FOREIGN INVESTMENT AND WAGES: A CROWDING-OUT EFFECT IN MEXICO

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The purpose of this article is to determine the impact of foreign direct investment (FDI) on a country's overall economy rather than simply the sectors receiving such investment. The strategy consisted of adopting a crowding-in/crowding-out approach to Mexico's total capital volume in the 1993-2010 period. The substitutability of foreign and local capital implies a lower-than-expected economic dynamism. Using a dynamic panel analysis, a negative relationship was found between FDI and the general wage. Throughout the analysis, firm size stands out as a key variable in explaining the impact of FDI.

JEL classification: F21, O11, C23

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1. INTRODUCTION

The economic liberalization of Mexico in recent decades has induced a substantial increase in international trade as a share of GDP and has generated a significant increase in the influx of foreign capital, especially in the years following enactment of the North American Free Trade Agreement (NAFTA). A significant economic consequence of trade reform is the rise in wage inequality driven by the higher wages received by skilled labor as a result of increased foreign capital (Hanson, 2003).

The expectation on the part of policy makers is that foreign direct investment (FDI) in Latin America would have effects similar to those seen in Asia, where technological breakthroughs stimulated investment and triggered economic growth in the region, i.e., a complementarity of investments (Petri, 2012). However, the results for Mexico under the NAFTA framework do not reveal an acceleration of capital accumulation, productivity or increasing wages. In this sense, the objective of this article is to determine the contribution of FDI to overall economic activity. Therefore, a crowding-in/crowding-out perspective on total capital is adopted, and a wage equation is estimated using a dynamic panel.

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This article provides evidence of the substitutability of foreign and local capital and the negative impact of FDI on overall wages in the Mexican economy. This evidence could be used to reformulate policies to strengthen the domestic market, thereby reducing the impact of the Great Recession, as Ben Bernanke has referred to the period following the 2008 crisis. Furthermore, our findings indicate that to achieve the benefits of a policy to attract foreign investment, a lower international productivity gap is required.

The paper is structured as follows: In the first section, the crowding-in (CI) and crowding-out (CO) effects are discussed in terms of the complementarity or substitutability of foreign direct investment (FDI) with local capital. In the second section, FDI is associated with per-capita income as a function of production. In the third section a static panel model is estimated to determine the effect of FDI on total capital. The fourth section contains an estimation of the impact of FDI on wages using a dynamic panel. In Section 5, the static and dynamic estimates are reconciled and discussed. Finally, the concluding remarks affirm the importance of efficiency and average firm size in explaining the crowding-out effect of capital.

2. INVESTMENT: CROWDING-IN AND CROWDING-OUT EFFECTS

In the literature, FDI is understood to confer advantages on the region that receives it. Generally, these advantages consist of information regarding external markets, technology transfer, improvement in administrative skills, and job creation, among other factors. Lipsey (2004) presents a summary. There are also numerous articles that seek to verify the existence and magnitude of these benefits. An interesting subject for Latin America is the role that FDI plays in the promotion of local investment while reducing corruption (Larrain *et al.*, 2004). The procedures used to validate the benefits of FDI vary and are based on the researcher's interests.

An approach that is useful to our purposes is to determine the relationship between foreign and local investment. There are three possibilities: a neutral effect, crowding in, and crowding out. The first occurs when one dollar of FDI increases total investment by exactly one dollar, the second effect reflects an increase in local investment whereby total investment increases by more than a dollar, and finally,

the third effect occurs when total investment increases by less than one dollar for each dollar of FDI.

It is not possible to determine *a priori* which of the three effects will prevail in an economy (Agosin and Mayer, 2000). However, it is possible to identify certain determinants that could explain the final effect. In general, national investment policies and the strength of local businesses determine the impact that FDI will have on host regions. Specifically, FDI's positive impact tends to be greater when it occurs in new markets or is oriented towards foreign markets due to the provision of knowledge and technologies. However, when FDI flows into existing markets, the impact may be positive, though small, or fully negative if it shifts competition.

