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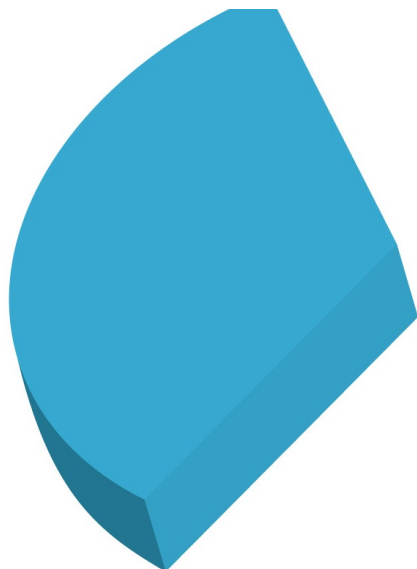
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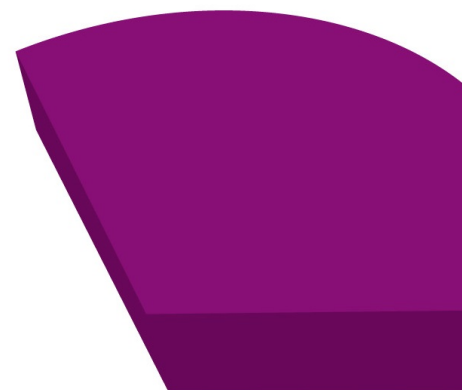
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Inflation Targeting and Developing countries' Performance : Evidence from Firm-Level Data

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Abstract

We examine the impact of inflation targeting on manufacturing firm performance for a panel of 30,993 firms in 46 developing countries from 2006 to 2020. Using the entropy balancing method, thus mitigating potential endogeneity issues, we show that inflation targeting increases firm growth and productivity in targeting countries compared to non-targeting ones. Our findings are economically meaningful and robust to various checks. Moreover, we provide evidence that our results are not biased towards unobservables nor are they confounded with the effects induced by other reforms, such as IMF programs. The paper further examines a few heterogeneity features of the treatment effect, depending on some factors. Specifically, economic and institutional factors such as the quality of regulation, fiscal discipline, central bank deviations from announced targets, and natural resource endowments also influence the link between the monetary framework and firm performance. Finally, we explore the main transmission channels and identify monetary policy credibility as the key driver of the regime's effectiveness.

Keywords : • Inflation targeting • Manufacturing firm performance • Developing countries
• Entropy balancing • Monetary policy credibility

JEL Classification : E22, E23, E31, E51, D22, D24

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1 Introduction

Over the past decades, developing countries have implemented numerous reforms to set their economies on a path of sustained and sustainable growth. A long tradition of examining the impact of structural reforms on the performance of developing countries is found in the literature. Overall, empirical evidence suggests that economic reforms foster growth ([Abiad et al., 2010](#); [Prati et al., 2013](#); [IMF, 2014](#)), reduce financial constraints ([Quinn and Toyoda, 2008](#)), or increase productivity and job creation ([Larrain and Stumpner, 2017](#); [Bordon et al., 2018](#)). Other studies show a strong complementarity between economic reforms and the institutional framework, notably property rights protection ([Tressel and Detragiache, 2008](#)). Another part of the literature focuses on the microeconomic implications of structural reforms, particularly those related to financial and trade sectors, assessing their impact on firm performance ([Rajan and Zingales, 1996](#); [Galindo et al., 2007](#); [Larrain and Stumpner, 2017](#); [Kouamé and Tapsoba, 2019](#)).

Besides financial and trade sector reforms, the 1970s and 1980s witnessed the emergence of monetary regime reforms, in a context marked by a surge in inflation in many countries. Indeed, in the aftermath of the collapse of the Bretton Woods system, countries whose currencies were pegged to the US dollar had to find a monetary policy framework that would substitute the Bretton Woods exchange rate system. Exchange rate targeting, adopted by the majority of developing countries during the 1970s, 1980s and early 1990s, failed due to the massive increase in capital that led to rising inflationary pressures. In 1990, New Zealand became the first to adopt a new monetary framework based on inflation targeting objectives. This new monetary policy framework involves an explicit announcement by the central bank of a quantitative level of inflation and its commitment to achieve this target to ensure price stability.

Since the 1990s, inflation targeting has spread widely in many developing countries, especially after the Asian crisis. One of the main reasons for the increasing diffusion of this new monetary regime is the effectiveness and credibility it provides to monetary institutions in the conduct of their policy ([Walsh, 2009](#); [Bordo and Siklos, 2014](#)). The early 2000s were marked by a substantial body of empirical work on the economic effects induced by the adoption of this new monetary policy framework. A number of empir-

ical studies show that inflation targeting improves developing country performance, by reducing the level and volatility of inflation (Neumann and Von Hagen, 2002 ; Lin and Ye, 2009), interest and exchange rate volatility (Vega and Winkelried, 2005 ; Lin, 2010), output volatility in the presence of exogenous shocks (Fratzscher et al., 2020), by lending credibility to the central bank (Pétursson et al., 2004), or promoting fiscal discipline (Lucotte, 2012 ; Minea and Tapsoba, 2014 ; Combes et al., 2018; Ogrokhina and Rodriguez, 2018; Minea et al., 2020).

The benefits of inflation targeting on developing country performance raise further interrogations, notably regarding its influence on the activity and behaviour of domestic firms. Does inflation targeting adoption enhance manufacturing firm performance in developing countries ? So far, the literature dealing with the effects of inflation targeting has focused mainly on the macroeconomic impacts induced by the adoption of the monetary framework, associating it in particular with enhanced monetary policy credibility or greater fiscal discipline. In this paper, we look at the side effects induced by the adoption of the regime, examining its impact on firm performance. Thus, the framework adopted in this study allows us to capture the effect of the policy at a disaggregated level, in contrast to the standard literature that invariably focuses on purely macroeconomic effects.

This paper contributes to the literature on four grounds. We ask whether inflation targeting improves firm performance in developing countries, using 30,993 manufacturing firms in 46 countries over the period 2006-2020. First, we provide a relevant theoretical framework to identify the main channels through which inflation targeting might affect firm outcomes. We thus document the link between volatility and economic performance and argue that enhanced monetary policy credibility resulting from inflation targeting adoption — involving greater macroeconomic stability — is the main channel through which the monetary framework might affect firm performance.

Second, we empirically quantify the effect of inflation targeting on firm sales and productivity growth. To sharpen identification, we address the potential selection bias associated with the treatment, using a novel identification strategy : the entropy balancing method developed by Hainmueller (2012). One reason for the superiority of this method over traditional program evaluation approaches such as propensity score match-

ing methods is that entropy balancing combines both matching and linear regression, allowing to control for individual and time-fixed effects in the second stage. Our results suggest that inflation targeting adoption increases firm sales and productivity growth in countries that adopt the policy, compared to those that do not, with economically meaningful effects. These findings are robust to a series of tests, including a fixed effects estimation, alternative samples, and additional controls. Moreover, we show that inflation targeting increases total factor productivity, value added per worker, investment and firm export capacity. These results could potentially be driven by confounding factors, such as the adoption of other reforms over the study period. Nevertheless, a sensitivity analysis reveals that our coefficients are not spurious and confounded by shocks, unobserved trends, or other reforms such as IMF programs.

Third, we highlight some heterogeneity features of the treatment. On the one hand, we find that inflation targeting is more effective in countries with sound institutions that encourage private sector development, and countries with good fiscal discipline and reputation. On the other hand, the effectiveness of the regime is mitigated in the presence of large deviations of achieved inflation from the announced targets. Moreover, we provide some evidence that inflation targeting helps reduce the risk of exposure of manufacturing firms to Dutch disease in resource-rich countries.

Fourth, the paper empirically analyzes the different transmission channels through which the effect of the monetary regime could transit. First, we highlight that inflation and its volatility, as well as interest rate and exchange rate volatility, are factors that negatively affect firm performance. We then show that enhanced macroeconomic stability resulting from the adoption of the monetary framework is the main channel through which inflation targeting operates. This contribution therefore underlines the importance of monetary policy credibility in anchoring public expectations and reducing distortions arising from uncertainty, in line with previous findings in the literature.

Our paper relates to research trying to isolate the microeconomic effects induced by policies implemented at national or regional level.¹ Rather than focusing on macroe-

¹Among the studies that assess the effect of macroeconomic policies on microeconomic behaviour, we can cite the famous work of [Card and Krueger \(1993\)](#). Instead, regarding the literature on inflation targeting, to the best of our knowledge, we are the first to assess the effect of this regime on disaggregated data.

conomic factors, we analyze the side impacts induced by the inflation targeting regime at a more disaggregated level, drawing two conclusions. First, in line with previous work, volatility matters for firm outcomes. Second, inflation targeting, by fostering greater macroeconomic stability, improves firm performance, which reveals the benefits of enhancing monetary policy credibility over public expectations.

The article is organized as follows. The following section offers a relevant theoretical framework linking the monetary regime and firm outcomes. Section 3 reports some stylized facts. Section 4 presents our empirical methodology. Section 5 describes our data. Our main findings are presented in Section 6. Section 7 analyzes the sensitivity of our results. Section 8 deals with the key transmission channels. A last section concludes.

