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# FDI and the labor share in developing countries: A theory and some evidence\*

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**Abstract:** We address the effects of FDI on the labor share in developing countries. Our theory relies on the impacts of FDI on productive heterogeneity in a frictional labor market. FDI have two opposite effects: a negative force originated by technological advance, and a positive force due to increased labor market competition between firms. We test this theory on aggregate panel data through fixed effects and system-GMM estimations. We find a U-shaped relationship between the labor share in the manufacturing sector and the ratio of FDI stock to GDP. Most countries are stuck in the decreasing part of the curve.

**Keywords:** FDI; Matching frictions; Firm heterogeneity; Technological advance

**J.E.L classification:** E25; F16; F21

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# 1 Introduction

Labor shares have plunged in developing countries over the past three decades. Harrison (2002) estimates that developing countries have experienced a yearly 0.1 point decrease in labor share from 1970 to 1993 and 0.3 point from 1993 to 1996. Focusing on the manufacturing sector only, labor shares have fallen by 10 points in less advanced economies between 1980 and 2000. Those changes are contemporaneous of the rise of multinational firms and associated Foreign Direct Investment. The idea of this paper is to put together these two elements. Namely, we argue that the rise in Foreign Direct Investment is partly responsible for the fall in labor shares in developing countries.

The idea whereby FDI modifies the factor distribution of output in the host country is ubiquitous in the literature. Most of the papers focus on wage inequality (recent theoretical contributions include Liang and Mai, 2003, Marjit et al, 2004, and Das, 2005), and display mixed evidence in favor of the thesis according to which FDI causes wage inequality, either at industry level<sup>1</sup> or country level<sup>2</sup>. By contrast, we focus on the labor share. A decrease in labor share originated by FDI inflows may indicate that the overall benefits accruing to globalization are captured by foreign investors, with unchanged standard of living for the population. This is especially true when the host country fails to design the fiscal tools to tax the benefits made by firms financed by foreign capital. FDI-induced falls in labor shares in developing countries also strengthen the protectionist view according to which developed economies should not trade with low-wage countries. These different effects are likely to rally political support against FDI and the multinationals, both in developed and developing countries.

We propose a theory that relies on the impacts of FDI on firm heterogeneity in a frictional labor market. FDI rises the proportion of high-productivity firms in developing countries.<sup>3</sup> In turn, such a proportion governs the degree of productive heterogeneity between firms: firms are very similar when foreign firms produce no output, and when they produce most of output. Owing to matching frictions, foreign firms are endowed with market power. The labor share responds to changes in the proportion of foreign firms as a result. The model predicts an inverted Kuznets curve (a U-shaped curve) between the labor share of income and the proportion of foreign firms. The magnitude of the relationship is governed by the technological gap between foreign and local firms.

We also consider three extensions to the basic model. The first extension deals with the welfare impacts

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<sup>1</sup>Feenstra and Hanson (1997) on Mexico, Figini and Görg (1999) on Ireland and Taylor and Driffield (2005) on the UK find a positive effect of FDI on wage inequality, while Blonigen and Slaughter (2001) on the US do not find any significant effects.

<sup>2</sup>Tsai (1995) and Gopinath and Chen (2003) find that FDI has increased wage inequality only in a subset of developing countries, while Basu and Guariglia (2007) find a more general relationship. Figini and Görg (2006) argue that the positive effect of FDI on wage inequality decreases with development.

<sup>3</sup>Foreign firms are more productive than local firms for several reasons. First, foreign firms are likely to benefit from advanced technologies. Second, theoretical models of FDI like Helpman et al (2004) predict that only the most productive firms become multinational companies. Third, foreign owners self-select into high-productivity sectors, and/or where they have a comparative advantage. Fourth, foreign-owned firms have easier access to capital. The particular reason why foreign firms are more productive does not matter.

of financial openness policies. Opening the country to foreign firms always increases wage payments. However, depending on the nature of entry costs, openness may be detrimental to overall income. Foreign firms replace local firms, and the fall in labor share implies that the small wage gain does not necessarily compensate for the loss in local output. In the second extension, we account for a richer structure of firm heterogeneity: there are high-productivity firms among both the local and the foreign firms. The U-shaped relationship is unchanged provided that the share of high-productivity firms is sufficiently low among local firms, and sufficiently high among foreign firms. This condition is likely to be met in poor countries, and should not be satisfied in rich countries. The final extension deals with capital choices. It does not affect the logic of the model, but, however, it suggests to include capital intensity among the factors that can affect the labor share, just like in the competitive model.

In the empirical part of the paper, we estimate a linearized version of the model on aggregate panel data. The dataset covers a large panel of countries whose GDP per capita was 60% or lower than US GDP per capita in 1980. The dependent variable is the labor share in the manufacturing sector, that is the ratio of the total wage bill to GDP produced in that sector. The variable that captures the magnitude of foreign firms' activity is the stock of inward FDI in percentage of GDP. One minus the ratio of local GDP per capita to US GDP per capita is a proxy for the technological gap between local and foreign firms. We typically explain the labor share by means of FDI stock to GDP, FDI stock to GDP squared, proxy for technological gap, ratio of capital to output, unemployment rate, and time dummies. We first focus on fixed effects regressions, but we also discuss outliers, control for endogeneity and autocorrelation bias with system-GMM estimates, and control for alternative measures of globalization. Our estimations show a significant U-shaped relationship between the labor share and FDI stock to GDP. The other determinants of the labor share have the predicted sign: technological gap (-), unemployment rate (-), capital to output ratio (0/+).

The threshold above which the labor share starts increasing with FDI is in the range 150-180% of GDP. FDI have decreased the labor share in most of the host countries of our dataset. This casts some doubt on the ability of openness policies to attract FDI above the threshold. One of the likely reasons suggested by our model is that opportunity costs matter a lot for foreign firms. The countries above the threshold are Hong-Kong, Ireland, Macao, and Singapore. Those countries experienced very high growth rates, and attracted enormous volumes of FDI. A Government may shape a high-quality institutional environment to please foreign investors; but the Government cannot reduce alternative profit opportunities in other countries.

Overall, the quantitative impact of FDI is substantially large. Consider a country that is characterized by the mean value of FDI/Y and experiences an increase of one standard deviation in this ratio, *everything else equal*. Fixed effects estimates imply a fall in the labor share that varies between 3.0 to 7 points. This impact amounts to between 10% to 20% of the mean labor share in our sample. FDI have substantially contributed to falling labor shares in these countries.

Our paper argues that a component of financial globalization, e.g. FDI, alters the labor share of

income. We partly borrow from Rodrik (1997) who explains that the current wave of globalization mainly increases the relative mobility of capital vis-à-vis labor. The argument has received some support from recent papers that examine how trade and capital account openness affect the labor share of income.<sup>4</sup> In those papers, the bottom line is that globalization lowers the wage at given output. Our paper adopts a different perspective based on firm heterogeneity. We do not argue that wages go down with FDI inflows, simply that they do not rise as fast as productivity in a first stage of financial openness. The mean wage goes up with the proportion of foreign firms in our model, and workers always fare better with FDI. Some of our regressions include a consensual measure of institutional financial openness. Our basic result remain unaffected.

The impact of globalization on firm heterogeneity has been put forward by Melitz (2003). Helpman and Itskhoki (2009, 2010) introduce matching frictions in the Melitz framework. Firms differ in total factor productivity, and trade openness modifies the share of output produced in each firm, as well as the lowest TFP compatible with participation in international trade. Helpman and Itskhoki (2009) study the impacts of globalization on unemployment, while Helpman et al (2010) focus on wage inequality. This latter model features a U-shaped relationship between wage inequality and the degree of trade integration. The productive side of the theoretical framework is richer than ours: firm continuously differ in total factor productivity and there are price effects induced by trade openness. However, their model does not allow to discuss changes in the labor share. The wage is a fixed proportion of output in each firm, so that the labor share is constant both at the micro level and at the aggregate level.<sup>5</sup>

Finally, this paper is related to the growing literature on globalization and labor market imperfections. This literature mostly focuses on trade liberalization. A first strand of contributions incorporates matching frictions in two-sector models of international trade (see Davidson et al, 1999, Moore and Ranjan, 2005, Davidson and Matusz, 2006a, 2006b). Another strand of contributions uses models of international trade with firm heterogeneity (see Egger and Kreickemeier, 2009, Davis and Harrigan, 2008, Helpman and Itskhoki, 2009). Mitra and Ranjan (2007) analyze the impact of offshoring in the home economy, while Davidson et al (2008) discuss the outsourcing of high-skill jobs. A third strand of contributions focuses on multinational activity and labor market imperfections. Most of the existing studies in this literature investigate trade unions as the main source of labor market frictions and focus on partial equilibrium settings (see e.g. Leahy and Montagna, 2000; Lommerud et al, 2003). Our paper complements these various papers as we are interested in the labor share rather than in unemployment and/or wage inequality.

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<sup>4</sup>Ortega and Rodriguez (2002) focus on trade openness, Diwan (2000, 2002) examines exchange rate crises, and Harrison (2002) and Jayadev and Lee (2005) focus on capital controls.

