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Structural Reforms and Firms' Productivity

Evidence from Developing Countries

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Abstract

This paper assesses the effects of selected structural reforms on labor productivity growth for 37 developing countries over 2006–14. It combines newly constructed reform indexes using the International Monetary Fund's Monitoring of Fund Arrangements data set and firm-level productivity from the World Bank Enterprise Surveys. The paper highlights the following results. Structural reforms under consideration in this study—financial, fiscal, real sector, and trade reforms—significantly improve productivity at the firm level. Interestingly, real sector reforms have the most sizable effects on firms' productivity. The relationship between reforms and productivity is nonlinear and shaped by certain characteristics of firms, including financial access, a distortionary environment, and firms' size. The pace of reforms matters, since being a "strong reformer" is associated with a clear productivity dividend for firms. Finally, except for financial and trade reforms, all the macroeconomic reforms considered are bilaterally complementary in improving firms' productivity. These findings are robust to several sensitivity checks, including alternative methodologies and measures of productivity, and a counterfactual experiment based on unsuccessful reforms.

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Structural Reforms and Firms' Productivity: Evidence from Developing Countries

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I. INTRODUCTION

The literature on the economic effects of structural reforms has focused so far on developed countries.[3] Most papers document that structural reforms have positive effects on productivity. In this stream of work, there is a consensus in the literature that reforms are important to boost and sustain long-term growth. Reforms matter for macroeconomic performance (Bordon *et al.*, 2016; Christiansen *et al.*, 2013; Bouis *et al.*, 2012; Bourlès *et al.*, 2010) and promote growth (Prati *et al.*, 2013) by increasing aggregate productivity (Nicoletti and Scarpetta, 2003) and raising employment (Bordon *et al.*, 2016).

Little is known about how reforms affect industries or firms in developing countries. In this group, the role of reforms to buttress firm-level productivity is crucial. Constraints to the business environment are huge (Almeida and Carneiro, 2009; Aterido *et al.*, 2011); the business environment is characterized by macroeconomic instability with negative effects on taxation and private investment (Krugman, 1988); labor market and entry regulations are heavy (Dabla-Norris *et al.*, 2016; Klapper *et al.*, 2006); and financial and market distortions are severe (Ayyagari *et al.*, 2016; Bah and Fang, 2015; Giannetti and Ongena, 2009).

This paper focuses on four key structural reforms viewed as productivity enhancing in developing countries. First, *fiscal reforms* are key to improving productivity at the firm level through changes in labor supply and investment in physical and human capital. For instance, tax reforms aimed at addressing youth unemployment improve firms' productivity (Banerji *et al.*, 2015). Reforming public investment in human capital (education and health) accelerates the technological catch-up and enhances the skills of domestic workers and firms' labor productivity (Pritchett, 2013; Baldacci *et al.*, 2008). Likewise, basic reforms such as expenditure rationalization, revenue base broadening, or taxing "excess returns" and rents could minimize distortions and reduce cumbersome burdens and improve firms' productivity (IMF, 2015, Cottarelli and Keen, 2012).

[3] In this paper, we adopt the common definition in the literature (Spilimbergo *et al.*, 2009). Reforms refer to government policies aiming to address market failures, reduce or remove impediments to the efficient allocation of resources, government intervention (including removal of state-imposed price controls and the abolition of state monopolies), and restriction on trade, domestic and financial transactions.

Second, several papers find that *financial sector reforms* have positive effects on productivity through more efficient allocation of resources (Galindo *et al.*, 2005) and easier access to external financing (Rajan and Zingales, 1998). Financial sector reforms aiming at removing financial restrictions and financial repression have the potential to lower the cost of capital and boost productivity and growth at the firm level. They align the allocation of financial resources to more productive firms and, therefore, contribute to boosting firms' productivity (Larrain and Stumpner, 2015).

Third, several authors also document that *real sector reforms* enhance productivity at the firm level. Various studies using rich micro-level data sets find robust evidence that reforms that promote competition in product markets could help boost firms' productivity (Nicoletti and Scarpetta, 2003; Faini *et al.*, 2006; Buccirossi *et al.*, 2009; Bourlès *et al.*, 2010). Excessive labor market regulation and collective bargaining in developing countries are sources of inefficiency that reduce firms' output and employment (World Bank, 2013). Looser regulations could also encourage competition and firms to experiment with new ideas and technologies and facilitate the shift of resources from slow to fast-growing sectors (Daude, 2016).

Fourth, *trade sector reforms* were found to be productivity enhancing at the aggregate level (Trefler, 2004; Melitz, 2003). For developed countries, Topalova and Khandelwal (2011) find that trade reforms increase firms' productivity, with input tariff reforms having a larger impact. Melitz (2003) and Melitz and Ottaviano (2008) find, for example, that trade sector reforms increase competition, which results in a reallocation of resources from less productive to more productive firms. In summary, there is ample evidence that the key reforms of interest in this paper are positively associated with increases in productivity at the firm level, especially in developed countries.

The paper examines whether structural reforms are followed by significant changes in firms' productivity on a large sample of developing countries over the 2006-14 period. To account for the fact that firms in the same country deal with similar contextual characteristics, the paper uses a multilevel modeling approach to assess the impact of structural reforms on firms' productivity. By capturing both the between-country and within-country effects, the multilevel model accounts for the fact that firms are nested within the country and allows including both

firm-level and macroeconomic variables. The paper also explores the relevance of potential conditional factors of the relationship between structural reforms and firms' productivity and whether reforms are substitutes or complementarity in affecting firms' labor productivity growth.

The paper constructs an index of structural reforms from the IMF Monitoring of Fund Arrangements (MONA) database. Structural reform indexes are matched with firm-level data from the World Bank Enterprise Surveys (WBES) for 37 Lower and Lower-Middle income countries over the 2006-14 period. The MONA database contains comparable information on the economic objectives and outcomes in the IMF-supported arrangement programs. It tracks the performance of countries regarding scheduled purchases and reviews, quantitative and structural conditionality, and macroeconomic indicators. To construct our structural reform indexes, we assume that conditionalities met under IMF-supported programs in developing countries could be identified as major macroeconomic structural reforms. We use the information available on structural benchmarks affecting the fiscal sector, the financial sector, the real sector, and the trade sector.[4] For each measure, we focus on measures for which targets have been met or met with minor delays. The WBES is a collection of firm-level surveys in developing countries based on a representative sample of the economy's private sector. It contains cross-country information on individual firms' characteristics and allows the calculation of productivity measures.

In addition to using the multilevel model, the paper devotes efforts to minimize endogeneity concerns. We present sample balance tables showing that the sample developing countries are not statistically different from those without the IMF's program regarding key macroeconomic variables.[5] Having the pre-treatment macroeconomic variables well matched allows us to minimize the concerns that the estimated effects of reforms on productivity are driven by the pre-reforms macroeconomic environment. Moreover, the identification strategy relies on matching productivity data only with reforms within the 3 previous years. The matching strategy limits potential reverse causality issues between reforms and productivity by ensuring

[4] Structural benchmarks are reform measures that are important to achieve program goals and are intended to assess program implementation during a review.
[5] Current account and overall balance, debt and interest payment on external debt, inflation rate, GDP growth, and exchange rate.

that the approval year of each the IMF's arrangement programs corresponds exactly or is after the reference year of labor productivity growth. This means that the possibility of the level of productivity determining the implementation of reforms can be ignored.

Key findings are as follows. In developing countries, the macroeconomic structural reforms under consideration in this study (financial, fiscal, real sector, and trade reforms) significantly improve productivity at the firm level.[6] We also find that the pace of reforms matters since being a "strong reformer" is associated with a clear productivity dividend for firms. Interestingly, real sector reforms have the most sizable effects on firms' productivity. In addition, we find that financially-included firms benefit less from financial reforms; financial access also strengthens the relationship between fiscal reforms and firms' productivity; the effects of fiscal and trade reforms on labor productivity growth are hindered by distortions; and, furthermore, the evidence suggests that small firms benefit more from financial reforms relative to the larger ones. Finally, except for financial and trade reforms, all macro reforms considered are bilaterally complementary in improving firms' productivity. The findings are robust to several sensitivity analyses, including alternative measures of productivity, alternative methodology, the inclusion of a variable accounting for the economic crisis conditions. Moreover, we take advantage of unsuccessful reforms and conduct a counterfactual experiment. The latter consists in estimating the impacts of reforms not met on labor productivity growth. The counterfactual experiment validates our findings in the sense that unsuccessful reforms tend to have a negative impact on productivity.

This paper brings at least two key contributions to the literature. It is the first paper to use IMF's MONA data to construct new reform indexes. Constructing these indexes is one of the contributions of this paper, as the indexes can be used in other research on the impact of structural reforms in developing countries. Moreover, our reform indexes have the advantage of focusing on reforms successfully implemented, while the existing literature mostly uses a liberalization index as a proxy of structural reforms.[7] We use the performance criteria defined by the IMF review board to identify reforms met or met with minor delay. Second, to the best

[6] The paper considers the impact of reforms under the IMF arrangement programs. Reforms implemented might raise productivity but are not considered in this paper.
[7] See, for instance Arnold et al. (2015); Prati et al. (2013); Abiad and Mody (2005); Abiad, Detragiache and Tressel (2008).

of our knowledge, this is the first paper to assess the impact of structural reforms on firms' productivity in developing countries. The paper is close to Tressel (2008), which investigates the effects of financial and trade sector reforms on real output growth at the industrial level in 91 countries, including developed countries. However, Tressel (2008) focuses on financial and trade liberalization and does not examine the effects of these reforms on firm-level productivity. The few studies examining the impact of reforms on firms' productivity in developing countries mainly focus on a specific reform in China, Colombia, India, and Indonesia.[8] We take advantage of the MONA and the WBES data sets and cover a broad range of sectors (financial, fiscal, real, and trade sector reforms) in a large sample of developing countries.

The rest of the paper is structured as follows. Section II describes the data sets. Summary statistics and the empirical strategy are discussed in Section III. Section IV reports and discusses the estimation results. Section V examines the sensitivity of the findings. Finally, Section VI presents concluding remarks.

II. DATA SETS

The data are compiled from four different sources. Reform indexes are computed from the IMF Monitoring of Fund Arrangements (MONA) database, firms' characteristics are culled from the World Bank Enterprises Surveys (WBES), and the other macroeconomic variables are collected from the World Bank's World Development Indicators (WDI) and World Governance Indicators (WGI).

A. The IMF Monitoring of Fund Arrangements (MONA) database

As argued in the literature, reforms are more difficult to measure than typical macroeconomic policies, limiting the scope for quantitative analysis of the micro effects of economic reforms. They typically concern policies geared towards raising productivity by improving the technical efficiency of markets and institutional structures and by reducing or removing impediments to the efficient allocation of resources. Thus, reforms have typically been associated with

[8] See for instance Arnold et al. (2015); Javorcik and Li (2013); Bas and Causa (2013); Topalova and Khandelwal (2011); Eslava et al (2004).

regulatory policies aimed at strengthening market-based incentives in the domestic product and service markets, labor markets, trade, and capital and financial markets, among others. However, reforms may also involve actions to address market failures (such as the increased emphasis on effective financial sector regulation since the crisis) or other government policies that could affect productivity more directly.

