, how much does private consumption (or saving) respond to temporary and permanent reductions in public consumption and transfers, and to temporary and permanent increases in overall taxation? (Corbo and Schmidt-Hebbel 1992, Edwards 1995).

5. Financial repression and liberalization

- How sensitive is saving to the real interest rate and to marginal tax rates? Are specific tax incentives (on retirement saving and/or other special saving accounts) effective in raising overall private saving or do they affect only the composition of private asset portfolios?
- What is the effect of domestic financial liberalization -- through reduction in intermediation spreads, changes in deposit interest rates, financial deepening, and enhanced access to housing and consumer loans -- on private saving? (See Honohan 1995, Jappelli and Pagano 1994).
- Does liberalization of the external capital account raise or lower national saving ?
- What is the role of special financial institutions (savings banks, postal savings accounts, etc.) in mobilizing private saving ?

6. Demographic transition

- Many Sub-Saharan Africa countries are still at early stages of the demographic transition. How does Africa's young population structure affect its saving rates? (Mason 1988, Masson et al. 1995, Edwards 1995).

7. Income distribution and poverty

- Do income (or wealth) distribution and the incidence of absolute poverty affect saving -- and by how much? (Ogaki, Ostry and Reinhart 1995, Schmidt-Hebbel and Serven 1995).

Methodology

In order to address the above listed issues, a methodology is proposed that focuses subsequently on data, overview of the region's performance, econometric estimation, and counter-factual simulations.

1. Data

The empirical part of this paper will rely on three data bases that have been recently completed or are under construction:

(a) The core data base for saving-consumption-investment-income data of aggregate (national accounts) annual time series for all (most) Sub-Saharan African countries, preferably covering 1960-1994, will be extracted from the Saving Project's World Data Base.

(b) Data on foreign aid will be extracted from a World Aid Data Base under construction (Fernandez-Arias et al. 1996). This source includes both conventional foreign aid flows -- as

reflected by the OECD's ODA (Official Development Aid) flows (and as used by Boone 1994) -- and more relevant, adjusted foreign aid flows (comprising grants, transfers, and the grant element of foreign loans).

(c)   Data on income distribution variables will be extracted from the recently completed world data base (that includes 22 Sub-Saharan African countries) constructed by Deininger and Squire (1995).

Data from the latter three sources will be complemented by additional information required for this study.

2. Initial Overview of the Region's Experience

Making use of the above data, an overview and summary assessment of Africa's saving performance will be provided, highlighting the main trends and changes in saving and its composition -- as well as in investment and growth -- during the sample period, discussing the evolution of the main saving determinants from both qualitative and quantitative dimensions, and identifying the main issues to be addressed by the analysis.

A comparative evaluation of the saving record of the region will be performed, based on the cross-country regression results from the world studies of the Saving Project. This comprises assessing how similar the region is to other major regions in its saving and growth behavior and in terms of the main saving-related variables. (As the cross-country results will be available only at a later stage of the Saving Project, this comparative evaluation, which can proceed independently of the region-specific work, could be performed after the latter has been completed). The tests for assessing if the average saving behavior in Sub-Saharan Africa differs from that in other regions will be made possible by including shift and interaction dummies for African countries in the broader world sample.

3. Testing of main hypotheses through econometric analysis

The statistical analysis will investigate:

(i)   The inter-linkages between saving, investment, foreign saving (foreign aid), and economic growth in Sub-Sahara Africa, based on VARs, correlation, and causality analyses. The explicit aim is to establish the causal links between the above mentioned variables in Sub-Saharan Africa. Particular attention will be devoted to the dynamic relations between these variables (see Blomstrom et al. 1993, Carroll and Weil 1994), as discussed of this proposal in more detail in Section B3.

(ii)   The behavior of private saving (and consumption)and its responsiveness to policies. For this purpose general functional forms (not derived from first principles) will be econometrically estimated for the levels of current-price national saving, private saving, and household saving and/or for their

ratios to current-price national or private (as applicable) disposable income, and for the levels of constant-price private consumption and/or its ratio to constant-price private disposable income, encompassing the above mentioned set of issues. The specification will broadly follow similar wide-encompassing equations as applied recently by Edwards (1995), Masson, Bayoumi and Samiei (1995), and Mwega (1995). A range of estimators -- from fixed-effect static panels to dynamic GMM panels, as discussed in Section A2 of this proposal -- will be applied and subsequently tested for robustness. Particular importance will be attached to relevant policy instruments as regressors. The study will examine for the presence and significance of feedback effects from the private saving rate to potentially endogenous variables (including real the real interest rate, capital inflows, and income). If feedback effects are important, the models will be estimated using instrumental-variable techniques.