<sup>5</sup>There is also another difference with our paper. Helpman et al assume decreasing returns to scale and derive the distribution of firms by firm size. By contrast, we assume constant returns to scale and the size of individual firms is indeterminate. Helpman et al obtain wage homogeneity within each firm, while wage disparity for homogenous labor is the same at the firm level and in the overall economy in our case. The reality is somewhere in the middle. For instance, Abowd et al (1999) and subsequent work by Postel-Vinay and Robin (2002) use French data and show considerable wage dispersion once controlled for firm and individual effects.

The rest of the paper is organized as follows. Section 2 introduces our model. Section 3 contains the empirical part of the paper. Section 4 concludes.

## 2 The model

In this section, we introduce and solve our model. We also discuss three extensions: the welfare effects of financial openness policies, firm heterogeneity, and capital choices.

### 2.1 Basic environment

The model is static. There are a continuum of workers normalized to one and a continuum of firms. Workers are homogenous. Firms are not. Foreign firms differ from local firms. The labor market is characterized by frictions. Matching frictions parameterize the ability of people to generate wage competition between potential employers.

Each firm, foreign or local, is endowed with a single job slot. Foreign firms are more productive than local firms: the amount of output produced by a foreign and a local firm are respectively  $y_F$  and  $y_R$  with  $y_F > y_R$ . This reflects the technological advance of foreign firms (so that total factor productivity is higher), and/or their better access to the financial market (so that capital intensity is higher).

The labor market features matching frictions. Firm entry involves paying a cost that is proportional to expected output. From a national accounting perspective, it is important to make explicit the nature of the cost. It can receive two interpretations. On the one hand, it can correspond to the purchase of capital units prior to searching a worker. On the other hand, it can be due to the regulation that limits the number of firms and guarantees superprofits for the firms managing to enter.<sup>6</sup> Capital costs and superprofits are part of value added and do not coincide with labor income. By contrast, entry costs cannot correspond to spendings in intermediary goods (that would be subtracted from value added) or to wage payments (that would enter the wage bill).

The cost per unit of output depends on whether the firm is foreign or local. Foreign firms pay  $c_F$ , while local firms pay  $c_R$ . We assume that foreign firms face higher costs than local firms and  $c_F > c_R$ . The entry cost differential  $c_F - c_R$  is due to imperfect financial openness, which raises installation costs for the foreign firms. It may also be due to alternative profit opportunities for the multinationals.

Workers and vacancies meet according to the meeting technology  $M = M(u, n)$ . Here,  $u$  stands for the effective number of job-seekers and  $n$  stands for the number of vacancies. The meeting technology  $M$  is homogenous of degree one to ensure that the unemployment rate does not depend on the number of traders in the economy. It is also strictly increasing in both arguments, strictly concave, and bounded by  $\min\{u, n\}$ .

Each worker is endowed with two search units – two applications. Hence,  $u = 2$ . Given such an assumption,  $M(2, n)/2 = m(n)$  is the probability for a given worker to receive an offer per search unit.

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<sup>6</sup>Blanchard and Giavazzi (2003) consider such shadow costs to ensure that pure profits are not dissipated in entry costs.

It is increasing in  $n$ . Similarly,  $2m(n)/n$  is the probability of a firm finding a worker. It is decreasing in  $n$ .

Firms set wages. If a worker receives a unique offer, he is paid the monopsony wage. Without loss of generality, the market value of outside opportunities is normalized to zero, and so is the monopsony wage. If a worker receives two offers, one from each application, firms enter Bertrand competition to attach labor services. Therefore, the model is static, but it features some of the properties of dynamic models with on-the-job search.

## 2.2 Labor market equilibrium

We first consider wage determination. The probability that a worker receives a single job offer is  $2m(n)(1 - m(n))$ . Then, the wage is nil and the firm gets the whole output. The probability of receiving two offers is  $m(n)^2$ . Then, the wage depends on the productivity of the two firms. Let  $\rho$  denote the proportion of foreign firms. With probability  $(1 - \rho)^2$ , the two offers are from local firms and the worker receives output  $y_R$ . With probability  $\rho(1 - \rho)$ , one of the offers comes from a foreign firm, and the other comes from a local firm. Then, the worker is hired by the foreign firm and his wage is  $y_R$ . The firm gets the difference  $y_F - y_R$ . Finally, with probability  $\rho^2$ , the two offers come from foreign firms. Then, the worker gets the marginal product  $y_F$ .

Expected profits for the two types of firms are:

$$\pi_F = -c_F y_F + \frac{2m(n)}{n} [(1 - m(n)) y_F + m(n)(1 - \rho)(y_F - y_R)] \quad (1)$$

$$\pi_R = -c_R y_R + \frac{2m(n)}{n} [1 - m(n)] y_R \quad (2)$$

Firms enter the economy until profits cover the costs. In equilibrium,  $\pi_R = \pi_F = 0$ .

$$c_F = \frac{2m(n)}{n} \left[ 1 - m(n) + m(n)(1 - \rho) \frac{y_F - y_R}{y_F} \right] \quad (3)$$

$$c_R = \frac{2m(n)}{n} [1 - m(n)] \quad (4)$$

These two equations simultaneously define  $\rho$ , the proportion of foreign firms, and  $n$ , the total number of firms. The system can be solved recursively. The free-entry condition (4) for the local firms determines the total number of firms  $n$ . Then, the free-entry condition (3) determines the proportion of foreign firms  $\rho$ . The facts that  $c_F > c_R$  and  $y_F > y_R$  imply that there exists a unique equilibrium with a non-trivial proportion of foreign firms.

The reason why the total number of firms only depends on the effective entry cost faced by local firms is the following. If  $c_F$  decreases, profits for foreign firms become positive. New foreign firms enter as result. Since  $c_R$  remains constant, profit expectations for local firms become negative as they find it more difficult to recruit a worker. The number of local firms goes down until the total number of firms returns to its initial value.

Changes in foreign firms' entry cost  $c_F$  do not modify the total number of firms, but increase the proportion of foreign firms – applying the implicit function theorem to equations (3) and (4) shows that  $dn/dc_F = 0$  and  $d\rho/dc_F < 0$ . An increase in productivity gap  $(y_F - y_R)/y_F$  has similar effects to a fall in foreign firms' entry cost  $c_F$ . It increases the proportion of foreign firms, but does not impact the total number of firms.

### 2.3 Labor share

The total wage bill paid by foreign firms is

$$W_F = m(n)^2 \rho [\rho y_F + 2(1 - \rho)y_R] \quad (5)$$

The wage bill corresponds to workers who receive two offers. This happens with probability  $m(n)^2$ . With probability  $\rho^2$  the two offers are from foreign firms and the worker receives the totality of output  $y_R$ . With probability  $2\rho(1 - \rho)$ , one of the two offers is from a local firm, and the worker gets  $y_R$ .

The total wage bill paid by local firms is

$$W_R = m(n)^2 (1 - \rho)^2 y_R \quad (6)$$

Wages correspond to workers who receive two offers from local firms.

Total output in foreign firms is

$$Y_F = m(n) \rho [2 - m(n) \rho] y_F \quad (7)$$

The probability that a worker does not receive a job offer from a foreign firm is  $(1 - m(n) \rho)^2$ . Therefore, the probability that a worker receives an offer from such firms is  $1 - (1 - m(n) \rho)^2$ . However, the worker may receive two offers from such firms with probability  $m(n)^2 \rho^2$ . But, only one of the firms hires him. Hence, we subtract  $m(n)^2 \rho^2$ . The result follows.

Similarly, total output in local firms is

$$Y_R = m(n) (1 - \rho) [2 - m(n) (1 + \rho)] y_R \quad (8)$$

The total wage bill is  $W = W_F + W_R$ , while total output is  $Y = Y_F + Y_R$ . We obtain

$$\text{LS} = \frac{W}{Y} = \frac{m(n) [\rho^2 y_F + (1 - \rho^2) y_R]}{\rho [2 - m(n) \rho] y_F + (1 - \rho) [2 - m(n) (1 + \rho)] y_R} \quad (9)$$

### 2.4 Impact of foreign firms on the labor share

In this sub-section, we analyze how the labor share responds to changes in foreign firms' entry cost. First, entry costs only affect the labor share through effective changes in the proportion of foreign firms. Second, there is a U-shaped relationship between the labor share and the proportion of foreign firms. Finally, multinationals' opportunity costs of entry limit the effectiveness of openness policies, and may forbid the possibility of reaching the increasing part of the curve.



According to the free-entry conditions (3) and (4), changes in foreign firms' entry costs only lead to changes in the proportion  $\rho$  of foreign firms in the total number of firms. Therefore, to capture the impact of a decrease in foreign firms' entry cost, we only need to differentiate LS given by equation (9) with respect to  $\rho$ . We obtain:

$$\begin{aligned} \frac{dLS}{d\rho} &\stackrel{sign}{=} -dY/d\rho \times LS + dW/d\rho \\ &\stackrel{sign}{=} \underbrace{-(1 - \rho m(n)) (y_F - y_R) LS}_{\text{technological gap effect}} + \underbrace{\rho m(n) (y_F - y_R)}_{\text{wage competition effect}} \end{aligned} \quad (10)$$

Two opposite forces are involved:

The *technological gap effect* tends to decrease the labor share. An increase in the proportion of foreign firms raises output, as they benefit from better productivity. At given wages, this reduces the labor share. This effect depends on the ability of foreign firms to extract a rent on labor thanks to their better technology.