2 Theoretical background

Inflation targeting (IT) is one of many factors that can influence firms' expected returns and the predictability of economic conditions. In this section, we provide an appropriate theoretical framework to identify the main channels through which the monetary regime may affect firm activity. First, we briefly review the literature dealing with volatility and economic performance. Then, we discuss monetary policy credibility as a potential transmission channel for the effect of inflation targeting on firm performance.

2.1 Volatility and economic performance

A general approach. The literature on the effects of macroeconomic volatility is long-standing and well documented. Among the pioneering theoretical models, we can cite those of Lucas Jr (1967) and Nickell (1974), which highlight the negative effect of uncertainty on investment in the presence of adjustment costs, or when there is irreversibility in the production process. The theory of investment under uncertainty made a major advance in the 1990s following Dixit et al. (1994), who offered an explicit formalization of the negative impact of uncertainty on investment. Since then, this literature has expanded widely and is structured around two concepts : irreversibility and expectation under uncertainty. Indeed, macroeconomic volatility, by creating uncertainty, reduces

the predictability of the business cycle, which can significantly affect investment through *irreversibility effects* (Carruth et al., 2000; Dixit and Pindyck, 2012). Such repercussions stem from the fact that investment involves irreversible costs that affect firms' earnings or expected profitability. Hence, if the economic outlook is not good, it is worth waiting as it gives the entrepreneur the opportunity to process new information before making the effective investment decision. Thus, when faced with uncertainty, investors tend to adopt a *wait-and-see strategy* and postpone investment decisions until uncertainty is resolved (Bachmann and Bayer, 2013; Stokey, 2016). Empirical evidence of the effect of volatility on economic performance is found in the literature. For example, using a panel of 42 developing countries, Aizenman and Marion (1999) show that higher volatility reduces the average rate of investment, with proportional effects to the magnitude of variability in different macroeconomic indicators. Similar evidence is provided by Gavin and Hausmann (1998) for Latin American economies. Studies have also looked at firm-level data to investigate the impact of uncertainty on firms' investment behaviour. For instance, using an error correction model (ECM) of investment on a panel of 672 UK listed manufacturing firms over the period 1972-1991, Bloom et al. (2007) provide empirical evidence that stock price volatility, leading to high uncertainty, makes firms more cautious when investing. These results are further corroborated by Chong and Gradstein (2009) on a detailed cross-country firm-level dataset. Additionally, these authors provide evidence that institutional barriers amplify the negative effect of perceived volatility on firm growth. Finally, according to some studies, uncertainty can also negatively affect total factor productivity, as it leads to an inefficient allocation of the factors of production across firms (Bloom et al., 2018).

Exchange rate volatility and economic performance. It is well known that exchange rate volatility is also a major factor affecting economic performance. Indeed, in an open economy with a fully flexible exchange rate system, exchange rate movements also impact domestic prices through imported goods (*exchange rate pass-through effect*). A rise in domestic prices may result in higher production costs, leading to a deterioration in the investment environment. This effect can be significant and contribute to inflation persistence (e.g. see Agénor, 2000; and Gagnon and Ihrig, 2004). That said, there is a high degree of complementarity between exchange rate stability and inflation stability

(Devereux and Yetman, 2014). Belke and Gros (2001), drawing on the model of Dixit (1989), consider that the return on investment is composed of two factors : a certain element, and a random one, which is closely linked to exchange rate movements. Thus, at each period t , an exchange rate movement increases the value of the *wait-and-see strategy* relative to the immediate investment strategy. In other words, as with inflation volatility, exchange rate uncertainty leads to a delay in investment decisions. Regarding studies using macroeconomic data, a significant negative impact of exchange rate volatility on investment is reported by most cases (e.g. see Serven, 1998; Bleaney and Greenaway, 2001; Servén, 2003). Yet, there is limited empirical evidence on the impact of exchange rate volatility on firm performance. Nevertheless, some stylized facts seem to emerge from the existing literature. Kelilume (2016)'s work on Nigeria over the period 2004-2013 suggests that the higher the exchange rate volatility in the economy, the lower the performance of firms. Similarly, Vo et al. (2019), conducting an analysis for the manufacturing sector in Vietnam over the period 2000-2015, show that exchange rate volatility disadvantages manufacturing exports in the long run. Finally, Khosrowzadeh et al. (2020) investigate the impact of exchange rate movements on investment risk in the Iranian petrochemical industry, using time series data from November 2008 to March 2019. Their results show that exchange rate movements have had a direct and significant effect on the investment risk of this industry, thus supporting the conclusions of previous studies.²

2.2 Credibility as a transmission channel of monetary policy on firm performance

Based on the existing literature, we believe that IT may affect firm performance through one main channel, namely : monetary policy credibility.³ As argued by Kydland and Prescott (1977), credibility is a key factor in the conduct of monetary policy, as it in-

²Empirical analyses also show a negative influence of exchange rate volatility on foreign direct investment (see e.g. Bénassy-Quéré et al., 2001). This negative effect of exchange rate volatility on FDI can in turn be transmitted to domestic private investment (Chauvet and Ehrhart, 2018).

³Another potential channel for the impact of IT on firm performance could be related to variations in fiscal variables, induced by the disciplinary effect of the monetary regime on government behaviour. (e.g. see Lucotte, 2012; Minea and Tapsoba, 2014; and Combes et al., 2018). However, this effect would rather be an indirect channel.

fluences public expectations and implies a weak effort by the central bank to achieve the announced target. The literature provides empirical evidence that the explicit announcement of an inflation target plays an important role in coordinating expectations and significantly increases the credibility of monetary policy in developing countries, thus reducing inflation and its volatility, interest rate, exchange rate, and output volatility (Neumann and Von Hagen, 2002; Minella et al., 2003; Calderón et al., 2004 Vega and Winkelried, 2005; Rose, 2007; Gonçalves and Salles, 2008; Lin and Ye, 2009; Lin, 2010; López-Villavicencio and Pourroy, 2019; and Fratzscher et al., 2020).⁴ Furthermore, monetary policy credibility is enhanced by the frequent communications held by central banks that adopt inflation targeting, e.g. in the form of a quarterly or half-yearly publication of an « inflation report » (Mishkin and Posen, 1998; and Bernanke et al., 2018).

Regarding empirical evidence, in a study focusing on the Brazilian economy, de Mendonça and Lima (2011) analyze some determinants of investment, over the period from January 2000 to September 2009. Their results suggest that enhanced credibility, by improving the anchoring capacity of public expectations and reducing uncertainty, allows for an efficient increase in investment. Elsewhere, credibility is also an important factor in boosting entrepreneurial confidence. According to Montes (2013), greater confidence and optimism among entrepreneurs about the macroeconomic environment and about their own business is conducive to investment decisions. Testing this channel in the case of Brazil over the period 2001Q4 to 2011Q2, the author shows that credibility helps build business confidence and promotes investment.⁵ Finally, a credible monetary policy framework — notably inflation targeting — that anchors inflation expectations and stabilizes inflation, tends to limit exchange rate movements and reduce exchange rate pass-through. Empirical evidence is provided by Aleem and Lahiani (2014) for Latin American and East Asian countries, or López-Villavicencio and Pourroy (2019) on a sample of 48 advanced and emerging economies over the period 1982-2016.

⁴The most immediate effect of IT is on the level of inflation. However, there is a strong correlation between the level of inflation and its volatility. On the one hand, Ball (1992) states that high inflation leads to uncertainty about future monetary policy, which in turn results in higher volatility. On the other hand, the relationship may also be made in the reverse direction. Cukierman and Meltzer (1986) and Devereux (1989), through Barro-Gordon models of time-consistent policy, explain that an increase in the variance of inflation leads to an increase in average inflation in the discretionary equilibrium.

⁵Similar evidence is further provided by de Mendonça and Almeida (2019).

Last but not least, interest rate volatility is also a key factor in the transmission of monetary policy shocks. Yet, interest rate movements are also closely linked to those of inflation. For instance, in a context of high inflation, a central bank following the Taylor rule will pursue a restrictive monetary policy by increasing the interest rate. High interest rates in turn limit access to credit and depress investment demand, as is well known in the traditional neoclassical framework (Harrison et al., 2004 and Beck et al., 2005).⁶ Meanwhile, credit constraints also reduce the likelihood of exporting through the increased cost of accessing international markets (Berman and Héricourt, 2010). However, achieving a relatively low inflation target under the monetary inflation targeting framework may prevent interest rate increases from converging inflation towards the target. Using OLS estimates to test the impact of different credibility indices on interest rate volatility, de Mendonça and e Souza (2009) provide empirical evidence for the Brazilian economy that higher credibility involves smaller changes in the interest rate to control inflation. This result deserves to be paralleled with that of Montes (2013) who provides evidence that changes in the short-term interest rate have a significant impact on the real cost of capital and hence on firms' investment decisions.⁷

Thus, in our view, monetary policy credibility is the main channel through which inflation targeting might affect firm performance. This involves inflation, exchange rate, and interest rate stability; lower price increases in response to nominal exchange rate shocks; or lower interest rate increases to break inflationary expectations.⁸ Therefore, our main hypothesis is the following : by stabilizing the macroeconomic environment, inflation targeting should reduce uncertainty and improve the predictability of the business cycle, and hence business investment decisions. Increased private investment may, in turn, boost sales and productivity. Additionally, by limiting the exchange rate pass-

⁶Asset prices, such as stocks, bonds or real estate, could also be another transmission channel for monetary policy. This mechanism is closely linked to changes in the interest rate through a wealth effect. However, in the context of this study, this channel is probably of little relevance for developing countries as the participation of these firms in stock markets is generally low. Similarly, for foreign firms, the relevant wealth effect depends on the market in which they are listed. Finally, Bretscher et al. (2022) show that uncertainty also generates risk premium shocks, which can restrict the flow of credit to households and firms.