As part of the econometric analysis, and provided an acceptable number of time-series observations are available, the time-series properties of the country data (unit root and co-integration tests) could be assessed, following standard techniques and procedures (see Hamilton 1995 and Hendry 1995).

In the frame of the time-series cross-country econometric analysis, particular care should be attached to identifying the presence and importance of specific country outliers (among the latter are possibly the two African take-off countries, Botswana and Mauritius) in inferring regional trends and results.

4. Counter-factual simulations and policy analysis

Making using of the estimated equations, counter-factual simulations of shocks and relevant policy changes will be performed and their qualitative and quantitative impact on consumption and saving will be evaluated.

Assessment of Policies and Saving Incentives and Derivation of Policy Lessons

Finally, the effects of actual and potential policies and incentives on private and national saving will be assessed, based on:

(i)   the regressions and policy simulations carried out above,
(ii)   the region's policy experience assessed from a qualitative perspective, and
(iii)   the international experience.

This will provide the underpinnings for the study's derivation of policy lessons and recommendations for the region.

D4.   Methodology for Country Case Studies

The purpose of the country case studies is to complement the cross-country research on saving by focusing in depth on consumption/saving behavior and policies in selected countries that satisfy at least two conditions: they should encompass relevant policy and consumption/saving experiences, and they should highlight policy issues relevant to World Bank country economic work and operations.

Below we spell out the common issues, proposed methodology, and prospective policy lessons that should be addressed by each country case study. We also list country-specific issues to be addressed separately by each of the five selected case studies: China, Colombia, India, Mexico, and Pakistan. Application of a common set of issues and methodologies across countries will allow cross-country comparisons of results and policy implications.

<u>Common Issues</u>

The country studies should address two inter-related sets of issues. The first refers to the relationship between saving and other key macroeconomic variables. The second concerns the impact of shifts in policies closely linked to saving (tax policies, financial reform, etc). Among the latter, the relevant questions may differ across countries depending on their specific policy experiences. A comprehensive list is given below:

1. Income per capita, income growth, and saving interactions

- Does saving follow income per capita (or its growth rate growth), or is the opposite pattern observed? (See Deaton 1995, Carroll and Weil 1994).
- How strongly pro-cyclical is saving?

2. International financial integration, foreign inflows, domestic investment, and national saving

- Did the country have -- and does it have now -- continuous access to voluntary private capital inflows -- i.e., is foreign saving (the current account deficit) endogenous or exogenous to domestic investment and national saving decisions ? If there were regime changes in this regard, how was national saving affected ?
- Are national saving and investment strongly correlated? (See Feldstein and Horioka 1980 and the subsequent literature surveyed for example in Schmidt-Hebbel, Serven and Solimano 1996).
- How does saving respond to temporary and permanent foreign-aid inflows ? (Boone 1994, Obstfeld 1995). What is the saving impact of terms-of-trade changes ?

3. Fiscal policy and saving

- By how much does private saving offset changes in public saving? More specifically, how much does private consumption (or saving) respond to temporary and permanent reductions in public consumption and transfers, and to temporary and permanent increases in overall taxation? (See Corbo and Schmidt-Hebbel 1992, Edwards 1995, Schmidt-Hebbel and Serven 1995a and other studies/surveys on Ricardian equivalence).

4. Private corporate and household saving

- By how much does household saving offset changes in corporate saving -- i.e., are households able to "pierce the corporate veil" ? (See OECD 1994).
- What are the key determinants of corporate saving as opposed to household saving ? Does a shift of private sector taxation from firms to households raise saving?

5. Interest rate and tax incentives

- How sensitive is the intertemporal allocation of private consumption (i.e., its rate of growth) to the real interest rate and to marginal tax rates? (See literature on consumption Euler equations; for LDCs see for instance Burnside 1995, Ogaki, Ostry, and Reinhart 1995). Are private consumption and saving levels sensitive to the real interest rates and to marginal tax rates?
- Are specific tax incentives (on retirement saving and/or other special saving accounts) effective in raising overall private saving or do they affect only the composition of private asset portfolios? (For OECD countries see OECD 1994; for a discussion on specific tax incentives in the U.S. see Engen, Gale and Scholz 1994).

