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Structural Reforms to Set the Growth Ambition

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Abstract

The effect of structural reforms on growth in Europe and Central Asia is assessed by looking separately at each supply-side channel: capital, labor, and productivity, with the last estimated using the stochastic frontier approach. By controlling for the interaction with the economic cycle, the paper also investigates whether timing matters. Improvements in human capital, regulatory quality, and government effectiveness have the most impact on potential growth, along with financial development. European Union accession may also boost growth, mainly by encouraging capital deepening. However, changes in labor market regulation and tariffs may have ambiguous effects. Applying the results to Serbia, the analysis demonstrates that closing certain structural gaps with the frontier would help boost its potential.

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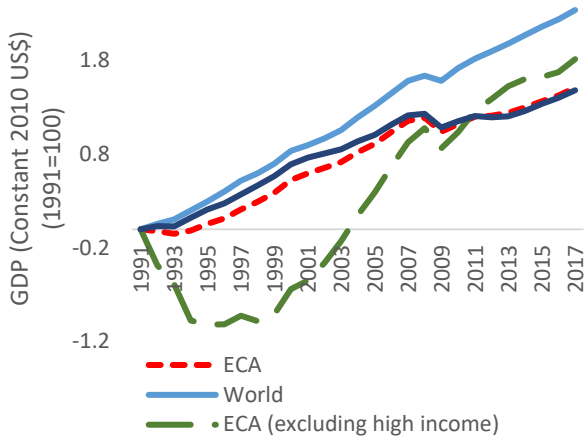
Overview

The impact of structural reforms on growth has generated new interest. In an era of secular stagnation, it has become a major concern in Europe and Central Asia (ECA), where growth has been stagnating, mainly because growth in advanced economies has been subdued (Figure 1). As a result of weaker than expected activity in the euro area, the pace of growth in the region's developing countries has also decelerated and so has not yet fully recovered from the slowdown after the global financial crisis, hence showing the weakness of the underlying structural fundamentals. Also, the forecast is subject to further deceleration, more pronounced for Central Europe and the Baltics, due not only to the tight connections with euro area economies but also to the region's own worsening demographic trends and minimal growth in productivity and investments (World Bank 2019a).

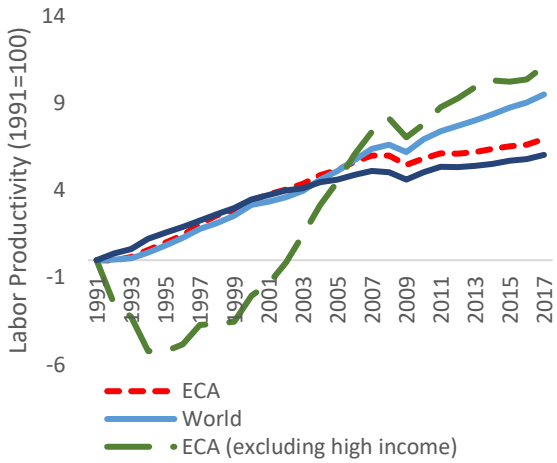
For the last decade labor productivity in ECA has stagnated, and since 2006, its pattern has been significantly diverging from the rest of the world (Figure 2). In the past, productivity in ECA mirrored the world pattern, but it has taken a different path since 2006 and especially since 2009. Growth of labor productivity has been falling in both industrial and developing countries for decades.[2] The slowdown is driven not only by stagnation in the EU but also by the deceleration of growth in low-income countries. In fact, since 2009 labor productivity growth in ECA (high-income countries excluded) has been considerably less than in the first decade of the 21st century.

Figure 1. Real GDP Growth



Source: World Development Indicators (WDI).

Figure 2. Labor Productivity Growth



Source: WDI.

This paper attempts to identify the structural determinants of growth in ECA. The analysis builds on the approach introduced by Bouis and Duval (2011), Barnes et al. (2013), and Johannson et al. (2013) and elaborated by Egert and Gal (2016). The methodology allows to identify the main structural determinants of potential GDP growth by studying separately capital, labor, and productivity—the channels through which those determinants may work. As in Lusinyan (2018), productivity here is

[2] See Cusolito and Maloney (2018), Arteta and Kasyanenko (2019) and World Bank (forthcoming) for a recent analysis of productivity trends in ECA.

proxied by an estimate of technical efficiency, based on stochastic frontier analysis (SFA). The structural reform indicators are selected and interpreted based on the 12-pillar classification developed for the Global Competitiveness Index (WEF 2018).

Institutions and better-functioning domestic product markets are a key structural determinant of growth. Perception of the quality of government services and policies significantly affects economic growth, mainly through the capital and productivity channels, probably through their impact on investment decisions and reduction of operating costs. Lower taxes and higher regulatory quality contribute to higher growth. The effect of such structural reforms would be transmitted through all three input channels, hence spurring the use of labor and capital and thus promoting productivity.

Better educational attainments, which contribute to higher quality of human capital, are associated with both higher employment and productivity, hence higher economic growth. The results show that an increase in the level of educational attainments affects both the use of labor and the efficiency channel, and the result is robust across alternative model specifications.

Growth is positively affected by how well-developed a country's financial systems are and by its innovation capability. The higher the share of domestic credit to the private sector as a percent of GDP, the deeper and more efficient its use of capital. Availability of the latest technologies improves the use of both labor and capital inputs.

Changes in labor market regulation may have ambiguous effects. A reduction of the extent to which working time conditions are regulated seems to increase overall productivity, hence spurring growth. The result is weak for the other two input channels, most importantly for labor. The weakness of the result may however reflect also the inability of the model and/or indicators to properly capture the impact of labor market reforms.

Trade liberalization does not have a straightforward relationship with growth. Once institutions are controlled for, the net effect of greater trade openness, proxied by a decrease in tariffs, customs border procedures, or other nontariff trade barriers, depends on the relative strength of the impact that different degrees of protection have on both capital accumulation and productivity.

Other factors, including infrastructure and use of information and communications technology (ICT), also matter for growth. For example, the higher the number of Internet users, the higher the growth, although the effect is relatively small. The results are stronger when the sample is enlarged.

If Serbia were to close the gap with Germany, reforms would add significant contribution to Serbia's potential growth. It is possible to quantify the likely effect of structural reforms on Serbia's economic growth—assuming that, following the reforms, the country's main structural variables would over a certain time horizon converge to the value for Germany. Keeping in mind the underlying linearity assumption of the model, more than at providing a precise estimate, the simulations aim at quantifying the relative importance of each reform. In particular, enhancing government effectiveness, regulatory quality, human capital and financial development may contribute the most to economic growth. EU accession would also add to economic growth, mainly by boosting capital deepening.

Pro-competition reforms may have less impact on real GDP growth if they occur during economic slowdowns. In assessing the impact of structural reforms, the potential endogeneity to the economic environment should be considered. This makes it possible to disentangle the effects of a reform carried out on the verge of a cyclical economic upswing (downswing) from those of the upswing (downswing) itself. The issue is important because often implementation gaps, perhaps because of bad timing, make

structural changes less effective. Based on the approach by Bordon et al. (2016), the effect of better regulation may be reduced if the reform occurs during an economic slowdown.

The remainder of the paper is organized as follows: Section 1 briefly discusses the literature review; Section 2 describes the database and methodology used; Section 3 reports the baseline results for the structural determinants of the three supply-side channels and their impact on GDP growth; Section 4 discusses robustness exercises; and Section 5 considers how timing may influence how reforms affect growth. Section 6 narrows the focus to Serbia and quantifies the impact if the country were to close its structural gaps with the frontier. The final section spells out conclusions.

1. Literature Review

The literature on structural reforms has been growing. With a sample of almost 60 countries, 32 of which were emerging markets (EMs), Lusinyan (2018)—to whom this paper is highly indebted—found that reducing entry barriers, especially the cost of starting a business, and trade tariffs boost capital deepening. Capital intensity is affected negatively by output volatility and positively by the availability of private credit and the latest technologies. Lusinyan (2018) identified a robust positive link between employment and pro-competition regulation. Changes in labor market regulation, however, are not closely related to the employment rate. Finally, efficiency is closely associated with both product and labor market indicators, but human capital does not have much of a role.

This paper departs from Lusinyan (2018) by focusing on ECA and expanding the structural indicators considered. The analysis highlights the role of human capital, as proxied by educational attainment, in economic growth in ECA. The supply-side framework is combined with the methodology developed in Bordon et al. (2016) to control for the interaction of structural changes with the economic cycle. This makes it possible to illuminate the effect of implementation gaps, which may undermine the effectiveness of reforms. While the literature is mainly concerned with labor market regulation, this analysis focuses on changes in regulatory quality.

Many studies have found that the long-run effects of structural reforms on output are strongly positive. For example, Egert (2018) studied the effects of structural reforms across the three channels on a large set of OECD and non-OECD countries. He found that lower barriers to entry and reduced state control of businesses improve productivity and the use of both capital and labor. Productivity is also affected by the degree of financial development. This is aligned with the findings of Biljanovska and Sandri (2018) and Elkhuizen et al. (2018). Based on a sample of 86 advanced and emerging countries, for instance, Biljanovska and Sandri (2018) demonstrated that structural reforms, including those of the banking sector, have positive effects on productivity growth. Similarly, this study finds that financial development has a positive impact on output growth, and the effect mainly works through capital deepening. In a literature review, Martins (2019) has highlighted the fact that investment in education is among the most critical ways to accelerate structural change—and thus aggregate productivity. In line with these findings, this analysis sheds light on the significant role of human capital and how it affects growth by favoring labor accumulation, productivity, and capital deepening. Also, recently, Rodriguez-Pose and Ketterer (2019) have instead focused on the impact that institutions and improvements in government quality have had for growth and in lagging regions of ECA. Also, IMF (2019), using a newly constructed database on structural reforms, finds that a reform push in areas including governance, domestic and external finance, trade, and labor and product markets could deliver sizable output gains in the medium term.

Timing has become a central issue in the literature on structural reforms. Based on a DSGE model, Eggertsson et al. (2014) first showed that during a crisis structural reforms do not increase output.

When the economy is constrained by the zero-lower bound, reforms may even have negative impact by fueling expectations of deflation, which may push up the real interest rate and further depress aggregate demand. Similarly, Cacciatore et al. (2016) showed that although less sensible, product market reforms may have an ambiguous impact due to the interaction with the business cycle Using a sample of large OECD countries, Bordon et al. (2016) focused on labor and product market reforms and found a lagged but positive impact on job creation that remained even after controlling for the endogeneity of the decision to reform. However, the effects of labor market reforms undertaken during periods of economic distress tend to be negative. More recently, Campos et al. (2017) also stressed the importance of timing when assessing the impacts of all kinds of structural reforms. Using firm-level data, de Almeida and Balasundharam (2018) found that structural reforms do have a positive effect on output and employment, particularly over the medium term, but different reforms have different payoffs, with labor market reforms having the least impact. This may be because most labor market reforms had occurred during economic downturns. Aiyar et al. (2019) also discussed the interaction between structural and cyclical policies and showed that structural reforms are needed to enhance the resilience of countries, and the monetary union as a whole. Recently, IMF (2019) demonstrates that some reforms, including easing job protection regulation and liberalizing domestic finance, may entail significant short-term costs if carried out in bad times. In line with other research, this study shows that structural reforms may have less effect on product markets if implemented during periods of significant slack.

Finally, this paper is also related to the literature on the effects of EU accession, with two main views prevailing: (1) EU accession may result in large upfront costs of structural reforms or in reduced incentives to reform, especially for small countries joining the monetary union, as they are unlikely to affect union-wide inflation bias. Duval and Elmeskov (2006) found that indeed countries that have little or no monetary autonomy because they have fixed exchange-rate regimes or participate in a monetary union apparently undertake fewer reforms. (2) EU accession may increase the incentives for structural reforms to facilitate a market-based adjustment to shocks. Moreover, reduced costs of trading, increased mobility of capital, and greater transparency may foster pro-competition regulatory changes. In line with this second view, Dias da Silva et al. (2017) found a positive and robust link between growth and being part of the EU single market. This is actually true for many countries pursuing EU accession (see the recent report on Poland, World Bank Group [2017a]). Aligning with the second view, this study found a positive and robust nexus between EU accession and output growth that mainly worked by boosting capital deepening and productivity as a result of accession to a single market.

2. Database and Methodology

Database

This paper builds on the database developed by Lusinyan (2018), a large collection of macroeconomic variables and structural indicators for many advanced and emerging economies for the period 1980–2016. The sample varies, however, depending on data availability for countries and variables.

The analysis here, in particular the baseline model (see Section 3), uses a sample of about 50 countries in ECA. The extended model builds instead on a larger set of advanced and emerging economies.

Working with a focused sample of countries ensures greater precision when applying the stochastic frontier approach (SFA) to obtain a proxy for productivity. The SFA in fact, given a sample of

countries, estimates the "common" production frontier. For consistency, the labor and capital regressions are performed using the same sample. However, results are robust to enlargement of the sample (see Section 4).

Table 1 lists the countries in the sample, classified by EU membership/Schengen area.

Table 1. Countries in the Study Sample

EU Members/Schengen Area	Other ECA Countries
Austria, Belgium, Bulgaria, Croatia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom	Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Georgia, Kazakhstan, Kosovo, Kyrgyz Republic, Moldova, Montenegro, North Macedonia, Russia Federation, Serbia, Turkey, Tajikistan, Turkmenistan, Ukraine, Uzbekistan

Since the number of structural indicators could be very large, variables are selected and classified according to their interpretation and in line with the WEF competitiveness approach. Since 2005, the WEF has published the annual Global Competitiveness Index (GCI), which identifies and measures the microeconomic and macroeconomic foundations of national competitiveness. The GCI has identified 12 areas ("pillars") as sources of national competitiveness.[3] Table 2 lists the indicators used in the analysis, classified according to the WEF-GCI 2018 pillars.