The paper uses the IMF Monitoring of Fund Arrangements (MONA) database, which is publicly available and covers all aspects of the program conditionality. The MONA database provides a cumulative history of Fund-supported programs from Executive Board approval through its completion. The Monitoring of Fund Arrangements (MONA) database contains comparable information on the economic objectives and outcomes in Fund-supported arrangements. It tracks the performance of countries in terms of scheduled purchases and reviews, quantitative and structural conditionality, and macroeconomic indicators. Data are available for most arrangements since 2002 to the present and are collected at the time of arrangement approval and following each review. The data set covers 94 countries with an IMF arrangement program since 2002.

Most IMF financing features disbursements made in installments that are linked to the Board's approval or review. Program reviews provide a framework to assess periodically whether the IMF-supported program is on track and whether modifications are necessary to achieve the program's objectives. Reviews combine a backward-looking assessment (were the program conditions met per the agreed timetable?) with a forward-looking perspective (does the program need to be modified considering new developments?).

Program approval or reviews are based on various policy commitments agreed with the country authorities. Conditionalities could take different forms, including prior actions (PA), quantitative performance criteria (QPC), indicative targets (IT) or structural benchmarks (SB). Prior actions are measures that a country agrees to take before the IMF's Executive Board approves financing or completes a review. They ensure that the program has the necessary foundation to succeed or is put back on track in the event of deviations from agreed policies. Examples include the elimination of price controls or formal approval of a budget consistent with the program's fiscal framework. Quantitative performance criteria (QPCs) are specific

and measurable conditions that must be met to complete a review. QPCs always relate to macroeconomic variables under the control of the authorities, such as monetary and credit aggregates, international reserves, fiscal balances, and external borrowing. For example, a program might include a minimum level of net international reserves, a maximum level of central bank net domestic assets, or a maximum level of government borrowing.[9] Indicative targets may be established in addition to QPCs as quantitative indicators to assess the member's progress in meeting the objectives of a program. Sometimes they are also set when QPCs could not be because of data uncertainty about economic trends (for the latter months of a program). As uncertainty is reduced, these targets are normally turned into QPCs, with appropriate modifications. Structural benchmarks (SB) are (often non-quantifiable) reform measures that are critical to achieving program goals and are intended as markers to assess program implementation during a review. They vary across programs: examples are measures to improve financial sector operations, build up social safety nets, or strengthen public financial management.[10]

Using the economic sector classification, we regroup the different SBs in four categories reported in Table 1. Fiscal sector reforms include both fiscal policy related and public sector reforms. Financial sector reforms include reforms in the banking and financial sectors aiming to ensure the supervision of financial institutions and lessen regulation. Real sector reforms contain reforms on the investment climate, price controls, and labor markets. Finally, trade sector reforms account for international trade policy and regime reforms.

[9] If a QPC is not met, the Executive Board may approve a formal waiver to enable a review to be completed if it is satisfied that the program will, nonetheless, be successfully implemented, either because the deviation was minor or temporary or because the country authorities have taken or will take corrective actions.
[10] Structural benchmarks and indicative targets do not require waivers if they are not met but are assessed in the context of overall program performance.

Table 1. Description of reforms indices	
Reforms indices	Description
Financial sector	• Financial sector legal reforms • Regulation and supervision of financial institutions • Restructuring and privatization of financial institutions • Bank regulation and supervision
Fiscal sector	• Tax policy (excluding trade policy) and revenue administration measures; • Expenditure (including arrears clearance and poverty reduction); • Debt management measures; • Auditing, accounting, and financial controls; • Fiscal transparency (including publication, parliamentary oversight); • Central Bank financing to Government or the public sector; • Pensions and social sector reforms (including social safety nets, health, and education); • Anti-corruption legislation or policy.
Real sector	• Private sector and regulatory environment reform (non-financial sector); • Public firm reform and privatization (including pricing and subsidies) and restructuring other than pricing; • Price controls and marketing restrictions; • Labor market reform.
Trade sector	• Changes in trade regime and policies (excluding customs reforms).
Source: Authors' classification based on MONA database.	

B. The World Bank Enterprise Surveys (WBES) database

We use the WBES to compute firms' productivity. The WBES is a collection of firm-level surveys in developing countries based on a representative sample (random stratified sampling) of the economy's private sector mainly. The surveys cover a broad range of business environment topics including access to finance, corruption, infrastructure, crime, competition, and performance measures in most countries of the world. The surveys follow common guidelines in design and implementation, thereby allowing cross-country analyses. We use the standardized questionnaires and data set over the period 2006 to 2014 in order to be able to match firm level productivity and structural reforms data from the MONA data set. The standardized data set has a pseudo-panel structure. While the data set contains information on 117,358 firms in 136 countries, this paper focuses on developing countries under an IMF program and having at least one round of the WBES. In addition, our identification strategy requires matching firm-level data with reform programs within the 3 previous years. The median sample size is 360 firms, with only three having samples over 1,000 observations (Bangladesh, Pakistan, and Ukraine). The WBES contains information on firms' performance such as employment, investment, and sales. The existence of retrospective information on

employment and sales allows capturing labor productivity growth over the period of reforms. All firms in the sample are producing in the formal sector i.e., registered with local or national authorities. Approximately, 54 percent of the observations reflect firms in manufacturing and 46 percent are in the service sector. Table 14 in appendix B reports a complete list of countries with the number of firms in each country.

The analysis includes a set of firm-level characteristics such as size, age, ownership, financial access, distortions in facing firms, connection to foreign markets and the initial performance of the firm. Firm's age is captured by three categorical variables: Young (1-5 years old), Mature (6-15 years old), and Older (more than 15 years old). Older is the reference category. Ownership is measured as the percentage of the firm owned by the government/state and by private foreign individuals, companies, or organizations. To capture the initial conditions, we use the 3-year-lagged natural logarithm of the real total sales. Demand condition and production environment facing firms within the country are captured by a dummy variable that takes 1 if the firm is in a city with a population over one million and 0 otherwise. Firm size is captured by four categorical variables based on the number of permanent employees: Micro-firms (1 to 10), Small (11 to 50), Medium (51 to 200), and Large (more than 200). Large is the reference category. Connection to foreign markets is captured by a dummy variable that takes 1 if a positive share of sales is exported directly or indirectly and 0 otherwise. Financial access is a dummy variable that takes 1 if a firm has a credit line or an overdraft facility and 0 otherwise. Finally, distortions in the business environment are measured as the costs in the percentage of sales of power outages, insecurity, and bribe or an informal payment to public officials "to get things done." The level of distortions facing firms is captured by a dummy variable that takes 1 for firms in the fourth quintile of the distribution of distortions, i.e., firms facing high levels of distortions. All the nominal values are adjusted for inflation. Table 2 in the next section reports the descriptive statistics.

C. Other macroeconomic data

We control for three main macroeconomic variables that could affect both reforms and firms' productivity, which are the average GDP growth, the inflation rate and the quality of the regulatory environment over the period covered by the reforms. The average GDP growth

controls for change in productivity due to the economic environment and the inflation rate to control for macroeconomic stability. The inflation rate is measured by the consumer price index and captures the annual change in the prices of a basket of goods and services. The quality of the regulatory environment captures the ability of the government to formulate and implement sound policies that permit and promote private sector development. This variable is a proxy of the institutional framework in which firms operate. Also, this variable helps to control for the fact that the average institutional quality may affect the initial reform targets, reform implementation as well as the productivity. The average GDP growth and inflation level data are from the World Development Indicators database while the average quality of the regulatory environment is from the World Governance Indicators.[11] The macroeconomic variables and fixed effects help to minimize potential endogeneity issues. They control for the country's business cycle and aggregate productivity trend, the institutional capacity, and the ambitiousness of the authorities, the political situation and several other factors such as the availability of development partners in providing technical assistance.

III. EMPIRICAL STRATEGY

The empirical analysis first presents the estimation strategy of productivity at the firm level. The subsection discusses the estimation strategy that helps assess the effects of reforms at the macroeconomic level on productivity at the firm level.

A. Calculation of Firms' Productivity and Structural Reform Indexes

We first compute productivity at the firm level and then an index of structural reforms. The literature has proposed several measures of productivity at the firm level. The common ones are the labor productivity, value-added per worker and the total factor productivity (TFP). In this paper, we focus primarily on labor productivity growth for two main reasons. First, the labor productivity growth measured as sales per worker has the advantage of being dynamic and is computed over the period covered by structural reforms, an advantage that might allow

[11] The World Governance Indicators proxy the quality of governance at the macroeconomic level over six dimensions including the quality of the regulatory framework. The indicators rely on perception-based governance data from a set of 31 sources, including survey of firms, households, non-governmental organizations, and multilateral organizations, and other public sector bodies. See Kaufmann, Kraay and Mastrizzi (2011) for more detailed information on the methodology.

us to better capture the change in labor productivity due to structural reforms. Second, although the TFP, the most used measure of productivity, accounts for the level of capital and the production technology, we are unable to capture the change in TFP stemming from structural reforms as the WBES database collects information only on the current stock of capital. The information on the past stock of capital required for calculating retrospective TFP is not reported. Recall that the standardized WBES data set used in this study has a pseudo panel structure.[12] The sensitivity analysis explores the robustness of the findings using TFP and value-added per worker as alternative measures of productivity.

Labor productivity growth is computed as the annual average growth of labor productivity over the last three years. Firms are asked during the surveys to report their total annual sales and full-time employees at the end of the previous fiscal year ($t-1$) and three years ago ($t-3$), respectively. At each period, labor productivity LP is computed as the ratio of total annual sales over total permanent full-time employees. Following Davis and Haltiwanger (1999) and World Bank (2016), we compute labor productivity growth by dividing the change in productivity between $t-1$ and $t-3$ ($LP_{t-1} - LP_{t-3}$) by the average value of initial and final labor productivity $\frac{(LP_{t-1} + LP_{t-3})}{2}$. This approach helps to reduce the influence of outliers. Further, since there were two full years between the two points in time, we calculate the annual average labor productivity growth as follows:

$$LPG_{it} = \frac{1}{2} * \frac{(LP_{t-1} - LP_{t-3})}{\frac{(LP_{t-1} + LP_{t-3})}{2}} \quad (1)$$

LPG_{it} is ranged between -1 and 1 and refers to the information on labor productivity growth available at time t.

To construct the structural reform indexes, we use the SB indicators in the MONA database as described above. The IMF supporting programs begin during the approval year and are supposed to finish at the initial end period. Only a very few programs end early or are delayed until the next year. In general, the IMF supporting programs cover a 3-year period. We focus on the SBs that have been met or met with minor delay during the last review of the program

[12] The lack of panel data on firms limits the possibility to use robust measures of productivity such as the TFP from Levinsohn-Petrin (Levinsohn and Petrin, 2003).

by the IMF board. Based on Nardo et al. (2005) and OECD (2008), we use the centered-reduced normalization, or Z-score approach which consists of transforming a given variable X characterized by its mean μ and standard deviation σ, into an index or Z score expressed as follows:

$$Z = \frac{(X - \mu)}{\sigma}.$$

If X is normally distributed, then Z follows a centered-reduced normal distribution, with a zero mean and a unit standard deviation. With this standardization, all reform variables are expressed in the same unit, namely the standard deviation, and can, therefore, be meaningfully compared in terms of effects.[13]

For each class of reforms described above and for each period, we compute a normalized reform index by country as follows:

$$Reform_{ct} = \frac{N_{ct} - N_{avgt}}{\sigma_{Nt}} \quad (2)$$

N_{ct} is the total number of successful reforms (met or met with minor delay) in country c during the last review by the IMF board at year t. N_{avgt} and σ_{Nt} are, respectively, the average number of reforms met or met with minor delay and the standard deviation of the number of successful reforms for all countries at a given year. The index takes the value 0 if the number of reforms corresponds to the average number of successful reforms. All the indexes of reforms are computed using the entire sample of the MONA data set i.e., the 94 countries.