6. Financial reform

- What is the effect of domestic financial liberalization -- through reduction in intermediation spreads, changes in deposit interest rates, financial deepening, and enhanced access to housing and consumer loans -- on private saving? (See Honohan 1995, Jappelli and Pagano 1994).
- Does liberalization of the external capital account raise or lower national saving ?
- What is the role of special financial institutions (savings banks, postal savings accounts, etc.) in mobilizing private saving ?

7. Aging population and pension system

- How much do demographic factors affect saving? (Mason 1988, Masson et al. 1995, Edwards 1995)
- What type of mandatory pension system, if any, is in place (pay-as-you-go or fully-funded, low or high population coverage, mature or immature system) and how does it affect saving

(World Bank 1994, Arrau and Schmidt-Hebbel 1993, 1994, Feldstein 1995). What has been the impact on saving of reforms in the pension system?

8. Income Distribution and Poverty

- Do income (or wealth) distribution and the incidence of absolute poverty affect saving -- and by how much? (Ogaki, Ostry and Reinhart 1995, Schmidt-Hebbel and Serven 1995b).

Methodology

In order to address the above listed issues, a four-step methodology is proposed, focusing on data, overview of the country's performance, econometric estimation, and counter-factual simulations.

1. Data

The construction of a saving-consumption- income data base using aggregate (national accounts) data is a top priority. Preferably it should make use of published sources. However, typically additional data is required for disaggregating national account aggregates into public-sector and private-sector saving and income, introducing necessary measurement adjustments (see Section A1 above) and, data permitting, breaking down private saving into corporate and household saving (see Schmidt-Hebbel, Webb and Corsetti 1992). The frequency of the sample should be annual and, if available, quarterly, with a sample extension extending as far into the past as possible (preferably before 1960). The variables should comprise current-price saving and both current and constant-price consumption and income, as well as measures of each of the relevant causal determinants of saving (taxes, interest rates, fiscal stance, and so on) listed above and corresponding references. A disaggregation of private consumption expenditure into durables and non-durables, if available, is desirable.

If possible, this data base should be complemented by making use of existing microeconomic (household and firm survey) data.

2. Overview and evaluation of the country's experience

Making use of the above data, an overview and summary assessment of the country's saving performance should be provided, highlighting the main trends and changes in saving and its composition during the sample period, discussing the evolution of the main saving determinants form both qualitative and quantitative dimensions, and identifying the country-specific issues to be addresses by the analysis, in addition to those listed above.

In addition, a comparative evaluation of the saving/consumption/growth performance of the country should be provided, based on the cross-country regression results from other studies of the

Saving Project. This comprises assessing how similar the country is to other economies in its saving and growth behavior and in terms of the main saving-related variables. (As the cross-country results will be available only at a later stage of the Saving Project, this comparative evaluation, which can proceed independently of the country-specific work, should be performed after the latter has been completed).

3. Testing of main hypotheses through econometric analysis

3.1 Using aggregate data

In order to make efficient use of the available aggregate data, the econometric analysis should rely on both consumption/saving models with firm theoretical foundations but somewhat narrow characterizations of saving behavior, and broader models with less solid analytical grounding but providing a more encompassing view of saving. The following three types of equations are proposed for empirical implementation:

(i)   An Euler equation for the rate of real private consumption growth, derived from consumer optimization in a permanent income framework, extended to include elements such as habit formation (Burnside 1995), separation of risk aversion and intertemporal utility (Weil 1995, Epstein-Zin 1989), Stone-Geary preferences (Burnside 1995), and/or wealth-dependent intertemporal consumption substitution (Ogaki, Ostry and Reinhart 1995).

(ii) A general equation for the level of private constant-price consumption and for its ratio to constant-price private disposable income, not derived from first principles, but capable of addressing the 8 issues listed earlier.

(iii) A general equation for the levels of current price national saving, private saving, and household saving and for their ratios to current-price national or private (as applicable) disposable income, not derived from first principles, but encompassing the above mentioned 8 issues.

The equations implemented under (ii) and (iii) would generalize recent consumption and saving specifications, such as those by Masson et al. (1995) and Edwards (1995). Particular importance should be given to include all relevant general and specific policy instruments as regressors.

As part of the econometric analysis, the time series properties of the data (including unit-root and co-integration tests) should be assessed, following standard techniques and procedures (for general reference see Hamilton 1995 and Hendry 1995).