Table 2. Structural Reform Indicators Classified Following WEF-GCI 2018

Pillar	Indicator	Description	Source
Pillar 1: Institutions	Government effectiveness	Captures perception of the quality of public services, the civil service and its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to its policies.	WGI (2016)
Pillar 2: Infrastructure[a]	Per capita energy use	Energy use, kg of oil equivalent.	WDI
Pillar 3: ICT adoption[b]	Individuals using Internet (%)	Individuals who have used the Internet, from any location, in the last three months	WDI
Pillar 4: Macroeconomic stability	Output gap *or* Change in terms of trade	Output gap Change in terms of trade (log).	WEO WEO
Pillar 5: Health Pillar 6: Skills	Human capital[c]	Index of human capital per person, based on years of schooling (Barro and Lee 2013) and returns to education (Psacharopoulos 1994)	Penn World Table
Pillar 7: Product market	Taxes[d]	Top marginal income and payroll tax rate, percent	Fraser (2016)
	Regulatory quality[e]	Measures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.	WGI (2016)

[3]The tenth pillar in the WEF GCI classification is market size (proxied by either GDP or volume of imports), a variable that either coincides or is highly correlated with the dependent variable.

	Tariffs	Trade-weighted average applied tariff	WEF
	Openness[f]	Defined as the sum of export and import over GDP.	WEO
Pillar 8: Labor market	CBR labor regulation index Women (% of population)	Calculated as the average of sub indicators pertaining to laws and regulations related to work time. Women (% of population)	Cambridge Center for Business Research database WDI
Pillar 9: Financial system	Domestic credit to private sector (% of GDP)[g]	Resources provided to the private sector by financial corporations	WDI
Pillar 10: Market Size	GDP *or* volume of imports	GDP *or* volume of imports [dropped as highly correlated with dependent variable]	WDI
Pillar 11: Business dynamism	Cost to start a business[h]	Number of days and procedures to start a business	Doing Business database
Pillar 12: Innovation capability	Availability of latest technology	The extent to which the latest technology is available in the country.	WEF

Note: [a] Results are robust to the use of other variables, incl. quality of roads index (WEF), which reflects the perceived quality of roads in the country; infrastructure (WEF), which reflects the perception of quality of infrastructure in the country (transport, telephony, energy). Also, an infrastructure index is used, built as weighted average of energy and internet use.
[b] Results are robust to the use of International Internet bandwidth (kb/s) per Internet user (Source: WEF), and to the use of infrastructure indexes (see previous Note).
[c] Results are robust to the use of other variables, such as average years of schooling (not shown).
[d] Results are robust to the use of average tax rate (not shown).
[e] The use of the regulatory index (component of Pillar 7) within the same model with government effectiveness (Pillar 1) and cost of doing business (Pillar 11) may lead to biased results due to collinearity. Alternative specifications are used to test the results, incl. the use of the extent of market dominance (WEF).
[f] Results are robust to the use of other variables related to trade facilitation. For example, the Fraser regulatory trade barriers index is used (see Annex 4)
[g] Results are robust to the use of an indicator of credit market regulation (Fraser, see Annex 3).
[h] See note e.

The classification encompasses determinants of competitiveness in terms of the institutions, policies, and factors that affect a country's productivity, prosperity, and potential growth.[4] It brings together factors of production that build and boost the structural side (human capital, innovation adoption, energy, and Internet adoption); means of growth (financial intermediation, openness to trade); and reforms that affect institutional quality (government effectiveness, competition and regulatory quality).

The first competitiveness area—the first four pillars—deals with the enabling environment for business. Pillar 1 recognizes the importance of institutional quality for sustainable and strong economic growth. In this study it is proxied by the government effectiveness indicator (WGI). Pillars 2 and 3 refer to extensive and efficient infrastructure and ICT adoption; these are proxied by the use of energy and the Internet (WDI) in the baseline model. The extended version also uses the quality of roads and diffusion of broadband (WEF), respectively; the WEF infrastructure index; an infrastructure index, built as the average of energy consumption and Internet adoption, weighted equally. Pillar 4 stresses the relevance of macroeconomic stability to business development and thus growth.

[4] Read more about the WEF methodology at reports.weforum.org.

The second competitiveness area deals with human capital because a healthy and educated labor force is pivotal to national competitiveness. Pillars 5 and 6 therefore concern health and skills. In this study, these components are indistinctly proxied by human capital (Penn World Table). This index is based on average years of schooling from Barro and Lee (2013), weighted by an assumed rate of return to education based on Mincer equation estimates around the world (Psacharopoulos 1994).

The characteristics of input and product markets are also crucial for productivity and growth. Pillars 7 to 10 therefore look at markets as sources of growth: Pillar 7 deals with the efficiency of product markets and healthy market competition, both domestic and foreign, as drivers of business productivity. For domestic markets, the top marginal income and payroll tax rate (Fraser 2016) and the regulatory quality indicator (WGI) are used as proxies. Regulatory quality captures perceptions of the government's ability to formulate and act on sound policies and regulations that promote private sector development. In terms of foreign markets, openness is proxied either by the trade-weighted average applied tariff rate (WEF) or by the trade-to-GDP ratio (WEO). Pillar 8 refers to the flexibility of the labor market to quickly shift workers from one economic activity to another at low cost, and to allow for wage fluctuations without much social disruption. This is proxied by the labor market regulation index developed by the Cambridge Business Research (CBR) Center, including the subcomponent related to regulation of work time. The index measures the extent of protection and regulation of work time in the labor code.[5] Pillar 9 deals with efficient financial markets and financial development, proxied here by the ratio of domestic credit to the private sector to GDP (WDI). Finally, Pillar 10 refers to market size (which could be proxied by either GDP or volume of imports), a variable that either coincides or is highly correlated with the dependent variable and was therefore dropped as a determinant.

Finally, the extent to which an economy operates as an innovation ecosystem also matters**.** Pillars 11 and 12 relate to business dynamism and innovation capability; dynamism is proxied here by the cost of starting a business (Doing Business) and innovation by the availability of the latest technology (WEF).

Methodology

The first part of the analysis relies on the supply-side methodology introduced by Bouis and Duval (2011), Barnes et al. (2013), Johansson et al. (2013) and further elaborated by Egert and Gal (2016). The supply-side framework is based on a production function approach and has the advantage that GDP growth can be expressed as the sum of separable and independent supply-side components. This makes it possible to study separately the link between structural variables and each supply-side channel: labor, capital, and productivity.

Assume a standard Cobb-Douglas production function,

$$Y = f(K, L, \theta)$$

with K denoting capital input, L labor, and θ productivity. Rethinking it in per capita terms, and with some rearrangement, the production function can be written as follows

$$\Delta\ln\left(\frac{Y}{N}\right) = \frac{\alpha}{1-\alpha}\Delta ln\left(\frac{K}{Y}(z)\right) + \Delta ln\left(\frac{E}{WP}(z)\right) + \frac{1}{1-\alpha}(\Delta\theta(z)) \quad (1)$$

[5] See Annex ***6*** for details on the CBR labor market regulation index.

where ln is the natural logarithm; Δ represents the difference over time; N measures population, E employment, and WP working-age population; α is the output elasticity of capital and equals a standard value of 0.33; z is the structural variables listed in Table 2. Constant return to scale and a constant WP ratio are assumed.

The estimation period spans from 1996 to 2016, although it shortens when some structural indicators are added to the model specification, in particular the indicators from the World Economic Forum (WEF) database which are available only since 2006 – see Table 2.

As shown in equation 1, all components are separable and independent of each other. It is therefore possible to compute the effect on output growth of structural reforms, namely changes in structural variables, z. Each dependent variable is in fact regressed on all the competitiveness indicators (Table 2) to identify those structural variables whose explanatory power remains robust and statistically significant across different model specifications.[6] Table 3 lists dependent variables, their description, and source. Cross-country panel data regressions are used to estimate both the capital-output ratio and employment rate equations. The Hausman test is used for fixed and random effects.[7]

Table 3. Dependent Variables

Variable	Description	Source
Real output	Real GDP in billions of constant 2011 international dollars	WEO
Total stock of capital	Capital stock, billions of constant 2011 US dollars, extended with depreciation and investment series from the WEO	Penn World Table, WEO
Employment	Employees and self-employed in thousands, extended with employment growth rate from the WEO	Penn World Table, WEO

The methodology is subject to several caveats, the most important being the endogeneity of the regressors. First, the Hausman test is performed to verify whether the random-effect specification may be appropriate for cross-country regressions. The Pesaran (2004) test is used to control for the presence of cross-sectional dependence in panels with many cross-sectional units and few time-series observations. The robustness of the estimates is also verified by employing the Arellano-Bond General Method of Moments (GMM) estimator, although that is also subject to caveats. For example, it may underestimate the impact of several common determinants of the steady-state level of income, such as human capital, as discussed in Hauk and Wacziarg (2004). The adoption of the GMM estimator requires losing at least two periods of data, which may alter the results when the starting sample is small. Finally, it may also be subject to the problem of weak instruments: the first-stage relationship between differenced independent variables and lagged dependent ones may be weak. The problems are addressed by using the Blundell and Bond System GMM (see Section 4).

To better control for potential endogeneity, the ideal would be to cross-check the estimates based on macroeconomic time series with those obtained from using sector- and firm-level data (see also the discussion in Egert and Gal 2016).

[6] The baseline model does not control for the lagged dependent variable, but the robustness of the results is tested under this specification (see Section 4).

[7] As discussed in Lusinyan (2018), the random effect specification may allow to capture both between and within-country information, the latter being relevant especially for factor utilization.

Productivity—how firms and the economy as a whole combine labor and capital inputs into ever-more-efficient uses—can be measured at several levels and in several ways. It can be expressed as labor productivity (output per employee or per hour worked) or capital productivity (output per unit of capital). An alternative is to use the growth accounting approach to measure total factor productivity (TFP), which is defined as the difference between growth of outputs and of inputs. A different approach is to estimate TFP growth via stochastic frontier analysis (SFA).

The SFA makes it possible to estimate the production frontier, which represents the maximum amount of output that can be obtained given the factors of production and the technology available. An economy may then operate below what would be predicted by the production frontier due to pure errors and uncontrollable factors. The distance of actual output from potential may therefore expose the inefficiency of the economy. Following the approach in Battese and Coelli (1995), technical efficiency is estimated using the SFA approach conditional on structural and macroeconomic variables. One advantage of the SFA is that efficiency (or inefficiency) and its determinants are simultaneously estimated and, unlike alternative approaches, productivity is not recovered as a residual but is estimated jointly with its structural determinants. From a statistical point of view, the regression model is characterized by a composite error composed of a classical idiosyncratic disturbance and a one-sided disturbance that measures inefficiency.

With this methodology, output $Y_{s,t}$ in a given state *s* can be expressed as

$$Y_{s,t} = f\left(X_{s,t}, t\right)\mu_{s,t}e^{v_{s,t}}$$

where Y is output in the given state s, and $f(.)$ is the production function of inputs $X_{s,t}$ and technological change t. The variable $\mu_{s,t}$ equals 1 if the economy operates at full efficiency in state s; $e^{v_{s,t}}$ is a random shock.

Assuming a log-linear production function, given labor and capital inputs, and letting $u_{s,t} = -ln\left(\mu_{s,t}\right)$ denote inefficiency, the production function can be rewritten as

$$y_{s,t} = \beta_0 + \beta_L L_{s,t} + \beta_K K_{s,t} + \beta_t t + \varepsilon_{s,t}$$

where $\varepsilon = v_{s,t} - u_{s,t}$ is the model error. A time trend is introduced to capture the impact of global shocks and the change in the production frontier caused by technological progress. Country-specific random shocks are used to capture cyclical variability.

The model error, $\varepsilon = v_{s,t} - u_{s,t}$, is the sum of two unobservable error terms: $v_{s,t}$ is assumed to be i.i.d normally distributed, with mean 0 and variance σ_v^2 capturing measurement and specification errors; $u_{s,t}$ is assumed to be independently distributed and obtained by a positive truncation of the normal distribution with mean $z_{s,t}\delta$ and variance σ_u^2. These distribution and independence assumptions are needed for the model to be estimable. As Battesi and Coelli (1995) show, with these assumptions, the inefficiency component, used to recover the point estimates for technical efficiency, can be recovered from the conditional expectation:

$$\mathrm{E}\left[\exp\{-u_{s,t}|\varepsilon\}\right].$$

Following Battese and Coelli (1995), inefficiency can be modeled as time-varying conditional inefficiency:

$$u_{s,t} = z_{s,t}\delta + w_{s,t} \qquad (2)$$

where $z_{s,t}$ is a vector of explanatory variables associated with technical inefficiency of production in state s, and $w_{s,t}$ is defined by the truncation of the normal distribution with zero mean and variance σ_u^2. This specification makes it possible to capture exogenous influences in the inefficiency model and heterogeneity.

Alternatively, it is possible to introduce exogenous influences in the inefficiency model by scaling the distribution of the error and introducing heteroskedasticity so that the variance of the pre-truncated inefficiency distribution is modeled as

$$\sigma_u^2 = z_{s,t}\varphi$$

Using the SFA approach, both the parameters of the stochastic frontier and the model of technical inefficiency are simultaneously estimated with a maximum likelihood method (Belotti et al. 2012), which means that productivity and its determinants are simultaneously estimated.

In the second part of the paper, the focus is on the timing of structural reforms. Following Bordon et al. (2016), initial conditions and implementation matter for structural reforms and must be considered. Therefore, it is possible to control for the interaction between growth and reforms, conditional on the economic cycle.

The cyclical variable is a dummy taking the value of 1 in each year in which the output gap (WEO) as a percentage of potential output is lower than –2 percent (bad times), and 0 otherwise:

$$I_{s,t} = 1[\, Output\ gap\ < -2\,]$$

For example, equation (2) can be rewritten as follows:

$$u_{s,t} = (\gamma_1 + \gamma_2 I_{s,t})R_{s,t} + z_{s,t}\delta + w_{s,t}$$

where $R_{s,t}$ is the reform variable and $I_{s,t}$ is the cyclical dummy. Following Dias da Silva et al. (2017), reforms are identified as simple positive or negative annual changes of the indicators. The reform variable is defined as a dummy variable, which takes the value of 1 when there is a reform shock (i.e., a change in the indicator).

Hence, the association of reforms with changes in technical efficiency is measured as γ_1 in good times and $(\gamma_1 + \gamma_2)$ in bad times.