We also build an average index of reforms by averaging indexes of different reforms (fiscal, financial, trade, and real sectors). The average index of reforms is computed using equal weights for each reform and ranges between -1.6 and 3.5 with high values corresponding to a higher intensity of successful reforms on average. Compared to the existing literature, our reform index focuses on reforms "truly" implemented as we select successful reforms based on performance criteria in countries under IMF programs. Moreover, the database allows

[13] One matter of concern related to this approach is the sensitivity of the transformed Z variable to the presence of outliers. In the robustness section, we address this issue by using the min-max approach.

(continued…)

covering fiscal and real sector reforms whereas the existing literature mostly uses trade and financial liberalization indexes as a measure of structural reforms.[14] The indexes of reforms for each country of the sample are reported in table 13 of appendix B.

We minimize potential endogeneity issues between productivity and reforms by matching structural reform indexes with firm-level data from the WBES considering only reform programs within the 3 previous years. For example, for firm-level data available in 2010, we match successful reforms in 2009, 2008, or 2007. Matching structural reform data from the MONA data set and firm-level data from the WBES data set, we obtain a pair of reform indexes and firm characteristics for 37[15] Low and Low-middle income countries from six different regions (Sub-Saharan Africa, East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, the Middle East and North Africa, and South Asia).[16] The final sample contains 10,822 firms in 37 countries over the period 2006-14.

Table 2 summarizes the statistics of the variables described above. In a nutshell, micro and small firms dominate the sample by a proportion of almost 77.5 percent. Most firms in the sample are mature (between 5 and 15 years old) or old (more than 15 years old) with a proportion of 84 percent. On average, 18.4 percent of firms are exporting, and only 11.65 percent of firms have a credit line or an overdraft facility. The average GDP growth over the period is 4.54 percent, the average level of inflation is 7.13 percent, and the average index of the quality of regulation is -0.46.

In addition, a visual inspection of the data in Figure 1 indicates that, in the sample, reforms comprise mostly fiscal and financial reforms. This is in line with the choice of the sources of reforms. IMF programs are mostly dominated by fiscal and financial measures under the macro-critical reforms. The real sector and the trade sector are often added under the section

[14] See, for instance, Arnold *et al.* (2015) Prati *et al.* (2013); Abiad and Mody (2005); Abiad, Detragiache and Tressel (2008).
[15] Seven countries in the sample experimented with two IMF programs over the period and at least two rounds of the enterprise surveys over the period. We keep all the observations in those countries as they fit our matching strategy. Tables 13 and 14 in Appendix B report the list of countries and related descriptive statistics.
[16] The list of countries in the sample is as follows: Afghanistan, Armenia, Bangladesh, Bolivia, Bosnia and Herzegovina, Burkina Faso, Burundi, Central African Republic, Republic of Congo, Democratic Republic of Congo, Djibouti, Dominican Republic, El Salvador, Ethiopia, Ghana, Guatemala, Honduras, Kosovo, Kyrgyz Republic, Madagascar, Malawi, Mali, Mauritania, Moldova, Mongolia, Nepal, Nicaragua, Niger, Pakistan, Rwanda, Senegal, Tajikistan, Tanzania, Uganda, Ukraine, Republic of Yemen, and Zambia.

of structural reforms and business climate improvement. Reforms spiked around 2007-2009 following the significant increase in IMF programs after the fallout of the global financial crisis. Also, as can be seen in Figure 2, there is a positive correlation between the average labor productivity growth and the reform indexes in line with our assumptions that structural reforms stimulate firm level productivity.

Table 2. Summary statistics				
Variables	Mean	Std.Dev.	Min.	Max.
Firms' size				
Share of microenterprises	37.55	0.48	0	100
Share of small firms	39.88	0.49	0	100
Share of medium firms	15.41	0.36	0	100
Share of large firms	7.16	0.25	0	100
Firms' age				
Share of young firms	15.54	0.36	0	100
Share of mature firms	45.13	0.50	0	100
Share of old firms	39.32	0.49	0	100
Connection to foreign market				
Proportion of firms exporting	18.41	0.39	0	100
Financial access				
Proportion of firms having a credit line or an overdraft facility	11.65	22.98	0	100
Ownership				
Average foreign share	8.66	26.26	0	100
Average government/states share	0.51	5.39	0	100
Macroeconomic variables				
GDP growth	4.54	2.77	-1.90	12.42
Inflation	7.13	6.12	-0.28	33.22
Quality of regulation	-0.46	0.41	-1.51	0.37
Note. Outside of the quality of regulation, all variables are in percent. The summary statistics are at the firm level.				

Figure 1: Composition of successful reforms over time, all sample

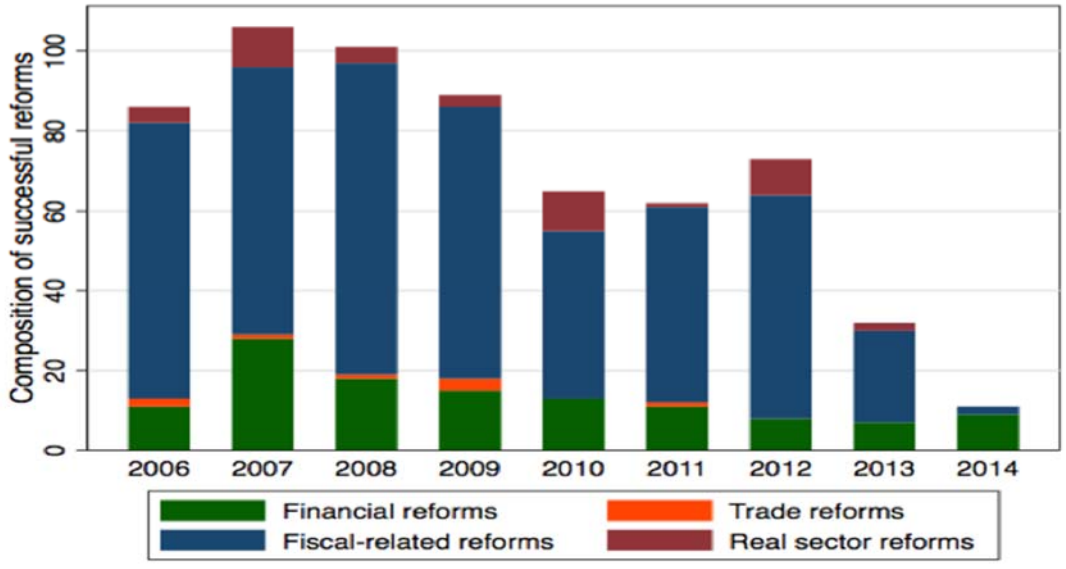
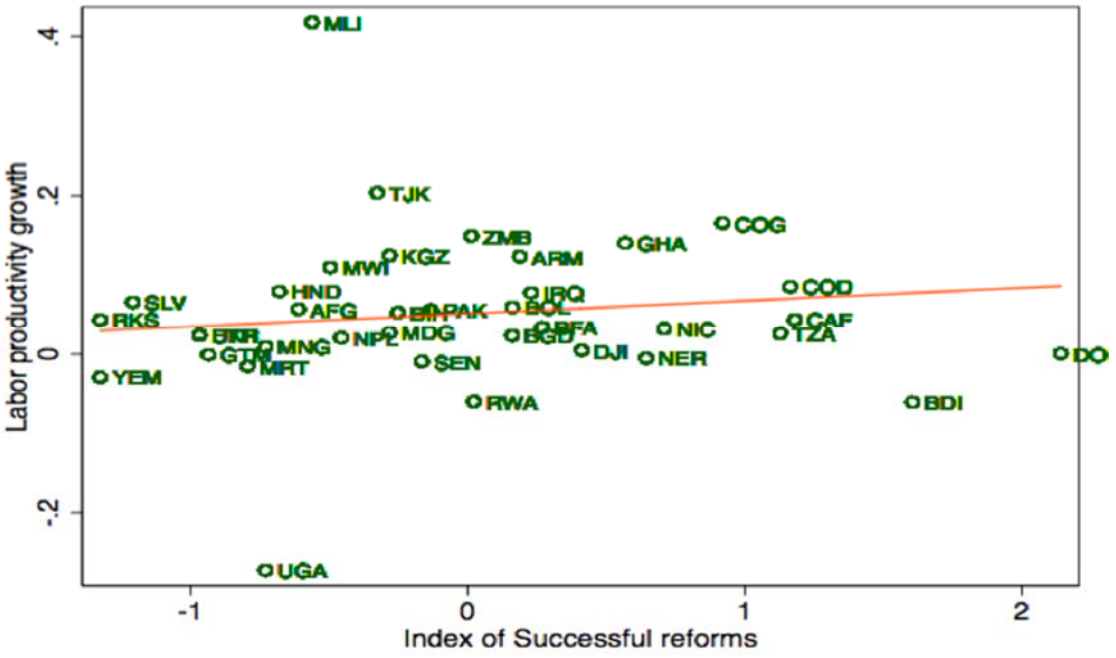


Figure 2: Average labor productivity growth and successful reforms, over 2006-14



B. The multilevel mixed model

Estimating the effects of structural reforms at the country level on the outcomes at the firm level is challenging because of the hierarchical structure of the data. Firms in the same countries may not be independent. Within countries, firms share similar contextual characteristics such as institutional environment, macroeconomic framework, and policies affecting their productivity. Standard econometric methods ignore such clustering effects, which may generate biased and underestimated standard errors. To account for such bias, we rely on multilevel mixed modeling, which has the advantage of considering such clustering effects by allowing the intercept to vary across countries and takes into account the heterogeneity that exists at the country level.[17] Finally, the multilevel model allows accounting simultaneously for country-level variables and country fixed-effects. The last point is particularly important for this study as the paper examines the impacts of reforms at the country level on firms' productivity.

[17] See Hox et al (2010) for more extensive discussion on the multilevel analysis.

An additional challenge is the potential endogeneity issues between structural reforms and productivity, which may originate from omitted variable bias. To minimize the latter, we include in all estimates a set of country, sector, and year fixed effects. In addition to controlling for some potentially important omitted variables, these fixed effects control for differences in demand conditions and survey differences, and time-invariant omitted variables. Moreover, our matching strategy between reforms and the firm level data set limits potential reverse causality issues between reforms and productivity. We match structural reform indexes with firm-level data considering only reform programs within the 3 previous years. The matching strategy ensures that the approval year of each IMF supporting program corresponds exactly or is after the reference year of labor productivity growth. This means that the possibility of the level of productivity determining the implementation of reforms can be ignored. Finally, we ensure that the estimated effects of reforms are not driven by the difference in key pre-treatment macroeconomic variables by presenting a sample balance table. Table 11 in appendix A compares low and low-middle income countries under an IMF program and those without an IMF program three years prior to the reforms. The analysis focuses on key macroeconomic condition variables that are the level of debt, the current account and overall balances, the GDP growth, the level of inflation, the exchange rate, and interest payment on the external debt (% of exports). As it can be seen, countries under an IMF program and those without are not statistically different. The evidence suggests that the challenge of identifying the impacts of reforms due to the difference in the pre-treatment macroeconomic conditions can be ignored. This evidence suggests that the estimated effects of structural reforms are not driven by the difference in pre-reform macroeconomic environment. As an additional robustness check, we account explicitly for countries in crisis over the period of the analysis.