The *wage competition effect* tends to increase the labor share. An increase in the proportion of foreign firms raises wage competition between them, which increases wages. At given output, this tends to raise the labor share.

The impact of foreign firms' entry cost on the labor share results from the interplay between these two forces. We get:

$$\frac{dLS}{d\rho} \stackrel{sign}{=} \rho^2 y_F - (1 - \rho)^2 y_R \quad (11)$$

Hence,  $dLS/d\rho$  is non-monotonic in  $\rho$ . It decreases at first, reaches a minimum, and finally increases. The technological rent effect initially dominates, while it is dominated at a larger proportion of foreign firms. The threshold proportion of foreign firms  $\rho^*$  below (above) which increased financial openness deteriorates (raises) the labor share results from  $dLS/d\rho = 0$ . We find

$$\rho^* = \frac{1}{1 + (y_F/y_R)^{1/2}} \quad (12)$$

The pattern of the labor share with respect to the proportion of foreign firms reflects the pattern of productive heterogeneity among firms. The labor share is the same when there are no foreign investors ( $c_F$  sufficiently large, which implies that  $\rho = 0$ ), and when output is only produced by foreign firms ( $c_R = c_F$ , which implies that  $\rho = 1$ ). For these two extreme cases:

$$LS = \frac{m(n)}{2 - m(n)} \quad (13)$$

Figure 1 depicts the U-shaped relationship between the proportion of foreign firms and the labor share.

Reducing foreign firms' entry costs  $c_F$  means moving along the curve from the left to the right. By setting institutions that favor foreign investment, Governments can alter the proportion of foreign firms, which affects the labor share. Financial openness has no impact per se: it only affects the labor share to the extent it alters the proportion of foreign firms. This prediction differs from Rodrik-type models in which the labor share decreases with institutional openness.

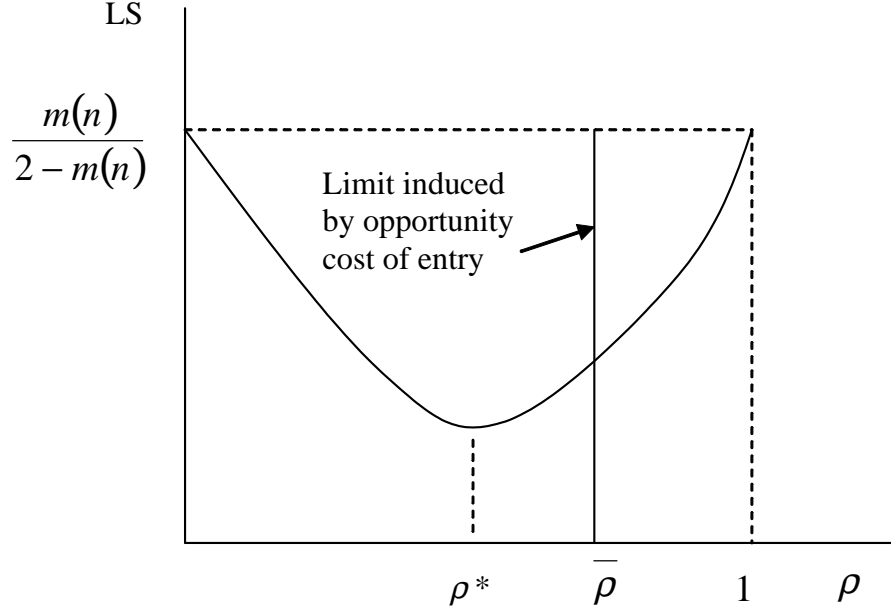


Figure 1: Labor share and proportion of jobs in foreign firms. LS goes from 0 to 1 as  $c_F$  goes from infinity to  $c_R$ . The proportion  $\bar{\rho}$  corresponds to  $c_F = c_R + \bar{\pi}$ .

However, financial openness policies cannot arbitrarily attract foreign investors. Those policies are limited by multinational firms' alternative profits in the rest of the world. Suppose for instance entry costs correspond to capital costs, and that the entry cost for foreign firms has three components: the cost  $c_R$  borne by local firms to open a new business, the cost induced by imperfect financial openness  $c_O$ , and the opportunity cost of entry  $\bar{\pi}$ . Formally,  $c_F = c_R + c_O + \bar{\pi}$ .

Governments can alter the degree of financial openness; however, they cannot reduce profit opportunities in alternative countries. The proportion of foreign firms easily responds to financial openness policies at early stages of financial openness. It is, therefore, easy to go along the decreasing part of the curve. However, opportunity costs of entry limit the ability of openness policies to reach the increasing part of the curve. In Figure 1,  $\bar{\rho}$  is the proportion of foreign firms implied by the entry cost  $c_F = c_R + \bar{\pi}$ . This constraint may be so tight that  $\bar{\rho}$  is actually lower than  $\rho^*$ .

In our empirical analysis, we show that most of the developing countries are actually stuck on the decreasing part of the locus. In line with the current discussion, we argue that this is implied by multinationals' alternative profit locations.

We now turn to various extensions of the basic framework.

## 2.5 Financial openness, entry costs and aggregate welfare

Does the host economy benefit from financial openness? In this subsection, we show that the entry of foreign firms may have ambiguous impacts on aggregate income depending on the nature of entry costs. We consider two cases: in the first case, entry costs correspond to capital costs. In the second case, entry costs correspond to shadow costs. In both cases, we assume that the local Government can reduce foreign firms' entry cost  $c_F$  through financial openness policies.

Let us start with the case where entry costs correspond to capital costs. Both local and foreign investors have access to the world capital market, which pays a fixed price for each unit of capital. If  $K$  is the amount of capital held by local people, and  $p$  is the unit price, then aggregate income is

$$GNP = rK + W \neq GDP = Y \quad (14)$$

Openness policies only affect the total wage bill  $W$ . Whether the labor share goes up or down is irrelevant for aggregate income. The relevant question is whether  $W$  increases or not. Using equations (5) and (6), the total wage bill is

$$W = W_R + W_F = m(n)^2 [y_R + \rho^2 (y_F - y_R)] \quad (15)$$

A marginal decrease in  $c_F$  implies a marginal increase in  $\rho$ . As foreign firms pay better wages, the mean wage goes up and aggregate income increases. On the basis that workers receive a small part of capital income, the rise in  $W$  should lower overall income inequality. Put otherwise, everyone should benefit from openness to foreign capital, and workers should gain both in absolute and in relative terms.

Now, we assume that entry costs correspond to shadow costs. The idea here is that the Government can limit the number of competitors of each type (foreign or local) to ensure that incumbents make superprofits. In that view,  $c_i$  is the amount of expected profits made by type- $i$  firm owners.

Aggregate income in the host country is:

$$GNP = Y_R + W_F < GDP = Y_R + Y_F \quad (16)$$

Local people can enjoy the whole output produced by local firms plus wage payments made by foreign firms. The rest of output,  $Y_F - W_F$ , accrues to foreign firm owners.

Using equations (5) to (8), we obtain

$$GNP = m [2 - m - 2(1 - m)\rho - m\rho^2] y_R + m^2 \rho^2 y_F \quad (17)$$

It follows that

$$-\frac{dGNP}{dc_F} = -\frac{d\rho}{dc_F} 2m [m\rho(y_F - y_R) - (1 - m)y_R] \quad (18)$$

which has the sign of the term between brackets.

Opening the country to foreign firms has two effects. On the one hand, it increases labor income. This effect depends on workers' ability to capture foreign output, which, in turn, increases with the proportion  $\rho$  of foreign firms. On the other hand, it reduces local output. When the proportion of foreign firms

is sufficiently small and when the job offer probability is sufficiently low, the negative effect dominates the positive effect and aggregate income decreases. Conversely, when the proportion of foreign firms is sufficiently large and the labor market is not too frictional, aggregate income increases with financial openness.

The main lesson is that aggregate income for the residents may decrease with financial openness. The explanation relies on the fall in labor share that follows foreign capital entry. As foreign firms enter the host country, they replace local firms, which cannot compete with them. Local output  $Y_R$  goes down as a result. Foreign output increases, and GDP goes up. However, only the wage payments  $W_F$  stay in the host country, while the rest of income produced by foreign firms  $Y_F - W_F$  belongs to foreign firm owners. At early stages of financial openness, the proportion of foreign firms is small, and the increase in  $W_F$  cannot compensate for the loss in local output.

Following this interpretation of entry costs as shadow costs, our model advertises against partial financial openness. With partial financial openness, very few foreign firms enter the host country. Lack of wage competition implies that the labor share falls. Full openness grants that many different firms enter the economy. Wage competition ensures that the mean wage increases by more than local output declines and aggregate wealth goes up.

Finally, the model highlights the complementarity between financial openness and labor market well-being. Opening to foreign investment in the context of a very frictional market lowers the chances of economic success. FDI can be very good for the country as a whole when workers are very mobile across jobs and easily capture a large share of output produced in foreign firms.