3. What Works, and How

Labor Channel

Table 4 reports the results of the baseline model for the employment ratio.

First, improving the educational attainment is associated with higher use of labor. Better education outcomes, contributing along with health to higher quality of human capital, translate into a higher

employability of the country's labor force. The relationship is robust across the alternative specifications, including the GMM and the extension of the sample to a larger number of countries (see Section 4 for discussion and Annexes 2 and 3 for results). Previous studies have shown that human capital indeed has positive effects on growth in output and employment. For example, using firm-level data, Ciccone and Papaioannou (2009) show that these effects are stronger in schooling-intensive industries, which suggests that higher human capital promotes more rapid adoption of technology and faster output growth in education-intensive industries.

Secondly, there is a close relationship between the use of labor and the product market (Pillar 7). The health of product markets, with both market competition and a business-friendly environment, is crucial to boost employment. The results are robust across alternative specifications, including the GMM and the extended model.

In particular, there is a robust positive link between the employment ratio and pro-competition regulation, as captured by the index of regulatory quality. This result is aligned with previous studies. For example, Nicoletti and Scarpetta (2005) found that in overly regulated countries significant employment gains can be obtained by deregulating product markets, and the gains are likely to be particularly high when the labor market is rigid. The result is robust to the use of a large data set, though stronger for ECA countries, as captured by the interaction term (Annex 3, Table A3.4).

The effect of dropping the tax rate is positive and statistically significant on the use of labor, in line with Gal and Theising (2015) and IMF (2015). High labor income taxes may indeed slow job creation and work incentives by making formal jobs less appealing. The beneficial effect of lowering the tax rate seems stronger for ECA (Annex 3, Table A3.4). The analysis however does not consider important factors, including the dimension of the tax base, the existence of employment subsidies and the extent of informality.

Interestingly, variables related to the degree of openness, e.g. tariffs, openness and regulatory trade barriers, do not show a significant relation with the labor channel. Similarly, accession to the EU single market is not statistically significant and is not associated with a higher employment ratio. It may be that labor is relatively less mobile than capital or other inputs, and processes like EU accession and enlargement create both winners and losers not only among countries, including large migration flows from poorer to more advanced countries, but also among sectors. The EU Commission Report (2009) identified sizable short-term adjustment costs that arose in some sectors because employment in the older member states was negatively correlated with the rise in employment in new member states. It is important however to consider factors which may affect this result, as: (i) collinearity with the EU dummy and other structural variables, including trade liberalization and institutional quality; and (ii) the period of observation, as the most radical structural reforms which happened in the early 1990s are not captured by the sample.

Finally, the effect of labor market regulation is not robust and statistically significant. Employment regulations can be controversial, and evidence of the effects on employment and productivity is mixed (see also Lusinyan 2018). For example, as discussed in Betcherman (2014), employment effects may be negative in industries characterized by high turnover, and they may vary by type of worker. The weakness of the result may reflect also the inability of the model and/or indicators to properly capture the impact of labor market reforms.

Table 4. Use of Labor, Baseline Model

Dependent variable: log of employment ratio, ln(E/WAP)

	(1) FE 1996-2013	(2) RE[a] 1996-2013	(3) RE[b] 1996-2013	(4) RE 1996-2013	(5) RE 1996-2013	(6) RE 1996-2013	(7) RE 1996-2013	(8) RE 1996-2013	(9) RE 1996-2013	(10) RE 1996-2013
Pillar 1								-0.009	0.006	-0.007
								(-0.55)	(0.32)	(-0.42)
Pillar 2								0.00004***	0.00004***	0.00003***
								(5.40)	(5.92)	(4.65)
Pillar 3								-0.0006***	-0.0006***	0.00004
								(-2.14)	(-2.04)	(0.22)
Pillar 4	0.006***	0.006***	0.007***	0.006***	0.007***	0.006***	0.006***	0.005***	0.006***	0.005***
	(12.79)	(12.77)	(12.22)	(12.61)	(11.78)	(12.59)	(12.60)	(9.53)	(10.24)	(9.52)
Pillar 5,6	-0.023	0.0416	-0.0350	0.0520	0.0614	0.0562	0.0542	0.0586*	0.0573*	0.0978***
	(-0.37)	(0.81)	(-0.92)	(0.99)	(1.28)	(1.12)	(1.07)	(1.41)	(1.41)	(2.47)
Pillar 7										
Tax rate	-0.185***	-0.205***	-0.156***	-0.198***	-0.206***	-0.204***	-0.204***	-0.213***	-0.212***	-0.194***
	(-4.31)	(-4.89)	(-5.96)	(-4.70)	(-5.01)	(-4.90)	(-4.82)	(-4.78)	(-5.02)	(-4.30)
Regula-tory quality	0.069***	0.077***	0.058***	0.076***	0.074***	0.077***	0.076***	0.064***	0.052***	0.066***
	(3.68)	(4.23)	(4.56)	(4.20)	(4.09)	(4.35)	(4.11)	(3.06)	(2.56)	(3.14)
Tariffs				-0.001						
				(-1.31)						
Openness					0.00001	-0.00012	-0.00013	-0.00004	0.00010	0.00005
					(0.08)	(-0.77)	(-0.80)	(-0.28)	(0.59)	(0.31)
Pillar 8										
Women	-0.046***	-0.034***	-0.021***	-0.033***	-0.029***	-0.031***	-0.031***	-0.015	-0.014	-0.018*
	(-2.63)	(-2.30)	(-2.27)	(-2.27)	(-2.10)	(-2.20)	(-2.18)	(-1.26)	(-1.21)	(-1.56)
CBR	0.091	0.102*	0.008	0.0965*	0.129**	0.0964*	0.0952*	0.0644	0.0554	0.0602
	(1.28)	(1.46)	(0.20)	(1.37)	(1.83)	(1.36)	(1.33)	(0.96)	(0.83)	(0.89)
Pillar 9								0.0236*	0.0171	0.0220
								(1.33)	(0.99)	(1.22)
Pillar 11	0.0002	0.0003		0.0003	0.0002	0.0003	0.0003	0.0004*	0.0002	0.0003
	(1.07)	(1.18)		(1.22)	(0.69)	(1.17)	(1.17)	(1.53)	(0.86)	(1.05)
Pillar 12	0.009*	0.00806*		0.00831*	0.00336	0.00779*	0.00772*	0.00431	-0.00319	0.00825*
	(1.29)	(1.45)		(1.49)	(0.44)	(1.41)	(1.37)	(0.69)	(-0.38)	(1.33)
EU	0.0001	0.0001		0.004	0.0111		0.0066	0.0306	0.0257	-0.0152
	(0.00)	(0.00)		(0.05)	(0.16)		(0.09)	(0.56)	(0.47)	(-0.29)
Time trend	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No	No
Year effect	No	No	Yes	No	Yes	No	No	No	Yes	No
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	240	239	397	238	239	239	239	237	237	237
Wald test	259.42	366.2	4184.78	367.1	411.9	357.8	358.5	356.8	431.7	333.5
P value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: *t* statistics in parentheses; * p<0.2, ** p<0.1, *** p<0.05.

[a] In the current specification, the initial hypothesis that individual effects are adequately modelled by a random-effects model cannot be rejected: the Hausman test chi-sq 6.98, with p-value 0.5389.

[b] In the current specification, the initial hypothesis that there is no cross-sectional dependence cannot be rejected: Pesaran's test of cross-sectional independence chi-sq is -2.053, with Pr. 1.96.

The robustness of the results is tested through several alternative approaches (see Section 4). First, the system-general method of moments (system-GMM) is employed to address endogeneity bias of the lagged dependent and explanatory variables.[8] The results (Annex 2) show that most of the structural determinants of labor are statistically significant. Although parameter estimates are not directly comparable, results seem robust from a qualitative point of view. The robustness of the results is also tested by enlarging the data set to more countries (extended model, Annex 3).

Capital Channel

Table 5 reports the results for capital from the baseline model.

Pillar 1, as proxied by government effectiveness, is a statistically significant and robust determinant of capital deepening. This may likely work through the investment channel, since institutions are a decisional variable for any investment decision. Similarly, extensive and efficient infrastructure, as captured by energy consumption, Internet adoption, and infrastructure quality (WEF), turns out to be also positively associated with capital accumulation, especially in the extended version of the model (Section 4; Annex 3).

A reduction of entry barriers, especially tax rates and tariffs, and an improvement in regulatory quality also boost capital deepening. Irwin (2001) has argued that tariffs in late nineteenth century America may have discouraged capital accumulation by raising the price of imported capital goods. He also observed that productivity growth was most rapid in nontraded sectors whose performance was not directly related to a tariff. This suggests that more open economies may benefit from higher capital accumulation and deepening. Similarly, the EU accession dummy positively affects capital by facilitating capital mobility. Finally, an improved business environment, with a lower cost of doing business, stimulates capital deepening. The results are robust to expansion of the data set to more countries, and seem stronger for ECA countries, as captured by the interaction term.

Table 5. Use of Capital, Baseline Model

Dependent variable: log of capital stock ratio ln(K/Y)

	(1) RE 1996-2013	(2) RE 1996-2013	(3) RE 1996-2013	(4) RE 1996-2013	(5) RE 1996-2013	(6) RE[a] 1996-2013	(7) RE 1996-2013	(8) RE 1996-2013	(9) RE 1996-2013
Pillar 1						0.0628*	0.0468**	0.0414*	0.0511**
						(2.55)	(1.77)	(1.44)	(1.85)
Pillar 2						0.00005***	0.00005***	0.00005***	0.00005***
						(3.80)	(4.03)	(3.58)	(3.99)
Pillar 3							0.0004	0.0006*	0.0007**
							(1.11)	(1.35)	(1.70)
Pillar 4[b]						0.0282	0.0340	-0.0111	0.0380
						(0.55)	(0.65)	(-0.22)	(0.71)
Pillar 5,6						0.0885	0.0176	0.0523	0.0192
						(1.03)	(0.19)	(0.53)	(0.20)
Pillar 7									
Tax rate					-0.395***	-0.225***	-0.193***	-0.208***	-0.187***
					(-5.84)	(-3.66)	(-2.92)	(-3.10)	(-2.83)
Regulatory quality						0.049***	0.0550***	0.0443*	0.0555**
						(1.98)	(1.99)	(1.53)	(1.96)

[8] The instrument set is limited to one lag. The one-step estimator is used.

Tariffs	0.00133	0.00206					-0.00279**		-0.0372***
	(-0.87)	(1.10)					(-1.79)		(-1.80)
Openness								-0.0006**	
								(-1.71)	
Pillar 8									
Women (%)						0.0227***	0.0159**	0.0193**	0.0134***
						(2.64)	(1.77)	(1.89)	(1.37)
CBR						0.1501*	0.0732	0.0528	0.114
						(1.49)	(0.62)	(0.41)	(0.94)
Pillar 9		0.096***	0.097***	0.116***	0.065***	0.0313	0.025	0.015	0.0347
		(3.57)	(3.94)	(4.73)	(2.53)	(1.20)	(0.97)	(0.48)	(1.22)
Pillar 11[c]	-	-	-0.004***	-	-0.006***		-0.001	-0.001	-0.001
	0.005***	0.005***		0.006***					
	(-3.00)	(-2.97)	(-2.07)	(-3.29)	(-3.65)		(-0.58)	(-0.39)	(-0.55)
Pillar 12			0.0281***		0.0168***		0.0143***	0.0200*	0.0189*
			(3.39)		(2.05)		(1.61)	(1.53)	(1.51)
EU	1.766***	1.731***	1.684***	1.712***	1.783***	0.850*	0.819**	0.865**	0.784*
	(3.58)	(3.980	(3.68)	(3.74)	(3.91)	(1.40)	(1.70)	(1.91)	(1.54)
Time trend	Yes	No	Yes	Yes	Yes	No	Yes	No	No
Year effect	No	Yes	No	No	No	Yes	No	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	433	393	396	396	351	266	257	259	257
Wald test	733.8	720.8	765.9	732.3	819.7	786.7	664.2	627.7	680.4
P-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note *t* statistics in parentheses; * p<0.2, ** p<0.1, *** p<0.05

[a] In the current specification, the initial hypothesis that there is no cross-sectional dependence cannot be rejected: the Pesaran's test of cross-sectional independence chi-sq is -0.997, with Pr. 1.68. The test cannot be performed with the full model because the panel is highly unbalanced. Bootstrap standard error is also used to assess the robustness of the estimates

[b] Pillar 4: change in terms of trade (log)

[c] Pillar 11: no. days to start a business

Financial development is also a determinant of capital deepening. The literature offers alternative measures for capturing different dimensions of financial development, most of which focus on financial deepening—the extent to which financial institutions increase the size and variety of financial services they offer. In this study, domestic credit to the private sector (% of GDP) is used as a proxy for financial development, which has a positive and robust impact on capital deepening. Robustness is conducted by using alternative and/or additional indicators, including credit market regulation (WEF). Greenwood et al. (2013) discussed the central role of financial development in economic growth. As countries adopt the world's best financial practices, for example, the interest-rate spread would decline, lowering the cost of borrowing and allowing for capital deepening.

Finally, variables related to technological readiness (Pillar 12) also positively impact capital deepening because they measure a country's agility in using technology to enhance productivity and the use of inputs.

The robustness of the results is tested through several alternative approaches (see Section 4). First, the system-general method of moments (system-GMM) is employed to address endogeneity bias of the lagged dependent and explanatory variables.[9] The results (Annex 2) show that most of the structural determinants of labor are statistically significant. Although parameter estimates are not directly comparable, results seem robust from a qualitative point of view. The robustness of the results is also tested by enlarging the data set to more countries (extended model, Annex 3).

[9] The instrument set is limited to one lag. The one-step estimator is used.

Technical Efficiency

Figure 3 shows the production frontier as estimated through the SFA for ECA for 2000 and 2016. [10] As it shows, not only did capital stock rise, but the frontier shifted upward over time.