The estimated multilevel mixed model is based on a two-level model where the highest level is the country, and the lowest level is the firm:

$$Level\ 1: LPG_{ict} = \alpha_{0c} + \beta Reforms_{c,(t-1,t-3)} + \eta X_{ict} + \gamma Z_{ct} + \varepsilon_{ict},\ \varepsilon_{ict} \sim N(0, \sigma^2) \quad (3)$$

LPG_{ict} is the labor productivity growth of firm i in country c at year t as described above. $Reforms_{c,(t-1t-3)}$ refers to indexes of the 3-year lagged successful reforms in country c. X_{ic} refers to a set of firm individual characteristics that were described above. The vector Z_c refers

to a set of macroeconomic variables described as well in the previous section. Finally, ε_{ic} refers to the firm-level error term. The coefficient β is the parameter of interest that captures the impact of structural reforms on firm-level productivity. We expect a positive sign in line with the expectation that structural reforms raise firm-level productivity in developing countries.

$$Level\ 2: \alpha_{0ct} = \alpha_{00t} + \vartheta_{ct,}\ \vartheta_{ct} \sim N(0, \delta^2), \vartheta_{ct} \perp \varepsilon_{ict} \quad (4)$$

Combining equations (3) and (4), the baseline model could be written as follows:

$$LPG_{ict} = \alpha_{00t} + \beta Reforms_{c,(t-1,t-3)} + \eta X_{ict} + \gamma Z_{ct} + \vartheta_{ct} + \varepsilon_{ict} \quad (5)$$

$\vartheta_{ct} + \varepsilon_{ict}$ is the random part of the model with ϑ_{ct} the country-specific error term. The multilevel model has the advantage of capturing both between and within country effects of structural reforms. In addition, we include country, sector, and year fixed effects to control for some potentially important omitted variables, differences in demand conditions[18] and survey differences. The standard errors are clustered at the country-level in all specifications.[19] In the section below, we discuss the key findings from a sample of 10,822 firms across 37 countries over the 2006-14 period.

IV. ESTIMATION RESULTS

A. Package and pace of reforms

Aggregate index of reforms

Baseline results are reported in Table 3. All estimates are standardized and can be compared across structural reforms. Column (1) reports the estimates with the average reform index. We find that the aggregate structural reform index has a positive impact on labor productivity growth. The associated coefficient is positive and statistically significant at the 1 percent level. A one standard deviation increase in the reform index is an improvement of 0.284 percentage

[18] This accounts for the short-term economic recovery effects as some countries might begin the IMF programs in a near-crisis condition with a weak macroeconomic environment. From a sluggish economy, domestic demand may be restored as a result of the program. The year fixed effects help to distinguish between the impacts of structural reforms from the effects of economic recovery. The findings are robust using different combinations of country, sector, and year fixed effects.

[19] The findings are robust clustering the standard errors at the country-sector and country-sector-year levels respectively.

point in firm-level labor productivity growth.

Most of the control variables are statistically significant. Exporting and foreign-owned firms have a positive impact on labor productivity growth. Estimated coefficients are significant at 1 percent with a magnitude between 0.05 and 0.072 standard deviation increase for a 1 standard deviation increase in the index of reforms. Initial conditions matter and are significant, at least at the 1 percent level. Labor productivity growth is lower for firms having large sales at the beginning of the period. The magnitude of the effects is relatively higher at 0.62 standard deviation decrease in labor productivity growth for a 1 standard deviation differential in real sales. Mature firms have a lower labor productivity growth. The coefficient is statistically significant at, respectively, the 1 and 5 percent levels. Likewise, micro, small, and medium-size firms have lower labor productivity growth relative to the large ones. Relative to the large firms, the gap in labor productivity growth is, respectively, 0.429 standard deviation for micro-firms, 0.294 standard deviation for small firms, and 0.102 standard deviation for medium firms. Large cities and government-owned firms are significant drivers of labor productivity growth.

The macroeconomic environment influences firm level labor productivity growth. Higher GDP growth favors firm level productivity growth. The estimated coefficient is significant at 1 percent. A 1 standard deviation improvement in GDP growth translates to 0.526 standard deviation increase in labor productivity growth. Conversely, higher inflation (often considered as an indicator of macroeconomic instability) has a negative impact on labor productivity growth. The estimated impact is significant at 1 percent. An increase of inflation by 1 standard deviation decreases labor productivity growth by 10.74 standard deviation. Further, a good quality of institutions stimulates labor productivity growth. The associated coefficient is positive and significant at 1 percent. An increase of 1 standard deviation in the quality of regulation indicator raises labor productivity growth by 2.77 standard deviation.[20]

“Strong reformer” vs. “Weak reformer”

As discussed in Figure 2, there is significant country heterogeneity in structural reforms across

[20] Table 12 in appendix A presents the evidence on the sub-group of low-income countries. All the reforms under consideration increase labor productivity growth.

countries. This suggests that the effect of structural reforms might vary according to the pace of reforms. This section tests whether the positive effect of structural reform on labor productivity growth evidenced above varies with the intensity of reforms implemented. Distinguishing countries by the pace of reforms implemented might be tricky. To avoid a priori bias, we chose the median of the reform index as a threshold.[21] We generate a dummy variable taking the value 1 when the average of the reform index for a country is above the median and 0 otherwise.[22] We extend equation (5) and introduce additively and multiplicatively (with $Reforms_{c,(t-1,t-3)}$), the "strong reformer" dummy variable.[23]

$$LPG_{ict} = \alpha_{00} + \beta\, Reforms_{c,(t-1,t-3)} + \delta Strong\ Reformer_{ict} + \theta Strong\ Reformer_{ict} * Reforms_{c,(t-1,t-3)} + \eta X_{ict} + \gamma Z_{ct} + \vartheta_{ct} + \varepsilon_{ict} \qquad (6)$$

LPG_{ict} denotes labor productivity growth, $Reforms_{c,(t-1,t-3)}$ the reform index, $Strong\ Reformer\ Dummy_{ict} * Reforms_{c,(t-1,t-3)}$ the interaction between the "strong reformer" dummy variable ($Strong\ Reformer_{ict}$) and the reform variable. As in equation (5), we control for firm-level characteristics, macroeconomic variables, and a set of country, sector and year fixed effects.

The results are reported in the second column of Table 3. It turns out that there is a clear dividend for being a "strong reformer". We find that countries dubbed as "strong reformer"

[21] Although, the indexes of reforms capture the intensity of reforms for each country, it is limited in distinguishing between the quality and the quantity of reforms. One can imagine that high quality reforms might be more ambitious and thereby less successful relative to less-ambitious reforms. We are unable to explore those aspects, as the MONA data set does not allow us to categorize the reforms by level of ambition or quality. The indexes of reforms as well as the findings in this paper are interpreted as the impact of the intensity of successful reforms on firms' productivity.

[22] According to this classification, the list of strong reformer countries over the period is as follows: Armenia, Bangladesh, Bolivia, Burkina Faso, Burundi, Central African Republic, Republic of Congo, Democratic Republic of Congo, Djibouti, Dominican Republic, Ghana, Honduras, Moldova, Nicaragua, Niger, Rwanda, Tanzania, Zambia.

[23] Among countries under the IMF's program, we could expect countries with good pre-reform conditions to perform better than those with weak pre-reform macroeconomic conditions. On the opposite, we could expect countries in pre-crisis or crisis context (weak macroeconomic environment) to perform better in terms of labor productivity than the others due to the economic recovery. In each case, the effects of reforms for strong and weak reformers may be misleading. We ensure that the difference in the estimated effects of reforms between strong and weak reformer countries is not driven by the difference in pre-treatment macroeconomic conditions. The sample balance test reported in Table 11 in Appendix A shows that "strong reformer" countries are not statistically different from the "weak reformers" on the pre-treatment basis. The sample balance analysis uses the same macroeconomic variables as previously, i.e., the level of debt, the current account and overall balance, the inflation and exchange rate, the interest rate on the external debt over GDP, and the GDP growth.

might drive the baseline results. Note that firms in the "strong reformer" category do not appear to be more productive than the counterfactual group (dubbed as "weak reformer"). The coefficient of the strong reformer dummy is negative and statistically not significant. However, the gains from reforms in labor productivity growth between a firm in the "strong reformer" group and one in the control group is about 0.257 percentage point. This corresponds to the coefficient associated with the interactive term between the reform indexes and the dummy variable indicating "strong reformer" countries. The findings indicate that structural reforms have a positive effect on labor productivity growth in countries dubbed as "strong reformer". The net effect of structural reforms is very close to the estimate in the baseline.

B. Specific reforms and conditional effects

So far, the analysis focuses on the aggregate index of reforms. We analyze in this section the effect of specific reforms. The effects of structural reforms on labor productivity growth might vary according to their nature. To shed light on this assumption, we split the reform index into its subcomponents: financial sector reform, fiscal sector reform, real sector reform, and trade sector reform, respectively. We then re-estimate equation (5) for financial, fiscal, real and trade sector reforms. The findings are presented in columns (3) to (6) of Table 3. We find that all structural reforms considered have positive impacts on labor productivity growth. The estimated coefficients are all positive and statistically positive at the 1 percent level.

Interestingly, the real sector reform turns out to be the reform with the most sizable impact on firms' labor productivity growth. Indeed, the effect of real sector reform stands out in magnitude relative to the baseline result. The associated coefficient is positive and estimated at 9.7, implying that a one standard deviation increase in the real sector reform index leads to an improvement of 9.7 percentage points in labor productivity growth at the firm level, which is more than 34 times higher than the baseline estimate. Next, we find that the impacts of financial and fiscal reforms (dominant in the sample given the fact that reforms are extracted from IMF programs' measures) are close in magnitude at around 0.35, slightly above that of the average index. A one standard deviation increase in these reform indexes is associated with an improvement of 0.37 and 0.34 percentage point in labor productivity growth at the firm level. Finally, the impact of trade reforms is close to the one estimated with the aggregate

index.

Conditional factors

We further refine the estimates of the effect of structural reforms on labor productivity growth. We focus on firms' characteristics that shape that effect. Even though in the same country, firms face similar macroeconomic and policy environments, they have different individual characteristics, which could amend the impact of reforms on their productivity.