3.2 Using microeconomic data

If a series of household surveys is available, it should be used to complement the analysis based on macro aggregates. Depending on the variables included in the survey data, the following issues should be addressed through the empirical implementation of equations similar to (ii) and (iii) but describing individual (or household) consumption and saving (see Section B5):

- saving and growth: are saving rates higher for those groups of households experiencing faster income growth ?

- liquidity constraints (or excess sensitivity): is household consumption 'too sensitive' to current disposable income (after controlling for past consumption and permanent income)?

- demographic factors: after controlling for income (or wealth), does consumption/saving behavior differ systematically across households depending on age composition ?

- distributive factors: do marginal propensities to consume/save differ systematically across income groups ?

4. Counter-factual simulations and policy analysis

Making using of the estimated equations, counter-factual simulations of shocks and relevant policy changes should be performed and their qualitative and quantitative impact on consumption and saving should be evaluated.

Assessment of Policies and Saving Incentives and Derivation of Policy Lessons

In order to maximize the policy usefulness of the country study, it is proposed to assess the effects of actual and potential policies and incentives on private and national saving, based on:

(i)   the regressions and policy simulations carried out above,
(ii)   the country's policy experience assessed from a qualitative perspective,
(iii)   the international experience.

This will provide the underpinnings for the country study's derivation of policy lessons and recommendations.

Country-Specific Issues

The countries selected for case studies are China, Colombia, India, Mexico, and Pakistan. These countries represent currently 55% of the population in the (non-transition) developing world, and 25% of its GDP. They encompass a rich diversity of saving and policy experiences. (See

Figure 10 with 1965-1993 saving and growth rates in the five countries). Saving rates are at world record-high levels in China and exceed the typical levels of low-income countries in India, but reach only moderate levels in the other three countries. In Colombia and Mexico (and also in India to a more limited extent) private saving rates have fallen significantly in recent years -- in the case of Mexico contributing to the occurrence of the 1994-95 crisis. Policies that directly and indirectly affect saving also differ significantly across each country, as discussed next.

(a)   China [47]

China, the world's largest country population-wise and in a foreseeable future the world's largest country income-wise, is also currently the world's record saver, with a 40% national saving ratio to GNP in 1994. During 1983-93 China's national saving rate has averaged 36.8%, while per capita real GNP growth has averaged 8.7% per year. Such outstanding performance stands in particular contrast to the output loss and saving decline observed in most other transition economies. While certain initial conditions (China's initial low income and rural dominance) and differences in systemic transformation modes can explain part of the difference between the performance of China and that of other transition economies, it remains both a puzzle and a policy challenge to assess the causes of China's performance and the likelihood of its future continuation.

Some of the key issues to be addressed in the proposed country study on saving in China are the following:

•   *Data measurement problems.* It is likely that China's saving rate is over-stated due to the combination of two factors: the distortion of relative prices and inadequate measurement of the contribution of services (that could lead to a proportionately larger under-estimation of output than consumption) and the peculiarly large inventory component in gross investment (that could partly represent unsaleable output of state-owned enterprises).

•   *Saving composition.* Decomposition of national saving into its three main contributing sectors (public sector, enterprises, households) is complicated by the large extent of the extra-budgetary fiscal sector and the significance of concessional non-recoverable central government lending through the banking system, the sizable "grey" market through which household savings are unofficially channeled to private investment projects, and inadequate accounting practices that complicate corporate saving measures. One of the objectives of the paper will be to attempt to estimate residual saving by relying on direct estimates of sector saving flows.

•   *Effects of financial reforms on saving.* Although there have been some financial-sector reforms during the 1980s, China's financial sector remains highly restricted and distorted, as

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[47] Prepared in collaboration with Aart Kraay.

