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IMF Working Paper

Assessing the Impact of Structural Reforms Through a Supply-side Framework: The Case of Argentina

by Lusine Lusinyan

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IMF Working Paper

Western Hemisphere Department

Assessing the Impact of Structural Reforms Through a Supply-side Framework: The Case of Argentina

Prepared by Lusine Lusinyan

Authorized for distribution by Roberto Cardarelli

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Abstract

The paper uses a supply-side framework based on a production function approach to assess the role of structural reforms in boosting long-term GDP growth in Argentina. The impact of product, labor, trade, and tax reforms on each supply-side channel—capital accumulation, labor utilization, and total factor productivity, proxied with an efficiency estimate—is assessed separately and then combined to derive the total impact on growth. The largest effect of structural reforms, involving regulatory changes that promote competition and facilitate flexible forms of employment, comes through the productivity/efficiency channel. Pro-competition regulation also improves labor utilization, while lower entry barriers and trade tariffs are important for capital accumulation. Structural reforms could have substantial effects on Argentina's long-term GDP growth; for example, an ambitious reform effort to improve business regulatory environment would add 1–1½ percent to average annual growth of GDP.

JEL Classification Numbers: C53; D24; E22; E24; E27; J08; O43; O47

Keywords: Economic growth; structural reforms; productivity; product market competition; labor market reforms; trade openness; Argentina

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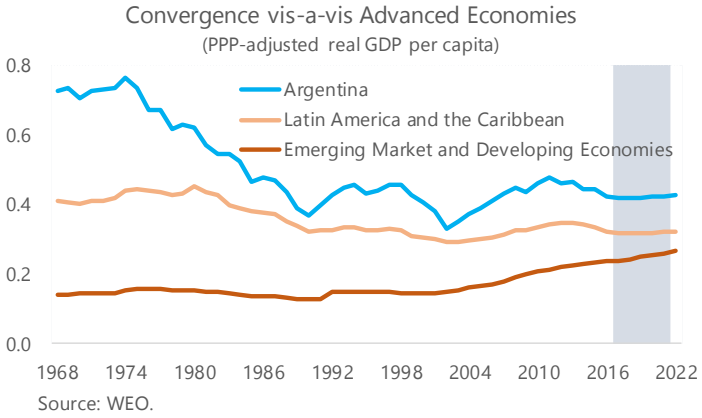
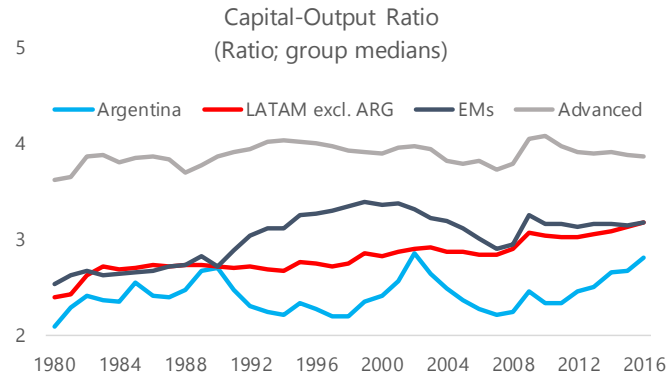
A. Motivation

Argentina's economic fortune has been on a declining path for a long time. Argentina's per capita output relative to that of advanced economies nearly halved over the past 50 years (Chart). After the end of the commodity boom of the mid-2000s, the divergence has increased again. Underlying this, has been a disappointing productivity performance: yearly labor productivity growth has been close to zero on average since 1980, compared with a 2½ percent average increase in emerging market economies (EMs).



Low labor productivity reflects relatively weak total factor productivity and, even more, low resource utilization (particularly capital). Years of underinvestment have left Argentina with an estimated 10 percent gap in capital intensity compared to the median of EMs (Chart).[1] As of 2017, Argentina's employment rate (67 percent of working-age population) is close to the EMs median, but 10 percentage points below the median of advanced economies, and is particularly low for women.[2] Finally, Argentina's total factor productivity growth (TFP), proxied by a simple Solow-type residual, averaged essentially zero since 1980 compared to an average growth of over 1 percent in other EMs. However, this measure may be biased by the relatively greater cyclical volatility of Argentina's economy over the last few decades. When adjusted for labor and capital utilization, TFP growth averaged ¾ percent per year since 1980 (BCRA, 2017).[3]



Supply-side measures are needed to boost Argentina's economy's potential. Structural reforms should include opening-up the economy to international trade, increasing domestic competition, improving infrastructure, developing capital markets, and strengthening governance and institutional frameworks (for a summary of key structural policy areas, see Table 1). Without a

[1] IMF (2016) discusses in detail Argentina's capital accumulation and infrastructure gaps.

[2] Artana and others (2010) show that while Argentina's gap in labor utilization—measured in per capita hours worked relative to the United States—declined since mid-1990s, it remained relatively high at close to 10 percent by 2008.

[3] TFP growth is very volatile with or without adjusting for resource utilization.

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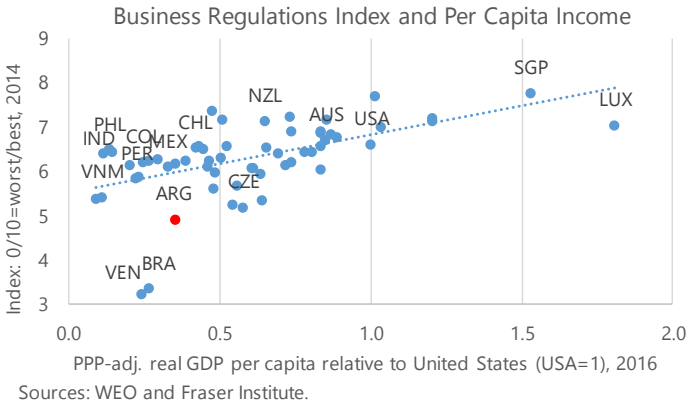
significant reform effort, staff baseline projects only a gradual pick-up of Argentina's GDP growth over the medium term, with limited catching up vis-à-vis advanced economies.

Advances in product market reforms appear particularly important. Argentina's regulatory and administrative burden on businesses is one of the heaviest among EMs (Chart). The OECD indicator of product market regulation (PMR) shows Argentina has the worst overall PMR index among 42 OECD and non-OECD countries, owing to high barriers to entrepreneurship (including complex regulatory procedures which impede firm entry/expansion, and barriers in network sectors), a weak competition policy framework, high trade and other external barriers, and a significant involvement of the state in the economy, both through state-owned enterprises and price controls (see, Licetti and others, 2018; OECD, 2017). Particularly affected are retail and transport sectors (Appendix Figures A1–A2). A large body of literature shows that product market reforms are likely to have a strong impact on growth and productivity (see, for example, EU, 2004; IMF, 2015a; Égert and Gal, 2016; Bouis and others, 2016). In addition to lowering the cost of doing business, well-functioning product markets facilitate a better allocation of resources across firms and sectors, lead to a better utilization of labor and capital, and yield stronger incentives to innovate.



Sources: WEO and Fraser Institute.

Reforms of labor market regulations and tax systems would also likely increase efficiency and resource utilization. Stringent labor market regulations, such as high firing costs and restrictions on temporary employment, hamper efficient allocation of resources in the economy, discourage investment, and lead to labor underutilization and informality (see Canales Kriljenko and others, 2017). High tax burden, especially on labor, have similar adverse effects on investment, labor utilization (particularly formal employment), and overall competitiveness of the economy (see Dudine and others, 2017).