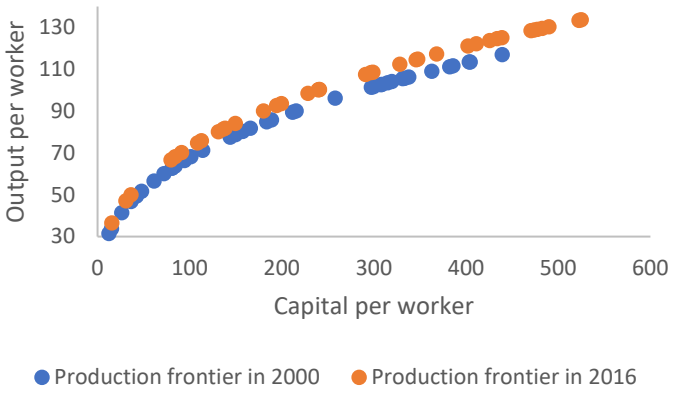


Figure 3. Production Frontier for ECA

Table 6 reports regression results for the baseline specification for the efficiency model.

First, the institutional environment of the country, which depends on the efficiency and the behavior of both public and private actors (proxied by the index of government effectiveness), is a determinant of productivity, robust across different model specifications and to the inclusion of more countries in the sample (Section 4; Annex 3).

Infrastructure, captured by the extent of energy consumption and Internet adoption or by infrastructure quality (WEF), is also critical for productivity, especially in the extended model (Section 4; Annex 3).

The results show that also the quality of education matters for the efficiency level at which an economy operates, as good health and education outcomes enhance the efficiency and productivity of each individual worker. The results are robust to enlargement of the sample (Section 4; Annex 3). Human capital has a central role in endogenous growth theory, either as an accumulative factor along with physical capital that affects income per capita, or by facilitating the production or absorption of new technologies. Several papers, starting with Barro (1997), have provided robust evidence of this positive link. More recently, researchers have instead shown that the impact may depend on the initial level of education (Krueger and Lindahl 2001; Bassanini and Scarpetta 2001) or on the distance from the technology frontier (Vandenbussche, Aghion and Meghir 2006).

Although labor market regulation and its rigidity matter slightly for productivity, the efficiency of product markets has considerable impact in several dimensions. First, as the literature has uncovered, in the product market reforms to enhance regulatory quality also enhance a country's productivity—as does a business-friendly environment that encourages competition. A reduction in tax rates or a shift to a more open economy, as captured in the extended model by a lower customs burden, lower tariffs, or regulatory trade barriers, may have a positive effect on efficiency, although it is not always strong and statistically significant.

The literature on how trade openness affects productivity is vast and the results are not consistent. Most researchers look into the correlation between some measure of openness—such as trade relative to GDP or tariffs—and the growth of real GDP or real GDP per capita. Many have found a positive relationship between trade and growth, but Rodriguez and Rodrik (2001) questioned these findings, arguing that the indicators of openness used most commonly are either bad measures of trade barriers

[10] For chart purposes, the model does not consider heterogeneity and heteroskedasticity.

or are highly correlated with variables that also affect the growth of income. Rodrik, Subramanian, and Trebbi (2004) found that openness has no significant effect on growth once institution-related variables are added to the regression analysis. Other studies show that the relationship between trade policy and growth depends on a country's level of development. For example, Yanikkaya (2003) and DeJong and Ripoll (2006) found a negative relationship for developing countries between trade openness and growth.[11]

Table 6. Stochastic Frontier Analysis with Conditional Inefficiency Effects, Baseline Model

Dependent variable: log real GDP

	(1) 1996-2013	(2) 1996-2013	(3) 1996-2013	(4) 1996-2013	(6) 1996-2013	(7) 1996-2013
Frontier						
Ln (E/WAP)	0.568***	0.425***	0.476***	0.466***	0.501***	0.483***
	(20.44)	(29.29)	(25.03)	(24.18)	(34.48)	(28.65)
Ln (K/Y)	0.409***	0.581***	0.542***	0.546***	0.493***	0.483***
	(15.99)	(38.66)	(29.52)	(27.01)	(33.75)	(25.61)
Time trend	Yes	Yes	Yes	Yes	Yes	Yes
Inefficiency model						
Pillar 1					-0.78***	-0.306***
					(-3.32)	(-3.66)
Pillar 2						-0.0002***
						(-8.56)
Pillar 4[11]					-2.75***	-0.392*
					(-5.08)	(-1.37)
Pillar 5,6		-0.73***	-1.336***	-0.387**	0.227***	0.227***
		(-2.70)	(-2.44)	(-2.00)	(4.55)	(3.04)
Pillar 7						
Tax rate				1.988***	0.467	0.975***
				(3.16)	(0.97)	(4.32)
Regulatory quality		-1.82***	-1.142***	-0.268***	0.36*	-0.013
		(-6.80)	(-2.36)	(-1.52)	(1.56)	(-0.14)
Tariffs			-0.045*	-0.0547***		
			(-1.28)	(-3.88)		
Openness					0.002*	0.00131***
					(1.59)	(3.02)
Pillar 8						
Women (%)					0.227***	
					(4.55)	
CBR					0.185	0.969***
					(0.57)	(6.34)
Pillar 9					-0.048	0.200***
					(-0.24)	(3.06)
EU					-0.259*	-0.214
					(-1.31)	(-0.26)
Variance of inefficiency						
Pillar 4[a]			-18.88*	-5.016***	-8.26***	-7.951***
			(-5.88)	(-2.35)	(-5.60)	(-4.91)
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1300	573	316	308	444	409
Wald test	8153.7	21346.8	18740.9	15878.0	17114.7	15135.8
P-value	0	0	0	0	0	0
LogLik	787.5	55.29	101.6	96.55	112.3	197.0

Note: *t* statistics in parentheses; * p<0.2, ** p<0.1, *** p<0.05

[a]Pillar 4: change in terms of trade (log).

[11] As already discussed, results may be affected by factors, including collinearity of variables and the choice of time period.

Finally, the effect of labor market regulation on productivity is also controversial, as discussed in Betcherman (2014). On the one hand, by slowing labor reallocation, more protective regulation may limit the potential efficiency gains from workers' mobility from low- to high-productivity sectors and firms. For example, Bassanini et al. (2009) demonstrated that strict employment protection regulation makes it more difficult for firms to respond quickly to changes in technology or product demand that require reallocating or downsizing staff, forcing them to use their resources less efficiently. However, more protective regulation could result in higher productivity if firms were to adjust to having less flexibility by investing more in capital or in employee training. The evidence on this link is mixed. For example, Caballero et al. (2004) found that the impact on TFP growth depends on the state of the rule of law, and the effect is negative when the rule of law is strong. Conversely, Micco and Pages (2006) found that stricter employment protection does not affect labor productivity much, although it may affect output by reducing business dynamism. In line with the second view, a shift to less regulated labor markets seems to be associated with greater efficiency. However, the net contribution of changes in labor market regulation to output growth depends ultimately also on other factors, including the initial level of regulation.

The robustness of the results is tested through the extended version of the model (Section 4; Annex 3).

4. Robustness

This section discusses a series of robustness exercises to assess the validity of the findings of the baseline model:

- Annex 1 presents the results from a simple GDP regression when real GDP (ln) is regressed over the set of regressors, selected to respond to the 12 Competitiveness Pillars. The results confirm the importance of certain determinants, including high quality of education and healthy product markets.
- Annex 2 presents the results from an application of the GMM technique to the labor and capital regression, along with pooled, FE, RE OLS specifications. Most of the results discussed from the baseline model remain robust across the alternative specifications.
- Annex 3 presents the results from the extended model, which builds on a larger set of economies, both advanced and emerging. In general, the results support the baseline model.
    - An increase in the quality of human capital, lower tax rates, and a better regulatory quality boost employment (Table A3.1). For capital, besides what was already discussed in the previous section, infrastructure plays a relatively important role (Table A3.2). A similar result applies to productivity, which is positively related to government effectiveness, education, low restrictions to domestic and foreign trade, and more flexible working time arrangements (Table A3.3).
    - The robustness of the results is tested also by controlling for the lagged dependent variable in both the labor and capital regressions. When controlling for the dummy for the ECA region, variables for Pillar 7 related to the product market seem to have a relatively larger role (Table A3.4).
    - Finally, the relevance of the key structural variables remains robust when using alternative indicators in the extended model, in particular: the indicator of road quality for Pillar 2 (WEF); International Internet bandwidth (kb/s) per Internet user for Pillar 3 (WEF). Results are shown in Table A3.5.
- Finally, Annex 4 explores the role of human capital, especially technology adoption, by interacting human capital accumulation with the country's level of development. Both the initial level and changes in human capital have positive growth effects, and the effects are

heterogeneous depending on the level of development (Sunde and Vischer 2015). To address this issue, the proxy indicator of human capital quality, based on educational outcomes, is interacted with the level of income and with a dummy for emerging economies, both for the labor and capital regressions. The results confirm the importance of education for the use of labor. The results in Table A4.1 also show that the quality of human capital also matters for capital accumulation, is stronger for emerging economies, and rises with the income level, as it may speed input accumulation and technology adoption more quickly in relatively poor economies.

5. When Structural Reforms Work

This section investigates the interaction between structural reforms and business cycles to assess whether timing affects the outcome of structural reforms. Following Dias Da Silva et al. (2017), reforms are identified as simple annual changes, positive or negative, to the indicators. The reform dummy takes the value of 1 when a change in the regulatory quality indicator is positive. As an alternative, the focus could be restricted to major reforms, defined as cases in which the change in the indicator is larger than one standard deviation from the changes over all observations.

Tables 7, 8, and 9 report the results of the estimation. As with Bordon et al. (2016), the impact of reforms may be reduced whenever the reforms are not launched in a growth-friendly environment. Supportive macroeconomic policy amplifies the medium-term benefit of labor and product market reforms by enhancing their impact on employment. Bordon et al. (2016) demonstrated that this finding mostly applies to labor market reform.

Several reasons have been suggested to explain the limited impact of reforms carried out during an economic slowdown. As discussed in Bordon et al. (2016), if there is no slack in the economy, the beneficial effects of reform may be favored by growth-friendly macroeconomic policies, and the opposite may occur when fiscal or monetary policies (or both) are more restrictive. In general, the economy may not be able to absorb the additional supply capacity created by structural reforms when aggregate demand is low, leading to deflationary pressures. The results for the other structural indicators are robust compared to the previous specifications. [12]

[12]In this specification, the EU dummy gains significance across all the three channels in the SFA and thus may be mostly capturing the incentives to reform triggered by the EU accession process.

Table 7. Use of Labor and Timing of Structural Reforms.

Dependent variable: log of employment ratio, ln(E/WAP)

	(1) 1996-2013	(2) 1996-2013	(3) 1996-2013	(4) 1996-2013
Pillar 1	0.00926	0.0281*	0.0119	-0.001
	(0.57)	(1.62)	(0.72)	(-0.07)
Pillar 2	0.0000452***	0.0000511***	0.0000370***	0.00004***
	(5.93)	(7.01)	(5.18)	(5.74)
Pillar 3	-0.0006***	-0.0006**	0.0006	-0.0006
	(-2.11)	(-1.94)	(0.29)	(-2.12)
Pillar 4	0.00564***	0.00641***	0.00578***	
	(8.93)	(9.41)	(8.95)	
Pillars 5 and6	0.0644*	0.0595*	0.104***	0.058*
	(1.52)	(1.55)	(2.59)	(1.40)
Pillar 7				
Tax rate	-0.244***	-0.236***	-0.227***	-0.214***
	(-5.47)	(-5.44)	(-5.01)	(-4.72)
Regulatory quality reform	-0.001	0.001	0.001	0.003
	(-0.17)	(0.22)	(0.14)	(0.78)
Regulatory quality reform, slack	0.00345	0.002198	0.00544	0.007*
	(0.64)	(0.21)	(0.74)	(0.70)
Regulatory quality (t-1)				0.059***
				(2.80)
Openness	-0.000	0.000	0.000	-0.000
	(-0.40)	(0.86)	(0.19)	(-0.48)
Pillar 8				
Women (%)	-0.0257***	-0.0161*	-0.0297***	-0.0132
	(-2.22)	(-1.51)	(-2.58)	(-1.09)
CBR working time	0.0481	0.0356	0.0450	0.039
	(0.70)	(0.54)	(0.65)	(0.56)
Pillar 9	0.0362***	0.0330**	0.0349**	0.0228*
	(2.05)	(1.89)	(1.94)	(1.26)
Pillar 11	0.000574***	0.000298	0.000448**	0.0004**
	(2.20)	(1.14)	(1.70)	(1.60)
Pillar 12	0.00301	-0.00906	0.00694	0.0045
	(0.48)	(-1.07)	(1.10)	(0.72)
EU dummy	0.0776*	0.0589	0.0345	0.0249
	(1.45)	(1.22)	(0.67)	(0.45)
Time trend	Yes	No	No	Yes
Time effect	No	Yes	Yes	No
Constant	Yes	Yes	Yes	Yes
Observations	237	237	237	237
Wald Test	332.7	403.7	310.7	350.51
Wald Test p-value	0	0	0	0

Note: t statistics in parentheses; * p<0.2, ** p<0.1, *** p<0.05.