## 2.6 Firm heterogeneity

The basic model assumes that national firms and multinational enterprises differ in factor productivity for exogenous reasons. While there is indeed empirical support for a productivity advantage of multinational firms, recent theoretical work focusing on international trade considers compositional effects to be responsible for this outcome (see e.g. Helpman et al, 2004). Put differently, recent work on heterogeneous firms has emphasized that only the best firms engage in foreign investment, implying that multinationals are on average more productive than their foreign competitors. However, the basic model assumes that all national firms are less productive than foreign multinational. In this sub-section, we relax this assumption.

We modify our model as follows. A firm may either be a high-productivity firm or a low-productivity firm. High-productivity firms, whether foreign or local, produce  $y_F$ , while low-productivity firms produce  $y_R$ . Firms do not know ex-ante whether they will turn highly productive or not.

Let  $p_i$  be the proportion of high-productivity firms among the firms of type  $i$ ,  $i = F, R$ . The overall

proportion of high-productivity firms is  $\tilde{\rho} = \rho p_F + (1 - \rho) p_R$ . Profit functions write

$$\begin{aligned} \pi_i = & -c_i + \frac{2m(n)}{n} p_i [(1 - m(n)) y_F + m(n)(1 - \tilde{\rho})(y_F - y_R)] \\ & + \frac{2m(n)}{n} p_i (1 - m(n)) y_R \end{aligned} \quad (19)$$

In equilibrium,  $\pi_F = \pi_R = 0$ , which jointly determines  $n$  and  $\rho$ . In an interior solution, that is  $\rho \in (0, 1)$ , the proportion of foreign firms strictly decreases with the cost of entry specific to such firms.

The labor share now writes

$$\text{LS} = \frac{m(n) [\tilde{\rho}^2 y_F + (1 - \tilde{\rho}^2) y_R]}{\tilde{\rho} [2 - m(n) \tilde{\rho}] y_F + (1 - \tilde{\rho}) [2 - m(n) (1 + \tilde{\rho})] y_R} \quad (20)$$

The only difference comes from the fact that  $\tilde{\rho}$  is now the proportion of high-productivity firms rather than the proportion of foreign firms.

Following a decrease in foreign firm entry cost, the proportion of foreign firms goes up. That increase in the proportion of foreign firms modifies the labor share of income as follows:

$$\frac{d\text{LS}}{d\rho} = \frac{\partial \text{LS}}{\partial \tilde{\rho}} \frac{d\tilde{\rho}}{d\rho} = \frac{\partial \text{LS}}{\partial \tilde{\rho}} (p_F - p_R) \quad (21)$$

The relationship is qualitatively similar as before provided that the proportion of high-productivity firms is larger among the foreign firms than among the local firms. However, there is a non-trivial proportion of high-productivity firms when  $\rho = 0$  and when  $\rho = 1$ . Therefore, the relationship between the proportion of foreign firms and the labor share is U-shaped if and only if

$$p_R < \rho^* \equiv \frac{1}{1 + (y_F/y_R)^{1/2}} < p_F \quad (22)$$

The proportion of high-productivity firms must be sufficiently low among the local firms, and sufficiently large among the foreign firms. The threshold depends on the technological gap between local and foreign firms. This condition is likely to be satisfied in developing countries, and much less likely in developed economies.

When the proportion of high-productivity firms is too large among the local firms, the labor share strictly increases with the proportion of foreign firms. This is so because foreign firms contribute to reducing firm heterogeneity in such a case. Conversely, when the proportion of high-productivity firms is too small among the foreign firms, the labor share strictly decreases with the proportion of foreign firms. Foreign firms always raise firm heterogeneity in such a case.

## 2.7 Accounting for capital choice

The basic model abstracts from capital choice. In this sub-section, we allow firms to set their capital intensity. We also make the difference between foreign and local firms, which face different capital costs and different total factor productivity. Provided that the elasticity of substitution between capital and

labor is lower than one, a decrease in foreign firms' entry cost can raise the labor share by increasing average capital intensity.

Let  $k$  denote capital intensity, and assume that output is  $a_i y(k)$ , with  $y(0) = 0$ ,  $y'(k) > 0$ , and  $y''(k) < 0$ . The elasticity of output with respect to capital intensity is  $\alpha(k) \equiv ky'(k)/y(k) \in (0, 1)$ . Total factor productivity parameters and the rental cost of capital are asymmetric. Local firms face the price  $r_R$ , while foreign firms face the price  $r_F \leq r_R$ . To simplify, capital investment is made once the worker is recruited.

Capital intensity results from the equality between marginal productivity and marginal cost of capital:

$$a_i y'(k_i) = r_i, \quad i = F, R \quad (23)$$

This implies that foreign firms are more productive than local firms. The labor share is:

$$\text{LS} = \frac{m(n) [\rho^2 (1 - \alpha_F) y_F + (1 - \rho^2) (1 - \alpha_R) y_R]}{\rho [2 - m(n)\rho] y_F + (1 - \rho) [2 - m(n)(1 + \rho)] y_R} \quad (24)$$

where  $a_i y_i = y(k_i)$ , and  $\alpha_i = \alpha(k_i)$ ,  $i = F, R$ . As  $r_R = r_F$  and  $a_F = a_R = \alpha$ , foreign and local firms are no longer different, and the labor share tends to

$$\text{LS} = (1 - \alpha) \frac{m(n)}{2 - m(n)} \quad (25)$$

The labor share is composed of two terms, of which the first is the elasticity of output with respect to labor, and the second accounts for monopsony power derived from search frictions. As  $m(n) \rightarrow 1$ , the second term tends to one and we are back to the competitive model.

A marginal increase in  $\rho$  induced by a marginal decline in  $c_F$  has the following impacts:

$$\frac{d\text{LS}}{d\rho} \stackrel{\text{sign}}{=} \underbrace{-(1 - \rho m(n)) (y_F - y_R) \text{LS}}_{\text{technological gap effect}} + \underbrace{\rho m(n) [(1 - \alpha_F) y_F - (1 - \alpha_R) y_R]}_{\text{wage competition effect}} \quad (26)$$

The wage competition effect now depends on the competitive wage differential  $(1 - \alpha_F) y_F - (1 - \alpha_R) y_R$ , rather than on the output differential  $y_F - y_R$ . Given that  $k_F > k_R$ , we have  $\alpha_R > \alpha_F$  whenever the elasticity of substitution between capital and labor is lower than one. The wage competition effect is magnified when capital and labor are complementary. This point has important implications for the empirical analysis. In the empirical part of the paper (next section), changes in  $\rho$  are captured by changes in FDI stock to GDP ratio. This means that changes in  $\rho$  and changes in total capital held by foreign firms are observationally equivalent. This may induce a spurious positive impact of FDI stock to GDP ratio on the labor share: an increase in such a ratio may simply raise aggregate capital intensity. It follows that one must control for changes in aggregate capital intensity while trying to find an empirical relationship between the proportion of foreign firms and the labor share. In the empirical part of the paper, regressions include a proxy for capital intensity.

## 2.8 From the theory to empirical analysis

The theoretical model explains the labor share of income as a function of exogenous parameters, among which the degree of financial openness, foreign firms' opportunity cost of entry, and the cost to set up

jobs. However, these parameters only affect the labor share because they have an impact on endogenous variables like the vacancy/unemployment ratio, or the proportion of jobs in foreign firms. Formally, the labor share is a function  $LS(\rho, m(n), k, \Gamma)$  where  $\Gamma$  is a set of exogenous parameters. Our empirical analysis consists in estimating a linearized version of this equation, allowing for a quadratic impact of the variable  $\rho$ .

### 3 Empirical analysis

This section examines the relationship between the size of economic activity due to foreign firms and the labor share. We use panel data covering developing countries. Fixed effects estimations show that the stock of inward FDI to GDP has a non-monotonic impact on the labor share: decreasing at first, and then increasing. The threshold above which the labor share starts increasing with FDI is in the range 150-180%. Most of the countries are stuck in the decreasing part of the curve. This relationship appears robust to the consideration of outliers, to endogeneity and autocorrelation problems, and to the introduction of globalization variables. The other determinants of the labor share are in line with the theoretical model, especially the technological gap (-), unemployment rate (-), and capital intensity (weakly +).

#### 3.1 Data

The dataset covers 98 developing countries over the period 1980-2000. We consider all available countries whose GDP per capita was lower than 60% that of the US in 1980.<sup>7</sup> This threshold allows us to consider a large variety of countries, from very poor countries that received very few FDI to high-growth countries that received enormous amounts of FDI. In sub-section 3.3, we estimate our empirical model on alternative sub-samples. Our preferred estimates are performed on yearly data to keep the maximum number of observations. The number of observations depends on the number of variables included in the regression. The basic regression with country fixed effects, FDI variables and a proxy for the technological gap is run over 1203 observations. Adding controls and instrumenting some of the explicative variables lower the number of observations according to data availability. Data sources are detailed in the Appendix.

The dependent variable is the labor share. Following Daudey (2005) and Ortega and Rodriguez (2006), we compute it from the UNIDO dataset INDSTAT3. This dataset only covers the manufacturing sector. The data are collected through a survey in more than 180 countries and cover a period from 1963 to 2003 (with gaps). There are three reasons why we use the UNIDO dataset. First, UNIDO harmonizes data definitions and computations across countries. Second, this dataset allows to abstract from changes in the sectorial composition of output. Third, the UNIDO dataset reduces the measurement problems associated with self-employment.<sup>8</sup> There is a minimum level of activity that eliminates most

<sup>7</sup>If there is no observation in 1980, we consider the closest year available.