The main objective of this paper is to quantify the impact of structural reforms on long-term GDP growth in Argentina. We use a supply-side framework based on a production-function approach, following Égert and Gal (2016), to assess the role of the reforms in boosting long-term GDP growth through their impact on (i) capital accumulation, (ii) labor utilization, and (iii) total factor productivity or efficiency.[4] A key advantage of this method is that it presents GDP growth as the *sum of separable and independent supply-side components*, allowing us to analyze the effect of reforms for each component separately first and then together to obtain the overall impact on growth. The main novelty in our paper is that we proxy TFP with an estimated

[4] The paper does not cover short-run dynamics and the adjustment costs of the reforms.

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measure of efficiency (using a stochastic frontier analysis approach) rather than a Solow-type residual.

The paper finds that structural reforms can have significant impact on long-term GDP growth through all three supply-side channels. The largest effect of structural reforms generally comes through the productivity/efficiency channel. We find that regulatory changes that promote competition and ease labor market regulations (especially facilitating flexible forms of employment) matter the most for the efficiency channel. Pro-competition regulation also appears to improve labor utilization, together with lower tax rates on income and payroll, while lower entry barriers (cost of starting a business) and trade tariffs are especially important for capital accumulation. For Argentina, policies to promote capital and labor utilization promise to have larger payouts, given the size of the gaps accumulated in both areas. An ambitious reform effort, which were to improve business regulatory environment (closing half the gap with Australia and New Zealand over two decades), would add 1–1½ percent to average annual growth of GDP. Reducing trade tariffs and payroll taxes (closing half the gap with Australia and New Zealand) could *each* boost average annual real GDP growth by about 0.1 percent.

B. Framework and Data

A production function approach is used to estimate the impact of structural reforms on GDP growth. Following Égert and Gal (2016) and Égert (2017a), we quantify the impact of structural reforms on per capita GDP growth based on the following production function framework

$$\underbrace{\Delta ln\left(\frac{Y}{N}\right)}_{\text{GDP growth per capita}} = \underbrace{\frac{\alpha}{1-\alpha}\Delta ln\left(\frac{K}{Y}\{z\}\right)}_{\text{Change in capital-output ratio}} + \underbrace{\Delta ln\left(\frac{E}{WP}\{z\}\right)}_{\text{Change in employment rate}} + \underbrace{\frac{1}{1-\alpha}(\Delta TE\{z\})}_{\text{Change in technical efficiency}} \quad (1)$$

where α is the output elasticity of capital and z is a set of structural variables, including indicators of product and labor market regulations (see Appendix 1 Table A2). The specification in Eq. (1) assumes constant returns to scale and a constant working-age population ratio. Different from Égert and Gal (2016), the change in TFP is not derived as a Solow-type residual but is proxied by a change in technical efficiency, estimated with a stochastic frontier analysis (SFA) approach (see Box 1 and Appendix 2). In the SFA framework, the change in TFP can be expressed as a sum of (i) the change in the country-specific technical efficiency, and (ii) the technological change common to all countries. For our analysis, we assume that the common technological change is zero, as this is a component of GDP growth which is unlikely to be affected by Argentina's (or any small country) specific reform.

The link between structural variables and each supply-side channel is estimated separately. Following the literature (for example, Barnes and others, 2013; Bouis and Duval, 2011; Égert and Gal, 2016; Égert 2017a), cross-country, reduced-form panel data regressions are estimated

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for both the capital-output ratio and employment rate, relating them to both structural and macroeconomic variables. We rely mostly on random-effects model with robust standard errors (as opposed to cross-sectional or between estimates) as this allows us to capture both cross-sectional (between-country) and time-series (within-country) information.[5] This is important because, while we expect structural variables to vary more across countries, factor utilization is most likely to be affected by within-country cyclical fluctuations. Technical efficiency is estimated within an SFA approach, conditional on the same set of structural and macroeconomic variables (see Box 1).

A sample of about 60 advanced and emerging economies is used in the paper. We build a sample of 32 EMs (of which seven Latin American countries) and 27 advanced economies covering the period of 1980–2016 (the sample periods, however, vary for different variables depending on data availability). Real output, total stock of capital, employment, and other macroeconomic data are mainly from the IMF WEO database, The Penn World Tables, and World Bank WDI. A wide range of data sources are used for structural variables covering the areas of business regulations, labor market, taxation, trade barriers, governance, educational attainment, wealth, energy use, and financial development (see Appendix 1 for data description).

C. Structural Reforms and Impact on Capital, Labor, and Efficiency

Capital Deepening

There is evidence in the literature that product market reforms affect investment and capital accumulation. Regulation affects investment through its impact on: (i) price markups and entry costs, which affect the number of firms (Blanchard and Giavazzi, 2001; Alesina and others, 2005); (ii) the cost of adjusting or expanding the capital stock for existing firms; and (iii) the rate of return on capital, which affects the demand for capital. The empirical literature on investment has emphasized the role of macroeconomic and financial determinants at the expense of structural drivers. Still, there is some evidence that less restrictive product market regulation is conducive to greater capital deepening (see Égert, 2017b).[6] Alesina and others (2005), for example, explore the link between product market regulation and investment at a sectoral level (for network industries) and find that entry barriers are negatively related to investment in OECD countries. Simulations based on general equilibrium models also tend to illustrate the positive impact of product market reforms on capital accumulation (de Bandt and Vigna, 2008). In contrast, Bouis and others (2016), looking at major reform episodes in five network industries, do not find evidence that product market deregulation boosts investment. In our analysis, we explore the relation between a number of structural variables (see Appendix Figure

[5] The appropriateness of a random-effects model is tested and confirmed through the Hausman test (not reported in the paper).

[6] The relation between PMR and capital-intensity (which is the inverse of capital productivity) may, however, not be straightforward: if more efficient markets make capital more productive, less capital would be needed to produce the same output, and K/Y would be lower. This is unlikely the case for Argentina, though, which starts from a very low capital-output ratio (the stock of capital grew at an average annual rate of 2.8 percent since 1980, compared 3.7 percent in the regional peers, 4.2 percent in EMs, and 3.1 percent in the advanced economies).

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A3) and the capital-output ratio, controlling for macroeconomic (output) volatility (which we expect to discourage investment).

Our results confirm that reducing entry barriers, especially the cost of starting a business, and trade tariffs boost capital deepening (Appendix Table A3). This is in line with the finding in the literature that only policies that affect firms' cost of entry have long-run effects on investment (Blanchard and Giavazzi, 2003; Schiantarelli, 2010).[7] In addition, we find that capital intensity is affected (negatively) by output volatility and (positively) by the availability of private credit and latest technologies. The latter variable is related to the degree of trade openness and is used instead of trade tariffs in some specifications. Variables that proxy the cost of capital (corporate tax rate, real interest rate, relative investment prices) and labor market regulations do not seem to be strongly associated with investment. Simulations show that cutting the cost of starting a business (proxied by the number of required procedures) to close half the gap relative to the average of Australia and New Zealand would increase Argentina's capital-output ratio by 0.2 percentage points, bringing it closer to the median of EMs and regional peers. The increase would be more modest (less than 0.1 percentage point) if Argentina's trade tariffs were reduced half way to the levels in these two countries.