Figure 10

SAVING AND GROWTH RATES IN FIVE CASE-STUDY COUNTRIES
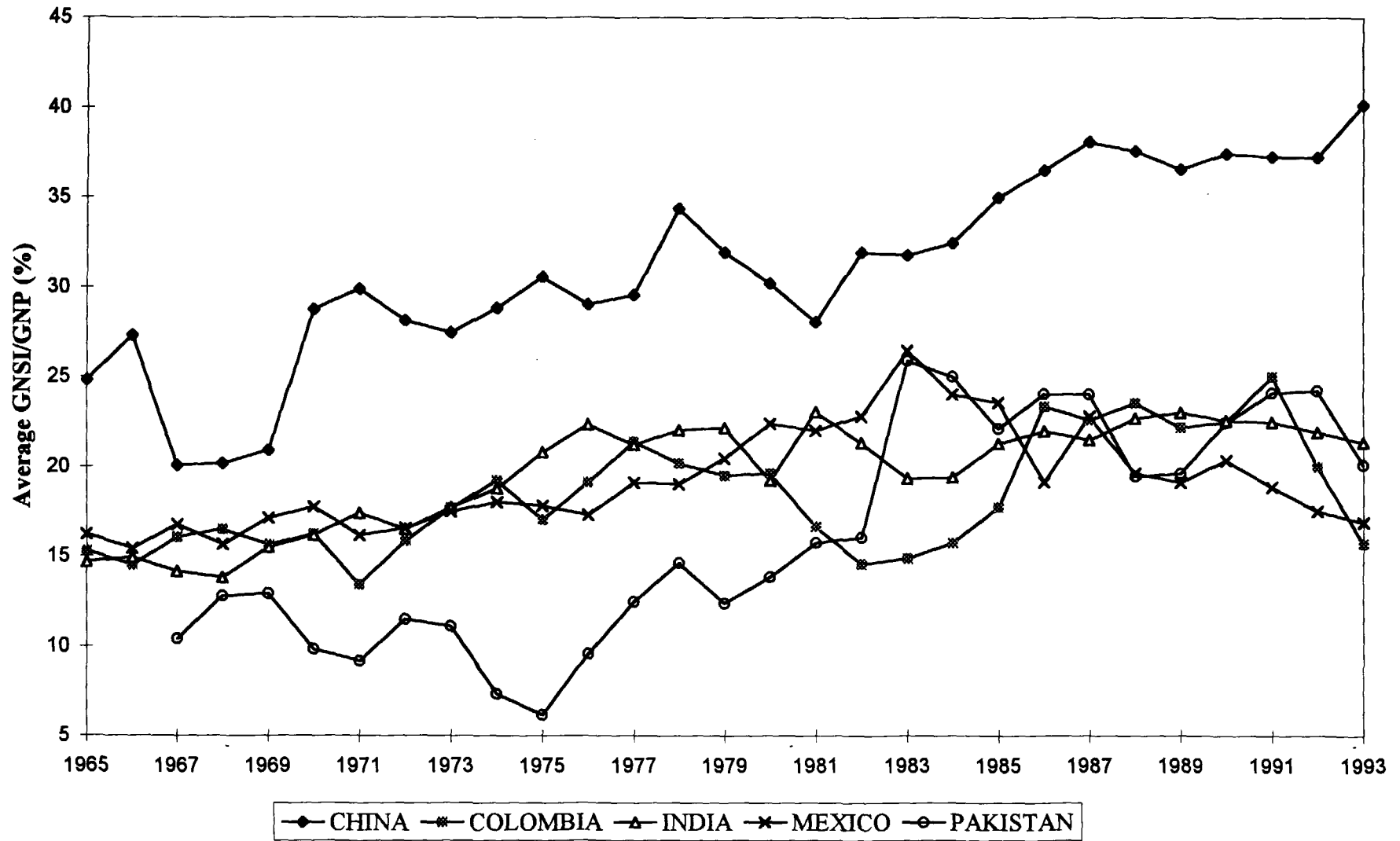
reflected by widespread interest controls, lack of variety of financial instruments, and binding credit allocation guidelines. This suggests that borrowing constraints on households and non-state firms are the norm. Thus an understanding of the likely effects of financial liberalization hinges on three questions: How will the expansion of the set of available assets (and, particularly, household access to credit) affect saving? What is the interest rate elasticity of private and household saving (and, more narrowly, of household deposits)? What is the extent of precautionary balances/buffer stocks currently held by households and enterprises?

- *Increasing uncertainty.* China's transition toward a market economy has introduced both larger economic opportunities and uncertainties to most of its population. Higher uncertainty in expected wage income, rates of return, and social services provided by the government lead to higher precautionary saving.

- *Demographics and social security reform.* China's one-child policy has significantly reduced dependency ratios, which could explain part of its saving increase. Coverage of the current pension system -- based on a enterprise-based pay-as-you-go (PAYG) scheme -- is very limited, covering mostly urban public-sector workers. However, the erosion in state pension benefits observed during the last decade could raise private retirement saving. In rural areas, where state pensions are limited or non-existent and intergenerational links are strong, the latter are weakening as a result of urban migration by the young, raising saving by the middle-aged parents who stay behind. Further extension of the existing pay-as-you-go scheme could reduce saving, while adoption of a fully-funded system could encourage saving.