<sup>8</sup>The labor share is the ratio of wage bill to value-added. The self-employed contribute to the denominator, but typically

self-employed and small-family firms from the sample. The main drawback of the dataset is that wages do not include employers' contributions. This tends to underestimate the labor shares. This problem is not very serious for our purpose, because we do not proceed to international comparisons. All our estimates include country fixed effects. Fixed effects models use within country variations to estimate the desired parameters. However, there may be changes over time in the labor shares that are only driven by changes in employers' contribution rates. Part of these changes will be captured by time dummies and by a variable that is highly correlated to GDP per capita.

The key explicative variable is the proportion of foreign firms. We use two different proxies: the ratio of (inward) FDI stock to GDP (FDI/Y), and the ratio of FDI stock to total capital stock (FDI/K). The former ratio is available from UNCTAD for 200 countries over the period 1980-2005. The latter ratio is computed from UNCTAD data on FDI stock and from Klenow and Rodriguez-Clare (2005) for the capital stock.<sup>9</sup> FDI refers to equity participation over 10%. Such investments indicate that foreign investors play an active role in the management of the firm. These firms are more likely to benefit from technological advance. Of course, other firms may also benefit from foreign investment. The presumption here is that the percentage of jobs concerned by our analysis is highly correlated with the ratio of FDI stock to GDP and/or the ratio of FDI stock to capital.

Stocks are computed from the historical record of FDI inflows given by the balance of payments. Capital account data have been criticized on the ground that they fail to account for the valuation effect.<sup>10</sup> We also use data on FDI stocks provided by Lane and Milesi-Ferretti (2006) – LMF –, which correct for the valuation effect. These data are available over the longer period 1970-2005 and allow us to test the robustness of our results.

The theoretical model suggests that the impact of FDI on the labor share depends on the technological gap  $TG = (y_F - y_R) / y_F$  between the host economy which receives FDI and the home-based transnational firm. Unfortunately, there are no time-varying statistics for the mean productivity differential  $y_R / y_F$  between local and foreign firms. As a proxy for this variable, we use the ratio of local GDP per capita to US GDP per capita, both measured at purchasing power parity. The technological gap variable is measured accordingly by one minus the latter ratio. The idea behind this proxy is that foreign firms are close to the productivity frontier, and the US GDP per capita broadly captures this frontier. Of course, the proxy is not perfect as GDP per capita not only depends on total factor productivity and capital intensity, but also on the skill level of the workforce. Average skills are much higher in developed countries than in developing countries, so that GDP per capita may overstate the productivity advantage

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do not appear in the denominator. There are several ways to ascribe a fictitious wage to the self-employed (see Bernanke and Gürkayanak, 2001, and Gollin, 2002). These methods require strong assumptions on such a wage, as well as data on self-employment. Focusing on the manufacturing sector does not require the gross wage bill to output ratio to be manipulated.

<sup>9</sup>Initial values for the capital stock and the FDI stock have not been computed in the same way. This explains why the ratio FDI/K can be larger than one.

<sup>10</sup>When a country is indebted in foreign money (dollars), changes in parity alter the debt level. This phenomenon is very large for the US.



of multinational firms.<sup>11</sup>

The labor share also depends on the matching probability  $m(n)$ . This probability shapes workers' ability to generate wage competition for their services. This probability is not available as such. However, we use the following property of our model. The probability of staying unemployed coincides with the unemployment rate. It is equal to  $UNR = (1 - m(n))^2$ . Therefore, we use the unemployment rate as a proxy for (one minus) the matching probability. This variable is available for a limited number of years and countries.

Finally, we must separate the impact of FDI from changes in overall capital intensity as indicated in subsection 2.7. We consider the ratio of capital stock to output  $K/Y$  rather than the ratio of capital stock to labor. The former ratio is governed by changes in the ratio of capital stock to effective units of labor. Unfortunately, the UNIDO dataset does not allow us to compute a reliable capital stock series – in many cases, the number of observations is clearly insufficient. Therefore, we use the ratio  $I/Y$  of investment to value added.

Some regressions include a measure of trade openness ( $OPENT$ , the usual openness degree, that is the ratio of imports plus exports to GDP), a measure of de jure capital account openness ( $OPENK$ ) (the composite index constructed by Chinn and Ito, 2007), a dummy variable ( $CRISIS$ ) that takes the value 1 when the nominal exchange rate depreciates by more than 25%.

Table 1 displays descriptive statistics for the core variables. There is substantial variation in the dataset: the standard deviation in the labor share variable accounts for half of the mean value. There is more volatility in the cross-section dimension than in the time dimension. However, the mean standard deviation within country is sufficiently large for panel data analysis.

TABLE 1

### 3.2 Core regressions

Let  $i$  denote the country and  $t$  the period. We aim to estimate the following fixed effects model:

$$LS_{it} = a_i^0 + a_t^1 + a^2 FDI/Y_{it} + a^3 (FDI/Y_{it})^2 + a^4 TG_{it} + a^5 UNR_{it} + a^6 K/Y_{it} + \varepsilon_{it} \quad (27)$$

where  $a_i^0$  is the country fixed effect, and  $a_t^1$  is a period dummy. The error term  $\varepsilon_{it}$  is supposed serially uncorrelated. The validation of our model requires that  $a^2 < 0$ ,  $a^3 > 0$ ,  $a^4 < 0$ ,  $a^5 < 0$ . This statistical model assumes that the different regressors have the same impact in each country. In particular, the relationship between financial openness and the labor share must be the same throughout the sample. This prediction differs somewhat from the theoretical model, whereby the magnitude of the relationship

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<sup>11</sup>Using data for total factor productivity would not be satisfying. Multinational firms benefit from both higher TFP and better access to the capital market. One solution would be to extract the contribution of education to GDP per worker, and consider the resulting productivity residual as a proxy for the mean local technological level.

depends on output gap. We also present regressions in which the variable FDI/Y is replaced by the interaction term FDI/Y×TG.

Table 2 depicts our main results. Each column is associated with a particular specification. In column a, we estimate the relationship without controlling for capital intensity (this assumes a Cobb-Douglas technology), unemployment rate and time dummies. In column b, we add time dummies. In column c, we include capital intensity (this allows for CES technologies for instance). In column d, we add the unemployment rate – and lose half the observations. In columns e and f, we replace the regressor FDI/Y by an interaction term between FDI/Y and technological gap. In columns b to f, regressors are one-period lagged. This allows for potential contemporaneous correlation between the regressors and the error term to be controlled. Squared errors are robust to arbitrary heteroskedasticity between countries.

TABLE 2

The results can be commented along five dimensions.

First, the estimations validate the existence of a U-shaped relationship between FDI/Y and the labor share. The coefficient associated with FDI/Y is negative, while the coefficient associated with  $(\text{FDI}/\text{Y})^2$  is positive. This relationship is robust to country fixed effects, time dummies, and to our different control variables. FDI has two opposite effects on the labor share, in line with our theoretical model. Our estimates also imply that the threshold above which an increase in FDI stock to GDP starts increasing the labor share is very high. This threshold can be computed as follows:  $-a^2/(2a^3)$ . It varies between 150% and 180%. This is far above the mean ratio in developing countries.

Second, the quantitative impact of FDI is substantially large. Consider a country that is characterized by the mean value of FDI/Y (given by Table 1) and experiences an increase of one standard deviation in this ratio, *everything else being equal*. Estimates in columns a to d imply a fall in the labor share that varies between 3.0 to 7 points. This impact amounts to between 9% to 21% of the mean labor share of our sample.

Third, the two other variables that our model emphasizes have the predicted negative impact. In columns a to d, the technological gap (TG) has a negative sign, in line with the argument whereby foreign firms use their technological advance to derive extra rents on the labor market. Consider a country that experiences a decline in technological gap of one standard deviation. The labor share should increase by 1.5 to 5.5 points. Note, however, that TG is highly correlated to GDP per capita, which means that TG captures a variety of factors that are embodied in GDP per capita. The unemployment rate (UNR) has a strong negative impact on the labor share.

Fourth, the parameter associated with capital intensity (K/Y) has a positive sign – though it is not always significant. This indicates that the elasticity of substitution between capital and labor is lower than one. The fact that capital and labor are complementary in output is not controversial, at least in developing countries (see for instance Duffy and Papageorgiou, 2000).

Fifth, Table 2 displays strong interaction effects between FDI/Y and TG. Columns e and f show that TG loses significance and impact once we replace the regressor FDI/Y by the interaction term FDI/Y×TG, and the regressor (FDI/Y)<sup>2</sup> by (FDI/Y)<sup>2</sup>×TG. This has two implications. On the one hand, the technological gap mainly affects the labor share through magnifying the effects of FDI/Y. This is in line with the theoretical model and strengthens the view according to which the technological gap variable is more than a simple proxy for time-varying country-specific features that are correlated with GDP per capita. On the other hand, the magnitude of the relationship between FDI and the labor share is conditional on TG. The higher the technological gap, the larger the impact of foreign firms on the labor share. These estimates do not invalidate the magnitude of the effects reported in columns a to d. For instance, consider a country characterized by the mean technological gap and the mean ratio FDI/Y, and assume that this country experiences an increase in FDI/Y of one standard deviation. According to columns e and f, this would reduce the labor share by 9 to 10 points.