Employment Rate

A large body of literature has looked at the effects of structural policies on labor market outcomes. A recent reassessment of such policies in advanced economies by Gal and Theising (2015) confirms earlier results of a positive impact on employment from a smaller tax wedge on labor (see also IMF, 2015b), lower unemployment benefits, and stronger active labor market policies. More competition-friendly product market reforms (which lower markups and prices and thus increase the demand for final goods) should stimulate firms' demand for labor and increase real wages (so that labor supply increases to match the greater demand for labor). Empirical evidence generally confirms that product market deregulation is likely to boost employment (see, for example, Nicoletti and others, 2001a/b; de Bandt and Vigna, 2008; Fiori and others, 2012; Gal and Theising, 2015; Schiantarelli, 2016). Evidence from both advanced and emerging market economies suggests that more rigid labor market institutions (stricter employment protection legislation or EPL) tends to negatively affect employment rates of more disadvantaged workers (women, less educated, youth) and could lead to greater labor market segmentation and informality (Muravyev, 2014). Fiori and others (2012) and Bouis and others (2016) find that, in countries with more stringent EPL, product market reforms have greater potential to deliver job gains.[8] In our analysis, in addition to structural indicators showed in

[7] Blanchard and Giavazzi (2003) show that product market deregulation which does not lower entry costs (number of firms remains unchanged) would have only short-term effects resulting in firms' exit and the return of the economy to its pre-deregulation equilibrium. Instead, lower entry costs decrease the rents the firms require to enter and stay in the market and lead to entry of firms and more competition in the long run.

[8] The basic intuition behind this is that the response of employment to product market deregulation depends on how far the economy is from the full-employment level. In countries with more stringent EPL, real wages are likely to exceed market-

(continued…)

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Appendix Figure A4, we include the output gap (to account for the macroeconomic conditions) and several demographic variables (such as shares of female and children in the population, and dependency ratios).

Results from panel data regressions show a robust positive link between employment rate and pro-competition regulation (Appendix Table A4). Implementing product market reforms to close half the gap with the average of Australia and New Zealand would increase Argentina's employment rate from the current 67 percent to 73. Changes in labor market regulations are not strongly related to the overall employment rate, in line with the literature. Instead, the effect of changes in the tax rate appears statistically important, though small (both with or without the interaction with tax compliance). A reduction in Argentina's top marginal income and payroll tax rate from the current 58 percent to 50 percent is associated with an increase in Argentina's employment rate of about one percentage point.

Efficiency of Factor Utilization

Total factor productivity is generally found to be the main channel through which structural reforms affect growth. Many studies (especially at firm- and industry-level) find robust evidence that pro-competition product market reforms help increase TFP growth (Nicoletti and Scarpetta, 2003; EU, 2004; Faini and others, 2006; Buccirossi and others, 2009; Bourles and others, 2013; IMF, 2015a; Dabla-Norris and others, 2016; Bailliu and others, 2016; Égert, 2017c). While labor market deregulation generally appears to have a smaller positive impact on TFP (Bouis and Duval, 2011), some studies find that stringent employment protection does lower productivity growth (Bassanini and others, 2009, and Cette and others, 2014). IMF (2015) shows that the most significant productivity gains for EMs are associated with reforms that improve business regulations, ease labor market restrictions, and fiscal structural reforms.[9] While all these studies tend to derive TFP as a Solow-type residual, we estimate technical efficiency using a SFA approach (see Box 1 and Appendix 2). This has the advantage to simultaneously estimate efficiency in the production function and its determinants. In addition to structural indicators, we control for the impact of the change in terms of trade and the output gap.

clearing levels and the economy is far away from full employment. Hence, a decrease in the markup as a result of deregulating product markets is more effective at the margin compared to the situation where EPL is less stringent and employment is closer to full employment levels.

[9] Capital market development also has the potential to deliver large benefits, especially when accompanied by a reform of the legal system and property rights.

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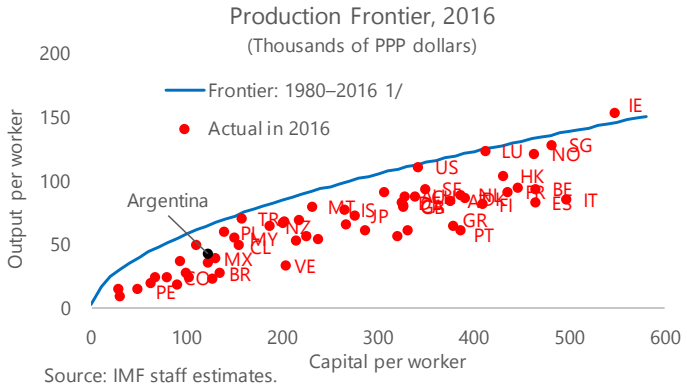
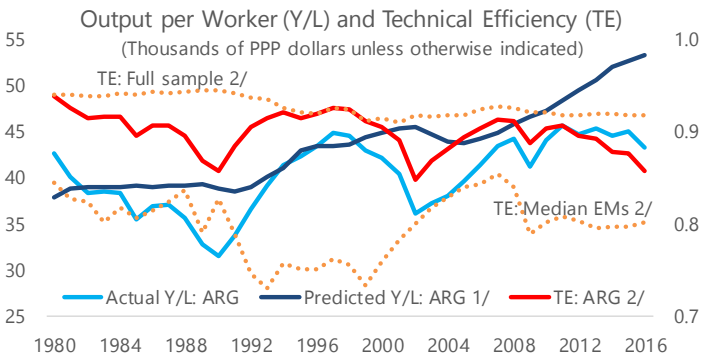
Box 1. Production Frontier and Efficiency: A Simple Illustration

For a given set of countries, a *production or efficiency frontier* is the greatest level of output that is possible to produce given the factors of production utilized, and the technology adopted. The further away a country's actual output is from the efficiency frontier, the less technically efficient is the country. This distance depends on country-specific characteristics. To estimate this frontier and a country's distance from it, a stochastic frontier analysis (SFA) technique is used in this paper (see Appendix 2 for technical details). In this setting, the efficiency of production is not a residual from the estimated production function, but a more "structured" variable—its mean and/or variance reflect factors (including structural determinants) that explain the level and volatility of efficiency across countries. Country-specific random shocks are expected to capture the cyclical variability of efficiency at the country level, while common time effects capture the impact of global shocks.

To illustrate the results of SFA, in a simple case output per worker is modeled as a function of capital per worker (see Appendix Table A5 for estimation results). The results show that as of 2016, given its very low level of capital per worker, Argentina was somewhat behind the production function but the distance was not out of line compared to other (more capital-intensive) economies (Chart). This is in line with BCRA's growth accounting framework (BCRA, 2017) showing that Argentina's low labor productivity growth seems more a consequence of underinvestment in physical capital. However, our results also show that the estimated efficiency for Argentina has worsened in the last decade, whereas the median of EMs and the full sample of countries remained broadly unchanged (Chart). Compared to the average technical efficiency of Australia and New Zealand in 2016, Argentina was more than 10 percent inefficient. Furthermore, the aggregate efficiency performance likely masks important differences in intersectoral productivity (not covered in this paper). For example, there is evidence that productivity growth in the agricultural sector has been relatively upbeat (Dabla-Norris and others, 2013).



Source: IMF staff estimates.
1/ Heterogenous and heteroskedastic efficiency model.



Source: IMF staff estimates.
1/ Heterogenous and heteroskedastic efficiency model; 2/ Index, right axis.