⁷This study supports Episcopos (1995)'s earlier work that showed that firms are sensitive to changes in the real interest rate.

⁸The different channels highlighted may be highly correlated and thus exert a combined influence on the expectations of entrepreneurs through the distortions they create in the relative price structure of tradable goods.

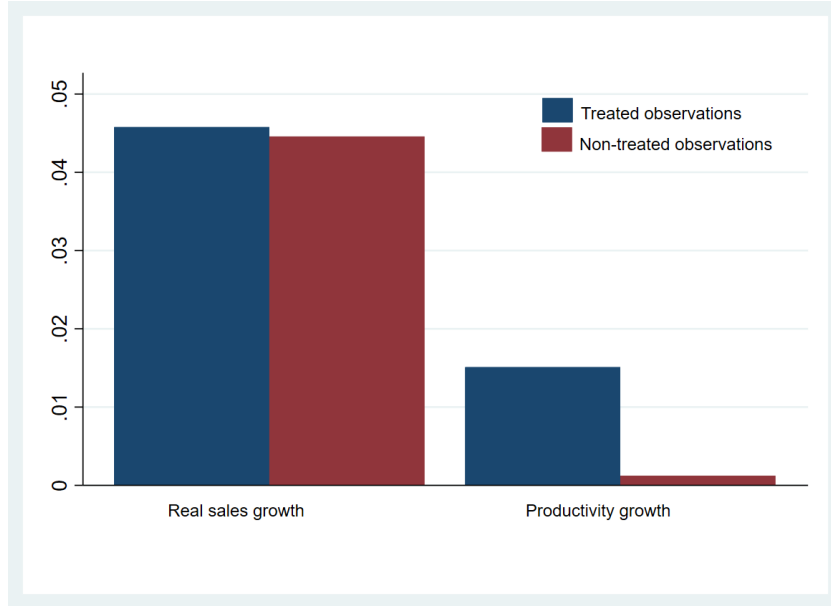
through effect, interest rate volatility (Vega and Winkelried, 2005), or by keeping interest rates low, inflation targeting should make firms less vulnerable to exchange rate or global interest rate shocks and relax investment constraints for firms, particularly for the most constrained.

3 Stylized facts

This section reports correlational evidence linking the monetary regime, average sales growth, and average productivity growth of the firms in our sample, over the period 2006-2020. Figure 1 presents the average rates of sales and productivity growth between treated and untreated observations. Although the average sales growth appears to be slightly higher for the treated observations, the registered difference is rather negligible and close to zero. However, the treated observations record a much higher average productivity growth than the untreated ones, with a difference of about 0.02 percentage points. This gap has to be related to our outcome indicators, bounded between -1 and 1.⁹ Finally, these stylized facts simply correlate our dependent variables with the treatment, but do not provide any causal relationship.

⁹Subsection 5.4 details the calculation method used.

Figure 1: Average sales and productivity growth rates between treated and untreated observations (2006-2020)



Notes : The statistics cover 30,993 firms in 46 developing countries, surveyed between 2006 and 2020. We consider 13,358 treated observations (firms located in countries operating under inflation targeting) and 17,635 untreated observations. We compute sales and productivity growth over the last three years. Labor productivity in a given year is calculated as the ratio of total sales to the number of workers.

4 Empirical methodology

Our analysis considers an observation as treated when the country is operating under inflation targeting. Since most countries that adopted IT emerged from a foreign exchange crisis or episodes of very high inflation, one may have selection concern as inflation targeting adoption may be correlated with unobservables which may also affect the overall performance of the economy, and thus potentially that of domestic firms. To allay this concern, we rely on a matching approach.

We consider two potential outcomes for each firm depending on whether it is exposed to the treatment or not, i.e. located in a country with an inflation targeting regime at a given time. We denote by Y^0 the firm's outcome when not situated in a target country ($T = 0$) and Y^1 the outcome associated with $T = 1$ (treated observations). Therefore, the causal effect corresponds to the difference between the situation due to the firm's exposure to the treatment and its situation in its absence. We adopt a counterfactual framework composed of untreated firms, but otherwise make up a potential control

group. If treatment assignment were random, a simple approach would be to compare average performance levels between treated and untreated units. However, as discussed earlier, this method is not relevant given the potential selection bias.

The matching approach is to reproduce a situation close to a setting where units would be randomly assigned to treatment. The latter are matched to those not exposed to treatment, based on their pre-treatment observable characteristics which are as comparable as possible. Then, the outcome variable from the matching or the average treatment effect on the treated (ATT) can be formalized as follows :

$$ATT(\chi) = E[Y_{i1}|T_i = 1, X = \chi] - E[Y_{i0}|T_i = 0, X = \chi] \quad (1)$$

χ is a set of pre-treatment country-level covariates described in subsection 5.2, correlated with treatment adoption and potentially correlated with the outcome variable. $E[Y_{i1}|T_i=1, X=\chi]$ is the expected outcome for the treated units, and $E[Y_{i0}|T_i=0, X=\chi]$ is the expected outcome for the best counterfactuals of the treated units.

In this study, we use the entropy balancing method of [Hainmueller \(2012\)](#) to match treated units with their untreated counterfactuals. This methodology was recently used by [Neuenkirch and Neumeier \(2016\)](#) to assess the impact of US sanctions on poverty, or [Balima \(2017\)](#) and [Balima et al. \(2021\)](#) to analyze the effect of domestic bond markets participation on financial dollarization, and the role of IMF-supported programs in mitigating the probability of subsequent sovereign defaults in borrowing countries, respectively. Entropy balancing is a two-step estimation method. The first step is to compute and apply weights to unit not subject to treatment, such as the average of pre-treatment variables in the control group is not statistically different from their average in the treated group. This step allows creating a synthetic group, not exposed to the treatment, but with pre-treatment observables close to the treated group. Then, in the second step, the weights resulting from entropy balancing are used in a regression analysis with the treatment indicator as an explanatory variable to neutralize the potential influence of pre-treatment differences on the treatment effect.

As pointed out by [Neuenkirch and Neumeier \(2016\)](#), entropy balancing has several advantages over traditional matching methods. First, unlike the propensity score matching

methods or the difference-in-differences estimator, entropy balancing is a non-parametric approach, thus requiring no specification of the functional form of the empirical model or the treatment assignment procedure, which may avoid specification errors or collinearity problems. Second, entropy balancing ensures a sufficient balance of pretreatment characteristics between treatment and control groups, even in the presence of a small sample or a limited number of untreated units. This makes it possible to construct a suitable control group, representing a near-perfect counterfactual of the treated group. Finally, in the second step, the estimator exploits the longitudinal nature of the data by including individual and time-fixed effects to control for heterogeneity across units and bias due to changes over time, independent of treatment.

5 Data

Firm-level data are extracted from the stacked World Bank Enterprise Surveys (WBES). The WBES database collects nationally representative firm-level surveys in developing countries using a standard sampling methodology — a representative sample (stratified random sampling) — with a standard questionnaire. We use the standardized dataset conducted between 2006 and 2020, which has a pseudo-panel structure consisting of aggregations of individual data from comparable surveys conducted in different periods.

We retained a sample of 30,993 manufacturing firms examined in 46 developing countries. The choice of this sample was conditioned by the availability of data, so that the countries selected have sufficient information at firm level on all the variables used in this study.¹⁰ We consider 13,358 treated observations (under IT) and 17,635 untreated observations (without IT). The potential synthetic control group (untreated units) widely covers the treatment group, which may allow us to obtain a good weighted control group for our treatment group.

¹⁰For comparison, using the same database over 2006-2014, [Kouamé and Tapsoba \(2019\)](#) examine the impact of structural reforms on firm productivity in a panel of 37 developing countries.

5.1 Treatment variable

We measure the treatment through a binary variable equal to 1 when a country is under inflation targeting in the year t , and zero otherwise. The literature generally considers two reference dates. Soft or informal inflation targeting is defined as the central bank's adoption date. In contrast, full-fledged or hard inflation targeting is defined regarding the adoption date declared by scholars.¹¹ Our sample consists of fifteen target countries. While Dominican Republic, Russia, and Kazakhstan that adopted IT between 2011 and 2017 are considered as controls in previous work (e.g., see [Lin, 2010](#); [Minea and Tapsoba, 2014](#); and [Ogrokhina and Rodriguez, 2018](#)), we consider them in this study as treated countries, referring to [Jahan and Sarwat \(2012\)](#) and [Cizkowicz-Pękała et al. \(2019\)](#).