### 3.3 Understanding the results

In this sub-section, we check the robustness of the relationship between FDI stock to GDP and the labor share. There are three main reasons why this statistical relationship may be spurious: existence of outliers, endogeneity and autocorrelation biases, and omitted globalization variables causing both FDI and the labor share.

We first start with outliers. Figure 2 plots the partial relationship between the labor share and the ratio of FDI stock to GDP. This displays two main features. First, there are some outliers, but they do not seem to drive the global negative impact of FDI.<sup>12</sup> Second, Figure 2 visually confirms that most of the sample is below the threshold. The flat and increasing parts of the curve are due to a very few countries.

The countries that drive the positive part of the curve are Hong-Kong, Ireland, Macao, and Singapore. These countries have two characteristics: they have experienced impressive growth rates over the period, and they have attracted enormous amounts of FDI. These two features are related. High growth rates imply high profit opportunities for the multinationals and foreign investors in general. In terms of our model, the effective cost of entry  $c_F$  is very low in these countries, not only because of financial openness  $c_O$ , but also because alternative profits  $\bar{\pi}$  are relatively low. Conversely, effective costs of entry are very large in the other countries despite financial openness, because opportunity costs of entry are very high. Put otherwise, FDI lowers the labor shares throughout the developing world because most of the FDI has been captured by booming countries in East-Asia and Europe. In terms of economic policy, multinationals' opportunity cost of entry limits the effectiveness of policies designed to attract FDI.

To confirm that view, we run the regressions over various alterations of the initial sample. Table 3 displays the results. We first compute the empirical distribution of percentage change in LS ( $\Delta LS_{it}/LS_{it}$ ).

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<sup>12</sup>Figure 2 shows one observation that is an obvious outlier: El Salvador in 1997, when the labor share goes from 26 to 81 before going back to 31.

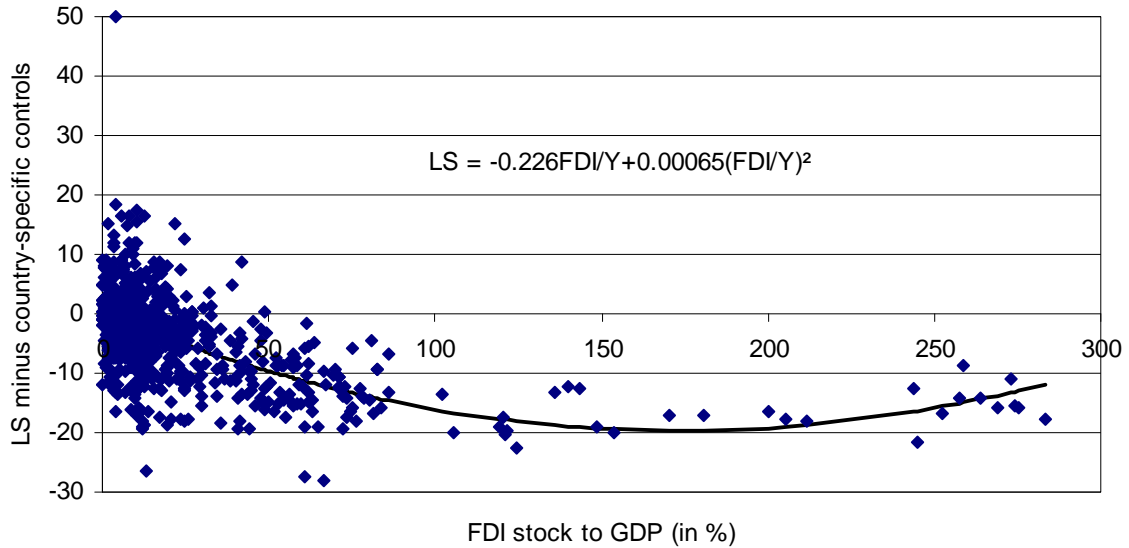


Figure 2: Partial relationship between labor share and FDI stock to GDP. Country-specific controls are TG, I/Y, time effects, and country fixed effects.

Then, we omit the observations belonging to the top 1 and top 2 percentile of this distribution, and run fixed effects regressions. The results are reported in columns a and b. The magnitude of the relationship between FDI/Y and LS is almost unchanged. Columns c and d omit observations where the FDI stock to GDP is larger than 100% and 75% respectively.<sup>13</sup> As expected, the negative coefficient associated to FDI/Y is much stronger, while the positive coefficient associated to  $(\text{FDI}/Y)^2$  is less significant. Column e restricts the sample to countries whose GDP per capita was lower than 50% that of the US in 1980. The results are close to the initial estimates.

TABLE 3

We then discuss endogeneity and autocorrelation biases.

Endogeneity may arise for two reasons. On the one hand, the regressors may be correlated with the error terms in the fixed effects model. The explicative variables and the labor share are general equilibrium variables. As such, they may be affected by correlated shocks, generating a statistical bias in the fixed effects estimator. Regressions displayed in Table 2 and Table 3 address this potential endogeneity bias by considering lagged regressors. This method is based on the idea that the regressors are strongly autoregressive, so that we do not lose too much information. The main advantage is that we do not lose

<sup>13</sup>We have also run regressions omitting the countries where such extreme changes have occurred. The results are very close.

many observations, and we do not bias the sample towards richer countries. On the other hand, the labor share may directly alter FDI incentives for reasons that our model leaves aside. For instance, a high labor share may mean a good social climate, which lowers investment risk and attracts foreign investors. If this relationship were true, the negative impact of FDI would be underestimated, while the increasing part of the curve would reflect the causal effect of the labor share on FDI. This type of bias cannot be addressed by lagging the regressors, because the lagged regressors would also be correlated with the error terms.

Autocorrelation is a serious problem with panel data. Table 2 accounts for heteroskedasticity, but not for autocorrelation. Dealing with autocorrelation requires us to add the lagged labor share to the set of regressors. However, the fixed-effect estimator is biased in finite samples because the residuals are correlated with the new regressor. The size of the bias is typically magnified in small-T-large-N panel datasets such as ours.

To address these two sources of bias, we use the system-GMM estimator due to Blundell and Bond (1998). This estimator proves to be more stable vis-à-vis sample and instrument alterations than the Arellano-Bond difference estimator. Formally, the model is written as follows:

$$\Delta LS_{it} = a^1 \Delta LS_{it-1} + a^2 \Delta FDI/Y_{it} + a^3 \Delta (FDI/Y_{it})^2 + a^4 \Delta TG_{it} + a^6 \Delta K/Y_{it} + \Delta \varepsilon_{it} \quad (28)$$

$$LS_{it} = a^1 LS_{it-1} + a^2 FDI/Y_{it} + a^3 (FDI/Y_{it})^2 + a^4 TG_{it} + a^6 K/Y_{it} + \varepsilon_{it} \quad (29)$$

where all the variables have been centered in their period mean to account for common period shocks. The model has two components: the difference and level submodels. In both components, the lagged dependent variable is correlated with the error terms and must be instrumented. In addition, FDI terms may also be weakly exogenous, which also requires an instrumenting strategy. In the absence of good instruments, the set of instruments only contains lagged endogenous regressors and exogenous variables. In the difference submodel, the differenced lagged labor share is instrumented by past levels of the labor share (from  $LS_{it-2}$ ), while the lagged labor share is instrumented by past differences of the labor share in the level submodel (from  $\Delta LS_{it-1}$ ). This generates a large number of instruments in GMM-style. The set of instruments is finally reduced by collapsing the matrix of GMM-style instruments<sup>14</sup>.

The model is estimated by two-step GMM, while reported squared errors feature Windmeijer correction. This method corrects for individual heteroskedasticity, arbitrary patterns of autocorrelation within individuals, and downward squared-error bias in finite sample.

TABLE 4

Table 4 reports the results. In columns a to d,  $FDI/Y$  and  $(FDI/Y)^2$  are presumed weakly exogenous, i.e.  $FDI/Y_{it}$  is correlated with  $\varepsilon_{it}$ . The regressors  $\Delta FDI/Y_{it}$  and  $\Delta (FDI/Y_{it})^2$  are instrumented by

<sup>14</sup>The number of instruments increases with the time index of each observation. The total number of instruments is quadratic in the number of periods as a result. Collapsing allows such a number to be reduced, while exploiting the same information displayed by the dataset (see Roodman, 2006).

FDI/Y<sub>it-2</sub> and (FDI/Y<sub>it-2</sub>)<sup>2</sup> in the difference equation, while the regressors FDI/Y<sub>it</sub> and (FDI/Y<sub>it</sub>)<sup>2</sup> are instrumented by ΔFDI/Y<sub>it-1</sub> and Δ(FDI/Y<sub>it-1</sub>)<sup>2</sup> in the level equation. In columns e and f, FDI/Y and (FDI/Y)<sup>2</sup> are presumed predetermined. The various regressors containing FDI/Y<sub>it</sub> are replaced by their first lags – like in the fixed effects regressions. However, they may be correlated with ε<sub>it-1</sub>, and still need to be instrumented (for the same reason LS<sub>it-1</sub> needs to be instrumented). The instruments are the same as in the case where FDI/Y<sub>it</sub> and (FDI/Y<sub>it</sub>)<sup>2</sup> are weakly exogenous.