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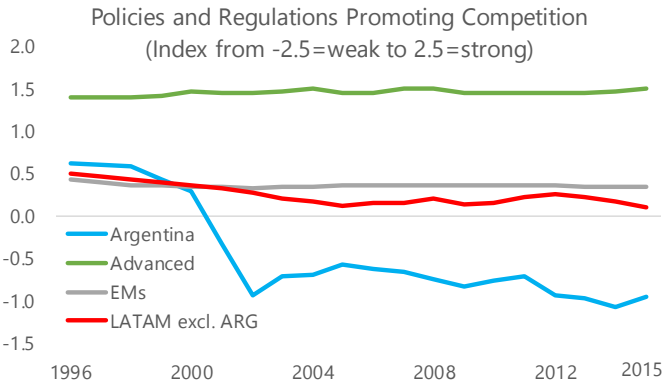
Our result show that efficiency is strongly associated with both product and labor market indicators. The results from a full-fledged SFA (Appendix Table A6) suggest that regulations promoting competition (the combined index of perceived regulatory quality from WB-WGI, 2016) and less regulated labor market (especially in terms of working time regulation) lead to greater efficiency (that is, lower inefficiency in the SFA model and Appendix Table A6).[10] This is especially relevant for Argentina as these are areas where the country seem to underperform relative to others (Chart)—hence, there is a greater scope to catch up. Using the conservative (lower-bound) estimate of the elasticity of technical efficiency with respect to the indicator of pro-competition regulations, suggests that Argentina's efficiency could increase by over 10 percent if reforms were to close half the gap with Australia and New Zealand.[11] It is important to note that this is unlikely to happen quickly, and would likely require many years of sustained reform effort.[12] Other potential determinants of efficiency, such as measures of human capital have not been found robust in our SFA regressions.



Source: World Bank WGI. 2016 Update.

D. What is the Potential Impact of Structural Reforms on Growth?

Finally, we combine the effects of structural reforms on efficiency, capital, and labor. We use Eq. (1) and the results from the previous Section on the estimated elasticities of efficiency, capital, and labor with respect to changes in structural variables (z).[13] We focus on the effects of the four policy changes which have been found to have the strongest impact on capital intensity, employment rate, and efficiency in our cross-country regressions, that is: (i) measures that make product market regulation more competition and private-sector friendly, in particular by reducing the costs to start a business; (ii) measures that ease labor market regulations, in

[10] To better control for cyclical effects, output gap (as a proxy for such effects) is included in some specifications (Appendix Table A6, columns 5–7), although in principle there may not be a clear delineation between underutilization of resources because of exogenous shocks or because of underlying inefficiency. The results show the expected negative sign between more the output gap and inefficiency (that is, the more positive is the output gap, the smaller is the distance from the frontier) but do not significantly affect other estimates.

[11] That is, with the average value of the WB-WGI (2016) indicator for these countries in 2015.

[12] To put this into perspective, in the scale of -2.5=weak to +2.5=strong for the WB-WGI regulatory quality index, Australia's indicator improved by about 0.6 points in twenty years from 1996. For Argentina, closing half the gap with the average of Australia and New Zealand would imply an improvement more than twice as large.

[13] Output elasticity of capital, α, is set to 0.33 in simulations, which is the standard value in the literature but is on the low side compared to 0.57 (implied from the recent values from Penn World Tables for Argentina) or about 0.61 estimated in Appendix Table A6.

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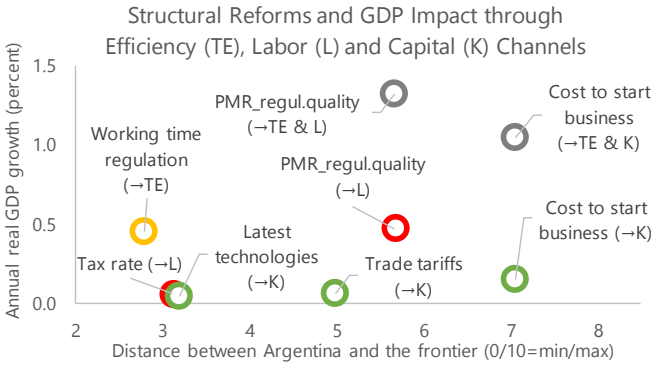
particular by facilitating flexible forms of work arrangements; (iii) eliminating trade tariffs; and (iv) cutting top marginal income and payroll tax rate.

Illustrative simulations suggest that structural reforms could have substantial effects on long-term GDP growth. We simulate the impact on long-term GDP growth of structural reforms that would get Argentina closer to Australia and New Zealand, two countries that have experienced significant reforms in the past and tend to show the highest scores in many structural indicators considered in this paper. We thus assume that, following the reforms, the structural policy variables for Argentina would slowly converge to the average value for Australia and New Zealand, with *half the distance* covered over a twenty-year period. For example, introducing measures to reduce the gap in the cost of starting a business (an area where Argentina's gap with the frontier is the largest) would be associated with additional annual GDP growth of 0.15 percent only through the increase in capital intensity and about one percent through both the capital and efficiency channels (Chart).[14]



Source: IMF staff estimates.
For each policy variable, the chart shows Argentina's distance from the frontier and the estimated increase in annual growth rate of real GDP if half of the distance is closed in twenty years, together with the supply-side channel through which GDP is affected.

E. Conclusion

Structural reforms will take time to materialize but are essential to boost Argentina's economic potential in a sustained way. Argentina's catching up with advanced economies in terms of GDP per capita requires a series of structural reforms that will take a long time to get ingrained. In Australia, for example, one of the benchmark counties in this paper, wide-ranging structural reforms continued for over three decades.[15] This paper provided some quantitative insights into potential long-run effects that structural reforms could have on Argentina's growth.

Policies and regulations which would promote investment and capital deepening should be at the core of the structural reform agenda. Facilitating firm creation and entry, including by reducing high costs to start a business, and opening the economy to trade, by lowering tariffs and

[14] For Argentina, OECD (2017) finds that implementing a wide range of structural reforms to converge to the OECD average over a ten-year period would add 1½ percent to the annual growth rate. Estimates from existing studies for other EMs suggest similar large effects from structural reforms: for example, Bailliu and others (2016) estimate that implementing the structural reforms planned since 2014 in China, India, Indonesia, and Mexico (including product market reforms, trade and FDI liberalization, and infrastructure investment), would increase average annual real potential GDP by 1½–2 percentage points.

[15] Structural reform process in Australia started in the 1970s, with tariff reductions; accelerated in the early 1980s, by further opening to trade, and in the late 1980s/1990s, with a focus on labor market reforms (shifting wage bargaining from centralized to enterprise level) and lowering company tax rate; and consolidated in the 1990s with strengthening competition policies (Banks, 2005).

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promoting technology spillovers, would contribute to growth through greater capital deepening and efficiency gains. In addition, productivity could further benefit from less restrictive labor market regulations, while lower tax burden and pro-competition policies and regulations would boost growth mainly through higher employment and efficiency.