Table 8. Use of Capital and Timing of Structural Reforms

Dependent variable: log capital stock ratio, ln(K/Y)

	(1)	(2)	(3)	(4)
	1996-2013	**1996-2013**	**1996-2013**	**1996-2013**
Pillar 1	0.0655***	0.0582***	0.0711***	0.054***
	(2.66)	(2.22)	(2.79)	(2.20)
Pillar 2	0.0000537***	0.0000504***	0.0000554***	0.00005***
	(4.19)	(3.79)	(4.24)	(3.88)
Pillar 3	0.000393	0.000530*	0.000651*	0.00044
	(1.12)	(1.29)	(1.63)	(1.28)
Pillar 4	0.0313	-0.0175	0.0294	0.023
	(0.61)	(-0.34)	(0.56)	(0.46)
Pillars 5 and 6	0.0254	0.0624	0.0347	00267
	(0.28)	(0.65)	(0.37)	(0.30)
Pillar 7				
Tax rate	-0.200***	-0.214***	-0.197***	-0.158***
	(-3.11)	(-3.27)	(-3.06)	(-2.43)
Regulatory quality reform	0.00429	0.00220	0.00246	0.009**
	(0.84)	(0.40)	(0.46)	(1.69)
Regulatory quality reform, slack	-0.0155***	-0.0137**	-0.0166***	-0.0101*
	(-2.53)	(-1.84)	(-2.34)	(-1.76)
Regulatory quality (t-1)				0.074***
				(2.74)
Tariffs	-0.00354***		-0.00386**	-0.0034***
	(-2.26)		(-1.89)	(-2.24)
Openness		-0.000521*		
		(-1.47)		
Pillar 8				
Women (%)	0.0137*	0.0181**	0.0123	0.0160***
	(1.55)	(1.79)	(1.27)	(1.85)
CBR working time	0.0579	0.0432	0.0925	0.0512
	(0.50)	(0.34)	(0.78)	(0.45)
Pillar 9	0.0394*	0.0227	0.0427*	0.179
	(1.58)	(0.76)	(1.54)	(0.70)
Pillar 11	-0.000996	-0.000993	-0.00118	-0.0016
	(-0.46)	(-0.41)	(-0.52)	(-0.75)
Pillar 12	0.0105	0.0139	0.0121	0.0157**
	(1.22)	(1.11)	(1.01)	(1.81)
EU dummy	0.859**	0.901**	0.833*	0.776*
	(1.73)	(1.91)	(1.56)	(1.55)
Year effect	No	Yes	Yes	No
Time trend	Yes	No	No	Yes
Constant	Yes	Yes	Yes	Yes
Observations	257	259	257	257
Wald Test	685.0	650.0	703.7	719.24
Wald Test p-value	0	0	0	0

Note: t statistics in parentheses; * p<0.2, ** p<0.1, *** p<0.05

Table 9. SFA with Conditional Inefficiency Effects and Timing of Structural Reforms

Dependent variable: log real GDP

	(1) 1996-2013	(2) 1996-2013	(3) 1996-2013	(4) 1996-2013	(5) 1996-2013	(6) 1996-2013	(7) 1996-2013
Frontier							
Ln(E/WAP)	0.457***	0.455***	0.354***	0.407***	0.453***	0.453***	0.430***
	(20.22)	(20.24)	(18.35)	(17.00)	(22.70)	(22.99)	(24.96)
Ln(K/Y)	0.552***	0.552***	0.661***	0.612***	0.555***	0.555***	0.588***
	(24.18)	(24.31)	(32.80)	(24.11)	(26.44)	(26.84)	(35.70)
Time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Inefficiency model							
Pillar 1			-0.281***	-0.385***	-0.621***	-0.635***	-0.334**
			(-9.42)	(-5.03)	(-5.06)	(-5.18)	(-4.36)
Pillar 4					0.451	0.410	1.432**
					(0.60)	(0.52)	(1.74)
Pillar 5,6	-1.648***	-1.486***	0.028	-0.009	-0.661***	-0.686***	-1.234***
	(-2.99)	(-3.00)	(0.62)	(-0.13)	(-3.10)	(-2.96)	(-4.36)
Pillar 7							
Tax rate	-1.898*	-1.959*	0.975***	1.091***	1.777***	1.832***	1.948***
	(-1.56)	(-1.57)	(6.45)	(4.79)	(3.28)	(3.40)	(2.70)
Regulatory quality reform	-0.152		-0.016		0.010		-0.197***
	(-1.01)		(-0.59)		(0.15)		(-2.16)
Regulatory quality reform, slack	0.299*		0.039		0.080		-0.001
	(1.69)		(1.33)		(0.54)		(-0.95)
Regulatory quality (t-1)							-0.662***
							(-3.05)
Major regulation quality reform		-0.247		-0.029		-0.032	
		(-1.19)		(-0.59)		(-0.39)	
Major regulation quality reform, slack		0.628		0.0158		0.0615	
		(1.22)		(0.13)		(0.29)	
Tariffs	0.024	0.021	-0.033***	-0.029***			
	(1.03)	(0.93)	(-5.96)	(-4.30)			
Openness					0.001	0.001	
					(0.66)	(0.57)	
Pillar 8							
CBR working time	6.328***	6.071***	0.425***	0.504***	2.013***	2.065***	2.741***
	(3.00)	(2.99)	(4.50)	(3.25)	(3.66)	(3.37)	(4.49)
Pillar 9	-0.262	-0.148	0.257***	0.314***	0.162	0.160	
	(-0.73)	(-0.43)	(6.27)	(4.35)	(1.02)	(1.01)	
EU dummy					-0.0183	-0.0345	
					(-0.11)	(-0.18)	
Variance of inefficiency							
Pillar 4	-6.4***	-6.2***	-8.7***	-11.8***	-29.3***	-29.6***	-75.9***
	(-2.13)	(-2.16)	(-3.16)	(-2.87)	(-4.09)	(-3.80)	(-4.72)
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	266	266	266	266	362	362	364
Wald Test	18074.4	18135.3	19911.4	16333.5	19857.9	19588.3	25877
Wald Test p-value	0	0	0	0	0	0	0
LogLik	74.52	73.92	120.5	118.0	150.7	150.6	154.2

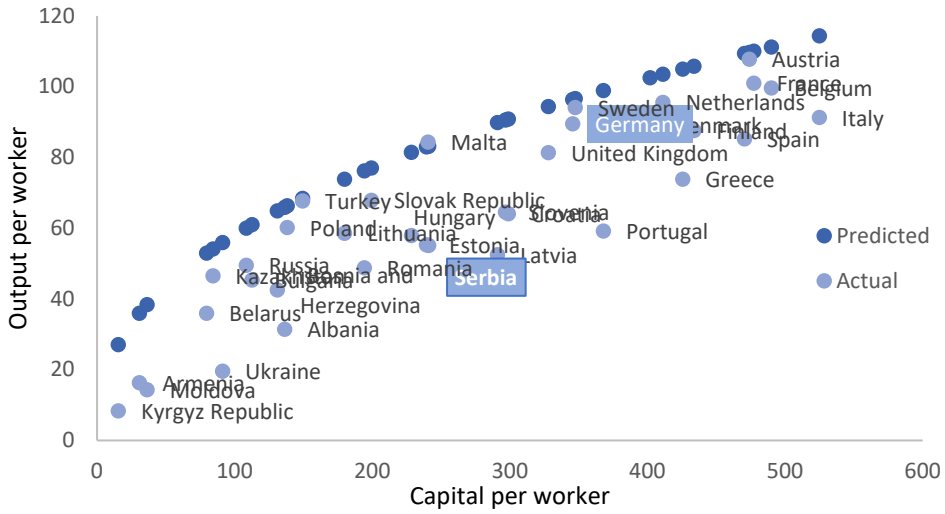
Note: t statistics in parentheses; * p<0.2, ** p<0.1, *** p<0.05

6. Structural Reforms and Growth: Serbia

By using equation 1 and the results from the baseline model (Section 3) on the estimated elasticities of efficiency, capital, and labor with respect to changes in structural variables, it is possible to compute the impact on GDP growth of the most significant changes in structural policy. In particular, it is possible to derive the additional annual GDP growth if Serbia were to close major structural gaps within a specific time horizon (the methodology is explained in Annex 5).

The selected benchmark is Germany, a highly developed country whose position is close to what would be predicted by the production frontier, suggesting that it employs the available inputs with great efficiency (Figure 4). The figure shows the relation between capital per worker in 2016 and the actual versus the potential output predicted by the estimated production frontier.[13] Unlike Germany, Serbia's performance is relatively low and it underperforms the predicted output per worker, suggesting inefficiencies in the economy. In fact, Serbia and other Western Balkans countries have large productivity gaps, and, as of 2016, Western Balkans countries had relatively little capital per worker: for a given level of capital per worker, actual output is below what could be achieved, and the efficiency gaps in Western Balkans countries are large and comparable in size throughout the region.

Figure 4. Production Frontier in 2016 Compared



Looking at the structural indicators that turned out to be most significant in the empirical analysis, Table 10 compares the values for Serbia and for Germany. Serbia trails in most competitiveness areas, except for the top income and payroll income marginal tax rate and the cost of starting a business.

Except in those areas where it performs relatively better than Germany, such as cost to start a business and tax rates, Serbia's potential growth would benefit greatly from closing structural gaps by introducing measures to improve, e.g. government effectiveness, regulatory quality, financial development, and worker skills.[14]

[13] See also World Bank (2019b) for an application of the production frontier for the Western Balkans countries.

[14] Serbia also performs better than Germany in terms of trade policy, if proxied by the tariff indicator developed by Fraser (2016), which considers not only mean tariff rates but also standard deviation of tariffs and trade revenues (% trade).

Table 10. Structural Indicators: Serbia vs Germany

Competitiveness indicator	Serbia	Germany	Min	Max
Regulatory quality	0.06	1.67	-2.50	2.50
Costs of starting business	6.00	9.00	18.00	1.00
CBR working time	0.69	0.50	0.00	1.00
Top marginal income payroll tax rate	39.00	47.00	17.00	70.00
Trade tariffs	5.06	1.04	0.00	10.00
Availability of latest technologies	4.14	6.14	1.00	7.00
Human capital	3.27	3.66	1.26	3.73
Financial development	43.37	77.95	0.00	100.00
Government effectiveness	0.11	1.74	-2.03	2.43
Energy use per capita	1859.43	3818.00	9.71	22762.00
No. individuals using internet	65.32	87.60	8.00	98.00

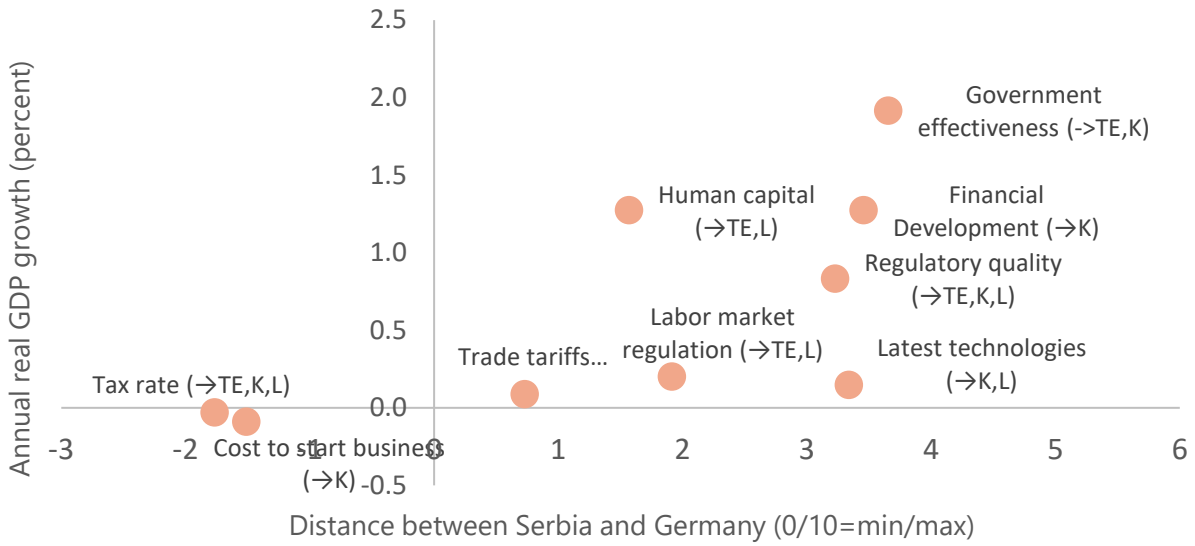
Figure 5 shows the additional annual growth associated with structural policies, and the channels through which it operates, assuming that Serbia would close the gap with Germany within a certain time horizon. In particular, for each policy variable, the figure shows how far Serbia is from the frontier (Germany) and the estimated increase in annual growth rate of real GDP if the distance is closed in 20 years (40 for government effectiveness), together with the supply-side channel that affects GDP (Annex ***5*** explains the methodology). Variables on the right of the y-axis indicate policy areas where Serbia is far from the frontier, variables on the left areas where Serbia has passed the frontier.

Given the linearity assumption, more than a precise estimate, the simulations aim at quantifying the relative importance of each reform. Enhancing government effectiveness, regulatory quality, human capital and financial development may contribute the most to economic growth. EU accession would also add to economic growth, mainly by boosting capital deepening.

Closing the gap in terms of government effectiveness would have the most impact. Not only is this variable statistically significant across different model specifications and different channels, but its impact on GDP growth is relatively large—Serbia's performance is poor compared to Germany's, so it is much farther from the frontier; and the estimated elasticity for government effectiveness is also relatively large. Areas where action is especially needed to enhance government effectiveness are tax administration, court processes, public procurement, and land administration. However, as discussed in the latest Country Partnership Framework, reforms are unlikely to be effective unless Serbia addresses such systemic issues in public sector management as poor policy coordination and capacity to carry out reforms; an overly complex central administration, with overlapping and duplicative institutions and functions; and the ineffective organization of service delivery (World Bank 2015). That is why making government more effective takes time—and why the longer horizon of 40 years was chosen for the simulation: building institutions and establishing credibility requires sustaining performance through government turnover and cyclical events like elections or economic downturns.

An improvement in regulatory quality would be associated to almost 1 percent more annual growth. Because all three channels—capital, labor, and technical efficiency—would benefit from an improvement in regulatory quality, each would contribute more to GDP growth. The government can support competition by rolling back or avoiding anti-competitive interventions. Regulation can be simplified, increasing transparency in the legislative process, consulting more with stakeholders, assessing regulatory impact frequently, reducing the administrative burden, and unbundling monopolies in crucial input and network sectors, such as energy, transport, and telecoms.