5.2 Matching variables

We consider two categories of country-level variables. The first category defines whether a country meets the pre-conditions to begin an inflation-targeting policy. Following [Lin and Ye \(2009\)](#); [Minea and Tapsoba \(2014\)](#); and [Ogrokhina and Rodriguez \(2018\)](#), we include the following variables : the lagged inflation rate, real GDP per capita growth, and fiscal balance. The lagged inflation rate is found to negatively affect IT adoption. Indeed, as discussed by [Masson et al. \(1997\)](#); [Minella et al. \(2003\)](#); and [Truman \(2003\)](#), a country is more likely to adopt an inflation targeting policy when its inflation rate is at a reasonably low level, preferably after successful disinflation. The sign for GDP per capita is often ambiguous (e.g., see [Lin and Ye, 2009](#); and [Lucotte, 2012](#)). One potential explanation for this mixed effect is that countries with good macroeconomic performance are more likely to adopt a credible targeting policy, just as it can be argued that a better economic situation may also reflect the achievement of successful macroeconomic policies and thus crowd out the adoption of a new monetary regime like inflation targeting. Finally, past fiscal discipline may encourage the adoption of the monetary regime, by enhancing the credibility of the monetary authorities. Alternatively, since IT adoption also improves fiscal performance, it can be argued that poor fiscal discipline

¹¹Indeed, in a soft targeting regime, the central bank's reaction following a deviation of inflation from the target is slower than in a full targeting regime.

may also lead the central bank to adopt the targeting regime to promote further fiscal consolidation. Therefore, the correlation between IT and fiscal discipline may in some cases be ambiguous.

The second group considers variables that may affect the probability of adopting exchange rate targeting as an alternative monetary policy framework. This category includes trade openness and the exchange rate regime. These variables are found to negatively affect IT adoption. A common explanation for this effect is that countries that are very open to international trade tend to choose exchange rate parities to protect themselves from exchange rate volatility (e.g., see [Fatás et al., 2007](#); and [Brenner and Sokoler, 2010](#)).

Most of our country-level variables are extracted from the World Bank’s World Development Indicator (WDI) database. Fiscal balance is extracted from [Kose et al. \(2017\)](#). Trade openness is measured by the sum of exports and imports as a share of GDP. The exchange rate regime is constructed from [Ilzetzki et al. \(2017\)](#)’s classification and is captured by a dummy equal to 1 if a country is classified as having a fixed exchange rate regime in the year t , and zero otherwise.

5.3 Firm-level controls

Information on sales and costs is provided in local currencies and at nominal values in the last fiscal year. Therefore, we first convert them to US dollars using the exchange rate variable from the WDI database. Then we adjust all nominal values for inflation, using the GDP deflator from the IMF’s International Financial Statistics (IFS) database. We take advantage of the richness of the WBES database and include a wide range of firm-level controls, such as : firm size; the ownership (share of capital owned by domestic households and firms, the government, and foreigners, respectively); the firm’s age; and the legal status of the company. Firm size is captured by an ordinal qualitative variable equal to 1 for small (less than 20 employees), 2 for medium (between 20 and 99 employees), or 3 for large firms (100 employees and over). The legal status of the company is captured by an ordinal qualitative variable.¹² We also include the logarithm

¹²Shareholding company with shares trade in the stock market, Shareholding company with non-traded shares or shares traded privately, Sole proprietorship, Partnership, Limited partnership, and

of the previous three years' sales to capture initial performance.

Finally, as commonly found in the literature, we include some additional country-level variables : institutional quality (proxied by political stability and the level of democracy), financial development, and access to financial markets. The political stability variable is from the Worldwide Governance Indicators database and ranges from approximately -2.5 (weak) to 2.5 (strong governance). The level of democracy is captured by the Polity V democracy score, ranging from -10 (absolute autocratic regime) to 10 (absolute democratic regime). Financial development is proxied by domestic credit to the private sector as a percentage of GDP. This variable is extracted from the World Bank's WDI database. Finally, access to financial markets provides from IMF's Financial Access Survey database and captures the ability of individuals and businesses to access financial services and products.

5.4 Dependent variables

In this study, we use real sales and labor productivity growth as measures of firm performance. Data on annual sales and workers are provided at the end of the previous fiscal year and three years ago (in $t-3$). Equipped with this dataset, we compute the average annual growth in sales (*Growth*) and labor productivity (*LPG*)¹³ over the last three years. To limit the influence of outliers, we refer to [Iarossi et al. \(2009\)](#) and compute sales growth by dividing the change in sales between $t-1$ and $t-3$ by the average value of initial and final sales. Similarly, the growth in labor productivity is calculated by dividing the change in labor productivity (*LP*) between $t-1$ and $t-3$ by the average value of productivity over this period. *LP* in a given year is calculated as the ratio of total sales to the number of workers. Since there are two points in time between this period, we further follow [Kouamé and Tapsoba \(2019\)](#) and smooth our two variables as

other.

¹³By considering only labor productivity, we make an implicit assumption about the nature of the "technical progress" that is supposed to be fostered by inflation targeting. Here, we assume that technical progress is Harrod-neutral, i.e. that it relates to labor and allows for growth in which the capital-output ratio remains unchanged at the real cost of capital. We further use total factor productivity for robustness.

follows :

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

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

$Growth_{it}$ and LPG_{it} are between -1 and 1, and capture the annual growth of real sales and labor productivity at time t respectively.

Appendix B provides descriptive statistics information for our main variables.

6 Empirical results

6.1 Descriptive statistics

First, we look at some descriptive statistics related to the first stage equation. As mentioned in subsection 5.4, since our dependent variables are computed over three years (between $t-1$ and $t-3$), we lag our country-level variables for two periods to circumvent problems of reverse causality. In other words, inflation rate, real GDP per capita growth, and fiscal balance are averaged from t-4 to t-6.

Panel A of Table 1 shows a simple comparison of pre-weighting sample means of all matching covariates between treated (Column [2]) and control (Column [1]) firms, which represent the potential synthetic group. On average, treated observations register a lower inflation rate and a lower level of trade openness compared to non-treated observations. In contrast, untreated observations have a higher GDP per capita growth rate, and a slightly better fiscal balance than treated ones. Column [5] shows significant differences between the two groups for all pre-treatment variables, as all p-values are equal to zero. Such differences could bias the true treatment effect due to a potential selection problem. Therefore, in Panel B (Column [1]), we compute a synthetic control group by re-weighting the control units using the pre-treatment covariates from the benchmark specification. This approach allows us to make the means of the pre-treatment covariates of the synthetic group as comparable as possible to those of the treated units. As can be seen in Column [5] of Panel B, the weighting eliminated any significant pre-treatment

Table 1: Descriptive statistics and covariate balancing

	[1]	[2]	[3] = [1] - [2]	[4]	[5]
Panel A : Descriptive statistics	Non-treated	Treated	Difference	t-Test	p-Val.
Lag Inflation	6.91	5.71	1.20	17.56	0.00
Lag GDP per capita growth	5.84	3.64	2.20	40.53	0.00
Lag Fiscal balance	-1.15	-1.58	0.43	8.45	0.00
Lag Trade openness	83.02	65.92	17.10	24.89	0.00
Lag Exchange rate dummy	0.16	0.00	0.16	30.03	0.00
Observations	8,418	4,776			
	[1]	[2]	[3] = [1] - [2]	[4]	[5]
Panel B : Covariate balancing	Non-treated	Treated	Difference	t-Test	p-Val.
Lag Inflation	5.70	5.71	-0.01	0.00	1.00
Lag GDP per capita growth	3.64	3.64	0.00	0.01	1.00
Lag Fiscal balance	-1.57	-1.58	0.01	-0.00	1.00
Lag Trade openness	65.92	65.92	0.00	0.00	1.00
Lag Exchange rate dummy	0.00	0.00	0.00	-1.45	0.16
Observations	4,776	4,776			

difference between the means of the treated and synthetic covariates. Thus, we can consider the synthetic group as a perfect counterfactual of the treated group.

6.2 Treatment effects

Second, we assess the effect of inflation targeting on firm performance using the following econometric model :

$$Y_{i,k,j,(t-1,t-3)} = \alpha + \beta T_{j,t-3} + \eta X_{i,k,j,t} + \gamma Y_{j,(t-1,t-3)} + \mu_k + \phi_j + \psi_t + \epsilon_{i,k,j,t} \quad (4)$$

Where $Y_{i,k,j,(t-1,t-3)}$ is a measure of the performance of firm i located in industry k and country j . T is a dummy equal to 1 when when country j is operating under inflation targeting, and zero otherwise. We lag the treatment variable by three years due to the lag in our outcome variables. $X_{i,j,k,t}$ is a set of time-varying firm-level characteristics, including the initial value of sales ($t - 3$). $Y_{j,t-3}$ is a set of country-level variables

averaged between $t - 4$ and $t - 6$. μ_k , ϕ_j , and ψ_j account respectively for industry,¹⁴ country, and time fixed effects, capturing specific characteristics that may be correlated with the treatment. Finally, $\epsilon_{i,k,j,t}$ is the usual idiosyncratic error term assumed to be uncorrelated with the treatment. Following [Chauvet and Jacolin \(2017\)](#) and [Kouamé and Tapsoba \(2019\)](#), we cluster standard errors at the country-level.¹⁵

Entropy balancing estimates. Using the weights computed previously, we estimate Equation 4 from weighted least squares regressions, in which sales and productivity growth are the dependent variables, respectively, and IT is the explanatory variable referring to conservative dates or full-fledged IT.¹⁶ Results for sales growth are reported in Panel A of Table 2, Columns [1]-[2]. The first column considers a simple uni-variate regression that includes only the treatment as an explanatory variable and country, year and industry fixed effects to capture multi-level heterogeneity. Column [2] includes control variables. Results from the first column show a positive and significant effect at the 1% threshold, suggesting that inflation targeting adoption has increased firm sales growth by about 0.03 percentage points (*pps*). The coefficient remains almost constant when we include control variables in the second column. Regarding productivity growth, results in Column [3] suggest a positive and significant effect of inflation targeting, with a magnitude of about 0.06 (*pps*). Although the inclusion of the controls in Column [4] slightly increases the coefficient (0.13 *pps*), the two effects remain qualitatively similar.