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Table 1. Argentina—Structural Policy Areas: Distortions, Effects, and Reform Actions

Main Distortion	Impact Channels and Implications	Reform Actions
Domestic competition		
Entry barriers (complex regulatory procedures, high administrative burden)	Low investment, limited firm creation and innovation leading to low productivity, limited job creation and low employment	Simplify regulations, coordinate across levels of government, improve governance
State control (regulated prices, subsidies, protection to SOEs, subsidized lending)	Low investment and efficiency, limited labor market flexibility, price distortions	Phase out price controls, rationalize subsidies, reduce state involvement, ensure regulatory neutrality, including by reviewing/removing regulatory protection of incumbent companies
Inefficient network industries	Low productivity, high cost of doing business	Open sectors to competition, strengthen regulatory framework
Weak competition framework	Weak enforcement and ineffective regulation, cartel behavior, disincentives to invest and innovate	Pass the Competition Law to strengthen anti-trust authority
Uncertain regulatory framework in network industries (e.g., energy)	Low investment and inefficiency in key network industries affecting input costs and productivity of the economy	Clarify and strengthen regulatory framework, ensure independence of regulatory bodies
Foreign competition		
Tariff and non-tariff barriers	Limited competitive pressure, low investment and efficiency, high cost of doing business	Reduce tariff and non-tariff trade barriers
Low trade integration	Limited competitive pressure, low investment and efficiency, limited technology spillovers	Promote integration through FTAs and GVCs
Low FDI	Limited competitive pressure, low investment and efficiency, limited technology spillovers, limited transfer of better management practices	Reduce barriers to investment by implementing a comprehensive reform of investment climate (including governance, red tape, infrastructure)
Labor market		
High termination costs	Low or inefficient use of labor, high informality, low human capital accumulation, low productivity; high cost of adjustment leading to low investment	Reduce termination costs, protecting workers with unemployment insurance and training instead of strict labor regulations
Restrictions on temporary work and flexible work arrangements	High cost of adjustment, low investment, low use of labor (negative impact on female and youth participation), high informality	Make work arrangements more flexible, including in terms of working time regulations; allow temporary contracts with few restrictions and protection increasing with job tenure
Tax burden		
High taxes on labor income	High labor cost, low use of labor, high informality	Reduce tax wedge
Distortionary taxes, such as financial transaction tax	Low financial intermediation, which affect investment and allocative efficiency	Phase out financial transaction tax

Sources: IMF staff, OECD, and World Bank (various publications).

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Appendix 1. Data Sources and Description

Table A1. List of Countries

The country sample includes 59 advanced and emerging market economies:	
Advanced economies (27)	Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong SAR, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, Taiwan Province of China, United Kingdom, United States
Emerging market economies (32)	Argentina, Brazil, Bulgaria, Czech Republic, Chile, China, Colombia, Cyprus, Estonia, Hungary, India, Indonesia, Korea, Latvia, Lithuania, Malaysia, Malta, Mexico, Pakistan, Peru, Philippines, Poland, Romania, Russia, Slovak Republic, Slovenia, South Africa, Thailand, Turkey, Ukraine, Venezuela, Vietnam

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Table A2. List of Variables

Variable	Description	Source
Output (real GDP)	Real GDP in billions of constant 2011 international dollars.	IMF WEO
Labor	Number of persons engaged, includes employees and self -employed (in thousands), extended with employment growth rate from IMF WEO.	PWT9.0
Capital	Total capital stock in billions of constant 2011 U.S. dollars, extended with depreciation and investment from IMF WEO; capital stock to readjusted for Argentina after 2002 with investment series from the revised National Accounts.	PWT9.0
Private capital	Private capital stock (constructed based on private investment flows), in billions of constant 2011 international dollars.	IMF (2017)
Public capital	General government capital stock (constructed based on general government investment flows), in billions of constant 2011 international dollars.	IMF (2017)
Output gap	Estimated with panel-data Hodrick-Prescott filter; as robustness, IMF WEO data on output gap are also used.	IMF WEO
Output volatility	Coefficient of variation of real GDP (ratio of 5-year rolling-window standard deviation to mean).	IMF WEO
Change in terms of trade	Change in terms of trade.	IMF WEO
PMR: regulatory quality	Measures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development; estimate of governance (ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance).	WB-WGI (2016)
Cost of starting a business	Number of procedures to start a business.	WEF
Trade tariffs	Trade-weighted average applied tariff rate. An applied tariff is a customs duty that is levied on imports of merchandise goods, calculated as a weighted average of all the applied tariff rates, including preferential rates that a country applies to the rest of the world.)	WEF
PMR: WEF_market dominance	Extent of market dominance; index ranging from 1 (dominated by a few business groups) to 7 (spread among many firms).	WEF
Private credit to GDP	Domestic credit to private sector, percent of GDP	WB-WDI
LMR: CBR_total	Labor regulation index, calculated as the average of all sub-indices which cover five areas of labor law: (i) definition of employment relationship and different forms of employment; (including the regulation of the parties' choice of legal form, and the rules relating to part-time, fixed-term and temporary agency work); (ii) working time; (iii) dismissal; (iv) employee representation; and (v) collective action. Index values range from 0=no protection or the lowest protection offered to workers, to 1=maximum or highest protection offered.	CBR-LRI
LMR: CBR_working time	Labor regulation index, calculated as the average of sub-indices pertaining to laws and regulations that govern working time. Index values range from 0=no protection or the lowest protection offered to workers, to 1=maximum or highest protection offered.	CBR-LRI
Top marginal income & payroll tax rate	Top marginal income and payroll (wage) tax rate, percent	Fraser (2016)

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Table A2. List of Variables (Concluded)

Variable	Description	Source
Tax compliance	Cost of tax compliance; based on World Bank's Doing Business data on the time required per year for a business to prepare, file, and pay taxes on corporate income, value added or sales taxes, and taxes on labor; from 0 hours to maximum 892 hours.	Fraser (2016)
Availability of latest technologies	Availability of latest technologies; index ranging from 1 (not available) to 7 (widely available).	WEF
Share of female in population	Female population, percent of total population	WB-WDI
Energy use	Total energy use, kg of oil equivalent	WB-WDI
WEF_government effectiveness	Measures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies; estimate of governance (ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance).	WB-WGI (2016)
Political stability	Measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism; estimate of governance (ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance).	WB-WGI (2016)
EM (or AE) dummy	Country dummy variable = 1 of country is emerging market (or advanced) economy; 0 = otherwise.	