Figure 5. Structural Reforms: Channels and Impact on GDP Growth



Note: For each policy variable, the figure shows the distance of Serbia from the frontier (Germany) and the estimated increase in annual growth of real GDP in the process of closing the distance in 20 years (40 for government effectiveness). Variables on the right of the y axis indicate policy areas where Serbia lags behind the frontier: financial development, measured by credit to the private sector as a percentage of GDP (WDI); regulatory quality, which reflects perceptions of the ability of the government to formulate and implement sound policies and regulations for private sector development (WB-WGI); government effectiveness, which reflects perceptions of the quality of public services, the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment (WB-WGI); availability of latest technology, which captures the perception of survey respondents of the extent to which latest technology are available in the country (WEF); a proxy for the quality of human capital, built as the average years at school weighted by an assumed rate of return to education (Penn World tables); CBR working time regulation index, which measures the extent of regulation of working time (Cambridge CBR); and trade-weighted average applied tariff rate (WEF). Variables on the left of the y axis indicate areas where Serbia has passed the frontier: number of hours to start a business (Doing Business); top marginal income and payroll tax rate (Fraser). Variables not included because of relatively small effects are energy use per capita (WDI) and Internet use (WEF). The EU accession dummy is also not included. The analysis relies on the supply-side methodology, which allows to decompose GDP growth as the sum of separable and independent components (capital, labor, and productivity) and to estimate the impact of key structural reforms for each input channel. The underlying linearity assumption may lead however to under/over estimate the importance of the reforms.

Better educational achievements, hence higher human capital quality, are associated to higher growth through a better use of labor and higher overall efficiency. Even though Serbia's performance is relatively close to Germany's, the beneficial effect of investing in raising the quality of human capital is particularly high. The quality of human capital measured as the average years at school weighted by an assumed rate of return to education (Penn World table) is in fact relatively high. Similar findings emerge from the new World Bank Human Capital Index (HCI) report. The HCI for Serbia is higher than the average for its region and income group and what would be predicted for its income level. Yet its low labor market engagement, the increasing skills mismatch, and the large share of youth who are functionally illiterate make it clear that education quality and equity could be improved.[15] And in fact, according to the HCI, the country does not do so well when quality of education is taken into account.

[15] Compared to 13.7 percent in 2014, in 2017 29.3 percent of companies reported problems with hiring new workers, mostly due to skills shortages.

Children in Serbia can expect to complete 13.4 years of schooling by age 18, but when adjusted for learning quality, this is equivalent to only 11.2 years. Some immediate priorities are to (1) finance tertiary education on a performance-oriented model based on a recognized system of quality assurance; (2) formulate a strategy to enhance the market relevance of education and establish an integrated information system for monitoring education and providing timely information on labor market prospects to help individuals select careers or degrees to pursue; (3) move from over-enrollment in vocational education to encouraging modernization of general education; (4) optimize the school network to raise efficiency and focus on quality; and (5) promote innovation and entrepreneurship in tertiary education so graduates acquire the mindset and tools to launch new enterprises.

Further financial development and greater availability of the latest technology would also stimulate economic growth. Structural changes in the banking sector are necessary for further consolidation, to allow the entrance of reputable players, and to make banking more efficient (World Bank 2018). This will eventually support access to finance and spur development of the financial sector.

Labor market reforms to encourage less protective and more flexible work arrangements have a positive, though weak, net relation with GDP growth. The results are in line with previous studies showing the positive effects on GDP per capita of easing work-time regulation, although they are generally minimal and may differ between countries in both sign and magnitude. Moreover, the labor market regulation gap between Serbia and Germany is relatively narrow. The OECD employment protection indicator puts the Western Balkans on a par with EU comparators, with Serbia having the highest protection related to dismissal and hiring procedures. Nevertheless, labor taxes are particularly high in the Western Balkans, with Serbia having one of the highest tax wedges at 42.2 percent (World Bank 2018b).

Promoting trade openness by reducing tariffs would also have a positive net impact on potential growth, as would completing the EU accession process. Capital deepening and productivity would be the channels that benefit most from EU accession. This process will, among other things, strengthen institutions and send a positive signal to investors, thus encouraging investment and capital accumulation.

For robustness, Annex 7 shows the impact of structural reforms in the extended version of the model, with the larger sample of countries (Section 4). The chart shows the impact of structural reform if Serbia were to close the gap with Germany in 20 years. Although the estimated additional annual real GDP growth related to each policy area is not fully comparable with the one estimated through the baseline model—the variables used for the regression are slightly different—the results show that priority reform areas, namely the one on the top right of the figure, remain: government effectiveness; financial development; human capital; and regulatory quality. Serbia imposes higher nontariff measures than Germany and adopting less cumbersome regulation would have a positive impact on growth.

Beyond the three input channels, several other mechanisms may be at work that the model does not capture. For example, improving the business environment and investing in human capital are also central for attracting and maximizing the benefits from foreign direct investment, which can facilitate growth of the economy through productivity spillovers, job creation, and upgrading of the goods basket (World Bank 2018).

Overall, the results support the government's priorities and current engagement with the World Bank. Based on the most recent Systematic Country Diagnostic, the 2016–20 Country Partnership Framework consists of two broad areas: economic governance and the role of the state, and private

sector growth and economic inclusion. The second area has six main objectives, among them the importance of working on business climate improvements and on closing medium- and long-term skill gaps. A major impediment to growth in Serbia is low labor productivity, caused by, among other factors, the low quality of human capital (World Bank 2017b). Similarly, among the most important challenges highlighted by the latest report of the European Commission (EC 2019) are the needs for labor to contribute more to growth, for greater transparency and predictability in the regulatory environment, and for increasing competition.

7. Conclusions

This paper studied the impact of structural reforms on economic growth in ECA, with special attention to Serbia. The analysis attempts to uncover the structural determinants of GDP growth by studying separately each supply-side channel—capital accumulation, labor utilization, and productivity. Productivity is proxied by a measure of efficiency estimated through stochastic frontier analysis. This approach makes it possible to estimate contemporaneously efficiency and its determinants, instead of recovering productivity as the residual of a growth regression.

Institutions and better-functioning domestic product markets are important structural determinants of growth. Higher quality of human capital, as proxied by educational outcomes, is positively associated with both employment and productivity, thus making a significant contribution to economic growth. Growth is also positively affected by the degree of development of financial systems and by the country's innovation capability, but labor market reforms and trade openness do not have a straightforward relationship with growth. Infrastructure, ICT adoption, and macroeconomic stability also matter for GDP growth. Finally, EU accession may contribute to GDP growth by promoting capital deepening.

Applying these results to Serbia, the analysis shows that if the country were to close certain structural gaps with Germany, it would significantly boost its potential. Measures that would contribute the most are those that would enhance regulatory quality, government effectiveness, financial development, and human capital.

When decomposing economic growth into its drivers, the methodology adopted in the study does not assign a direct role to human capital, which only enters as a deeper determinant of labor, capital, and productivity. Researchers have also studied how reforms may affect human capital accumulation by treating it as an additional input into the production function. For example, Lutz et al. (2008) introduced a model where human capital by broad age groups enters production both as differentiated labor force inputs and through the absorption rate of new technologies, which depends on the interaction between human capital and the distance to the frontier. It would be interesting to extend the analysis to allow for a more direct role of human capital and to study its structural determinants and the impact of reforms. Another extension of this study would be to conduct a more systematic assessment of model uncertainty by adopting frontier methodology, which would minimize endogeneity and the bias arising from discretional selection of models.

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Annexes

Annex 1. Robustness: GDP Growth Rate

Table A1.1 GDP Growth Regression

Dependent variable: log real GDP

	(1) FE[a] **1996-2013**	(2) RE **1996-2013**	(3) RE **1996-2013**	(4) RE **1996-2013**	(5) RE **1996-2013**
Pillar 1	0.00744	0.0124	0.0140	0.0140	0.0464*
	(0.20)	(0.32)	(0.36)	(0.36)	(1.56)
Pillar 2	0.0000765***	0.0000785***	0.0000938***	0.0000938***	0.0000298***
	(4.24)	(4.28)	(5.09)	(5.09)	(2.14)
Pillar 3	0.000695**	0.000708**	-0.000935**	-0.000935**	0.000386
	(1.95)	(1.94)	(-1.80)	(-1.80)	(0.95)
Pillar 4					
ToT	0.0849	0.0870	0.109*	0.109*	
	(1.20)	(1.20)	(1.51)	(1.51)	
Output gap					0.0107***
					(13.26)
Pillar 5,6	0.212**	0.195**	-0.133	-0.133	-0.126
	(1.92)	(1.74)	(-1.01)	(-1.01)	(-1.22)
Pillar 7					
Tax rate	-0.185***	-0.173**	-0.250***	-0.250***	-0.185***
	(-2.03)	(-1.85)	(-2.64)	(-2.64)	(-2.65)
Reg quality	0.166***	0.163***	0.149***	0.149***	0.0919***
	(4.28)	(4.08)	(3.76)	(3.76)	(2.77)
Tariffs	-0.0606***	-0.0622***	-0.0502***	-0.0502***	-0.0448***
	(-5.04)	(-5.04)	(-4.01)	(-4.01)	(-5.03)
Pillar 8					
Women (%)	0.0294***	0.0280***	0.0312***	0.0312***	-0.00947
	(2.27)	(2.11)	(2.38)	(2.38)	(-0.34)
CBR	0.188	0.128	0.161	0.161	0.0105
	(1.10)	(0.74)	(0.94)	(0.94)	(0.08)
Pillar 9	-0.0473	-0.0401	-0.0124	-0.0124	0.0209
	(-1.25)	(-1.03)	(-0.32)	(-0.32)	(0.74)
Pillar 11	-0.00250	-0.00237	0.000914	0.000914	0.00148
	(-0.80)	(-0.74)	(0.28)	(0.28)	(0.57)
Pillar 12	-0.00113	-0.000151	-0.0103	-0.0103	0.0154*
	(-0.09)	(-0.01)	(-0.83)	(-0.83)	(1.63)
EU		0.268	0.387	0.387	-0.540
		(0.48)	(0.80)	(0.80)	(-0.97)
T2000	No	No	Yes	No	Yes
T1990	No	No	No	Yes	No
Constant	Yes	Yes	Yes	Yes	Yes
Obs	259	259	259	259	237
Wald test		125.7	148.8	148.8	431.0
P-value	0	0	0	0	0

Note t statistics in parentheses; * p<0.2, ** p<0.1, *** p<0.05

[a] In the current specification, our initial hypothesis that the individual-level effects are adequately modelled by a random-effects model cannot be rejected at 99% and 95% CI.

Annex 2. Robustness: OLS vs GMM

Table A2.1. OLS vs GMM

	Employment ratio (ln)				Capital stock ratio (ln)			
	(1) Pooled 1996-2013	(2) FE 1996-2013	(3) RE 1996-2013	(4) GMM 1996-2013	(5) Pooled 1996-2013	(6) FE 1996-2013	(7) RE 1996-2013	(8) GMM 1996-2013
Dep. Var. (t-1)	1.004***	0.670***		1.000***	0.999***	1.007***		0.996***
	(611.61)	(19.43)		(102.95)	(469.38)	(138.33)		(1039.20)
Pillar 1	0.007***	0.013*	0.030***	0.007*	0.002	0.010***	0.006	0.007***
	(2.10)	(1.44)	(2.38)	(1.32)	(0.62)	(2.26)	(0.19)	(3.57)
Pillar 2 and 3[a]	-0.003*	-0.006*	-0.003	0.000	-0.002	-0.001	0.020*	-0.004***
	(-1.40)	(-1.38)	(-0.54)	(0.10)	(-0.58)	(-0.63)	(1.46)	(-3.38)
Pillar 4								
Output gap (t)	0.0012***	0.0033***	0.0066***	0.0039***	0.0024***	0.0024***	0.0071***	0.0026***
	(3.18)	(9.13)	(14.63)	(14.05)	(8.51)	(15.09)	(6.43)	(26.95)
(t-1)				-0.002***				-0.0002***
				(-8.81)				(-2.86)
Terms of trade	-0.0002	0.0029	0.0118	0.0023	0.0021	0.0021	-0.0214	-0.0031
	(-0.02)	(0.25)	(0.70)	(0.20)	(0.43)	(0.37)	(-0.53)	(-0.79)
Pillar 5 and 6								
(t)	0.0003	0.0427**	0.101***	0.218***	-0.0248***	-0.0250***	0.120*	-0.303***
	(0.10)	(1.93)	(3.39)	(2.87)	(-2.69)	(-2.33)	(1.63)	(-13.27)
(t-1)				-0.197***				0.248***
				(-2.67)				(11.34)
Pillar 7								
Tax rate (avg)	-0.0288**	-0.117***	-0.171***	-0.0849***	-0.0108	0.0222**	-0.208***	-0.0779***
	(-1.89)	(-4.54)	(-4.82)	(-3.87)	(-0.53)	(1.76)	(-2.36)	(-10.17)
Cost of doing business	0.0000	0.0001**	0.0001	0.0001	-0.0000	-0.0000	-0.0009***	-0.0001***
	(0.77)	(1.65)	(0.91)	(1.27)	(-0.60)	(-0.81)	(-3.01)	(-4.39)
Mean tariff rate	-0.0016	0.0003	0.0037	-0.0055*	0.0005	-0.0002	0.0280***	0.0075***
	(-1.23)	(0.08)	(0.66)	(-1.52)	(0.22)	(-0.13)	(2.02)	(6.13)
Pillar 8								
Women (%pop)	0.0003	-0.0241***	-0.0546***	0.0043*	-0.0040*	-0.0024	0.0252	-0.0144***
	(0.26)	(-2.11)	(-3.67)	(1.34)	(-1.38)	(-0.43)	(0.68)	(-11.21)
CBR	-0.0010	-0.0409	-0.0048	-0.113***	-0.0004	-0.0590***	0.463***	0.0146
	(-0.18)	(-0.74)	(-0.06)	(-3.50)	(-0.03)	(-2.16)	(2.48)	(1.18)
Pillar 9	-0.0075***	-0.0072	0.0139*	-0.0216***	0.0157***	0.0234***	0.0770***	0.0046***
	(-2.70)	(-1.04)	(1.47)	(-3.88)	(2.15)	(7.01)	(3.28)	(2.18)
Pillar 12	0.0036**	0.0014	-0.0047	-0.0029	-0.0002	-0.0005	0.0120	0.0022***
	(1.70)	(0.38)	(-0.90)	(-1.25)	(-0.07)	(-0.28)	(0.94)	(2.73)
EM dummy			-0.0654				0.281	
			(-0.62)				(0.84)	
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	502	502	502	502	511	511	511	511
Wald Test	1079114.1		357.0	27502.1	1041402.3		1227.5	2529429.4
p-value	0	0	0	0	0	0	0	0
LogLik		1404.5				1794.9		