- *Saving and growth.* China's currently record saving and growth rates pose various questions that are important from a policy perspective. Do they reflect a "virtuous cycle" as observed in other market-based take-off countries or are they high because of China's special mode of systemic transformation? Does causation run mainly from saving to growth (and/or income levels) or does it mainly run in the opposite direction? Are these rates sustainable or do they represent a unsustainable combination of remaining state controls, financial repression, and temporary consumption habits?

(b)   Colombia [48]

In recent years Colombia has experienced a sharp decline in its saving rate, from 21.3% of GDP in 1990 to 15.0% in 1994. Private saving fell even more, from 14.1% in 1990 to 6.2% in 1994. The private consumption boom was partly financed by higher foreign saving, reflected in a shift in the current account balance from a surplus of 1.6% of GDP in 1990 to a deficit of 4.2% in 1994.

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[48] Prepared in collaboration with Alejandro López and Ernesto May.

From the policy perspective, it is essential to disentangle the factors behind this evolution of saving, to assess if policy action is needed and, if so, to identify the measures most effective to restore saving levels. The recent evolution of the policy and external framework in Colombia indicates that the following issues should be addressed, and their impact on consumption and saving levels should be quantitatively assessed:

- *The resource boom*: have the oil and coffee bonanzas caused an upward reassessment of permanent income ? How much has this contributed to the consumption boom ?

- *Financial reform*: in recent years, mandatory portfolio allocation requirements on the banking system have been eased, and it is likely that borrowing constraints on the private sector have been somewhat relaxed. How has the availability and cost of consumer credit evolved in recent years ? How much has it contributed to the consumption boom ?

- *Fiscal policy*: how much of the decline in private saving is just an offsetting response to the rise in public saving ? Has the offsetting response been amplified by the fact that the higher public saving is partly temporary (as reflected by the termporary nature of tax surcharges currently in place) ?

- *Trade reform*: tariffs have been reduced and most non-tariff barriers (excluding agriculture) have been removed. Has this triggered off (i) a process of stock adjustment, particularly of imported durables, and/or (ii) intertemporal speculation on the possible reversal of the reforms, leading to anticipation of the purchases of (consumer) imports ?

- *Capital flows*: restrictions on capital inflows until 1992 may have diverted them to the current account, leading to an overestimation of foreign saving and underestimation of private saving (the residual). What is the likely magnitude of this factor ? More generally, which are the main directions of causality between saving and investment, and between saving and growth?

- *Pension reform*: the ongoing reform of the pension system could contribute to higher saving in the long term (Schmidt-Hebbel 1995). What is its likely impact on saving over the next few years? How much can it contribute to restore overall saving levels?

(c)   India [49]

Among developing countries, India stands out for her high saving, which exceeds by far the levels typically encountered in low-income countries. Historically, however, these high saving rates have not translated into fast growth, a problem that has been traced to India's distorted incentive structure in general and, more specifically, to the obstacles to investment posed by a comprehensive

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[49] Prepared in collaboration with Norman Loayza.

licensing regime and high barriers to capital goods imports, which resulted in abnormally high investment costs (DeLong and Summers, 1993).

Among the relevant policy issues concerning saving in India, three stand out:

- *Declining saving ratios and measurement problems:* Following the initiation of structural reforms in 1991, SNA data reveal a steady decline in private saving ratios in recent years. However, it is unclear whether this portrays accurately the evolution of saving or is just a statistical artifact. On the one hand, there are reasons why private saving could fall in response to reform: increased economic efficiency might have led to an upward reassessment of permanent income; the ongoing reduction of trade barriers could have triggered off a stock adjustment process in the demand for imported goods, or its permanence might be viewed as uncertain, leading to intertemporal reallocation of consumption towards the present; the incipient financial liberalization might have eased consumers' access to credit. Any one of these factors (or all of them simultaneously) could have resulted in a consumption boom, an experience witnessed by other reforming countries. At the same time, however, each of these explanations has drawbacks: in the first place, notwithstanding the financial reform measures, consumer access to credit is still very limited and liquidity constraints are likely to be the norm, so there is probably little scope for borrowing against future income; in addition, imports of consumer goods remain severely restricted.