Magnitude of the effects. Table 2 suggests that inflation targeting increases firm sales by 0.03 *pps* in treated countries compared to untreated ones. While this effect may seem small, it must be related to the construction of our performance indicators (bounded between -1 and 1) or the average firm performance in our sample. Indeed, a firm with an average annual growth rate of 0.04 (mean value of our sample, see Appendix B) would see its growth rate increase by about 75 percentage points if the country adopted the measure, all other things remaining equal. The difference in the level of productivity growth is considerable, 0.06-0.13 *pps*, which is significantly larger than the

¹⁴Examples include industries in food, construction, electronics, mechanical equipment, motor vehicles, etc.

¹⁵Clustering the standard errors at the country-industry, country-year, industry-year, country-industry-year levels, or even when including a trend in the equation, yield similar inference.

¹⁶Our findings remain robust when using an alternative definition of our treatment variable, referring to soft or informal IT.

average value for our sample (0.01).

Combined entropy balancing and trend. Since inflation targeting adoption has become widespread in developing countries in recent decades, we introduce in Panel B (Table 2) a trend in the linear regression. The introduction of the trend leads to a slight and non-significant drop in the coefficients (from 0.0308 to 0.0294 for sales growth and from 0.1335 to 0.1319 for productivity growth). Thus, for this new specification, we obtain similar results to those of the baseline model.

Fixed effects estimates. As argued in Section 4, inflation targeting adoption is often preceded by a foreign exchange crisis or episodes of hyperinflation. Therefore, the treatment may be correlated with unobservables (policy or institutional reforms, the behaviour of central banks, etc.) that may also explain the strategic behaviour of domestic firms. Using traditional estimation methods such as fixed effects regression could pollute the true effect of the treatment as these unobservables cannot be included in the estimation equation, which justifies in this study the choice of a method combining matching with linear regression. Nevertheless, for robustness purposes, we re-estimate our main equation using a simple fixed effects specification in Panel C, Table 2. In Column [1], besides control variables, we only consider country, industry and year fixed effects. Results for productivity growth are similar to those obtained using entropy balancing. Regarding sales growth, although the fixed effects model gives a moderately higher result (0.09) than that obtained with entropy balancing (0.03), the two coefficients remain qualitatively comparable. Moreover, the inclusion of the trend in the second column leads to a coefficient that is closer to the one obtained with entropy balancing (0.04). Overall, despite some minor variations in the magnitude of the coefficients, we can conclude that results obtained with the fixed effects model remain qualitatively similar to those obtained with entropy balancing.

Table 2: The effect of inflation targeting on firm performance

Panel A : Entropy balancing	Growth		Productivity	
	[1]	[2]	[3]	[4]
Full-fledged inflation targeting dummy	0.0309*** (0.0034)	0.0308*** (0.0108)	0.0617*** (0.0038)	0.1335*** (0.0172)
Observations	13172	12771	13172	12771
R-squared	0.0591	0.169	0.0452	0.1244
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Control variables	No	Yes	No	Yes
Level of se clustering	Country	Country	Country	Country
Panel B : Entropy balancing/trend	Growth		Productivity	
			[1]	[2]
Full-fledged inflation targeting dummy			0.0294*** (0.0106)	0.1319*** (0.0171)
Observations			12771	12771
R-squared			0.1692	0.1245
Country FE			Yes	Yes
Year FE			Yes	Yes
Industry FE			Yes	Yes
Trend			Yes	Yes
Control variables			Yes	Yes
Level of se clustering			Country	Country
Panel C : Fixed effects	Growth		Productivity	
	[1]	[2]	[3]	[4]
Full-fledged inflation targeting dummy	0.0942*** (0.0094)	0.0446*** (0.0085)	0.1545*** (0.0088)	0.1534*** (0.0089)
Observations	13294	13294	12949	12949
R-squared	0.189	0.1891	0.1481	0.1483
Country FE	Yes	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Trend	No	Yes	No	Yes
Control variables	Yes	Yes	Yes	Yes
Level of se clustering	Country	Country	Country	Country

Notes : This table reports estimates of the impact of inflation targeting on firm performance. The treatment variable is an inflation targeting dummy, referring to conservative dates. The outcome variables are firms' sales growth and productivity growth, respectively. Panel A uses weighted least squares regressions, including controls, country, industry, and year fixed effects. In Panel B the previous model is augmented by adding a trend. Finally, Panel C estimates the main equation using fixed effects regression. Robust standard errors clustered at the country-level in parentheses. All regressions include the constant, not reported in the table. * p < 0.1, ** p < 0.05, *** p < 0.01

7 Sensitivity

7.1 Robustness

7.1.1 Alternative samples and additional controls

First, we test the robustness of our results using alternative samples in Columns [2]-[5] of Table 3.¹⁷ The main sample includes some countries with a fixed exchange rate

¹⁷One might think that hyperinflationary episodes (i.e., observations with an inflation rate of 40% or more) could bias our results. However, no country has such a high inflation rate in our sample over the study period. Therefore, we can rule out this hypothesis.

regime and therefore having implicit inflation targeting that is consubstantial to their exchange rate regime.¹⁸ First, since the fixed exchange rate regime is not compatible with the adoption of an explicit inflation-targeting framework, in Column [2], we exclude countries belonging to a monetary union from our sample.¹⁹ In the same way, we exclude El Salvador (Column [2]), which has been committed to full dollarization since 2001. Second, we exclude from our sample countries that adopted inflation targeting at the end of our study period, namely Russia and Kazakhstan (Column [3]) to take into account the potential absence of a situation of monetary dominance among the new ITers. Indeed, since the positive effect of targeting on fiscal discipline may occur over time, one might think that these countries are unlikely to have a sound fiscal policy, which would allow the central bank to conduct a credible targeting policy. Third, in our sample, observations relating to a country that is not yet treated (but will be) are included in the control group used to compile the synthetic group. This approach is quite reasonable as our sample consists of a time dimension. That said, our approach may match some observations for certain treated countries to themselves at a different time when the country is not treated. Therefore, one might think that temporal evolution could drive our results.²⁰ For robustness, in Column [4], we exclude from the control group observations for a country that is not yet treated but will be (pre-treated observations). Fifth, Tunisia and South Africa, included in our sample, were surveyed in 2020, i.e. during the Covid-19 pandemic. Since this is a global shock, this effect is a priori captured by time dummies introduced in the different specifications. Nonetheless, in the last column, we restrict the study period before 2020. New estimates reported in Table 3 (columns [2]-[5]) yield qualitatively similar results to those of the main model.

Second, we re-estimate our results by changing our main equation specification in Table 4. First, we consider annual GDP growth instead of per capita growth. Second, we control for the net book value of capital and the investment in equipment and land,

¹⁸For example, four countries in the control group belong to the CFA Franc Zone, with an inflation target of 3%.

¹⁹Excluding countries belonging to a fixed exchange rate allows us to compare two groups of countries with a flexible exchange rate, one of which has an inflation target. Since this test leads to a result that is qualitatively similar to that of the basic model, we can dismiss the hypothesis of a potential bias in our coefficients, which would be related to the effects induced by the fixed exchange rate regime. Otherwise, this result suggests that among countries with flexible exchange rate regimes, those that explicitly target inflation perform better than those that do not.

²⁰The introduction of the trend in Panel B of Table 2 partly addresses this problem.

Table 3: Robustness : inflation targeting and firm performance (alternative samples)

Panel A : Sales growth	[1]	[2]	[3]	[4]	[5]
Full-fledged IT dummy	0.0308*** (0.0108)	0.1207*** (0.0093)	0.0312*** (0.0109)	0.0309*** (0.0108)	0.0308*** (0.0108)
Panel B : Productivity growth	[1]	[2]	[3]	[4]	[5]
Full-fledged IT dummy	0.1335*** (0.0172)	0.1940*** (0.0110)	0.1341*** (0.0173)	0.1335*** (0.0172)	0.1335*** (0.0172)
Control variables	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Level of se clustering	Country	Country	Country	Country	Country

[1] Main sample [2] Excluding regimes incompatible with IT adoption [3] Excluding new ITers [4] Excluding pre-treated observations [5] Before the COVID-19 crisis. Robust standard errors clustered at the country-level in parentheses. * $p < 0.2$, ** $p < 0.05$, *** $p < 0.01$

respectively. Third, we consider a series of additional country-level variables relating to the quality of institutions and the business environment : the ease of dealing with construction permits, the quality of land administration, and the quality of judicial processes. These variables are extracted from the Doing Business database. The score for the ease of dealing with construction permits ranges from 0 (worst construction regulation) to 100 (best construction regulation). The quality of land administration ranges from 0 to 30, and the quality of judicial processes ranges from 0 to 18. Finally, we also capture the 2008-2009 financial crisis by including a dummy variable. New results reported in Table 4 (Columns [2]-[10]) confirm the positive and meaningful impact of inflation targeting on firm sales and labor productivity growth.