Note *t* statistics in parentheses * p<0.2, ** p<0.1, *** p<0.05 ; [a] Infrastructure Index (WEF)

Annex 3. Robustness: Enlarging the Sample

Table A3.1. Use of Labor, Extended Model

Dependent variable: employment ratio (ln)

	(1) 1996-2013	(2) 1996-2013	(3) 1996-2013	(4) 1996-2013	(5) 1996-2013	(6) 1996-2013	(7) 1996-2013	(8) 1996-2013
Pillar 1	-0.001	-0.001	0.003	0.004	-0.001	0.004	0.005	0.003
	(-0.04)	(-0.06)	(0.87)	(0.92)	(-0.07)	(0.98)	(1.02)	(0.60)
Pillar 2 and 3								
Infra index[a]								-0.001
								(-0.24)
Infra index (WEF)	-0.001	-0.001	-0.002	-0.003	-0.002	-0.002	-0.003	
	(-0.11)	(-0.11)	(-1.09)	(-1.17)	(-0.41)	(-1.03)	(-1.13)	
Pillar 4								
Output gap	0.006***	0.006***	0.002***	0.001***	0.006***	0.002***	0.001***	0.001***
	(13.90)	(13.91)	(5.01)	(4.61)	(13.63)	(4.98)	(4.60)	(4.54)
Change in terms of trade	0.007	0.007	0.004	0.004	0.009	0.005	0.004	0.005
	(0.43)	(0.43)	(0.33)	(0.29)	(0.58)	(0.39)	(0.35)	(0.36)
Pillar 5 and 6	0.089***	0.088***	0.001	-0.001	0.095***	-0.001	-0.001	-0.001
	(3.08)	(3.05)	(0.01)	(-0.03)	(3.41)	(-0.15)	(-0.17)	(-0.17)
Pillar 7								
Tax rate	-0.098***	-0.098***	-0.018**	-0.020**	-0.093***	-0.017**	-0.018**	-0.018**
	(-3.49)	(-3.49)	(-1.92)	(-1.95)	(-3.36)	(-1.76)	(-1.79)	(-1.74)
Regulatory quality	0.068***	0.068***	0.003	0.002	0.059***	0.001	0.001	0.002
	(5.43)	(5.42)	(0.69)	(0.65)	(4.81)	(0.30)	(0.29)	(0.58)
Regulatory trade barriers[b]	-0.006**	-0.006**	-0.001	-0.001	-0.005**	-0.001	-0.001	-0.001
	(-1.86)	(-1.86)	(-0.44)	(-0.32)	(-1.67)	(-0.39)	(-0.27)	(-0.39)
Pillar 8								
Women	-0.041***	-0.041***	0.001	0.001	-0.043***	0.001	0.001	0.007
	(-2.87)	(-2.84)	(0.46)	(0.71)	(-3.07)	(0.50)	(0.73)	(0.63)
CBR	0.031	0.031	0.001	0.002	0.033	-0.000	0.001	-0.001
	(0.43)	(0.42)	(0.16)	(0.24)	(0.46)	(-0.05)	(0.06)	(-0.10)
Pillar 9								
Private credit	0.004	0.004	-0.009***	-0.015*		-0.009***	-0.016*	-0.017*
	(0.45)	(0.45)	(-3.09)	(-1.46)		(-3.13)	(-1.55)	(-1.61)
Private credit (t-1)				0.006			0.007	0.007
				(0.60)			(0.69)	(0.63)
Credit market regulations[c]					0.004***	0.001	0.001	0.001
					(2.07)	(1.14)	(1.02)	(0.97)
Pillar 12	-0.004	-0.004	0.003*	0.003	-0.003	0.003*	0.003	0.002
	(-0.81)	(-0.81)	(1.36)	(1.26)	(-0.59)	(1.39)	(1.27)	(0.98)
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Emerging market dummy	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Employment ratio (Ln, t-1)			1.004***	1.004***		1.004***	1.003***	1.003***
			(427.37)	(410.68)		(420.74)	(403.75)	(393.50)
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	496	496	496	494	507	496	494	494
Wald Test	417.9	418.1	242038.2	223432.0	439.1	235559.3	216851.0	214819.6
Wald Test p-value	0	0	0	0	0	0	0	0

Note *t* statistics in parentheses * p<0.2, ** p<0.1, *** p<0.05

[a] Weighted average of energy use pc (ln) and number of individuals using internet (ln), with equal weights.

[b] The index measures the extent to which non-tariff regulatory measures exist in the country. The higher, the lower the amount of NTMs. Fraser 2016.

[c] Fraser 2016.

Table 11. Use of Capital, Extended Model

Dependent variable: capital stock ratio (ln)

	(1) 1996-2013	(2) 1996-2013	(3) 1996-2013	(4) 1996-2013	(5) 1996-2013	(6) 1996-2013	(7) 1996-2013
Pillar 1	-0.002	-0.005*	-0.001	-0.004	-0.004	-0.004	-0.006*
	(-0.07)	(-1.31)	(-0.00)	(-1.14)	(-1.14)	(-1.10)	(-1.58)
Pillar 2 and 3							
Infra index[a]							0.006***
							(2.39)
Infra index (WEF)	0.010	-0.001	0.009	-0.001	-0.001	-0.001	
	(0.78)	(-0.04)	(0.67)	(-0.50)	(-0.50)	(-0.30)	
Pillar 4							
Output gap	0.006***	0.002***	0.005***	0.002***	0.002***	0.002***	0.002***
	(5.52)	(15.27)	(4.75)	(14.37)	(14.37)	(13.65)	(13.09)
Change in terms of trade	-0.032	0.001	-0.037	0.003	0.003	0.002	0.003
	(-0.80)	(0.19)	(-0.92)	(0.47)	(0.47)	(0.44)	(0.59)
Pillar 5 and 6	0.103*	-0.020***	0.165***	-0.020***	-0.020***	-0.020***	-0.024***
	(1.42)	(-4.29)	(2.31)	(-4.32)	(-4.32)	(-4.26)	(-4.81)
Pillar 7							
Tax rate	-0.015	-0.001	-0.034	0.002	0.002	0.002	0.004
	(-0.22)	(-0.02)	(-0.48)	(0.24)	(0.24)	(0.31)	(0.50)
Regulatory quality	0.035	0.007***	0.055**	0.005*	0.005*	0.006*	0.006**
	(1.13)	(2.12)	(1.76)	(1.50)	(1.50)	(1.64)	(1.79)
Regulatory trade barriers[b]	0.013**	0.002**	0.015**	0.002**	0.002**	0.002**	0.001*
	(1.77)	(1.71)	(1.93)	(1.93)	(1.93)	(1.76)	(1.34)
Pillar 8							
Women	0.019	-0.007***	0.008	-0.007***	-0.007***	-0.007***	-0.007***
	(0.54)	(-3.84)	(0.22)	(-3.85)	(-3.85)	(-3.99)	(-4.19)
CBR	0.100	0.005	0.100	0.005	0.005	0.004	0.002
	(0.54)	(0.45)	(0.55)	(0.43)	(0.43)	(0.37)	(0.18)
Pillar 9							
Private credit	0.082***	0.014***		0.013***	0.013***	0.025***	0.024***
	(3.52)	(4.80)		(4.47)	(4.47)	(4.85)	(4.87)
Private credit (t-1)			0.001	0.002***	0.002***	0.002***	0.002***
			(0.26)	(2.46)	(2.46)	(2.33)	(2.48)
Credit market regulations[c]						-0.015***	-0.015***
						(-2.81)	(-2.89)
Pillar 12	0.027***	-0.001	0.031***	-0.001	-0.001	-0.001	-0.001
	(2.23)	(-0.55)	(2.51)	(-0.26)	(-0.26)	(-0.19)	(-0.73)
Emerging market dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Capital stock ratio (ln, t-1)		0.998***		0.999***	0.999***	0.999***	0.998***
		(796.27)		(784.80)	(784.80)	(786.06)	(785.12)
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	505	505	516	505	505	503	503
Wald Test	1195.6	877051.3	1148.9	870619.9	870619.9	873441.5	847098.7
Wald Test p-value	0	0	0	0	0	0	0

Note *t* statistics in parentheses * p<0.2, ** p<0.1, *** p<0.05

[a] Weighted average of energy use pc (ln) and number of individuals using internet (ln), with equal weights.

[b] Fraser 2016

[c] Fraser 2016

Table A3.3. Stochastic Frontier, Extended Model

Dependent variable: real GDP (ln)

	(1) **1996-2013**	(2) **1996-2013**	(3) **1996-2013**	(4) **1996-2013**	(5) **1996-2013**
Frontier					
Employment ratio	0.368***	0.406***	0.449***	0.458***	0.456***
	(27.95)	(22.01)	(29.41)	(27.86)	(27.68)
Capital stock ratio	0.660***	0.626***	0.595***	0.574***	0.575***
	(58.12)	(37.84)	(42.70)	(39.62)	(39.62)
Time trend	Yes	Yes	Yes	Yes	Yes
Inefficiency model					
Pillar 1		-0.168***	-0.569***	-0.472***	-0.455***
		(-2.46)	(-4.98)	(-4.23)	(-4.14)
Pillar 2 and 3[a]		-0.211***	-0.249***	-0.302***	-0.293***
		(-5.19)	(-3.84)	(-4.38)	(-4.25)
Pillar 4					
Change in terms of trade		0.175***	0.238***	0.247***	0.252***
		(4.32)	(4.03)	(3.86)	(3.89)
Output gap			-0.031***	-0.022***	-0.019***
			(-3.36)	(-2.54)	(-2.39)
Pillar 5 and 6	-0.386***	-0.267***	-0.056	-0.186*	-0.198**
	(-5.63)	(-4.29)	(-0.64)	(-1.61)	(-1.70)
Pillar 7					
Regulatory quality	-0.171***	-0.102**	-0.076	-0.204***	-0.202***
	(-3.13)	(-1.78)	(-1.00)	(-2.45)	(-2.42)
Regulatory trade barriers[b]	-0.098***			0.160***	0.162***
	(-3.85)			(3.90)	(3.93)
Burden of custom procedure (WEF)			0.244***		
			(3.91)		
Mean tariff rate[c]		0.172***			
		(5.52)			
Tax rate		0.962***	0.942***	0.773***	0.725***
		(6.00)	(3.19)	(2.50)	(2.35)
Pillar 8					
Women				0.083***	0.084***
				(3.09)	(3.12)
CBR		0.405***		0.957***	0.993***
		(2.81)		(3.87)	(3.91)
Pillar 9					
Private credit		0.239***	0.805***	0.889***	
		(3.76)	(2.05)	(2.30)	
Private credit growth		0.0704			
		(0.48)			
Private credit (t-1)			-0.469	-0.521*	0.378***
			(-1.17)	(-1.31)	(3.87)
Pillar 12			0.0413	0.0745*	0.0571
			(0.84)	(1.50)	(1.16)
Emerging market dummy	No	Yes	Yes	Yes	Yes
Variance of inefficiency					
Change in terms of trade		-8.976***	-7.382***	-11.05***	-10.53***
		(-4.90)	(-4.98)	(-4.83)	(-4.77)
Constant	Yes	Yes	Yes	Yes	Yes
Obs	1186	612	576	494	498
Wald Test	58764.4	26532.9	34827.3	29684.2	29555.2
Wald Test p-value	0	0	0	0	0
LogLik	-59.86	105.6	104.8	121.0	121.2

Note *t* statistics in parentheses. * p<0.2, ** p<0.1, *** p<0.05.

[a] Weighted average of energy use pc (ln) and number of individuals using internet (ln), with equal weights

[b] Fraser 2016

[c] Fraser 2016

Table 12 The EU-ECA Dummy

	Employment ratio (ln)		Capital stock ratio (ln)	
	(1)	(2)	(1)	(2)
	1996-2013	**1996-2013**	**1996-2013**	**1996-2013**
Pillar 1	0.0002	0.0002	0.0001	0.0002
	(1.14)	(1.12)	(0.35)	(0.44)
Interaction ECA	-0.0005***	-0.0005**	-0.0003	-0.0002
	(-2.10)	(-1.90)	(-0.50)	(-0.44)
Pillar 3 and 4[a]	0.0000	0.0000	0.0003***	0.0003***
	(0.11)	(0.12)	(2.25)	(2.35)
Interaction ECA	0.0000	0.0000	-0.0003	-0.0002
	(0.06)	(0.17)	(-1.23)	(-1.05)
Pillar 4				
Output gap	0.0058***	0.0057***	0.0022***	0.0017**
	(12.16)	(12.12)	(2.14)	(1.71)
Terms of trade	0.0115	0.0129	-0.0232	-0.0170
	(0.71)	(0.81)	(-0.67)	(-0.51)
Pillar 5 and 6	0.0010***	0.0010***	0.0009*	0.0012**
	(3.30)	(3.12)	(1.31)	(1.72)
Interaction ECA	-0.0003	-0.0011***	-0.0035***	-0.0061***
	(-0.87)	(-1.97)	(-3.75)	(-4.96)
Pillar 7				
Tax rate	-0.0012	-0.0013	0.0275***	0.0275***
	(-0.35)	(-0.40)	(3.72)	(3.83)
Interaction ECA	-0.0153***	-0.0151***	-0.0554***	-0.0577***
	(-2.86)	(-2.86)	(-4.77)	(-5.11)
Regulatory quality	0.0004***	0.0003***	-0.0010***	-0.0009***
	(2.31)	(2.07)	(-2.74)	(-2.62)
Interaction ECA	0.0006***	0.0005***	0.0022***	0.0019***
	(2.31)	(2.10)	(3.84)	(3.40)
Trade barriers[b]	-0.0005*	-0.0004	0.0007	0.0012*
	(-1.31)	(-0.91)	(0.85)	(1.44)
Interaction ECA	0.0003	-0.0000	0.0015	0.0001
	(0.54)	(-0.06)	(1.06)	(0.07)
Pillar 8				
CBR	-0.0016	-0.0008	-0.0063**	-0.0012
	(-1.14)	(-0.47)	(-1.94)	(-0.35)
Interaction ECA	0.0025*	0.0010	0.0098***	0.0037
	(1.59)	(0.55)	(2.71)	(0.95)
female	-0.0363***	-0.0504***	0.0638***	0.0581**
	(-2.53)	(-3.30)	(1.99)	(1.79)
Pillar 9	0.0002**	0.0002**	0.0015***	0.0015***
	(1.90)	(1.92)	(6.01)	(6.12)
Interaction ECA	-0.0005***	-0.0004**	-0.0005	-0.0004
	(-2.33)	(-1.97)	(-1.04)	(-0.75)
Pillar 12	-0.0000878*	-0.0001*	0.0004***	0.0004***
	(-1.43)	(-1.48)	(3.33)	(3.06)
Interaction ECA	0.0000918*	0.0001**	-0.0004***	-0.0003***
	(1.32)	(1.67)	(-2.84)	(-2.37)
Time effect	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes
obs	496	496	505	505
Wald Test	451.6		1696.1	
Wald Test p-value	0	0	0	0
LogLik		1260.7		895.6