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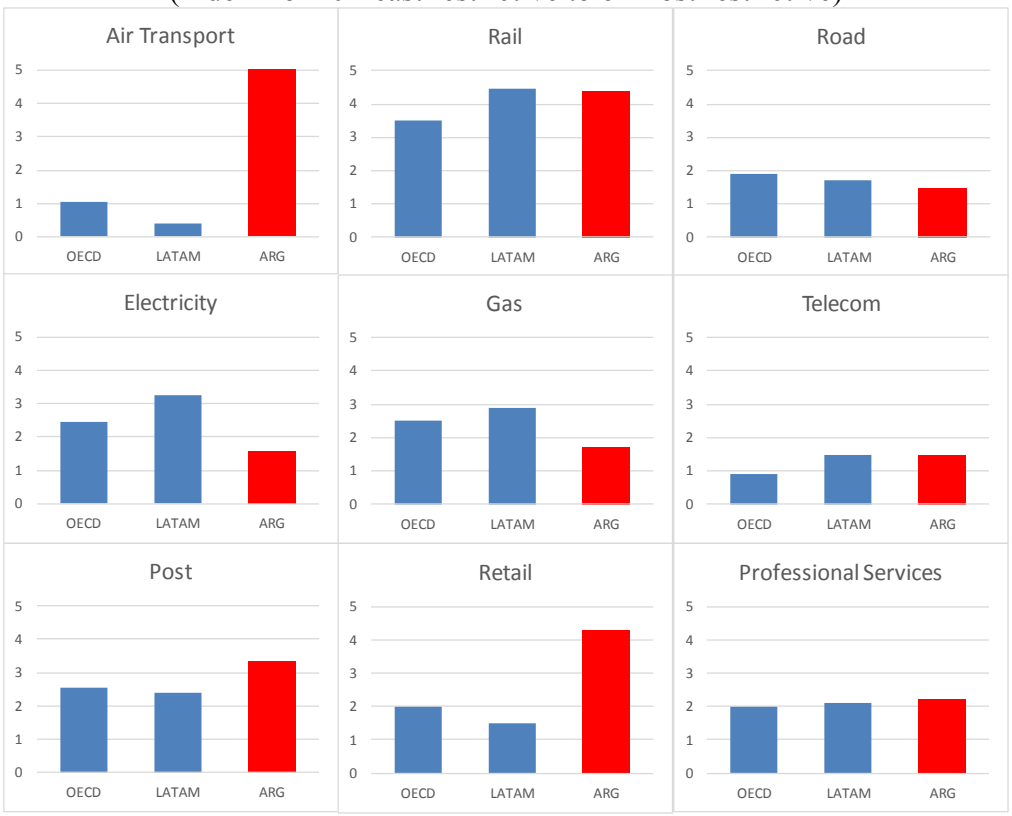
Figure A1. Restrictiveness of Product Market Regulations (PMR)
(Index from 0=least restrictive to 6=most restrictive)

Sources: OECD Going for Growth 2017, and OECD Economic Surveys: Argentina 2017.
Note: LATAM=average of Chile, Colombia, Mexico, Costa Rica, and Brazil.

Figure A2. Restrictiveness of Sectoral Regulation
(Index from 0=least restrictive to 6=most restrictive)



Source: OECD Going for Growth 2017.
Note: LATAM=average of Chile, Colombia, Mexico, Costa Rica, and Brazil.

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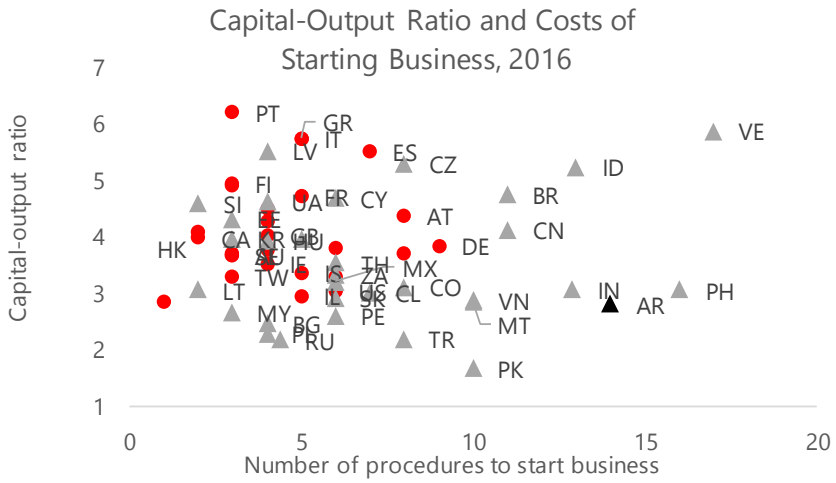
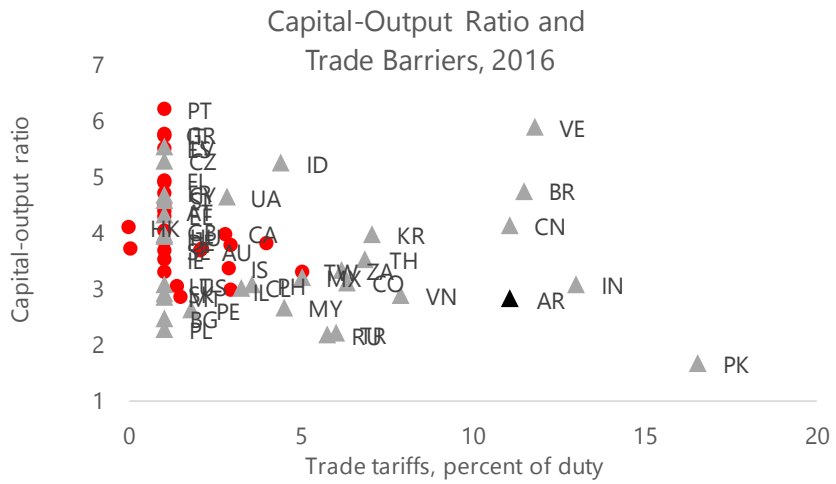
Figure A3. Capital Deepening and Structural Measures





Sources: World Bank, Penn World Tables, WEF, and WEO.

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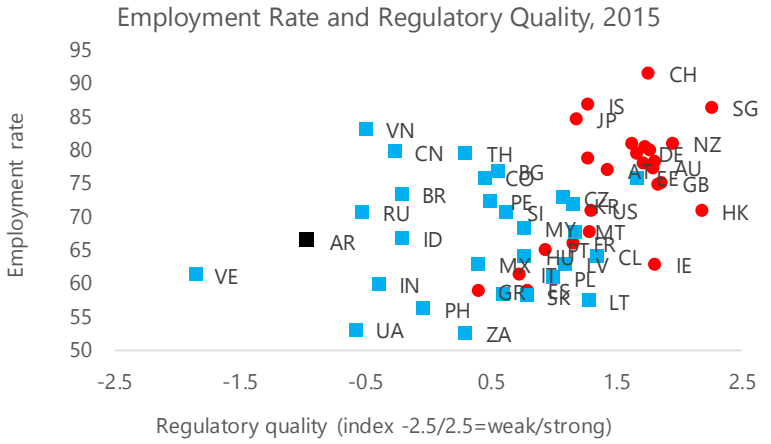
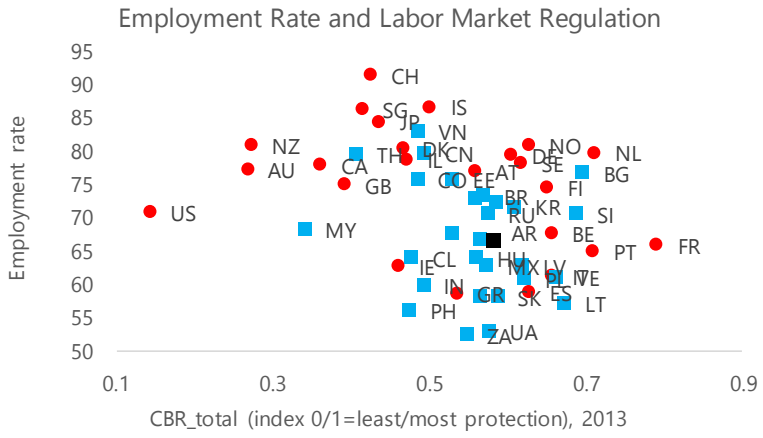
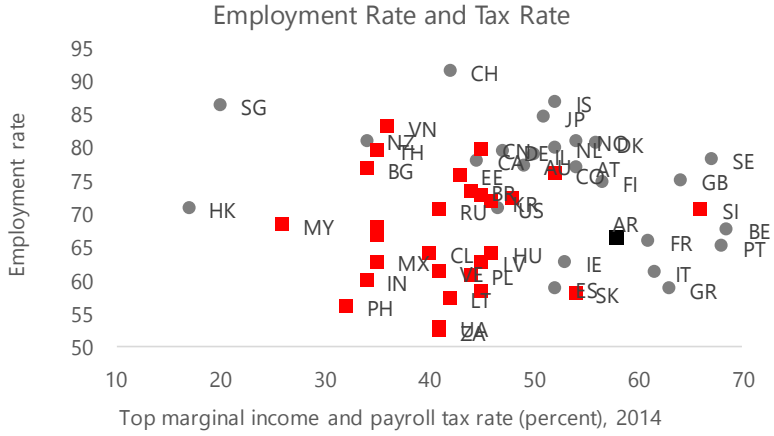
Figure A4. Employment Rate and Structural Measures







Sources: World Bank, Penn World Tables, Fraser, and CBR Labour Regulation Index Dataset, University of Cambridge.
Note: Excludes Luxembourg and Cyprus.