  An alternative view attributes the saving decline to measurement error. A particular source of measurement error that has been pointed out could be the apparent boom in unrecorded (or under-recorded) purchases of new housing. Closer inspection of the data reveals that household saving (an aggregate which includes saving by the unincorporated private sector) is the component responsible for the observed decline in overall private saving rates. In practice, household saving is primarily derived from household investment in physical assets, itself derived as the difference between aggregate gross investment and gross investment by the public sector and private corporations. Therefore, underestimation of total investment or overestimation of investment by private corporations could have resulted in the understatement of household investment and saving.

- *Public saving and aggregate saving:* Continuing large public deficits pose a major threat to the Indian economy. While public investment has declined somewhat relative to GDP in recent years, saving of the consolidated non-financial public sector has also been falling, and is close to zero at present. Restoring public saving levels is therefore regarded as a central policy priority. However, little is known about the impact that such policy would have on private saving and thereby on the economy's national saving levels. In particular, it is unclear what type of adjustment in public saving would maximize the impact on national saving: would tax hikes be preferable to cuts in public expenditure ?

• *Private saving determinants*: Notwithstanding India's comparatively high saving rates vis-a-vis other low-income countries, they still fall far short of those in East-Asian economies, and further increases in the saving rate are likely to be necessary to speed up growth in real per capita income. To guide policies aimed at this objective, a better understanding of the key determinants of private saving in India is necessary. For example, what is the sensitivity of saving to interest rates ? What is the effect of India's changing demographics on its saving rate ? Does foreign saving crowd-out domestic saving -- a question that acquires special relevance with the ongoing opening-up of the capital account ? Also, is it likely that as part of the development process households could shift their accumulation towards human capital (in education and health) and away from conventionally measured saving ?

(d)   Mexico

Mexico's national saving rate has declined steadily over the last dozen years, from a peak of 26.4% in 1983 to a trough of 16.9% in 1993. This evolution has coincided since 1988 with Mexico's significant efforts in pursuance of macroeconomic stabilization and structural reforms. The country's investment rate rose slightly during the reform period, which, combined with declining saving, required massive capital inflows that financed a current account deficit of up to 7% of GDP in 1993-94. Growth has been sluggish since the early 1980s.

Certain policy mistakes (including exchange-rate based stabilization, inadequate public debt management, inadequate bank supervision/regulation and, in 1994, a lax monetary policy) contributed to Mexico's low growth and deteriorating external condition. The latter combination was deemed unsustainable by market participants, as reflected by their massive speculative attack on Mexico's foreign reserves in late 1994 and early 1995, which led to the subsequent and still unfolding financial and economic crisis (see Leiderman and Thorne 1996).

Mexico's low saving performance has certainly contributed to its external fragility. In this respect -- as well as in regard the policy mistakes and subsequent crisis -- Mexico's recent experience replicates to a large extent Chile's boom-and-bust episode of the late 1970s and early 1980s. As in Chile in 1983-84, among Mexico's main current challenges is the need to raise substantially its national saving rate (see for instance Feldstein 1995d). This requires addressing, among others, the following issues:

• *Identifying the causes of Mexico's low saving performance.* Fiscal stabilization (reflected in rising public-sector saving rates) has contributed to higher national saving -- but the extent of this contribution is unclear. Private saving may have declined in response to fiscal contraction, financial reform leading to excessive consumer debt, intertemporal consumption speculation as a result of incomplete credibility in exchange-rate based stabilization and/or trade reform, and higher perceived permanent income associated to the reforms and NAFTA accession. By redressing the policy mistakes of the recent past, it should be possible to revert the private saving decline observed during recent years.

- *Saving effects of pension reform.* The Mexican government has identified pension reform and tax reform as the two main levers to raise long-term saving. With regard to its pension system, Mexico adopted in 1991 a partial pension reform based on a mixed scheme of contributions to both a dominating PAYG pension pillar and a small fully-funded pillar. Now the government has proposed to Congress a more comprehensive reform project, that gives a much larger role to a decentralized and fully-funded pension pillar. It is essential to disentangle the short and long-term contributions of such a reform to saving in Mexico.

- *Saving effects of tax reform.* Shifting taxation from direct to indirect taxation (and to consumption taxation in particular), and providing tax incentives to certain private savings instruments, could have positive effects on private and national saving.

The Mexico case study will assess quantitatively these and related issues following the common research questions and methods proposed for all country case studies above.