The various columns differ in the number of lags that we consider for the various endogenous variables. The number of instruments goes from 69 to 12. Clearly, 69 is too much with respect to the number of countries, 61. Column g displays the results of a standard fixed effects regression, where we restrict the sample to the one effectively used by system-GMM estimations.

The results are remarkably consistent across the various system-GMM estimations. Parameter  $a^1$  is about 0.60, which is lower than a unit root, but sufficiently high to prefer the system-GMM estimator rather than the difference estimator. Specification tests like the Sargan and Hansen tests of overidentifying restrictions, and the Arellano-Bover test of second-order autocorrelation, suggest that the model is well specified most of the times. This leads us to prefer the estimates with the smallest number of instruments, and in particular the one where FDI/Y and FDI/Y<sup>2</sup> are predetermined<sup>15</sup>. The estimated relationship between LS and FDI/Y is qualitatively similar to the one displayed by Table 2. Quantitatively, the magnitude of the parameters associated to FDI variables is in the range 50-75% of the initial one. This may receive three interpretations. First, we lose more than 60 observations, and selection bias may lead to a different estimation. Our model predicts that the threshold and the magnitude of the relationship should be governed by the technological gap. If the selected sample is richer than the initial sample, FDI have a smaller effect on the labor share as the typical productivity differential between foreign and local firms is lower. The fixed effects regression shows that the relationship between FDI/Y and LS is marginally smaller than the initial one. Second, endogeneity affects both the decreasing and increasing parts of the curve. Once purged of endogeneity bias, the true relationship proves to be more modest by 10-40%. Third, the statistical method itself may weaken the relationship. For those reasons, we interpret the GMM findings as a lower bound on the magnitude of the true relationship between FDI and the labor share.

We now discuss other globalization variables. They have received some attention in the recent past, and they may be correlated with both FDI and the labor share. Table 5 introduces a new set of regressors that deal with these various aspects of globalization: institutional financial openness, international trade, and, following Diwan (2002), exchange rate crises.

TABLE 5

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<sup>15</sup>Column f shows that the P-value of the Hansen test of overidentifying restrictions is 0.645. This is obtained with a remarkably low number of instruments, which suggests that this value does not suffer from upward bias.

Table 5 shows that globalization variables do not affect the relationship between FDI and the labor share. In particular, institutional financial openness does not lower the labor share. The variable OPENK is the Chinn and Ito (2006) index of financial openness. Other studies (see Harrison, 2002, Ortega and Rodriguez, 2002, Lee and Jayadev, 2005) point out that capital account openness can deteriorate the labor share through increased capital mobility, thereby improving the bargaining position of capital owners. In line with such a theory, they report positive impacts of capital controls. Our model suggests that such effects of capital openness should disappear once we account for actual changes in foreign capital stocks. Indeed, column b displays a positive coefficient for the index of capital openness. Our model does not predict anything regarding trade flows. However, trade flows are associated to multinationals. Therefore, it is difficult to disentangle the impact of trade from the impact of foreign firms. Harrison (2002) and Ortega and Rodriguez (2002) estimate a negative effect of trade on the labor share in developing countries. However, Harrison considers FDI flows (rather than stocks as we do), and Ortega and Rodriguez do not control for FDI variables. Table 5 displays a non-significant parameter.

Finally, we consider several alterations in the main explicative variable, i.e. the ratio of FDI stock to GDP. Column a reproduces our benchmark regression: FDI stock is from UNCTAD, and it is divided by GDP. In column b, FDI stock is from Lane and Milesi-Ferretti (2007) – hereafter LMF. In column c and d, the two FDI stock variables are divided by the total capital stock rather than GDP. Columns e to h introduce the unemployment rate among the regressors.

TABLE 6

Results are qualitatively unchanged: all the different parameters have the same sign and significance.

## 4 Conclusion

This paper addresses the impact of FDI on the labor share of income in developing countries. We build on the idea that FDI increases productive heterogeneity between firms acting in the host country. Foreign firms are more productive, and, in a frictional labor market, only need to pay slightly more than local competitors to attract workers. This explains why the labor share falls with FDI. At some point, the magnitude of foreign firms in host activity may become so large that productive heterogeneity starts going down. The labor share would then increase with FDI. The paper offers a search-theoretic model that allows these two effects to be discussed, and tests the main predictions on aggregate data through fixed effects and system-GMM estimations.

The model can be used to discuss the welfare effects of policies designed to attract FDI. Welfare implications crucially depend on the nature of firms' entry costs. When such costs correspond to capital costs, aggregate income increases with the proportion of foreign firms. The mean wage goes up and workers fare better. When such costs correspond to rents granted by shadow costs, aggregate income

may decrease with the proportion of foreign firms. Local output goes down when foreign firms replace local firms. Due to the fall in labor share, the rise in mean wage does not compensate for the loss in local output at early stages of financial openness.

We point out a negative relationship between productive heterogeneity and the labor share of income. This relationship naturally arises in the context of globalization where modern firms can meet technologically obsolete and under-equipped competitors. However, this also happens in times of rapid technological change with emerging industries. We leave this extrapolation of our paper to future work.

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## APPENDIX

- CRISIS: Exchange rate crisis. Dummy equal to one if the percentage increase in nominal exchange rate is larger than 25%. The exchange rate is measured at the end of the year.

Source: IMF

- $FDI/Y$  = Ratio of Foreign Direct Investment stock to GDP  
 Source: UNCTAD and Lane and Milesi-Ferretti (2007) for FDI  
 Data available at <http://www.imf.org/external/pubs/ft/wp/2006/data/wp0669.zip>
- $FDI/K$  = Ratio of Foreign Direct Investment stock to total capital stock  
 Source: UNCTAD and Lane and Milesi-Ferretti (2007) for FDI  
 Data available at <http://www.imf.org/external/pubs/ft/wp/2006/data/wp0669.zip>  
 Source: Klenow and Rodriguez-Clare (2005) for the capital stock
- $I/Y$  = Ratio of Investment to value-added in the manufacturing sector  
 Source: UNIDO industrial statistics database INDSTAT3 2005 ISIC Rev.2  
 Values lower than 0 have been omitted from the sample
- $K/Y$  = Ratio of total capital stock to total GDP  
 Source: Klenow and Rodriguez-Clare (2005)
- LS: Labor share = Ratio of wages and salaries to value added ( $\times 100$ )  
 Source: UNIDO industrial statistics database INDSTAT3 2005 ISIC Rev.2
- OPENK: Chinn and Ito financial openness index. Composite index varying between 2.62 (very open) and -1.75 (close). It is based on four dummy variables reflecting the four major categories on the restrictions on external accounts: presence of multiple exchange rates, restrictions on current account transactions, restrictions on capital account transactions, requirement of the surrender of export proceed.  
 Source: Chinn and Ito (2007)  
 Data available at [http://www.ssc.wisc.edu/~mchinn/kaopen\\_2006.xls](http://www.ssc.wisc.edu/~mchinn/kaopen_2006.xls)
- OPENT = Ratio of total exports and imports to GDP  
 Source: World bank. World Development Indicators 2005
- TG: Technological gap = One - percentage gap between local GDP (PPP) per capita and US GDP per capita ( $\times 100$ )  
 Source: World bank. World Development Indicators 2005
- UNR: Unemployment rate = Ratio of unemployed workers to total labor force  
 Source: World bank. World Development Indicators 2005

- List of the developing countries: Algeria, Argentina, Bangladesh, Barbados, Belize, Bolivia, Botswana, Brazil, Bulgaria, Burkina-Faso, Burundi, Cameroon, Central African Republic, Chile, China, China (Hong Kong), China (Macao), Colombia, Congo, Costa Rica, Cote d'Ivoire, Croatia, Cyprus, Dominican Republic, Ecuador, Egypt, El Salvador, Eritrea, Ethiopia, Fiji, Gabon, Gambia, Ghana, Guatemala, Honduras, Hungary, India, Indonesia, Iran, Ireland, Israel, Jamaica, Jordan, Kenya, Korea, Latvia, Lesotho, Madagascar, Malawi, Malaysia, Malta, Mauritius, Mexico, Mongolia, Morocco, Namibia, Nepal, Nicaragua, Niger, Nigeria, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Russian Federation, Rwanda, Senegal, Sierra Leone, Singapore, Slovakia, Slovenia, South Africa, Spain, Sri Lanka, Swaziland, Syrian Arab Republic, Tanzania, Thailand, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Uganda, Uruguay, Venezuela, Zambia, Zimbabwe
- List of the developed countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Italy, Japan, Kuwait, Netherlands, New Zealand, Norway, Sweden, United Kingdom, United States of America

**Table 1: Descriptive statistics**

Variable		Mean	Stand dev	Min	Max	Obs
LS	Overall	33.69	14.19	2.23	85.33	N = 1203
	Between		12.55	12.99	71.03	n = 98
	Within		7.12	3.63	83.90	T = 12.27
FDI/GDP (FDI/Y, UNCTAD)	Overall	21.27	34.69	0.00	283.60	N = 1203
	Between		25.92	0.14	165.75	n = 98
	Within		18.48	-68.07	193.71	T = 12.27

For sources and/or calculations see Appendix.