In Belgium, Backer and Sleuwaegen (2003) documented a negative impact for their study period. These authors argue, on the basis of their results, that long-term benefits may exist that help counteract short-term negative balances. However, competition in existing markets is not limited to customers; it also occurs in factor markets when there is competition to recruit the best workers and, occasionally, to attract investment. For certain industries, competition may center on permits for the use of natural resources, e.g., water, forests, or mineral resources. In each of these areas, multinationals compete with local businesses. When both local and multinational companies participate in complementary activities, CI effects could be generated by production linkages. In cases where competition is direct, CO effects are expected.

One study that provides evidence on the state of inter-industrial relations in Mexico describes minor production linkages between the leading and non-leading sectors of the country (Ortiz, 2007). This finding is based on the total linkage coefficients stemming from the input-output matrices available from 1950 to 1995. A more recent study that compares the major economies of Latin America identifies Colombia and Mexico as countries that produce less than one indirect job for each new direct job associated with exports (ECLAC, 2012: 142).

In addition to the lower level of integration in the production chains, two trends are evident: a) leading sectors maintain a behavioral dynamic in which they find it profitable to grow based on imports and losses in terms of trade, and b) sectors oriented towards the domestic market exhibit behavior more in accordance with standard factors of domestic integration and the pace of domestic accumulation (Ortiz, 2007). Hence, we analyze the effect that FDI exerts on total national investment.

To perform a specific estimation for Mexico, a panel analysis is conducted with information from all 32 federal divisions (states and district). We use the results of Agosin and Mayer (2000) as a reference. We begin from the simplification that the total amount of investment in an economy is the sum of domestic investment I_d and foreign investment I_f , that is, we ignore that FDI is not always greenfield investment. The time dimension was also incorporated into the investment identity, yielding $I_t = I_{d,t} + I_{f,t}$.

We assume foreign investment to be an exogenous variable. Unlike Agosin and Mayer (2000), our estimate is performed using census data in 5-year periods, which directly produces long-term coefficients. By contrast, Agosin and Mayer performed their estimate using an equation derived from a partial adjustment model with adaptive expectations to produce consistent estimates with their annual data. In particular, the long-term ratio $\hat{\beta}_{LT}$ determines the presence of CI or CO effects.

Agosin and Mayer found different results for the three regions studied over the 1970-1996 period. In Africa, there was evidence of a neutral effect, i.e., foreign investment increased total investment by a one-to-one ratio. As shown in Table 1, Asia registered a CI effect. In Latin America, the evidence confirmed a CO effect. However, subdividing the study period in Latin America altered the sign and magnitude of the coefficient $\hat{\beta}_{LT}$; values close to zero or negative were obtained. In the breakdown by country, the authors classified Mexico, as well as Brazil and Argentina, as experiencing a neutral effect and Chile and Guatemala as experiencing a CO effect.

The evidence presented in Table 1 demonstrates that when an economy receives foreign investment, total investment may increase by far less

Table 1. Positive effects of investment in Asia and offset effects in Latin America

Latin America		Asia	
1970-1996 -0.14		1970-1996 2.71	
1976-1985 -1.22	1986-1996 0.04	1976-1985 5.56	1986-1996 2.91

Source: Estimates by Agosin and Mayer (2000).
Note: There is evidence that FDI promotes local investment when $\hat{\beta}_{LT} > 1$, i.e., evidence of CI; CO evidence is obtained when $\hat{\beta}_{LT} < 1$, and finally, we say that a neutral effect persists when $\hat{\beta}_{LT} = 1$.

than the FDI or may not increase at all. In Asia there were high rates of investment and CI effect that were also accompanied by policies that selected foreign investment projects and provided support to local businesses. Such selective policies sought to ensure that FDI did not displace local companies and that multinational companies (MNCs) would contribute new technologies or new products. In contrast, in Latin America inward FDI is the policy itself, not the promotion of local development. This may result in CO effect. For example, in the case of Mexico, there is some evidence of vertical technology diffusion from FDI but no horizontal technology diffusion (López-Córdova, 2002; cited in Ito, 2010: 18).

3. FOREIGN DIRECT INVESTMENT AND THE EXPECTATION OF GROWTH

Several publications rank Mexico as one of the primary recipients of FDI. Mexico ranked sixth in the list of top host economies for FDI in 2010-2012 according to the number of times the country is mentioned as the top FDI priority by respondent transnational corporations (UNCTAD, 2010). Some articles also argue that the benefits of attracting FDI never materialized. For example, in their assessment of Mexico, Waldkirch *et al.* (2009) express disappointment at the poor results obtained from the country's economic development strategy based on attracting FDI. Meanwhile, Ito (2010: 16) concludes that FDI inflows rose rapidly in Mexico after NAFTA was signed in 1994, but states that there is no evidence of NAFTA having contributed to the convergence of productivity toward a narrower gap.