Table 4: Robustness : Inflation targeting and firm performance (additional controls)

Panel A : Sales growth								
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Full-fledged inflation targeting dummy	0.0308*** (0.0108)	0.0300*** (0.0108)	0.1362*** (0.0117)	0.1739*** (0.0245)	0.0308*** (0.0108)	0.0308*** (0.0108)	0.0308*** (0.0108)	0.0394*** (0.0098)
Lag GDP growth		-0.0061*** (0.0009)						
Log. net book value of capital			0.0105*** (0.0016)					
Log. Investment in capital				0.0299*** (0.0094)				
Quality of land administration					0.0981*** (0.0074)			
Quality of judicial processes						0.4904*** (0.0371)		
Ease of dealing with construction permits							0.0557*** (0.0042)	
2008-2009 financial crisis dummy								-0.0550*** (0.0089)
Observations	12771	12771	9630	5647	12771	12771	12771	12771
R-squared	0.169	0.169	0.1964	0.2607	0.169	0.169	0.169	0.169
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
All Fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Level of se clustering	Country	Country	Country	Country	Country	Country	Country	Country
Panel B : Productivity growth								
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Full-fledged inflation targeting dummy	0.1335*** (0.0172)	0.1326*** (0.0172)	0.2993*** (0.0144)	0.1269*** (0.0292)	0.1335*** (0.0172)	0.0308*** (0.0108)	0.1335*** (0.0172)	0.1386*** (0.0160)
Lag GDP growth		-0.0071*** (0.0009)						
Log. net book value of capital			0.0086*** (0.0017)					
Log. Investment in capital				0.0189** (0.0085)				
Quality of land administration					0.0791*** (0.0059)			
Ease of dealing with construction permits						0.0557*** (0.0042)		
Quality of judicial processes							0.3956*** (0.0295)	
2008-2009 financial crisis dummy								-0.0326*** (0.0093)
Observations	12771	12771	9630	5647	12771	12771	12771	12771
R-squared	0.1244	0.1244	0.1406	0.1802	0.1244	0.169	0.1244	0.1244
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
All Fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Level of se clustering	Country	Country	Country	Country	Country	Country	Country	Country

Notes : The drop in observations in Column 4 is due to missing information on capital investment. Robust standard errors clustered at the country-level in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

7.1.2 Alternative measures of firm performance

Total factor productivity. The literature considers another measure of firm productivity : total factor productivity (TFP). This measure of productivity has the advantage of allowing for both inputs and production technology. The Cobb Douglas function, commonly used in the literature to estimate the TFP, is based on a restrictive assumption of an elasticity of substitution of production factors equal to 1. The transcendental logarithmic (trans-log) function, however, has the advantage of allowing a more flexible form of the production function. For robustness, we estimate the TFP from the residual

term of Cobb Douglas (Equation 5) and trans-log (Equation 6) production functions :

$$\log Y_{i,k,j,t} = \theta + \alpha \log K_{i,k,j,t} + \beta \log L_{i,k,j,t} + \mu V_{i,k,j,t} \quad (5)$$

$$\begin{aligned} \log Y_{i,k,j,t} = \theta + \alpha \log K_{i,k,j,t} + \beta \log L_{i,k,j,t} + \eta \log(K_{i,k,j,t})^2 + \\ \delta \log(L_{i,k,j,t})^2 + \gamma \log(K_{i,k,j,t}) * \log(L_{i,k,j,t}) + \mu V_{i,k,j,t} \end{aligned} \quad (6)$$

$Y_{i,k,j,t}$ represents total real sales at the end of the previous fiscal year; $K_{i,k,j,t}$ and $L_{i,k,j,t}$ represent the net book value of capital and the total permanent full-time employees at the end of the previous fiscal year, respectively. Finally, $V_{i,k,j,t}$ is an independent and identically distributed shock, assumed to be exogenous to the firm's decisions.

Estimates are reported in Columns [1] and [2] of Table C1 (Panel A), using a Cobb Douglas and trans-log function, respectively. The coefficients of the TFP are positive and significant, suggesting that inflation targeting improves total factor productivity at firm-level. Then, our findings hold even when using the TFP.

Value-added per worker. We also re-estimate our baseline model using the logarithm of the value-added per worker as an alternative measure of firm productivity. This indicator is calculated as the difference between annual sales and raw materials and energy costs, divided by the number of workers. This measure of productivity is interesting as it considers both labor productivity and the efficiency with which labor and other factors of production are used in the production process. Results reported in Column [3] of Table C1 (Panel A) support the previous conclusions : inflation targeting not only increases labor productivity, but also the efficiency with which labor and other factors of production are used in the production process.

7.1.3 Does inflation targeting adoption relax firms' investment and export constraints ?

There are two follow-up questions. First, if inflation targeting improves firm growth and productivity, does it also increase firm investment ? Second, do firms in the target countries tend to be more outward looking ? In this section, we assess the direct impact

of the monetary regime on firm investment and export capacity.²¹ In Column [1] of Panel B (Table C1), we use the logarithm of investment in land and equipment as our dependent variable. In Column [2], we switch to a probit model to consider the firm's export status, using a binary variable equal to 1 if the firm exports its sales, and zero otherwise. Results suggest a positive and significant effect of inflation targeting on firm investment and export capacity. That is, inflation targeting adoption eases business investment constraints and tends to orient firms more towards the external market.

7.1.4 Does inflation targeting matter for investment in research and development ?

The previous subsection assesses the effect of inflation targeting on investment in land and equipment. It also seems interesting to examine the link between inflation and investment in research and development (R&D). This type of investment represents one of the basic inputs of innovation and technological progress, as is well known in the literature (Aghion and Howitt, 2008; Hall et al., 2013; Aghion and Jaravel, 2015). As with other types of investment, business cycle predictability and price formation are crucial in R&D investment decision-making (Kung and Schmid, 2015). Pioneering work such as Mansfield (1980)'s highlights that high inflation rates tend to discourage investment in R&D, given the increase in uncertainty. Since then, the relationship between inflation and investment in R&D or innovation has spawned a growing literature, including recent ones, notably based on neo-Schumpeterian models (for instance, see Chu and Lai, 2013; Chu et al., 2015; Oikawa and Ueda, 2018; Chu, 2020; Rocha et al., 2021). We therefore switch from the entropy balancing approach to the probit estimator to assess the effect of inflation targeting on R&D investment. We use as dependent variable a binary equal to 1 if the firm has invested in R&D during the previous fiscal year, and zero otherwise, including the controls used previously. Results from Panel B (Column [3], Table C1) suggest that inflation targeting increases the probability that a firm will invest in R&D. Thus, the monetary regime seems to increase both investment in land and equipment and investment in R&D.

²¹The variables used come from the WBES database.

7.2 Threats to identification : Falsification tests

So far, the various robustness tests conducted support our conclusions. However, as it is well known, economic policy adoption is generally associated with parallel reforms, so one could imagine that unobservables correlated with policy adoption and potentially with the outcome variables could drive our results. Certainly, the empirical method used in this study aims to address this type of concern. Nevertheless, we further strengthen our results by conducting some additional tests. First, in Columns [1]-[4] of Panels A and B (Table 5), we perform random assignment to treatment or « falsification regressions » within the entire sample, considering 20%, 30%, 40%, and 50% of sample observations as treated, respectively.²² If our results are biased toward unobservables or a trend, then the placebo tests could also show significant effects. Indeed, random treatments within the sample do not have any impact on firm performance. Therefore, we can rule out the possibility of confounding factors or trends driving our results.

Second, we further extend our sensitivity tests, including IMF-supported programs since 2002 from the Fund Arrangements database. Consistent with previous work on IMF programs (Dreher et al., 2010; Jorra, 2012; Papi et al., 2015; Balima and Sy, 2021), we set a dummy variable equal to the value 1 if a country has benefited from any type of IMF-supported program in the previous three years. If the effects of the monetary regime are confounded with those of other reforms, such as that of the IMF, the inclusion of these potential confounders should reduce or even make insignificant our previous coefficients. Results from Panel C (Table 5) suggest that inflation targeting improves firm performance even in the presence of IMF-adopted reforms, reinforcing the various falsification tests previously performed. That is, our results are not confused with those of other reforms.

²²A more efficient approach would be to randomly assign treatment only within treated countries. In our case, such a procedure is not relevant since almost all treated countries at the beginning of the study period (2006) remain treated until 2020. That is, we do not observe any episodes of regime exit within the treated countries.

Table 5: Robustness : Inflation targeting and firm performance (falsification tests)

Panel A : Sales growth				
	[1]	[2]	[3]	[4]
Full-fledged IT dummy	0.0051 (0.0071)	-0.0016 (0.0104)	-0.0031 (0.0047)	-0.0022 (0.0070)
Panel B : Productivity growth				
	[1]	[2]	[3]	[4]
Full-fledged IT dummy	0.0044 (0.0120)	-0.0018 (0.0106)	-0.0152 (0.0094)	-0.0141 (0.0093)
Panel C : IT and IMF programs				
			Sales growth	Productivity growth
			[1]	[2]
Full-fledged IT dummy			0.1931*** (0.0198)	0.2299*** (0.0170)
IMF programs dummy			0.1693*** (0.0274)	0.1005*** (0.0287)
Control variables	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Level of se clustering	Country	Country	Country	Country

This Table reports various placebo test results. In columns [1]-[4] we randomly assign the treatment to 20%, 30%, 40%, and 50% of the sample observations, respectively. Finally, in Panel C we include IMF-supported programs since 2002. Robust standard errors clustered at the country-level in parentheses. * $p < 0.2$, ** $p < 0.05$, *** $p < 0.01$

7.3 Heterogeneity

This section explores some potential heterogeneity features of the treatment effect, according to country and firm level variables. We consider the baseline model and augment it with several interactions. The coefficient on the interactive term captures the heterogeneity characteristics of the inflation targeting effect in the presence of a given variable. From a macroeconomic perspective, potential sources of heterogeneity include deviations from inflation targets, fiscal discipline, institutional quality, and natural resource endowments. On the microeconomic side, we consider firm size (proxied by sales level and the number of employees). Estimates are reported in Table 6.