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Appendix 2. Stochastic Frontier Analysis

SFA: Main Elements[1]

The level of output for country *i* at time *t*, denoted with $Y_{i,t}$ can be represented as

$$Y_{i,t} = \{f(X_{i,t}, t; \beta) \cdot exp(v_{i,t})\} \cdot \theta_{i,t}(z_{i,t}; \gamma) \quad (1a)$$

where the first term in {...} is the country-specific *efficiency frontier*, in which $X_{i,t}$ denotes the quantities of inputs (e.g., labor and capital), β is the vector of parameters that define the production function (common to all countries), *t* is time trend (proxy for technological change), and $exp(v_{i,t})$ is a random shock which captures measurement errors and exogenous shocks. The second term, $\theta_{it}(z_{it}; \gamma) \in (0,1]$, captures the time-varying distance of actual output from the efficiency frontier, and is referred to as the degree of *technical efficiency*, such that $\theta_{it} = 1$ indicates that the country is achieving the optimal output with the technology embodied in the production function $f(\cdot)$. Technical efficiency, in turn, is conditional on explanatory variables $z_{i,t}$, such as structural policy variables, with the vector of parameters γ. The SFA technique used in the paper allows for a simultaneous estimation of the parameters of the stochastic frontier and of the technical efficiency with a maximum likelihood method (see Battese and Coelli, 1995).

For a log-linear Cobb-Douglas production function, with capital (*K*) and labor (*L*) as inputs, and $u_{i,t} = -\ln(\theta_{i,t})$ denoting *inefficiency*, Eq. (1a) can be written as follows:[2]

Frontier: $\ln Y_{i,t} = \beta_0 + \beta_t t + \beta_L \ln L_{i,t} + \beta_K \ln K_{i,t} + v_{i,t} - u_{i,t}$ (2a)

Model of inefficiency: $u_{i,t} = z_0 + \gamma_z z_{i,t} + w_{i,t}$ (3a)

The point estimates of technical efficiency (TE) can be derived via $E[exp\{-u_{i,t}|\varepsilon\}]$, where $\varepsilon = v_{i,t} - u_{i,t}$ is the model error term comprised of the two independent, unobservable error terms. The coefficient $\widehat{\beta_t}$ on the time trend represents the change in the frontier output caused by technological change. Kumbakhar and Lovell (2000) show that a change in TFP, defined as output growth unexplained by input growth, can be expressed as

$$\Delta TFP = \Delta T + \Delta TE + (\epsilon - 1)\left[\frac{\epsilon_L}{\epsilon}\Delta x_L + \frac{\epsilon_K}{\epsilon}\Delta x_K\right]$$

where $\Delta T = \widehat{\beta_t} = \frac{dy}{dt}$ is technological change, $\Delta TE = -\frac{du}{dt}$ is change in technical efficiency, and $\epsilon_L(\epsilon_K)$ output elasticities with respect to labor (capital), with $\epsilon = \epsilon_L + \epsilon_K$ specifying returns to scale ($\epsilon = 1$ is the case of constant returns to scale).

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[1] Based on Cardarelli and Lusinyan (2015).

[2] A more general translog form [$\ln Y_{i,t} = \beta_0 + \beta_t t + \beta_L \ln L_{i,t} + \beta_K \ln K_{i,t} + 0.5\left[\beta_{LL}(\ln L_{i,t})^2 + \beta_{KK}(\ln K_{i,t})^2 + \beta_{tt} t^2\right] + \beta_{KL}(\ln L_{i,t})(\ln K_{i,t}) + \beta_{Lt} t \cdot \ln L_{i,t} + \beta_{Kt} t \cdot \ln K_{i,t} + v_{i,t} - \theta_{i,t}$] has also been tested for robustness but additional terms compared to the standard form in Eq. (2a) have not been found to be significant.

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Appendix 3. Empirical Results and Robustness Analysis

Table A3. Use of Capital
Dependent variable: log of employment rate ln(K/Y)

	(1)	(2)	(3)	(4)	(5)	(6)
Output volatility	-0.63**	-1.23***	-0.60*	-0.77**	-0.76**	-1.37***
	(-1.98)	(-6.79)	(-1.79)	(-2.37)	(-2.44)	(-3.25)
Cost of starting a business 1/	-0.01**	-0.01***	-0.01**		-0.01**	-0.001*
	(-2.15)	(-2.86)	(-2.53)		(-2.28)	(-1.85)
Trade tariffs	-0.47**	-0.57***	-0.47***			-0.69**
	(-2.51)	(-4.20)	(-2.78)			(-2.10)
Private credit to GDP			0.03	0.05**	0.04	0.10**
			(1.33)	(2.05)	(1.48)	(2.56)
Availability of latest technologies				0.02**	0.02*	
				(2.24)	(1.85)	
Constant	1.35***	1.40***	1.32***	1.09***	1.20***	0.44***
	(34.61)	(36.38)	(27.35)	(14.16)	(17.21)	(5.34)
Year effects	Yes	No	Yes	No	No	No
Time trend	No	No	No	Yes	Yes	Yes
Observations	636	592	551	564	551	551
No of countries	59	55	58	58	58	58
Outliers excl. (BLG/GRC/UKR/VEN)	No	Yes	No	No	No	No
R-squared						
within	0.45	0.45	0.52	0.45	0.45	0.24
between	0.12	0.23	0.15	0.16	0.12	0.36
overall	0.12	0.22	0.16	0.17	0.14	0.35
Estimator	RE	RE	RE	RE	RE	RE
Robust errors	Yes	Yes	Yes	Yes	Yes	Yes

Notes: z-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions include a constant term, year effects, and time trend (not reported here). RE=fixed-effects estimator. See Appendix 1 for the definitions and sources of variables.
1/ Columns (1)–(5): number of procedures; (6): number of days.