We follow the literature on the business environment and firms' productivity[24] and center on four potential conditional factors that are access to international markets, financial access, distortion in the business environment, and the size of firms. First, access to the foreign market is one of the channels through which trade sector reforms could affect productivity at the firm level. Trade sector reforms could affect all firms, while the exporting ones are the most exposed to changes in trade regimes such as liberalization, reduction of tariffs, and time necessary to comply with all export procedures. We expect, therefore, that exporting firms benefit more from trade sector reforms relative to the non-exporting ones. Second, financial access is one of the main channels through which financial reforms impact productivity at the firm level. As argued by Rajan and Zingales (1998) and Beck et al. (2005), access to finance is crucial for firms' development and growth. It remains one of the big obstacles weighing down on firms in developing countries. Given that financial reforms are aimed at improving the efficiency of the banking system and reducing financial repression, we expect firms, which are already financially included, to benefit less from financial reforms. Third, as highlighted by Bah and Fang (2015), firms in developing countries face idiosyncratic distortions affecting their productivity and economic performance. Distortions can take different forms such as bribery, nuisance or discriminatory taxes/subsidies, tax exemption, bias against exporters, the cost of insecurity, barrier to entry, complex tax system and the costs of power outages. In such environment, firms can be stifled and limited in their development potential. Finally, firms'

[24] See for instance, Bah and Fang, 2015; Aterido et al., 2011; Aghion et al., 2010; Berman and Héricourt, 2010; Rajan and Zingales, 1998.

size is one of the channels through which reforms, in general, affect firms' productivity. As pointed out in the literature, small businesses in developing countries are negatively affected by a heavy regulatory framework (Aterido et al., 2011), and strict labor market regulation negatively affects firm size (Almeida and Carneiro, 2009). Hence, by lightening the regulatory framework and price controls, real sector reforms could increase firms' productivity in developing countries, especially for smaller firms.

To capture these potential heterogeneous effects, we extend equation (5) and introduce additively and multiplicatively (with $Reforms_{c,(t-1,t-3)}$) a conditional factor variable (CF_{ict}) which captures firms' individual characteristics that could potentially affect the effect of structural reforms at the macroeconomic level on labor productivity growth at the firm level.

The empirical model estimated with a multilevel approach could be specified as follows:

$$LPG_{ict} = \alpha_{00} + \beta\, Reforms_{c,(t-1,t-3)} + \delta CF_{ict} + \theta CF_{ict} * Reforms_{c,(t-1,t-3)} + \eta X_{ict} + \gamma Z_{ct} + \vartheta_{ct} + \varepsilon_{ict} \quad (7)$$

LPG_{ict} denotes labor productivity growth, $Reforms_{c,(t-1,t-3)}$ the reform index, $CF_{ict} * Reforms_{c,(t-1,t-3)}$ the interaction between the reform index and conditional factors described below. As previously, we control for firm-level characteristics, macroeconomic variables, and a set of country-, sector-, and year-fixed effects. As described above, connection to foreign market is captured by a dummy variable that takes 1 if a positive share of sales is exported directly or indirectly and 0 otherwise.

Table 3. Impact of the structural reforms on labor productivity growth						
Dependent variable: Labor productivity growth						
	Package of reforms		Financial reforms	Fiscal reforms	Real sector reforms	Trade sector reforms
	(1)	(2)	(3)	(4)	(5)	(6)
Structural Reforms						
Structural Reforms	0.284*** (0.0160)	0.0380 (0.0763)	0.370*** (0.0209)	0.344*** (0.0194)	9.674*** (0.546)	0.266*** (0.0150)
Strong reformer dummy		-0.0693 (0.0632)				
Strong reformer dummy*Structural Reforms		0.257*** (0.0455)				
Firms' size						
Micro-firms	-0.429*** (0.0519)	-0.429*** (0.0519)	-0.429*** (0.0519)	-0.429*** (0.0519)	-0.429*** (0.0519)	-0.429*** (0.0519)
Small firms	-0.294*** (0.0382)	-0.294*** (0.0382)	-0.294*** (0.0382)	-0.294*** (0.0382)	-0.294*** (0.0382)	-0.294*** (0.0382)
Medium firms	-0.102*** (0.0218)	-0.102*** (0.0218)	-0.102*** (0.0218)	-0.102*** (0.0218)	-0.102*** (0.0218)	-0.102*** (0.0218)
Firms' age						
Young	-0.0174 (0.0114)	-0.0174 (0.0114)	-0.0174 (0.0114)	-0.0174 (0.0114)	-0.0174 (0.0114)	-0.0174 (0.0114)
Mature	-0.0419*** (0.0097)	-0.0419*** (0.0097)	-0.0419*** (0.0097)	-0.0419*** (0.0097)	-0.0419*** (0.0097)	-0.0419*** (0.0097)
Ownership						
Government share	0.0087 (0.0104)	0.0087 (0.0104)	0.0087 (0.0104)	0.0087 (0.0104)	0.0087 (0.0104)	0.0087 (0.0104)
Foreign share	0.0715*** (0.0180)	0.0715*** (0.0180)	0.0715*** (0.0180)	0.0715*** (0.0180)	0.0715*** (0.0180)	0.0715*** (0.0180)
Others firms' characteristics						
Exporting status - dummy	0.0491*** (0.0164)	0.0491*** (0.0164)	0.0491*** (0.0164)	0.0491*** (0.0164)	0.0491*** (0.0164)	0.0491*** (0.0164)
Financial access	0.0162 (0.0140)	0.0162 (0.0140)	0.0162 (0.0140)	0.0162 (0.0140)	0.0162 (0.0140)	0.0162 (0.0140)
Log. real sales (3 years ago)	-0.616*** (0.0528)	-0.616*** (0.0528)	-0.616*** (0.0528)	-0.616*** (0.0528)	-0.616*** (0.0528)	-0.616*** (0.0528)
Large city	0.0165 (0.0261)	0.0165 (0.0261)	0.0165 (0.0261)	0.0165 (0.0261)	0.0165 (0.0261)	0.0165 (0.0261)
Macroeconomic variables						
GDP growth (percent)	0.526*** (0.0301)	-0.0395*** (0.009)	1.359*** (0.0299)	0.294*** (0.0412)	-0.521*** (0.0848)	0.625*** (0.0259)
Inflation (percent)	-10.74*** (0.414)	-0.0107 (0.009)	-23.88*** (0.526)	-7.741*** (0.549)	-11.73*** (1.284)	-8.398*** (0.327)
Institutions						
Quality of regulation	2.772*** (0.0922)	0.0166 (0.0294)	6.058*** (0.169)	2.150*** (0.111)	4.394*** (0.099)	1.782*** (0.126)
R-squared	**0.236**	**0.236**	**0.240**	**0.240**	**0.240**	**0.240**
Observations	10,822	10822	10822	10822	10822	10822
Country FE Sector FE Year FE	YES YES YES	YES YES YES	YES YES YES	YES YES YES	YES YES YES	YES YES YES

Notes. The table presents standardized coefficients of the effects of reforms on firms' labor productivity growth using a multilevel mixed effects model. All estimates use the weights and are standardized so that can be compared across reforms. Robust standard errors clustered at the country level in parentheses. ***, **, * denote significance at the 1, 5, and 10 percent level.

Financial access is a dummy variable that takes 1 if a firm has a credit line or an overdraft facility and 0 otherwise. The level of distortions facing firms is captured by a dummy variable that takes 1 for firms in the fourth quintile of the distribution of distortions, i.e. firms facing a high level of distortions. Firm size is captured by four categorical variables based on the number of permanent employees: Micro-firms (1 to 10), Small (11 to 50), Medium (51 to 200), and Large (more than 200).

The findings reported in Table 4 confirm the existence of conditional effects of reforms. Contrary to our expectations, being connected to the foreign market does not generate specific labor productivity gains from reforms. The estimated coefficients are positive (except for the real sector reform) but not statistically significant. Also, we find that financially-included firms benefit less from financial reforms. The estimated coefficient of the interaction term is negative and statistically significant at the 1 percent level. Being financially included reduces the productivity gain from financial reforms by 0.135 percentage point for a one standard deviation increase in financial reforms. Moreover, financial access also strengthens the impact of fiscal reforms on firms' productivity. The coefficient associated with the interaction term between financial access and fiscal reform is positive and statistically significant at the 1 percent level. The magnitude of productivity gain is 0.089 for a one standard deviation increase in fiscal reforms. These findings suggest that financial sector reforms in developing countries help financially excluded firms to have better access to finance, thereby boosting their productivity. Regarding the additional gains from fiscal reforms for firms having access to finance, the findings suggest that fiscal reforms seem to open access to a new source of financing. Fiscal reforms such as debt management could lower borrowing rate spreads for firms having access to finance and enable the local currency financial market to function properly. In addition, other reforms such as tax reforms could increase the efficiency of the banking or financial system as these could reduce uncertainty and intertemporal incoherence.

As expected, the effects of fiscal reforms on labor productivity gain are hindered by distortions. The more a firm faces distortions in the business environment, the less are productivity gains from fiscal reforms. The estimated coefficient of the interaction term is negative and statistically significant at the 5 percent level. A one standard deviation increase in fiscal related reforms raises firms' productivity by 0.342 standard deviation. The cost of being a part of the

top 50 more distorted firms is 0.042 standard deviation decrease in productivity for a one standard deviation increase in fiscal reforms, respectively. The findings suggest that facing higher level of distortions, measured in this paper as the costs in the percentage of sales of crime, insecurity, power outage and bribe paid "to get things done," mitigates the effects of fiscal reforms. The findings suggest that fiscal reforms may help to reduce distortions in a business environment such as bribery activities. Consequently, firms using corruption to grease the wheels of the business environment[25] may be disadvantaged by these reforms, especially anti-corruption policies.

Finally, regarding firms' size, the evidence suggests that small firms benefit more from financial reforms relative to the other ones. The estimated coefficient of the interaction term is positive and statistically significant at 10 percent. Being a small firm improves labor productivity growth gains from financial reforms by 0.038 standard deviation for one standard increase in financial reforms. As pointed out by Atérido et al. (2011), small businesses have less access to formal finance. Hence, financial reforms that aim at easing financial constraints will impact small firms mostly.

In sum, financial, fiscal, real and trade reforms increase firm-level productivity in developing countries. Factors such as financial access, distortions, and the size of firms play a conditional role. The findings show that financial access and being a small firm enhance the impact of financial reforms on firms' productivity. The effect of fiscal reforms is improved by better financial access while hindered by distortions. The effect of trade reforms on labor productivity growth is also impaired by distortions in the business environment. We show in the appendices that our findings are robust to alternative measures of productivity, methodologies, additional control variables, and counterfactual experiment based on unsuccessful reforms.

[25] See Herrera and Kouamé (2017) for more extensive discussion on firms using corruption to grease the wheels of the business environment.