**Table 2: Fixed effects regressions**

Specification	(a)	(b)	(c)	(d)	(e)	(f)
FDI/Y	-0.219*** (0.036)	-0.121*** (0.042)	-0.226*** (0.034)	-0.254*** (0.052)		
(FDI/Y) <sup>2</sup>	0.00076*** (0.00012)	0.00040*** (0.00013)	0.00065*** (0.00010)	0.00070*** (0.00014)		
FDI/Y*TG					-0.0034*** (0.00053)	-0.0049*** (0.00090)
(FDI/Y) <sup>2</sup> *TG					9.49e-06*** (1.68e-06)	0.000013*** (2.40e-06)
TG	-0.086 (0.070)	-0.156** (0.065)	-0.319*** (0.075)	-0.187** (0.085)	-0.196*** (0.076)	0.030 (0.088)
I/Y			0.743 (0.610)	4.512* (2.515)	0.808 (0.607)	4.649* (2.483)
UNR				-0.671*** (0.167)		-0.799*** (0.174)
Fixed effects	yes	yes	yes	yes	yes	yes
Time dummies	no	yes	yes	yes	yes	yes
R-squared	0.045	0.154	0.230	0.280	0.233	0.296
No observations	1203	1137	794	460	794	460
No countries	98	96	76	55	76	55

Robust standard errors in brackets. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.  
In regressions b to f, all regressors are one-period lagged.

**Table 3: In search for outliers**

Specification	(a) 99%	(b) 98%	(c) FDI/Y<100	(d) FDI/Y<75	(e) TG>50
FDI/Y	-0.224*** (0.033)	-0.217*** (0.033)	-0.361*** (0.088)	-0.306*** (0.098)	-0.273*** (0.049)
(FDI/Y) <sup>2</sup>	0.00064*** (0.00010)	0.00061*** (0.00010)	0.0020** (0.00092)	0.0010 (0.0011)	0.00076*** (0.00013)
TG	-0.340*** (0.074)	-0.346*** (0.074)	-0.325*** (0.077)	-0.361*** (0.083)	-0.228*** (0.082)
I/Y	0.724 (0.603)	0.589 (0.597)	0.688 (0.620)	0.685 (0.621)	0.319 (0.579)
Fixed effects	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes
R-squared	0.269	0.282	0.230	0.234	0.265
No observations	781	773	766	753	703
No countries	75	75	75	75	70

Notes: Robust standard in brackets. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.  
All regressors are one-period lagged. For columns a and b, we compute the distribution of % change in LS.  
We then omit the observations corresponding to the top 1% and top 2% of such a distribution.

**Table 4: Accounting for endogeneity and autocorrelation**

Specification	(a) endogenous	(b) endogenous	(c) endogenous	(d) endogenous	(e) predetermined	(f) predetermined	(g) FE
LS-1	0.572*** (0.130)	0.600*** (0.173)	0.629*** (0.145)	0.641*** (0.140)	0.604*** (0.126)	0.669*** (0.136)	
FDI/Y	-0.122** (0.062)	-0.118** (0.052)	-0.120** (0.051)	-0.159** (0.078)	-0.092** (0.046)	-0.182** (0.081)	-0.219*** (0.039)
FDI/Y <sup>2</sup>	0.00031* (0.00017)	0.00028** (0.00013)	0.00029** (0.00013)	0.00032* (0.00016)	0.00027* (0.00014)	0.00037* (0.00019)	0.00061*** (0.00011)
TG	-0.229*** (0.070)	-0.201** (0.080)	-0.182*** (0.069)	-0.232*** (0.082)	-0.190*** (0.059)	-0.225*** (0.069)	-0.324*** (0.063)
I/Y	0.574 (1.185)	0.276 (1.322)	-0.169 (1.200)	0.145 (1.269)	-0.745 (0.866)	-1.038 (1.084)	1.117* (0.672)
No observations	750	750	750	750	750	750	654
No countries	69	69	69	69	69	69	67
Sargan	0.048	0.288	0.213	0.250	0.026	0.168	
Hansen	0.544	0.111	0.562	0.728	0.517	0.649	
AR(2)	0.258	0.268	0.276	0.298	0.255	0.288	
No instruments	69	36	21	12	69	12	
Lags	(2 max)	(2 11)	(2 6)	(2 3)	(2 max)	(2 3)	

Notes: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

Columns a to f report two-step system-GMM estimates with robust standard errors in brackets. In a to d, FDI/Y and FDI/Y<sup>2</sup> are considered endogenous.

They are supposed predetermined in e and f. The set of instruments contains levels and differences of the specified lags of the various endogenous regressors, and levels and differences of exogenous explicatives. Estimations have been achieved using the Stata command xtabond2.

The number of GMM-style instruments has been reduced using the option collapse.

Lines Sargan and Hansen provide the P-values for the Sargan and Hansen tests of overidentifying restrictions.

The null is that instruments are not correlated with the residuals.

Line AR(2) is the P-value for the Arellano-Bond second-order auto-correlation test.

The null is that errors in the difference regression do not exhibit second-order correlation.

Lags' indicates the range of lags that has been considered for the endogenous variables. The first figure is the first lag, and the second figure is the last lag.

Column g reports the estimates of a standard fixed-effect regression on the subsample data effectively used by system-GMM estimates.

**Table 5: Globalization**

Specification	(a)	(b)	(c)	(d)	(e)
FDI/Y	-0.226*** (0.034)	-0.236*** (0.051)	-0.245*** (0.055)	-0.225*** (0.055)	-0.276*** (0.078)
(FDI/Y) <sup>2</sup>	0.00065*** (0.00010)	0.00068*** (0.00014)	0.00071*** (0.00015)	0.00065*** (0.00015)	0.00078*** (0.00019)
TG	-0.319*** (0.075)	-0.390*** (0.079)	-0.388*** (0.094)	-0.401*** (0.094)	-0.294*** (0.111)
I/Y	0.743 (0.610)	1.356* (0.727)	1.407* (0.731)	1.513** (0.773)	6.701* (3.574)
OPENK		1.871*** (0.509)	1.821*** (0.527)	1.739*** (0.580)	0.910 (0.638)
OPENT			-0.0087 (0.023)	-0.0011 (0.024)	-0.012 (0.029)
CRISIS				-2.337** (0.916)	-3.007** (1.260)
UNR					-0.701*** (0.207)
Fixed effects	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes
R-squared	0.230	0.258	0.259	0.279	0.341
No observations	794	732	708	666	378
No countries	76	70	69	66	46

Robust standard errors in brackets. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. All regressors are one-period lagged.



**Table 6: Changes in FDI variable**

Specification	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Data	UNCTAD	LMF	UNCTAD	LMF	UNCTAD	LMF	UNCTAD	LMF
FDI/Y	-0.225*** (0.055)	-0.211*** (0.052)			-0.276*** (0.078)	-0.307*** (0.075)		
(FDI/Y) <sup>2</sup>	0.00065*** (0.00015)	0.00060*** (0.00014)			0.00078*** (0.00019)	0.00081*** (0.00021)		
FDI/K			-0.465*** (0.078)	-0.388*** (0.075)			-0.510*** (0.095)	-0.583*** (0.127)
(FDI/K) <sup>2</sup>			0.0020*** (0.00031)	0.0016*** (0.00044)			0.0021*** (0.00037)	0.0024*** (0.00066)
TG	-0.401*** (0.094)	-0.407*** (0.074)	-0.416*** (0.104)	-0.457*** (0.088)	-0.294*** (0.111)	-0.448*** (0.116)	-0.286** (0.122)	-0.507*** (0.135)
I/Y	1.513** (0.773)	1.279** (0.652)	1.789** (0.852)	1.346* (0.692)	6.701* (3.574)	2.629 (2.996)	11.160** (4.550)	4.225 (4.464)
OPENK	1.739*** (0.580)	1.035** (0.477)	1.776*** (0.600)	1.024** (0.505)	0.910 (0.638)	1.245** (0.636)	0.904 (0.654)	1.352** (0.677)
OPENT	-0.0011 (0.024)	-0.015 (0.022)	0.0022 (0.024)	-0.0088 (0.021)	-0.012 (0.029)	0.037 (0.029)	-0.034 (0.030)	0.040 (0.031)
CRISIS	-2.337** (0.916)	-2.382*** (0.869)	-2.396** (0.940)	-2.540*** (0.875)	-3.007** (1.260)	-3.479*** (1.312)	-2.962** (1.207)	-3.222** (1.278)
UNR					-0.701*** (0.207)	-0.452** (0.190)	-0.740*** (0.213)	-0.523** (0.205)
Fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes
R-squared	0.279	0.254	0.306	0.264	0.341	0.296	0.407	0.355
No observations	666	771	564	659	378	378	340	340
No countries	66	61	55	51	46	45	41	40

Robust standard errors in brackets. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

All regressors are one-period lagged.