As discussed previously (see Section 2), a credible targeting regime is expected to influence public expectations and promote greater policy effectiveness. Following [Ogrokhina and Rodriguez \(2018\)](#), we capture the monetary regime credibility in another way, computing the difference between achieved inflation and the inflation target announced by the central bank.²³ Over our study period, we report an average deviation of 0.6 percentage points among the target countries and a median of zero, suggesting

²³Data on inflation targets are extracted from the central bank publications of each country.

that very few countries deviate from their target. A few countries are reported to have significant deviations. For example, in 2007, Ghana had the largest deviation from its target, with a difference of 14.3 percentage points, followed by Romania in 2009 (8.5 percentage points), and Russia in 2019 (6 percentage points). To capture the regime's credibility, we interact our treatment variable with the squared deviations, as some deviations are negative. Although very few countries deviate from their target in our sample, the coefficient on the interactive (Column [1], Table 6) is negative and significant, suggesting that inflation deviations from the announced targets reduce the effectiveness of the policy. In other words, countries that deviate from their target are less effective compared to those that do not. These results deserve to be paralleled with those of [Ogrokhina and Rodriguez \(2018\)](#). Indeed, while these authors find no heterogeneity regarding deviations at the macro level, our results suggest that, at a disaggregated level, firms seem sensitive to inflation deviations from the target.

Referring to the famous Unpleasant Monetarist Arithmetic ([Sargent and Wallace, 1981](#)), or fiscal price theory ([Leeper, 1991](#); [Sims, 1994](#); [Woodford, 1995](#)), one can consider that in the presence of persistent fiscal indiscipline, the central bank may be forced to abandon its price stabilization policy to finance fiscal deficits or public debt. This situation of fiscal dominance would, therefore, reduce the monetary policy's effectiveness. To test this hypothesis, we cross in Column [2] the treatment with a dummy equal to 1 for countries with a foreign currency long-term sovereign debt ratings above the sample average, and zero otherwise. This variable is extracted from [Kose et al. \(2017\)](#) and captures the market's perception of a government's creditworthiness, as established by credit rating agencies, including Standard Poor's, Moody's and Fitch Ratings ([Afonso et al., 2011](#); [Reusens and Croux, 2017](#)). Results suggest that the targeting regime is more effective in countries with sound and solid fiscal reputation. Moreover, a better credit rating is also a manifestation of the credibility of economic policies, which in turn can reassure domestic and foreign investors.

Institutions play a crucial role in the success of economic reforms. They can take many forms, such as sociopolitical stability, control of corruption, socio-economic norms promoting private initiative or the protection of property rights, the nature of regulations, or administrative constraints, etc. In Column [3], we interact our treatment with

a dummy variable equal to 1 if the country has a quality of regulation above the sample average, and zero otherwise. This variable is captured at the country level and reflects the perceived ability of the government to formulate and implement sound policies and regulations that enable and encourage private sector development. The indicator ranges from -2.5 (weak governance performance) to 2.5 (strong governance performance). Results suggest that inflation targeting is more effective for countries with sound regulations that encourage private sector development.

In Columns [4]-[7], we check the existence of potential heterogeneity features according to firms' level of wealth and their size. The variable named "Rich firm" is a dummy equal to 1 if the firm's annual sales are above the sample average, and zero otherwise. Indeed, as small businesses are the most likely to be financially constrained, a monetary framework such as inflation targeting that would ease financial and investment constraints will have the greatest impact on small firms. However, no heterogeneity seems to emerge regarding firms' level of wealth or size when we test this hypothesis. In other words, inflation targeting seems to benefit all firms, regardless of their size and wealth.

Finally, given the stabilizing effect of inflation targeting on exchange rate movements, it is worthwhile to investigate the relationship between the monetary regime and the risk of Dutch disease in resource-rich countries. This long-standing problem was identified in the 1960s in the Netherlands, following the discovery of natural gas, when economists found that gas exports led to an appreciation of the exchange rate and threatened to destroy the country's entire manufacturing industry. Early studies on the subject were marked by seminal work such as the model of Corden-Neary ([Corden and Neary, 1982](#); [Corden, 1984](#); [1982](#)) before being popularized in the late 1990s by [Sachs and Warner \(1995; 2001\)](#). This phenomenon implies that a boom in natural resources generates an exchange rate appreciation to the detriment of outward-looking manufacturing firms, leading to a loss of competitiveness, a decrease in investment, and a gradual decline of the manufacturing sector. We assume that by reducing exchange rate movements, inflation targeting may limit the transmission of international resource price shocks to the domestic economy. This should, in turn, reduce the risk of exposure to Dutch disease of the manufacturing sector in resource-rich countries. In the literature, a simple measure commonly used to capture the impact of Dutch disease is the share of natural

Table 6: Heterogeneities of the effect of inflation targeting on firm performance.

Dependent : Growth	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Full-fledged inflation targeting dummy (IT)	0.1001***	0.0300***	0.0308***	0.0235**	0.0530***	0.1027***	0.0688***	0.0678***
IT * Deviations	-0.3469***							
	(0.0562)							
IT * Sovereign debt ratings		0.5516***						
		(0.0111)						
IT * Quality of regulation			0.2015***					
			(0.0270)					
IT * Rich firm				-0.0828				
				(0.0908)				
IT * Small firm					-0.0177			
					(0.0162)			
IT * Medium firm						0.0042		
						(0.0153)		
IT * Large firm							-0.0049	
							(0.0301)	
IT * Resource-rich countries								0.2455***
								(0.0229)
Observations	12771	12771	12771	12771	12771	12771	12771	12771
R-squared	0.169	0.169	0.169	0.1833	0.145	0.1107	0.1403	0.169
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes : Vector X variables in isolation (without interaction with FR) and controls are included but not reported for space purpose. Robust standard errors clustered at the country-level in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

resources in total GDP or total exports. In this study, we use oil exports as a percentage of GDP to test our hypothesis. Over our study period, oil exports represent on average 2.30% of the GDP of the countries in our sample. This magnitude seems rather small, however the observed standard deviation (around 4%) reflects a fairly heterogeneous dispersion of oil export dependency in the sample. We then cross the treatment with a dummy (“Resource-rich countries”) equal to 1 if the country has an oil export rate above the sample average, and zero otherwise. This approach allows us to capture the level of country endowments (about 8,500 observations are located in resource-rich countries, i.e. with oil exports accounting for more than the sample average). Results reported in Column [8] suggest that the targeting regime is all the more effective as it characterizes countries richly endowed with natural resources.²⁴ One might think that this heterogeneity could be explained by the presence of firms in the export market. However, as shown in subsection 7.1.3, inflation targeting also increases firms’ propensity to export. Therefore, this heterogeneity rather seems to corroborate our hypothesis regarding the absence of Dutch disease in inflation targeting countries.

²⁴Moreover, the coefficient on the “Resource-rich countries” variable (not reported in the table but available upon request) is negative and significant, suggesting that natural resource abundance appears to worsen firm performance.

8 Validity of transmission channels

This section empirically tests the main channels through which the monetary regime may operate. As is well known, the literature does not provide explicit and unique methods for evaluating transmission channels. In this study, we adopt a simple two-step approach. First, we estimate a simple uni-variate regression of the potential channel on firm growth, using OLS estimator. Second, we re-estimate our baseline model using OLS regressions, and replacing our dependent variable with the potential channel. Suppose that volatility negatively affects firm performance. If macroeconomic stabilization is a relevant channel through which inflation targeting is effective, then the monetary regime should, in turn, reduce volatility.

In Columns [1]-[3] of Panel A (Table D1), we estimate a uni-variate regression of inflation, exchange rate, and interest rate volatility on firm sales.²⁵ Consistent with economic theory, there is a negative relationship between macroeconomic volatility and firm growth.²⁶ These results are reinforced by Column [4] estimates, which suggest a negative and significant relationship between inflation and the outcome variable.²⁷ Finally, results reported in Panel B show that the monetary regime reduces inflation and macroeconomic volatility, consistent with previous work findings.

9 Conclusion

A long tradition of examining economic reforms on firm outcomes is found in the literature. Unlike many studies, we have focused on the effects induced by the adoption of a new monetary regime, notably inflation targeting, on manufacturing firm performance.

²⁵Each variable's volatility is calculated as the standard deviation of a three-year moving average of that variable for each country.

²⁶We also find a negative correlation between volatility and firm productivity. These results are not reported in this paper for space purposes.

²⁷The magnitude of the estimated coefficients is sometimes small, as we estimate simple univariate regressions. However, the negative relationship between volatility and firm performance is highly significant. Finally, it would also be interesting to investigate business confidence as a potential transmission channel of the monetary regime on firm performance. The Organisation for Economic Co-operation and Development (OECD) provides a measure of business confidence for some countries, but to our knowledge, data spanning an international sample do not exist.