Table 4. Impacts of specific reforms on productivity – Conditional factors				
	Financial sector reforms	Fiscal sector reforms	Real sector reforms	Trade sector reforms
Conditional factor: Exporting firm dummy				
Reforms	0.376***	0.342***	9.670***	0.266***
	(0.0223)	(0.022)	(0.543)	(0.017)
Reforms* Exporting firm dummy	-0.010	0.004	-0.003	0.001
	(0.013)	(0.018)	(0.019)	(0.0192)
Exporting firm dummy	0.04367***	0.0484***	0.0493***	0.0473***
	(0.0157)	(0.0180)	(0.0160)	(0.0163)
R-squared	0.2361	0.2361	0.2361	0.2361
Conditional factor: Financial access				
Reforms	0.505***	0.261***	9.678***	0.220***
	(0.040)	(0.0401)	(0.566)	(0.0342)
Reforms* Financial access	**-0.135*** **	**0.0891*** **	-0.007	0.0514
	(0.0414)	**(0.0323)**	(0.04593)	(0.0376)
Financial access	0.0492***	0.0484***	0.0491***	0.0491***
	(0.0163)	(0.0162)	(0.0164)	(0.0164)
R-squared	0.2368	0.2370	0.2360	0.2361
Conditional factor: Distortions				
Reforms	0.358***	0.374***	9.635***	0.271***
	(0.0268)	(0.0224)	(0.579)	(0.0193)
Reforms* Distortions	0.0133	**-0.0424** **	-0.0150	-0.0101
	(0.0111)	**(0.0170)**	(0.0219)	(0.0138)
Distortions	0.0377	0.0573	0.0055	0.0213
	(0.0359)	(0.0573)	(0.0301)	(0.0529)
R-squared	0.2362	0.2372	0.2362	0.2361
Conditional factor: Small firms				
Reforms	0.341***	0.353***	9.634***	0.282***
	(0.0334)	(0.0484)	(0.529)	(0.055)
Reforms* Small firms	**0.0375***	-0.0282	0.0267	-0.0180
	(0.0225)	(0.0417)	(0.0409)	(0.0393)
Small firms	-0.290***	-0.294***	-0.285***	-0.295***
	(0.0382)	(0.0382)	(0.0448)	(0.0386)
R-squared	0.2364	0.2370	0.2361	0.2361
Observations	10,822	10,822	10,822	10,822
Control variables	YES	YES	YES	YES
Country FE	YES	YES	YES	YES
Sector FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Notes: The table presents standardized coefficients of the effects of reforms on firm-level labor productivity growth using a multilevel mixed effects model. All estimates use the weights and are standardized so that can be compared across structural reforms. Robust standard errors clustered at the country level are in parentheses. ***, **, * denote significance at the 1, 5, and 10 percent level.

C. Complementarities between reforms

In this section, we assess whether structural reforms have substitutable or complementarity effects on productivity. Documenting the complementarity between reforms would help the design of the reform package when preserving productivity growth potential is at the core of policy recommendations. Complementarity and sequencing are vital issues while implementing several policies. As pointed out by Dewatripont and Roland (1995) and Hausmann et al. (2005), the success of implementation might depend on the order of reforms. Dewatripont and Roland (1995) suggest prioritizing political feasibility, and Hausmann et al. (2005) recommend targeting the most binding constraints. For instance, the effectiveness of growth-friendly reforms could have mutually reinforcing effects. Complementary reforms, such as trade liberalization or real sector reform (labor and product market reforms) could enhance the impact of fiscal reforms by promoting savings, stimulating investment, and unlocking productivity gains.

To analyze potential substitutability and complementarity between reforms, we estimate a modified version of equation (5) by introducing interaction terms between reforms:

$$LPG_{ict} = \alpha_{00} + \beta\, Reforms_{kc,} + \varphi Reforms_{hc} * Reforms_{kc} + \mu Reforms_{hc} + \eta X_{ic} + \gamma Z_c + \vartheta_c + \varepsilon_{ic} \qquad (8)$$

$$h, k = \{1,2,34\}$$

where LPG_{ict} refers to labor productivity growth, $Reforms_{kc,}$ and $Reforms_{hc}$ two different reforms among financial, fiscal, real and trade sector reforms, and $Reforms_{hc} * Reforms_{kc}$ the interaction term between them. The coefficient φ captures the complementarity effect. The latter is expected to be positive if two reforms have mutually reinforcing effects (complementarity effects) and negative if the reforms have mutually adverse effects (substitutability effect). φ is expected to be statistically insignificant if the effects of the reforms on firms' productivity are independent. The potential complementarity among reforms will be tested through six (6) equations, including each one-interaction theme between reforms. Each equation is estimated with a multilevel model as described above and controls for firm-level characteristics, macroeconomic variables as well as country-, sector-, and year-fixed effects.

Results are reported in Table 5. Columns (1), (2), and (3) check whether financial reforms are complementary with fiscal, real sector and trade sector reforms, respectively. Columns (4) and (5) assess potentially complementary effects between fiscal, real, and trade sector reforms, respectively. Finally, column (6) examines the potentially complementary effect between real sector and trade sector reforms. We find that, except for financial and trade reforms, all macroeconomic reforms considered are bilaterally complementary in improving firms' labor productivity growth. The coefficients associated with the interaction terms between reforms are positive and statistically significant at 1 percent. Although the potential substitute relationship between financial and trade reforms can be puzzling, it is explained by the stage of development of the countries in the sample. At an early stage of development, finance may not be a key determinant of the country's ability to perform (Henderson et al., 2013). Implementing financial reforms in that environment may not reinforce or hinder the effects of trade reforms (or inversely) as the financial sector is still weakly developed.

These results imply that most of the macroeconomic reforms under IMF programs can be implemented jointly to maximize their effects on the productivity of firms.

Table 5. Substitutable or complementary effects of structural reforms						
	(1)	(2)	(3)	(4)	(5)	(6)
Financial reform*Fiscal refom	0.213*** (0.0655)					
Financial reform*Real sector reform		1.122*** (0.0357)				
Financial reform*Trade reform			-0.170*** (0.0407)			
Fiscal reform*Real sector reform				0.341*** (0.0211)		
Fiscal reform*Trade reform					0.288*** (0.0231)	
Real sector *Trade reform						2.720*** (0.125)
Financial reform	0.0422 (0.0568)	0.994*** (0.0444)	-0.336*** (0.0239)			
Fiscal reform	0.231*** (0.0912)			0.237*** (0.0281)	-0.892*** (0.162)	
Real sector reform		-5.239*** (0.282)		0.105 (0.108)		1.307*** (0.221)
Trade reform			0.630*** (0.0589)		0.533*** (0.0796)	-1.376*** (0.0914)
Observations	10,822	10,822	10,822	10,822	10,822	10,822
R-squared	0.2360	0.2360	0.2360	0.2360	0.2360	0.2360

Notes. The table presents standardized coefficients of the effects of reforms on firm-level labor productivity growth using a multilevel mixed effects model. The specifications include firm's individual characteristics, sector and year fixed effects. At the macroeconomic level, the specifications include the average growth of GDP, the level of inflation, and the quality of policies and regulations related to the private sector and country fixed effects. All estimates use the weights and are standardized so that can be compared across structural reforms. Robust standard errors clustered at the country level are in parentheses. ***, **, * denote significance at the 1, 5, and 10 percent level.

V. ROBUSTNESS CHECKS

So far, the results are consistent with our hypothesis that reforms in developing countries increase firm-level productivity with specific effects for firms facing high levels of distortions, financially included firms and small firms. In the following, we perform a variety of sensitivity analyses to check the robustness of the impacts of reforms on productivity. First, we account for economic crisis context in order to distinguish the effects of reforms from the effects of economic recovery. Second, we add additional control variables. Third, we check the sensitivity of the findings using an alternative way of calculating the indexes of reforms. Fourth, we check whether our results are robust using alternative measures of productivity. Fifth, we investigate whether our results are robust to the use of an alternative methodology, especially the Difference and Difference approach from Rajan and Zingales (1998) following among others by Aghion *et al.* (2014). Finally, we use unsuccessful reforms as a counterfactual experiment to validate the hypothesis of the positive impact of successful structural reforms on productivity. Finally, we check the sensitivity of the findings using an alternative way of calculating the indexes of reforms.

Crisis and economic recovery. First, the MONA database includes both reforms implemented in a context of crisis (pre- and post-crisis reforms) and typical structural reforms, i.e., reforms implemented outside a crisis context. In the crisis context, the increase in productivity might be due to economic recovery and non-directly related to reforms implemented. From being sluggish in a crisis context characterized by weak economic growth, the domestic demand might be naturally restored and drive the increase in productivity. To ensure that the increase in productivity is due to reforms and not to economic recovery, we assess the robustness of the findings accounting for economic crisis context. The approach consists of identifying countries that were officially in crisis before and after the period of the reforms based on Laeven and Valencia's (2012) database of crisis.[26] Following Reinhart and Rogoff (2014), we consider that economic recovery can influence productivity growth within eight years following the crisis. [27] The crisis context analysis shows that only 7 countries of 30 were officially in crisis within

[26] The database documents systemic banking crisis, currency crisis, and sovereign debt crisis (default and restructuring).
[27] Reinhart and Rogoff (2014) show that it takes on average about eight years to reach the pre-crisis level of income.

the eight years preceding the reforms and the period covered by labor productivity growth. We account for economic recovery using a dummy variable that takes 1 if a country was officially in crisis and 0 otherwise. The list of countries and the types of crisis are summarized in Table 6 below.

Table 6. List of countries and types of crisis

	Types of crisis	**Crisis years**	**Period of reforms**
The Democratic Republic of Congo	Currency crisis	2009	2009-2012
Dominican Republic	Currency crisis Sovereign debt restructuring	2003 2005	2005-2008
Ghana	Currency crisis	2009	2009-2012
Madagascar	Currency crisis	2004	2006-2009
Moldavia	Sovereign Debt Restructuring	2002	2006-2009
Mongolia	Systemic Banking crisis	2008	2009-2010
Ukraine	Systemic Banking crisis	2008	2010-2012

We include then the dummy variable in equation (5) and re-estimate the model using the same methodology as previously. The findings reported in Panel A of Table 7 show that the increase in productivity is due to reforms implemented and not to economic recovery after the crisis. All coefficients are positive and statistically significant at the 1 percent level.[28] The sample balance analysis discussed earlier and presented in the appendices corroborates that the estimated effects of reforms are not driven by economic recovery. Tables 10 and 11 in the appendix show that countries under IMF reforms are not statistically different from those without reform programs regarding the level of debt, the current and overall balance, the inflation and exchange rate, the GDP growth, and interest payment on the external debt.

Additional control variables. By definition, labor productivity is affected by the stock of capital and investment. Consequently, both variables may affect labor productivity growth. Failing to account for those variables could weaken our findings or be a case of missing variable bias. We check in this session the robustness of the findings controlling for both the net book value of capital and the investment in equipment and land. The findings reported in Panel B of Table 7 confirm the positive of reforms on labor productivity growth. As previously,

[28] The same evidence is obtained by excluding countries officially in crisis from the sample and re-estimating equation (5).

the real sector reforms are the most impactful following by financial sector reforms, fiscal reforms, and trade reforms respectively.

Measuring structural reform: the "min-max" approach. The third robustness check involves an alternative way of calculating structural reform indexes. We re-compute the reform indexes based on the "min-max" approach as follows: $Index_{minmax} = \frac{N_{ct} - N_{min,t}}{N_{max} - N_{min,t}}$. X_{ct} is the total number of reforms met or met with a minor delay in country c. $N_{min,t}$ and $N_{max,t}$ are, respectively, the minimum and the maximal total number of the 3-year successful reforms in year *t*. We then re-estimate equation (5) using the min-max reform indexes. The results, reported in Table 7, Panel C, strongly corroborate the baseline findings. All coefficients are positive and statistically significant at the 1 percent level. In developing countries, structural reforms at the macroeconomic level increase firms' productivity with a larger impact of real sector reforms.