(e)   Pakistan [50]

Although Pakistan's saving rate has been rising in recent years, it remains among the lowest in Asia. The ratio of gross domestic saving to GDP has increased from about 9% in the mid-1980s to 14% in recent years, mainly reflecting a steady rise in household saving. Throughout the 1980's, Pakistan enjoyed high GDP growth (averaging 6.1 percent per annum) with low domestic savings rates (9.4 percent on average). During that period, high levels of workers' remittances (about 7% of GDP) and abundant bilateral and multilateral credit at concessional terms helped bridge the saving-investment gap. In recent years, however, the situation has changed: workers' remittances have fallen sharply (to 3% of GDP) and Pakistan is having to rely more on non-concessionary borrowing. The implication is that higher saving will be needed in the future to support the trend growth rate without adverse spillovers to the current account. In addition, in the coming years it will be necessary to finance an increase in public infrastructure expenditures to reverse the deterioration in the social infrastructure stock, which has resulted in poor welfare outcomes and poses a constraint to future growth. The need to increase domestic saving is thus high on the government's policy agenda.

Against this background, the Pakistan study will address several important policy issues:

Reconciling the evidence on saving: It is often argued that Pakistan's saving rate is considerably higher than National Accounts estimates. A relatively large and dynamic informal economy (whose size is estimated at about 25 to 30% of the formal economy) could lead to a serious underestimation of the private saving rate in Pakistan. It is important to determine whether the low measured saving rate is an accurate portrayal of the facts or is due to measurement error.

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[50] Prepared in collaboration with Ijaz Nabi.

Household saving performance: The household saving rate has risen considerably in recent years. An important policy question concerns the identification of the factors responsible for this trend. Is the rise in household saving due to changes in saving patterns of rural or urban households ? How has rural saving been affected by the decline in workers' remittances ? How has it responded to the performance of the agricultural sector, in view of the apparently close association between growth in agriculture and the overall saving rate ? To answer these questions, the proposed work will go beyond the use of aggregate data and will employ information from household surveys, which are readily available for Pakistan. The Federal Bureau of Statistics conducts periodically (lately on an annual basis) nation-wide Household Income and Expenditure Surveys (HIES). In addition, two Integrated Household Surveys (PIHS), which include also information on items such as borrowing and lending by households, have been conducted in recent years with World Bank support. Surveys of rural saving have also been carried out in recent years.

Financial sector reform and saving: Since 1990, Pakistan has embarked on a program of financial liberalization, that includes privatization of Banks, allowing new private commercial and investment banks (local and international), elimination of interest rate ceilings on bank credit, floating new debt instruments, deepening the stock market and introducing a more liberal foreign exchange regime. Nevertheless, interest rates on bank deposits have remained negative in real terms, reflecting continued mandatory and concessional credit schemes as well as the weakness of bank portfolios. How has private saving been affected by these reforms ? Will improved private sector access to credit affect saving performance ? How does private saving respond to interest rate changes ?

Public saving: Pakistan's high growth in the 1980s was accompanied by large fiscal deficits, which resulted in an increasing burden of public debt service, and large defense outlays. In addition, insufficient infrastructure expenditures lead to a dramatic deterioration of the physical infrastructure stock, whose reversal will now necessitate a heavy investment effort. The dismal levels of public saving (around 1% of GDP) is a major impediment for this task, and raising public saving is therefore a major policy concern. The program outlined to improve public saving consists of measures to streamline government expenditures as well as increase tax revenues. In designing the strategy to increase public savings it is important to select fiscal instruments that succeed in raising *aggregate* saving. This requires assessing the relationship between alternative fiscal instruments (public expenditure and tax measures) and private saving. For example, it is often argued that shifting taxation towards consumption taxes could have a positive effect on private saving. The key question in this area is to identify the policy measures that raise public saving while having a maximum impact on aggregate saving.

Contractual saving: Pakistan has had limited experience with contractual saving. The civil-service and military pension schemes are overly generous and will have adverse fiscal implications over the medium term. However, private pension schemes are still largely undeveloped. Increasing awareness of the importance of contractual savings in many successful countries of Southeast and East Asia is prompting policy makers to take a closer look at such savings schemes. Several questions arise in designing contractual saving schemes for Pakistan: should Provident Funds and Pension Plans be fully

funded or pay-as-you-go type? What implications do they have for private (household and firm) saving behavior ? How should such funds be managed ?

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