That is, for a sample of 30,993 firms surveyed between 2006 and 2020 in 46 developing countries and using the entropy balancing method, we show that inflation targeting adoption significantly improves firm growth and productivity. We then strengthen our results running several robustness tests, including the use of several alternative performance measures. Specifically, we find that inflation targeting increases total factor productivity, firm investment — including investment in research and development — and their export capacity. These findings are further extended through a few heterogeneity analyses. Results suggest that the monetary regime is more effective for countries with a sound quality of regulation and good fiscal reputation. However, this is not the case for countries where the central bank has weak credibility. Moreover, we provide some evidence of the absence of Dutch disease in resource-rich countries that have adopted inflation targeting. Finally, our results reveal that the effectiveness of the monetary framework appears to be driven by enhanced credibility following the adoption of the regime, leading to a reduction in macroeconomic volatility.

The main novelty of this paper is to examine the direct impact of the adoption of a new monetary policy framework on firm outcomes, thus combining country and firm-level data. From a theoretical perspective, we extend both the literature on the effects of inflation targeting and policies or reforms to improve firm performance in developing countries, grounding the work solidly in theory to identify the main channels through which the monetary regime may operate. On the empirical side, we use a novel method — entropy balancing — combining a matching approach with linear regression, thus mitigating endogeneity issues that may lead to scepticism about our conclusions. Furthermore, the identification strategy is strengthened by capturing country-, year-, and industry-level variability. Finally, we provide proof that our results are not driven by unobservables or trends, nor are they confounded by IMF program-induced effects.

This paper not only provides evidence that uncertainty resulting from the economic environment matters, but also that a credible monetary policy framework — notably inflation targeting — which firmly anchors public expectations, can help developing countries to stabilize their economic environment and promote greater economic predictability, enabling them to improve their economic performance. Finally, even if our results are not applicable to the potential impact of monetary policy in countries with

fixed exchange rate regimes, we can draw some parallels with the latter since they also feature an implicit inflation targeting framework regarding their convergence programs.

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Appendix A Data and sample

Table A1: List of countries

Inflation targeting countries		
	Soft IT (default starting dates)	Full-fledged IT (conservative dates)
Brazil	June 1999	June 1999
Colombia	September 1999	October 1999
Dominican Republic	2011	2012
Ghana	January 2007	January 2007
Hungary	June 2001	August 2001
Kazakhstan	August 2015	August 2015
Paraguay	May 2011	May 2011
Peru	January 2002	January 2002
Philippines	January 2002	January 2002
Poland	September 1998	September 1998
Romania	August 2005	August 2005
Russia	2014	2015
Serbia	September 2006	September 2006
South Africa	February 2000	February 2000
Thailand	May 2000	May 2000
Non-targeting countries		
Benin	—	—
Bhutan	—	—
Cameroon	—	—
Bolivia	—	—
Bulgaria	—	—
Cambodia	—	—
China	—	—
Costa Rica	—	—
Cote d'Ivoire	—	—
El Salvador	—	—
Gambia	—	—
Georgia	—	—
Honduras	—	—
Jordan	—	—
Kenya	—	—
Kyrgyz Republic	—	—
Lao PDR Republic	—	—
Lesotho	—	—
Malaysia	—	—
Morocco	—	—
Myanmar	—	—
Nepal	—	—
Nicaragua	—	—
North Macedonia	—	—
Papua New Guinea	—	—
Senegal	—	—
Sierra Leone	—	—
Solomon Islands	—	—
Trinidad and Tobago	—	—
Tunisia	—	—
Vietnam	—	—

Sources: [Rose \(2007\)](#); [Roger \(2009\)](#); [Jahan and Sarwat \(2012\)](#) and [Ciżkowicz-Pękała et al. \(2019\)](#).

Table A2: List of variables and their sources

Variables	Nature	Sources
1. Treatment variable		
Full-fledged Inflation Targeting	Dummy	Rose (2007); Roger (2009); Tapsoba (2012); Jahan and Sarwat (2012); Ciżkowicz-Pękala et al. (2019)
2. Control variables		
2.1 Country-level variables		
Inflation	Continuous	WDI, World Bank
Real GDP per capita growth	Continuous	WDI, World Bank
Domestic credit to private sector	Continuous	WDI, World Bank
Access to financial markets	Continuous	Financial Access Survey (IMF)
Fiscal balance	Continuous	Kose et al. (2017)
Trade openness	Continuous	WDI, World Bank
Fixed exchange rate	Dummy	Authors' calculations based on Ilzetzki et al. (2017)
Political stability	Index ranging from -2.5 to 2.5	Worldwide Governance Indicators database (Kaufmann et al., 2011)
Democracy score	Index ranging from -10 to 10	Polity V
2.2 Firm-level variables - (WBES)		
Log Real sales (3 years ago)	Continuous	
Firm size	Ordinal	
Firm age	Continuous	
Firm's legal status	Ordinal	
Share of private domestic assets in the company	Percentage	
Share of public domestic assets in the company	Percentage	
Share of foreign assets in the company	Percentage	
3. Firm performance indicators		
Sales growth	bounded between - 1 and 1	Authors' calculations
Productivity growth	bounded between - 1 and 1	Authors' calculations
Total factor productivity (Cobb - Douglas function)	Continuous	Authors' calculations
Total factor productivity (Trans-log function)	Continuous	Authors' calculations
Value-added per worker	Continuous	Authors' calculations
Log. investment in equipment and land	continuous	WBES
Export status	Dummy	WBES
Investment in research and development	Dummy	WBES
4. Additional controls		
Annual GDP growth	Continuous	WDI, World Bank
Log. net book value of capital	continuous	WBES
Log. investment in equipment and land	continuous	WBES
Ease of dealing with construction permits	Score ranges from 0 to 100	Doing Business database
Quality of land administration	Score ranges from 0 to 30	Doing Business database
Quality of judicial processes	Score ranges from 0 to 18	Doing Business database
2008-2009 crisis dummy	Authors' calculations	

Appendix B Summary statistics

Table B1: Descriptive statistics of the baseline model variables

Variables	Obs.	Mean	Sd	Min	Max
Sales growth	21,795	0.045	0.274	-1	1
Productivity growth	21,224	0.007	0.278	-1	1
Lag Inflation	30,993	5.978	4.225	-0.210	24.798
Lag GDP per capita growth	30,993	3.968	2.960	-1.719	11.606
Lag Fiscal balance	30,993	-1.738	2.729	-7.827	11.084
Lag Trade openness	30,873	76.578	34.732	11.676	166.552
Lag Fixed exchange rate	22,566	0.116	0.321	0	1
Log. Real sales sales (3 years ago)	25,158	8.852	2.174	0	26.252
Firm size	30,993	1.927	0.787	1	3
Firm age	27,725	24.798	15.043	2	203
Firm's legal status	30,407	2.696	1.118	1	6
National share capital	30,301	88.572	29.401	0	100
Foreign share capital	30,294	9.229	26.969	0	100
Government share capital	30,302	0.636	6.282	0	100
Lag Financial development	27,598	48.386	33.236	4.115	127.550
Lag Access to financial markets	24,447	0.283	0.239	0	0.642
Political stability	30,103	-0.385	0.632	-1.727	0.974
Democracy score (Polity V)	24,406	4.138	6.034	-7	10

Appendix C Robustness

Table C1: Robustness : alternative measures of firm performance

	[1]	[2]	[3]
Panel A	Total factor productivity (1)	Total factor productivity (2)	Log. Value-added per worker
Full-fledged IT dummy	0.3263*** (0.0692)	0.2787*** (0.0623)	0.3064*** (0.0490)
Observations	9129	9129	10496
Control variables	Yes	Yes	Yes
All Fixed-effects	Yes	Yes	Yes
Level of se clustering	Country	Country	Country
Panel B	[1]	[2]	[3]
	Log. Investment in capital	Exports dummy	R&D investment (probit estimations)
Full-fledged IT dummy	0.3544* (0.1985)	0.1907*** (0.0362)	0.2810*** (0.0458)
Observations	5336	14454	10755
Control variables	Yes	Yes	Yes
All Fixed-effects	Yes		
Level of se clustering	Country		

Notes : This table presents the effect of inflation targeting on alternative measures of firm performance, using weighted least squares regressions (except in Column [3] of Panel A). The treatment variable is a full-fledged inflation targeting dummy. In Panel A, the outcome variables are : Total factor productivity estimated from a Cobb Douglass function (Column 1), Total factor productivity estimated from a translog function (Column 2), and the logarithm of value-added per worker (Column 3). In Panel B, the outcome variables are : the logarithm of investment in equipment and land, firm export status (a binary variable equal to 1 if the firm exports its sales, and zero otherwise), and a dummy equal to 1 if the firm invested in research and development in the previous fiscal year and zero otherwise, respectively. Columns [2] and [3] of Panel B are estimated from a probit regression, controlling for the previously used variables. Robust standard errors clustered at the country-level in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01

Appendix D Transmission channels

Table D1: Validity of transmission channels

Panel A	[1]	[2]	[3]	[4]
	Growth	Growth	Growth	Growth
Inflation volatility	-0.0011*** (0.0004)			
Interest rate volatility		-0.0815*** (0.0048)		
Exchange rate volatility			-0.0068*** (0.0003)	
Inflation				-0.0011** (0.0005)
Panel B	[1]	[2]	[3]	[4]
	Inflation volatility	Interest rate volatility	Exchange rate volatility	Inflation
Full-fledged IT dummy	-0.0964*** (0.0109)	-0.1405*** (0.0055)	-3.1644*** (0.0886)	-2.0677*** (0.0673)

* p < 0.1, ** p < 0.05, *** p < 0.01