Alternative measures of productivity. As discussed previously, the paper takes advantage of the dynamic aspect of labor productivity to capture the impact of reforms on productivity. However, one may wonder whether the findings are robust using alternative measures of productivity. We explore in this section the robustness of the findings using value added per worker and total factor productivity as alternative measures of productivity.

Value Added (VA) per worker. The value added per worker is one of the standard measures of productivity in the literature. The value-added is computed as the annual sales minus the costs of raw materials and energy. The difference is normalized by the number of employees in order to obtain the value added per worker. The findings reported in Panel D of Table 7 confirm the positive impacts of reforms on productivity. All the individual reforms considered in this paper have a positive impact on the value added per worker.

Total Factor Productivity. Second, we use the TFP concept as an alternative measure of productivity at the firm level. TFP has the advantage to account for the technology of production and the level of capital but could not be applied in our sample to capture the

dynamics of productivity gains[29]; hence our preference for labor productivity growth. Nevertheless, we test whether our results hold with TFP. We derive TFP from a Cobb-Douglas production function with the following technology $Y_{ijct} = K_{ijct}^{\alpha} L_{ijct}^{\beta}$. Y_{ijct} refers to the gross output of firm i in sector j in country c during the previous fiscal year with K and L denoting capital and labor, respectively. Using the natural logarithm, production could be specified as follows: $y_{ijct} = \theta + \alpha k_{ijct} + \beta l_{ijct} + \gamma q_{ijct} + \varepsilon_{ijct}$. y_{ijct} is the natural logarithm of output at the end of the previous fiscal year; k_{ijc} and l_{ijc} represent the natural logarithm of the net book value of capital and the total permanent full-time employees (labor) at the end of the previous fiscal year.[30] q_{ijct} captures unobservable productivity shocks; and ε_{ijct} is an independent and identically distributed shock, which does not affect firm decision. Estimating the TFP at the firm level is challenging because of the potential correlation between productivity shocks and inputs. Firms facing a positive productivity shock could respond by using higher levels of inputs. Following Levinshon and Petrin (2003)[31] and Saliola and Seker (2012), we tackle this potentially endogenous issue by using the cost of energy as a proxy of unobservable productivity shock.[32] The TFP is estimated as the residual from the production function based on the following equation: $TFP_{ijct} \cong y_{ijct} - \hat{\alpha} k_{ijct} - \hat{\beta} l_{ijct} - \hat{\gamma} q_{ijct}$; where $\hat{\alpha}$, $\hat{\beta}$, and $\hat{\gamma}$ are the estimated coefficients from equation (5). Results reported in Table 7, Panel E, confirm that in developing countries, financial, fiscal, real sector, and trade reforms at the macroeconomic level increase firms' productivity. All coefficients associated with structural reforms are positive and statistically significant at the 1 percent level. As previously shown, real sector reform has the greatest impact on productivity gains at the firm level.

[29] As discussed above, information on previous netbook value of capital is missing in the WBES. We are therefore unable to compute the lag of TFP.
[30] The WBES database is a pseudo-panel that does not report previous information on the net book of capital. We are, therefore, unable to compute the growth of TFP between $t-1$ and $t-3$. Firm-level TFP are, therefore, calculated for a specific year.
[31] A robust application of the TFP approach from Levinsohn-Petrin requires panel data. However, we apply the intuition using the costs of energy as a proxy of unobservable productivity shocks.
[32] We are grateful to Frederica Saliola for sharing this paper.

Table 7. Robustness checks				
	Financial reforms	Fiscal reforms	Real sector reforms	Trade reforms
Panel A: Accounting for the effects of economic recovery				
Reforms	0.986*** (0.0344)	0.429*** (0.0150)	10.74*** (0.375)	0.342*** (0.0120)
Dummy - crisis	-2.651*** (0.0630)	-0.393*** (0.0259)	-0.176*** (0.0318)	-0.453*** (0.0244)
Observations	10,822	10,822	10,822	10,822
R-squared	0.2360	0.2360	0.2360	0.2360
Panel B: Additional control variables				
Reforms	0.244*** (0.063)	0.227*** (0.0432)	6.390*** (1.212)	0.176*** (0.033)
Log. Net book value of capital	0.020*** (0.006)	0.018*** (0.006)	0.018*** (0.06)	0.018*** (0.003)
Log. Investment in capital	0.005 (0.005)	0.005 (0.006)	0.005 (0.005)	0.005 (0.005)
Observations	2880	2880	2880	2880
R-squared	0.3470	0.3470	0.3470	0.3470
Panel C: min-max index				
Reforms	0.282*** (0.0159)	0.671*** (0.0378)	2.043*** (0.115)	0.253*** (0.0143)
Observations	10,822	10,822	10,822	10,822
R-squared	0.2360	0.2360	0.2360	0.2360
Panel D: Value Added per worker				
Reforms	0.116*** (0.007)	0.125*** (0.008)	3.264*** (0.210)	0.0898*** (0.006)
Observations	9. 942	9. 942	9. 942	9. 942
R-squared	0.80	0.80	0.80	0.80
Panel E: Total factor productivity				
Reforms	0.122*** (0.0271)	0.114*** (0.0253)	3.204*** (0.709)	0.0882*** (0.0165)
Observations	4,965	4,965	4,965	4,965
R-squared	0.3398	0.3398	0.3398	0.3398

Notes: The table presents standardized coefficients of the effects of reforms on firm-level labor productivity growth (Panels A, B, C), value added per worker (Panel D), and Total factor productivity (Panel E) using a multilevel mixed effects model. The specifications include firm's individual characteristics, sector and year fixed effects. At the macroeconomic level, the specifications include the average growth of GDP, the level of inflation, and the quality of policies and regulations related to the private sector and country fixed effects. All estimates use the weights and are standardized so that can be compared across structural reforms. Robust standard errors clustered at the country level are in parentheses. ***, **, * denote significance at the 1, 5, and 10 percent level.

Difference-in-difference approach. Finally, we investigate whether our results are robust to the use of the difference-in-difference methodology as suggested by Rajan and Zingales (1998). So far, we use a multilevel model to capture both the between and within country effects of reforms on firms' productivity. However, some might be concerned as to whether our findings are driven by the methodology used. To allay such concerns, we re-estimate the model using the difference-in-difference approach. The empirical model could be specified as follows:

$$LPG_{ict} = \alpha_{jt} + \gamma_{ct} + \beta\ Conditional\ factor_{ict} * Reforms_{c,(t-1,t-3)} + \eta X_{ict} + \varepsilon_{ict} \qquad (9)$$

α_j and γ_c are full sets of industry and country dummies which helps to control for unobserved heterogeneity across industries and across countries; $Exposure\ Variable_{ict}$ and X_{ict} are the conditional factors and firms' individual characteristics, respectively, as described previously. Equation (9) is estimated for each reform with a simple OLS procedure. Results are reported in Table 8. All interaction terms between reforms and exposure variables are statistically significant. As previously, firms with financial access benefit less from financial reforms while the latter benefit more from fiscal reforms; productivity gains from fiscal reforms are lower for firms facing significant distortions.

Table 8. Impacts of specific reforms on productivity – Alternative methodology

	Financial sector reforms	Financial sector reforms	Fiscal reforms	Fiscal sector reforms
	Conditional factor: Financial access	Conditional factor: Small firms	Conditional factor: Distortions	Conditional factor: Financial access
Reforms* Conditional factor	-0.103** (0.0452)	0.0358 (0.0216)	-0.0450*** (0.0160)	0.831** (0.0236)
Conditional factor	0.001 (0.0147)	-0.292*** (0.0347)	0.0656 (0.0147)	0.009 (0.0142)
Observations	11,807	11,807	11,807	11,807
R-squared	0.221	0.220	0.221	0.221
Firms Controls	YES	YES	YES	YES
Country FE	YES	YES	YES	YES
Sector FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

The table presents standardized coefficients of the effects of reforms on firm-level labor productivity growth using an OLS model. The specifications include firm's individual characteristics, sector and year fixed effects. Estimates include country fixed effects. All estimates use the weights and are standardized so that can be compared across structural reforms. Robust standard errors clustered at the country level are in parentheses. ***, **, * denote significance at the 1, 5, and 10 percent level.

Unsuccessful reforms. So far, our indexes of reforms consider only successful reforms. This can be problematic as one might wonder whether the findings allow drawing the strong conclusion that structural reforms matter for labor productivity growth. Although it is difficult to find a perfect counterfactual in economics, the MONA database provides an opportunity to explore the impact of unsuccessful reforms. If the hypothesis that successful reforms raise productivity holds, we should expect unsuccessful reforms to have no impact or a negative impact on productivity. This section examines the impact of reforms not met on labor productivity growth using the same sectorial categorization of reforms as in Table 1 and the Z-score approach described in section III to compute an index of unsuccessful reforms. The estimation strategy and control variables are similar to those described in the baseline analysis. The findings reported in Table 9 below seem to reinforce the conclusion that successful structural reforms matter for labor productivity growth. As can be seen, unsuccessful financial and real sector reforms have negative impacts on productivity. A one standard deviation increase in unsuccessful reforms in financial and real sector reforms decreases labor productivity growth by 1.121 and 3.975 standard deviation respectively. In both cases, the estimated coefficients are highly significant at the 1 percent level. On the opposite, unsuccessful fiscal and trade reforms seem to have a positive impact on labor productivity growth. However, the estimated coefficient for trade reforms is barely significant at the 10 percent level. Although the findings on fiscal reforms might appear counterintuitive, the high proportion of successful fiscal reforms implemented in parallel might drive it. The externality effects of successful fiscal reforms might drive the positive and significant coefficient.

Table 9. Impact of unsuccessful on labor productivity growth

	Financial reforms	Fiscal reforms	Real sector reforms	Trade reforms
Reforms	-1.121*** (0.091)	0.705*** (0.044)	-3.975*** (0.308)	0.115* (0.060)
Observations	5,126	8,347	7,987	2,615
R-squared	0.2376	0.2516	0.2535	0.1783

Notes: The table presents standardized coefficients of the impacts of reforms Not Met on firm-level labor productivity growth. The specifications include firm's individual characteristics, sector and year fixed effects. At the macroeconomic level, the specifications include the average growth of GDP, the level of inflation, and the quality of policies and regulations related to the private sector and country fixed effects. All estimates use the weights and are standardized so that can be compared across structural reforms. Robust standard errors clustered at the country level are in parentheses. ***, **, * denote significance at the 1, 5, and 10 percent level.

VI. CONCLUDING REMARKS

Structural reforms are at the core of policy advice to developing countries. Reforms are expected to ensure a sound macroeconomic and non-distortionary environment, improve productivity, deliver sustainable and inclusive growth, and raise long-term living standards. Several papers have analyzed the issue at the macroeconomic level, but few have focused on the transmission from macroeconomic reforms to the firm level productivity in developing countries.

This paper takes advantage of original data sets (structural reforms from the IMF and enterprise surveys from the World Bank) and examines the impact of structural reforms at the macroeconomic level on firms' productivity. Structural reforms computed from the IMF Monitoring of Fund Arrangements (MONA) database are based on conditionalities implemented (met as planned and met with minor delay) under IMF-supported arrangement programs. Using the economic description of each reform, we regroup reforms into four different classes: financial, fiscal, real sector, and trade reforms. Firms' characteristics and productivity measures are culled from the World Bank Enterprise Surveys (WBES) database.