Note: *t* statistics in parentheses * p<0.2, ** p<0.1, *** p<0.05
[a] Infra index WEF
[b] Fraser 2016

Table A3.5. The Labor Channel in the Extended Model

	Employment ratio (ln)			
	(1)	(2)	(3)	(4)
	Pooled	FE	RE	GMM
(t-1)	1.002***	0.534***		1.032***
	(364.54)	(6.66)		(38.97)
Pillar 1	0.0043	-0.0269*	0.0013	-0.0119
	(0.61)	(-1.42)	(0.06)	(-0.99)
Pillar 2	0.00245	-0.0043	-0.0057	-0.0017
	(0.87)	(-0.55)	(-0.63)	(-0.27)
Pillar 3	-0.0000	-0.0000	-0.0000	0.0000
	(-0.22)	(-0.09)	(-0.22)	(0.06)
Pillar 4				
Output Gap	0.0018**	0.0041***	0.0068***	0.0042***
	(1.92)	(3.30)	(4.92)	(3.23)
(t-1)				-0.0042***
				(-5.27)
Change ToT	-0.0181	0.0090	0.0356	-0.0188
	(-0.50)	(0.33)	(1.13)	(-0.72)
Pillar 5 and 6				
(t)	0.0015	0.0504	0.139***	0.398***
	(0.26)	(0.77)	(2.10)	(2.36)
(t-1)				-0.368***
				(-2.25)
Pillar 7				
Tax rate (avg)	-0.0473***	-0.0162	-0.0181	-0.0963*
	(-1.97)	(-0.19)	(-0.18)	(-1.46)
Mean tariff rate	-0.0000	0.0433***	0.0585***	0.0041
	(-0.02)	(2.17)	(2.66)	(0.32)
Pillar 8				
Women (%pop)	0.0017	0.0447	-0.0087	-0.0036
	(0.81)	(0.94)	(-0.25)	(-0.42)
CBR	-0.0098	-0.0211	0.0263	-0.183***
	(-1.20)	(-0.23)	(0.26)	(-2.29)
Pillar 9	-0.0094***	-0.0113	-0.0040	-0.0277**
	(-2.13)	(-0.40)	(-0.12)	(-1.75)
Pillar 11	0.0000	0.0003	0.0001	0.0003*
	(0.58)	(1.19)	(0.42)	(1.46)
Pillar 12	0.0029	-0.0015	0.0004	0.0092
	(0.44)	(-0.14)	(0.03)	(1.00)
EMS dummy			-0.0637	
			(-0.56)	
Year Effect				
Constant	Yes	Yes	Yes	Yes
Obs	195	195	195	195
Wald Test	318026.8		63.13	10898.6
p-value	0	0	0	0
LogLik		612.9		

Annex 4. Robustness: The Role of Human Capital

Table A4.1. The Interaction between Human Capital and Level of Development

	Employment ratio (ln)				Capital stock ratio		
	(1) RE	(2) RE	(3) RE	(4) FE	(1) RE	(2) RE	(3) FE
	1996-2013	**1996-2013**	**1996-2013**	**1996-2013**	**1996-2013**	**1996-2013**	**1996-2013**
Pillar 1	-0.002	-0.010	0.000	-0.007	-0.002	-0.000	0.002
	(-0.02)	(-0.72)	(0.03)	(-0.57)	(0.09)	(-0.02)	(0.64)
Pillar 2 and 3[a]	0.000	-0.001	-0.000	-0.002	0.027***	0.026***	0.009
	(0.07)	(-0.24)	(-0.07)	(-0.29)	(2.20)	(2.19)	(0.74)
Pillar 4							
Output gap	0.006***	0.006***	0.006***	0.006***	0.004***	0.004***	0.006***
	(13.35)	(13.87)	(13.85)	(13.82)	(4.2)	(4.23)	(5.57)
Change in terms of trade	0.009	0.008	0.007	0.009	-0.055*	-0.055*	-0.021
	(0.53)	(0.52)	(0.47)	(0.57)	(-1.49)	(-1.55)	(-0.57)
Pillar 5 and 6							
Human Capital	0.001***	0.001*	0.001***	0.000	0.001	0.001	-0.001
	(3.58)	(1.57)	(2.70)	(0.07)	(0.71)	(1.09)	(-1.01)
Interaction income pc	-0.000*	-0.000			0.001***	0.000***	
	(-1.64)	(-1.27)			(6.42)	(6.45)	
Interaction EM dummy			0.000	0.001**			0.003****
			(0.56)	(1.69)			(3.82)
Pillar 7							
Tax rate	-0.099***	-0.115***	-0.094***	-0.101***	-0.033	-0.034	0.056
	(-3.38)	(-4.10)	(-3.26)	(-3.46)	(-0.53)	(-0.56)	(0.82)
Regulatory quality	0.072***	0.073***	0.068***	0.074***	0.026	0.033	0.041*
	(5.53)	(5.88)	(5.43)	(5.93)	(0.90)	(1.23)	(1.42)
Regulatory trade barriers	-0.005**	-0.006**	-0.006**	-0.007***	0.010*	0.010*	0.007
	(-1.74)	(-1.89)	(-1.91)	(-2.27)	(1.40)	(1.44)	(0.99)
Pillar 8							
Women	-0.035***		-0.042***		-0.011		
	(-2.42)		(-2.91)		(-0.02)		
CBR	0.034	0.040	0.027	0.032	0.236*	0.310**	0.114
	(0.46)	(0.53)	(0.36)	(0.43)	(1.41)	(1.90)	(0.64)
Pillar 9	0.003	0.005	0.004	0.004	0.088***	0.084***	0.073***
	(0.32)	(0.50)	(0.43)	(0.46)	(4.15)	(4.09)	(3.27)
Pillar 12	-0.005	-0.007*	-0.004	-0.007	0.0243***	0.023***	0.021**
	(-1.06)	(-1.34)	(-0.85)	(-1.46)	(2.01)	(2.11)	(1.79)
Emerging market dummy					-0.488**		
					(-1.46)		
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	496	496	496	496	496	496	505
Wald Test	390.8		416.0		1373.6		66.08
Wald Test p-value	0	0	0	0	0	0	0

Note: *t* statistics in parentheses. * p<0.2, ** p<0.1, *** p<0.05.
[a] Infra index, WEF.

Annex 5. Methodology: The Impact of Structural Reforms on GDP Growth

For each policy variable, it is possible to compute the annual GDP growth that would be added if Serbia managed to close the gap with Germany in 20 years. In particular, assume that

- $z_0 = value\ of\ structural\ variable\ for\ Serbia$
- $z_1 = value\ of\ structural\ variable\ for\ Germany$
- $y = \ln Y$

where Y is output per capita.

The new level of GDP per capita for Serbia associated with the reform is computed as follows:

$$y_1 = y_0 + \beta\,(z_1 - z_0)$$

where y_0 is the level of GDP per capita in 2016 and β is the weighted average of the estimated elasticity for each structural variable along the relevant input channels, with weights as in equation (1) in the main text.

The growth rate necessary to reach the new level of income y_1 starting from y_0, in 20 years is:

$$g = \frac{y_1 - y_0}{20} 100$$

Therefore, g is the annual GDP growth rate that would be added by structural reforms if Serbia managed to close the gap with Germany in 20 years.

Annex 6. Details about Work-Time Regulation

The CBR Labor Regulation Index Dataset (CBR-LRI) provides data on labor law for 117 countries from 1970 to 2013. A value between 0 and 1 is assigned to each indicator for each year covered, where 0 stands for absence of any protection for workers and 1 is assigned for the highest protection. Five areas of the law are covered: definition of the employment relationship and different forms of employment; work-time; dismissal; employee representation; and collective action.

The index is a measure of the extent to which a certain aspect is regulated (protected). Note that existence of a law regulating a certain aspect does not say anything about its actual application.

Table A6.1 reports on regulation of work-time for Serbia over time and in comparison to Germany.

Table 13 Work-time Regulation, Serbia and Germany

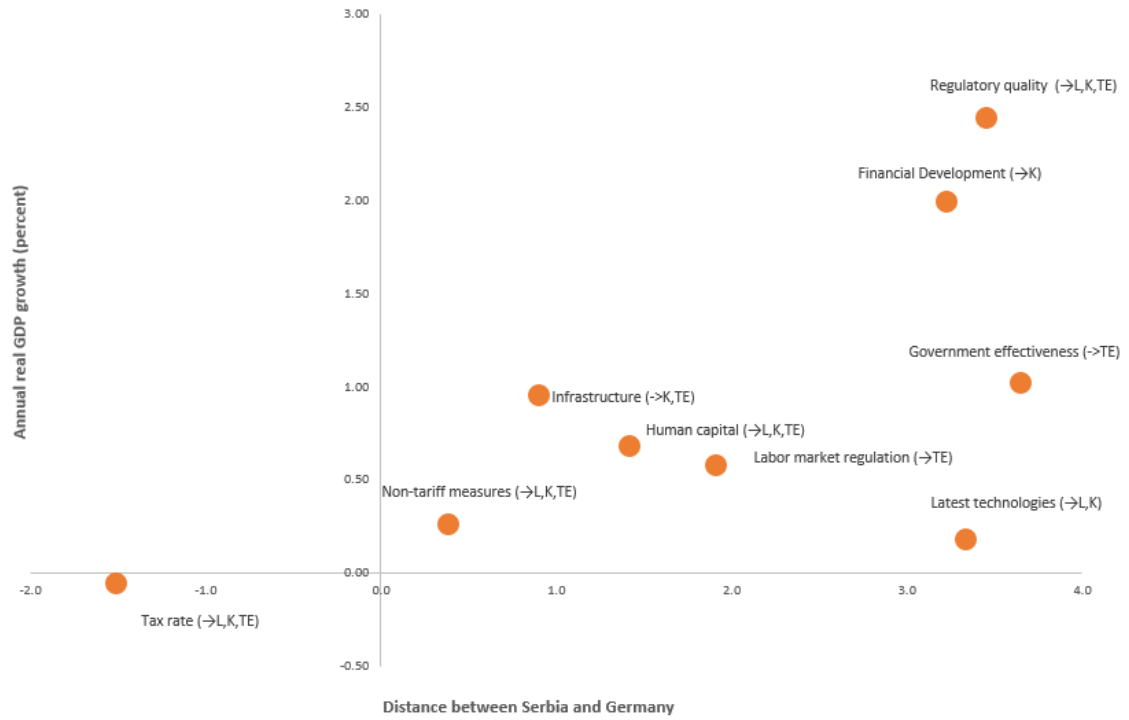
Regulation of work-time	Serbia		Germany	
Annual leave entitlement	1991: 0.6 2001: 0.67	20 days	1970: 0.5 1995: 0.67	24 work days if 6-day week; 20 if 5 day week: i.e., 4 weeks.
Public holiday entitlement	1991: 0.67 2007: 0.83	15 days	1970: 0.6	10.3 public holidays
Overtime premium	1991: 0 2001: 0.26	26% increase of basic salary	1970: 0.25	25% general norm
Weekend work	1991: 0 2001: 1	At least one day weekly rest	1970: 0.25	Sunday is not a normal working day. Premium 25–50%

Limits to overtime work	1991: 1	Law 2001: 8 hours per week, 4 per day	1970: 1 1994: 0.25	8 +2 overtime per week
Duration of the normal work week	1991: 0.53 2001: 0.67	60 hours per individual week	1970: 0.67 1994: 0.8	48 hours per individual week
Maximum daily work time	1991: 0.6 2001: 0.4	At least 10 hours uninterrupted daily rest	1970: 0.67	11 rest hours per day

Annex 7. The Impact of Structural Reforms in Serbia, Extended Model

The chart shows the impact of structural reform if Serbia were to close the gap with Germany in 20 years. Although the estimated additional annual real GDP growth related to each policy area is not fully comparable with the one estimated through the baseline model—the variables used for the regression are slightly different—the results show that key priority reform areas, namely the one on the top right of the chart, remain: government effectiveness; financial development; human capital; and regulatory quality. In terms of trade, the extended model builds on the freedom to trade indicator, developed by Fraser, and, in particular, on the index measuring the existence of non-tariff measures.

Figure A7.1. Structural Reforms, GDP Impact and Channel at Work



For each policy variable, the figure shows the distance of Serbia from the frontier (Germany) and the estimated increase in annual growth of real GDP if the distance is closed in 20 years (40 for government effectiveness). Variables on the right side of the y axis indicate policy areas where Serbia is far from the frontier: government effectiveness (WGI); financial development, measured by credit to the private sector (%GDP, WDI); regulatory quality (WDI); availability of latest technology (WEF); human capital, which measures return to education (Penn tables); an infrastructure index, built as a weighted average of energy use per capita (WDI) and Internet access (WEF); an indicator that measures the freedom to trade, capturing nontariff measures (Fraser). Variables on the left side of the y axis show areas where Serbia performs better than the frontier: top marginal income and payroll tax rate (Fraser).