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Table A4. Use of Labor
Dependent variable: log of employment rate ln(E/WP)

	(1)	(2)	(3)	(4)	(5)	(6)
Output gap	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***
	(9.13)	(8.68)	(10.04)	(9.79)	(8.76)	(9.00)
PMR: regulatory quality	0.05*	0.07***	0.07***	0.05***	0.08***	0.08***
	(1.82)	(2.71)	(3.04)	(2.68)	(4.52)	(4.01)
Share of female in population					-0.04**	-0.03*
					(-2.32)	(-1.67)
Top marginal income&					-0.001**	
payroll tax rate (τ)					(-2.04)	
Tax rate (τ) * tax compliance						-0.0002**
						(-2.14)
Constant	x	4.11***	4.11***	4.04***	6.27***	5.75***
		(186.85)	(144.20)	(133.11)	(7.01)	(5.95)
Year effects	Yes	Yes	No	No	Yes	No
Time trend	No	No	Yes	Yes	No	Yes
Observations	912	864	864	1,140	602	612
No of countries	57	54	54	57	55	57
Outliers excluded (LUX, CYP, VEN)	No	Yes	Yes	No	Yes	No
R-squared						
within	0.33	0.36	0.35	x	0.41	0.39
between	0.11	0.12	0.12	x	0.11	0.07
overall	0.12	0.14	0.14	x	0.13	0.10
Estimator	RE	FE	RE	MG	RE	RE
Robust errors	Yes	Yes	Yes	Yes	Yes	Yes

Notes: z-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Regressions include a constant term, year effects, and time trend (not reported here). RE=random-effects, FE=fixed-effects, MG=mean group estimator. See Appendix 1 for the definitions and sources of variables.

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Table A5. Stochastic Frontier Analysis: A Simple Illustration

Dependent variable: log real GDP-to-labor ratio

Frontier: $ln(Y/L)_{i,t} = \beta_0 + \beta_t t + \beta_1 ln(K/L)_{i,t} + v_{i,t} - u_{i,t}$

Model of inefficiency: $u_{i,t} = z_0 + \gamma_z z_{i,t} + w_{i,t}$

	1980–2016
Frontier	
Log capital-labor ratio	0.54***
	(54.75)
Time trend	0.005***
	(10.28)
Constant	1.20***
	(24.35)
Mean inefficiency	
AE dummy	-1.46***
	(-6.32)
Variance of inefficiency	
EM dummy	1.49***
	(6.70)
Constant	-2.65***
	(-10.78)
Log-likelihood	104
Observations	2,082
Number of countries	59

Notes: z-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1.
See Appendix 1 for the definitions and sources of variables.

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Table A6. Stochastic Frontier Analysis with Conditional Inefficiency Effects

Dependent variable: log real GDP

Frontier: $lnY_{i,t} = \beta_0 + \beta_t t + \beta_L \ln L_{i,t} + \beta_K \ln K_{i,t} + v_{i,t} - u_{i,t}$

Model of inefficiency: $u_{i,t} = z_0 + \gamma_z z_{i,t} + w_{i,t}$

	(1) 1980–2016	(2) 1996–2013	(3) 1996–2013	(4) 1996–2013	(5) 1996–2013	(6) 2006–2015	(7) 1996–2013	(8) 1996–2013	(9) 1996–2013	(10) 1996–2013	(11) 2006–2013	(12) 1996–2013
Frontier												
Log labor	0.31***	0.33***	0.38***	0.39***	0.38***	0.42***	0.39***	0.42***	0.39***	0.25***	0.25***	0.30***
	(24.22)	(46.58)	(30.30)	(32.60)	(28.17)	(22.17)	(23.45)	(30.38)	(21.39)	(14.80)	(13.15)	(30.10)
Log capital	0.65***	0.65***	0.60***	0.60***	0.61***	0.57***	0.59***	0.57***		0.61***	0.50***	
	(50.40)	(85.30)	(48.29)	(51.09)	(45.71)	(29.94)	(35.67)	(40.59)		(36.54)	(26.45)	
Time trend	-0.004***	0.002***	0.003***	0.003***	0.004***		0.005***	0.004***	0.01***	0.003***		0.01***
	(-3.65)	(2.54)	(3.02)	(3.15)	(3.85)		(4.14)	(4.19)	(7.68)	(9.92)		(7.77)
Log private capital									0.45***			0.46***
									(27.86)			(26.77)
Log public capital									0.14***			0.10***
									(9.46)			(9.37)
Log energy use										0.13***	0.22***	0.12***
										(9.63)	(11.64)	(9.61)
Constant	-0.97***	-1.38***	-1.57***	-1.59***	-1.61***	-1.68***	-1.64***	-1.73***	-1.04***	-0.84***	-0.52***	-0.40***
	(-12.43)	(-55.23)	(-36.17)	(-38.78)	(-36.15)	(-31.05)	(-29.49)	(-38.93)	(-12.59)	(-12.02)	(-5.32)	(-7.88)
Mean inefficiency												
PMR: regulatory quality		-0.16***	-0.23***	-0.24***	-0.24***	-0.16***	-0.08***	-0.07**	-0.21***	-0.12***	-0.14***	-0.12***
		(-12.99)	(-11.29)	(-11.30)	(-9.94)	(-7.54)	(-2.61)	(-1.99)	(-5.86)	(-7.82)	(-5.27)	(-7.90)
LMR: CBR_total		0.31***								0.22***		0.18***
		(7.55)								(5.34)		(4.08)
LMR: CBR_working time			0.44***	0.50***	0.44***	0.37***	0.43***	0.66***	0.53***		0.76***	
			(6.41)	(6.01)	(5.78)	(6.94)	(4.77)	(13.00)	(11.49)		(6.45)	
Log change in terms of trade				-0.54***	-0.53***	-0.63***	-0.61***	-0.88***	-0.91***		-0.66***	
				(-3.87)	(-3.48)	(-3.43)	(-3.31)	(-5.04)	(-4.67)		(-3.43)	
Output gap					-0.02***	-0.02***	-0.02***					
					(-4.19)	(-5.63)	(-4.62)					
Cost of starting a business						0.02***						
						(6.49)						
WEF_government effectiveness							-0.15***	-0.20***	0.00			
							(-4.17)	(-4.42)	(0.07)			
EM dummy								0.12***	0.06**		0.08*	
								(3.70)	(2.04)		(1.77)	
PMR: WEF_market dominance											-0.05**	
											(-2.33)	
Constant		0.37***	0.19***	0.16***	0.18***		0.21***			0.39***		0.32***
		(12.11)	(4.03)	(2.85)	(3.33)		(3.34)			(14.30)		(9.63)
Variance of inefficiency												
EM dummy		1.85***	2.35***	2.30***	2.22***	3.22***	2.15***			1.74***		1.54***
		(16.47)	(7.19)	(7.10)	(7.51)	(4.04)	(6.24)			(15.93)		(10.00)
Log change in terms of trade				-4.64***	-2.91***	-7.98***	-2.31**	-6.32***	-6.97***		-6.82***	
				(-4.27)	(-3.08)	(-4.82)	(-2.33)	(-4.78)	(-4.44)		(-4.41)	
Political stability								-0.84***	-0.96***			
								(-7.70)	(-7.73)			
Constant		-4.15***	-4.86***	-4.77***	-4.77***	-5.79***	-4.88***	-2.90***	-3.22***	-4.23***	-3.15***	-4.23***
		(-50.62)	(-14.35)	(-14.10)	(-15.39)	(-7.27)	(-13.66)	(-27.98)	(-24.89)	(-55.42)	(-17.88)	(-37.97)
Log-likelihood	1,629	278	282	296	318	182	285	275	359	318	199	416
Observations	2,082	1,040	1,038	1,036	972	437	820	866	866	1,013	451	1,013
Number of countries	59	57	57	57	55	55	55	57	57	56	56	56

Notes: z-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1. See Appendix 1 for the definitions and sources of variables.

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