The paper finds strong evidence that structural reforms are associated with productivity improvement in developing countries. All structural reforms considered in this paper (financial, fiscal, real sector, and trade reforms) have positive effects on firms' productivity. Interestingly, the real sector reform turns out to be the reform with the most sizable impact on firms' productivity. In addition, being a "strong reformer" is associated with higher productivity gains. Furthermore, the relationship between structural reforms and firms' productivity is nonlinear and influenced by certain firm characteristics, such as financial access, whether facing a distortionary environment, and size. We find that financial inclusion strengthens the impact of financial and fiscal reforms on firms' productivity; being a small firm enhances the impact of financial reforms on firms' productivity; and the effects of fiscal and trade reforms on firms' productivity are hindered by distortions. Finally, we find that, except for financial and trade reforms, all macroeconomic reforms considered are bilaterally complementary in improving firms' productivity.

In sum, we find that structural reforms are key to stimulate firms' productivity in developing countries. The design of reforms should be comprehensive and account for complementarities and nonlinearities between reforms. The standardized WBES data set used in this paper focuses only on the formal sector, while in low and low middle-income countries, an important share of the labor force works in the informal sector. Our findings capture, therefore, the productivity gain from reforms in the formal sector. As both the informal and formal sectors are interrelated in developing countries, we should expect the gains from reforms to spread over the informal sector through the externality effects and potential encouragement for informal firms to move into the formal sector. Similarly, this paper does not account for structural reforms not supported by IMF programs due to lack of data assessing successful reforms. However, our findings on complementary factors let us suggest that the coexistence of an IMF supporting program with other types of reforms will have a higher impact on labor productivity growth.

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APPENDICES

Appendix A – Sample balance checks

Table 10. Sample balance – Countries under program vs Countries not under program			
	Countries not under program	Countries under program	p-value (diff ≠ 0)
Current account balance (% of GDP)	-2.355 (24.378)	-4.986 (5.466)	0.257
Public debt (% of GDP)	79.01 (90.057)	67.67 (52.44)	0.191
Overall balance (% of GDP)	-1.879 (9.328)	-2.513 (3.378)	0.466
Inflation rate (%)	14.005 (46.817)	7.644 (7.730)	0.166
GDP growth (%)	2.573 (5.338)	3.207 (4.344)	0.220
Official exchange rate (LCU per US $))	139.10^5 (306.10^6)	337.3 (473.50)	0.613
Interest payment on external debt (% exports)	3.582 (5.523)	3.544 (2.706)	0.942
Notes: Public debt and fiscal balance data are from the World Economic Outlook 2017. The other variables are from the World Development Indicators. Standard errors in parentheses.			

Table 11. Sample balance - Strong reformers vs Weak reformers			
	Top reformer	Weak reformer	p-value (diff ≠ 0)
Current account balance (% of GDP)	-4.568 (6.203)	-5.389 (4.668)	0.429
Public debt (% of GDP)	66.94 (44.00)	68.34 (59.50)	0.3024
Overall balance (% of GDP)	-2.448 (2.823)	-2.581 (3.902)	0.831
Inflation rate (%)	6.789 (6.500)	8.549 (8.826)	0.2454
GDP growth (%)	3.532 (4.342)	2.900 (4.357)	0.4130
Official exchange rate (LCU per US $))	328.58 (368.24)	345.75 (559.52)	0.841
Interest payment on external debt (% exports)	3.779 (2.729)	3.317 (2.687)	0.357
Notes: Public debt and fiscal balance data are from the World Economic Outlook 2017. The other variables are from the World Development Indicators. Standard errors in parentheses.			

Table 12. Impact of the structural reforms on labor productivity growth – Low Income Countries				
	Financial reforms	Fiscal reforms	Real sector reforms	Trade reforms
Reforms	1.475*** (0.0407)	0.438*** (0.0121)	5.432*** (0.150)	0.385*** (0.0106)
Observations	10,822	10,822	10,822	10,822
R-squared	0.2608	0.2608	0.2608	0.2608
Notes: The table presents standardized coefficients of the effects of reforms on firm-level labor productivity growth in Low Income Countries. The specifications include firm's individual characteristics, sector and year fixed effects. At the macroeconomic level, the specifications include the average growth of GDP, the level of inflation, and the quality of policies and regulations related to the private sector and country fixed effects. All estimates use the weights and are standardized so that can be compared across structural reforms. Robust standard errors clustered at the country level are in parentheses. ***, **, * denote significance at the 1, 5, and 10 percent level.				

Appendix B – List of countries and statistics

Table 13. Indexes of reforms by countries

Country	Approval year	End year	Aggregate index of reforms	Fiscal reforms	Financial reforms	Trade reforms	Real sector reforms
Afghanistan	2011	2014	-0.6117583	-1.362004	1.695302	-0.2988166	-0.5703603
Armenia	2005	2008	1.071619	1.239591	0.7974541	-0.6068032	-0.2633663
	2009	2011	-0.7301394	-0.6306869	-0.0966838	-0.3278063	-0.8216249
Bangladesh	2003	2006	0.1596279	0.2731389	0.1791924	1.36533	-0.6276057
Bolivia	2003	2004	0.161249	0.1138408	0.971172	-0.6915562	-0.6716594
Bosnia and Herzegovina	2009	2012	-0.2526479	-0.103032	-0.0966838	-0.3278063	-0.8216249
Burkina Faso	2003	2006	0.2681517	1.457129	-1.070609	-0.5973788	-0.6276057
Burundi	2008	2011	1.604923	2.351658	-0.768036	-0.2988166	-0.5703603
Central African Republic	2006	2009	1.179827	1.611847	-0.544629	-0.3278063	-0.8216249
Congo, Rep.	2004	2007	0.9192942	1.964554	-0.7581587	-0.5973788	-0.0323602
Congo, Dem. Rep.	2009	2012	1.16401	1.925937	-0.5880653	-0.131852	-0.7319708
Djibouti	2008	2011	0.4113255	0.2295654	0.4636328	3.344147	-0.5703603
Dominican Republic	2005	2007	2.140975	1.338853	3.291972	-0.6068032	0.4801811
El Salvador	2009	2010	-1.20969	-1.065978	-1.174547	-0.363407	-0.6980247
Ethiopia	2009	2010	-0.9688852	-0.7626007	-0.9925742	-0.3278063	0.133477
Ghana	2003	2006	0.0511042	0.6114219	-0.4457083	-0.5973788	-0.3299829
	2009	2012	0.9228674	1.113771	-0.768036	-0.2988166	0.7362494
Guatemala	2003	2004	-0.9372912	-0.7566683	-0.5873028	-0.5705534	-0.8791274
Honduras	2004	2007	0.0510605	-0.1155414	1.336038	-0.6915562	-0.6716594
	2008	2009	-1.566127	-1.539762	-0.8655577	-0.6068032	-0.6351399
Kosovo	2010	2012	-1.327004	-1.026428	-0.9925742	-0.3278063	-0.8216249
Kyrgyz Republic	2005	2008	-0.2828995	-0.6463987	0.5895776	-0.6068032	0.1084074
Madagascar	2006	2009	-0.2828995	0.0484395	-0.8655577	0.4321579	-0.2633663
Malawi	2005	2008	-0.4967707	-0.2493483	-0.4498048	-0.6068032	-0.6351399
Mali	2004	2007	-0.5627232	-0.5339202	-0.9177791	0.6061228	0.8635321
Mauritania	2003	2006	-0.8312215	-0.48808	-1.069804	-0.5705534	-0.8791274
	2010	2013	-0.7385685	-0.4416437	-0.3839962	-0.2264968	-0.3067944
Moldova	2006	2009	0.2161335	-0.3486109	1.005331	1.471119	0.1084074
	2010	2013	0.2408115	0.4064064	0.1557156	-0.2988166	-0.5703603
Mongolia	2009	2010	-0.7301394	-0.7626007	-0.0966838	-0.3278063	0.133477
Nepal	2003	2006	-0.4567616	-0.3874089	0.0243646	-0.5018527	-0.4363659
Nicaragua	2002	2010	0.7088156	0.0521254	0.5896508	-0.5018527	1.188507
Niger	2005	2008	0.6438761	1.239591	-0.6576812	0.4321579	-0.2633663
Pakistan	2008	2010	-0.133275	0.0288818	-0.544629	-0.3278063	0.133477
Rwanda	2006	2009	0.0217124	0.0840037	0.3855484	-0.363407	-0.6980247
Senegal	2003	2006	-0.1659433	0.4422804	-1.070609	-0.5973788	-0.0323602
Tajikistan	2002	2005	-0.3829908	-0.065144	-0.4457083	-0.5973788	-0.3299829
	2009	2012	-0.2707303	-0.6546399	-0.1522016	-0.2988166	1.171786
Tanzania	2000	2003	2.881218	3.003569	0.8602014	2.71838	0.321443
	2007	2010	0.2248436	0.2927093	-0.0966838	-0.3278063	0.133477
Uganda	2006	2009	-0.7301394	-0.6306869	-0.0966838	-0.3278063	-0.8216249
Ukraine	2010	2012	-0.9688852	-1.026428	-0.544629	-0.3278063	1.088579
Yemen, Rep.	2010	2013	-1.327004	-1.158342	-0.9925742	-0.3278063	0.133477
Zambia	2008	2011	0.0119912	0.1040548	-0.0487214	-0.131852	-0.1886481

Table 14. Descriptive statistics by country

Country	Year	Number of observations	Average labor productivity growth	Number of successful reforms
Afghanistan	2014	410	2.73	11
Armenia	2009	374	22.33	37
	2013	360	5.28	7
Bangladesh	2007	1504	0.69	18
Bolivia	2006	613	13.49	16
Bosnia and Herzegovina	2013	360	2.22	11
Burkina Faso	2009	394	1.12	19
Burundi	2014	157	-5.44	24
Central African Republic	2011	150	5.95	23
Congo, Rep.	2009	151	19.68	25
Congo, Dem. Rep.	2013	529	9.53	22
Djibouti	2013	266	0.41	17
Dominican Republic	2010	360	1.03	52
El Salvador	2010	360	3.34	0
Ethiopia	2011	644	7.14	5
Ghana	2007	494	12.78	17
	2013	720	16.02	20
Guatemala	2006	522	7.29	1
Honduras	2006	436	9.21	15
	2010	360	14.73	0
Kosovo	2013	202	5.90	2
Kyrgyz Republic	2009	235	11.37	18
Madagascar	2009	445	6.54	18
Malawi	2009	150	15.16	15
Mali	2010	360	42.96	14
Mauritania	2006	237	-1.84	2
	2014	150	-1.46	14
Moldova	2009	363	13.70	25
	2013	360	4.26	16
Mongolia	2013	360	1.81	7
Nepal	2009	368	1.12	15
Nicaragua	2010	336	5.41	26
Niger	2009	150	-1.94	31
Pakistan	2013	1247	7.17	12
Rwanda	2011	241	-2.20	16
Senegal	2007	506	-1.46	15
Tajikistan	2008	360	23.60	13
	2013	359	18.90	13
Tanzania	2006	419	14.05	37
	2013	813	-30.88	15
Uganda	2013	762	-17.69	7
Ukraine	2013	1002	-0.63	5
Yemen, Rep.	2013	353	-7.61	2
Zambia	2013	720	9.51	14