Theory predicts that GDP can grow only if there is growth in productive factors, including the level of technology. The entry of FDI into a country contributes positively to the production process via two known factors: physical capital $K(t)$ and technology $T(t)$. The standard approximation is based on a production function that explains obtaining a product flow Y at time t using the factors of capital, technology and labor $L(t)$. Thus, the conventional production function states that $Y(t) = F[K(t), L(t), T(t)]$.

We assume that the attraction of greater amounts of FDI has two objectives. The first is to ensure a greater supply of capital to achieve higher worker productivity levels while the second is to reach a new steady state with higher capital and production. Using the intensive form of the production function $y = f(k)$, in which

the lowercase letters represent per capita variables, allows us to demonstrate¹ that the properties of the growth of capital $\dot{k}/k$ are immediately transferred to production growth:

$$\frac{\dot{y}}{y} = [k \cdot f'(k) / f(k)] \cdot (\dot{k} / k) \quad (1)$$

This result indicates that additional capital induces an increase in per capita income and is accomplished in cases more general than the Cobb-Douglas functional form, except that the share of capital income grows rapidly enough to more than offset the decline of $\dot{k}/k$, as the economy develops (Barro *et al.*, 2003).

Generally, in the context of economic liberalization, economic growth is seen as the result of the rate of capital accumulation (Calderon *et al.*, 2006:61). However, it is insufficient to explain the benefits of FDI in an economy merely with respect to production because national capital and foreign capital can be either complementary or substitute inputs. In Mexico, inward FDI did not prevent the total factor productivity international gap from growing in the years following the signing of NAFTA (Ito, 2010: 28). In American multinational firms, local and foreign investment decisions were complementary (intra-organizational complementarity). Nationwide, the foreign investment conducted by U.S. multinational companies reported a significant estimated coefficient of -1.855 (Desai *et al.*, 2005). This result means that an additional dollar of investment by foreign-owned firms in the United States reduces domestic investment by U.S. multinational firms by 1.9 dollars (substitution effect in U.S.).

A panel data analysis for 35 developing countries from 1970 to 2003 reveals that foreign capital has a negative effect on local capital, although not a significant one, which suggests that the process of capital accumulation by MNCs does not significantly displace local investment opportunities (Ahmad *et al.*, 2009: 30). In the following section, we analyze whether Mexico is experiencing substitutability or complementarity.

1. Let $\partial Y / \partial K = f'(k)$ denote the marginal productivity of capital. The expression in parenthesis is, under various assumptions, the share of capital, i.e., capital income's share of total income. The equation demonstrates that the relationship between $\dot{y}/y$ and $\dot{k}/k$ depends on the behavior and share of capital. In the Cobb-Douglas case, the capital share is constant and $\dot{y}/y$ mimics that of $\dot{k}/k$ (Barro *et al.*, 2003).

4. A PANEL ESTIMATE FOR MEXICO

Unlike international studies, we did not perform the estimates using investment rates (e.g., the investment/GDP ratio) but rather did so directly using the capital stock variable reported by the economic census. We believe that using capital stock in our estimate will provide a more valid coefficient and will more convincingly describe the relationship between domestic and foreign capital.

To explain total capital (domestic and foreign) per worker (k), we use foreign capital per worker (k^f) as an exogenous variable, two control variables, and a random error term e_{it} :

$$k_{it} = \alpha_i + \beta_i k_{it}^f + \theta_1 X_{1it} + \theta_2 X_{2it} + e_{it} \quad (2)$$

The first control variable X_1 is average firm size, as measured by number of employees; the second control variable X_2 is the average productivity of labor. The inclusion of both variables is fully justified by standard models of rational economic agents who pursue profit maximization. The relevance of X_1 in the equation is that it allows for identification of the demand for capital k required to realize productive investment projects.

The coefficient θ_1 must be positive whenever it reports the variation in the demand for capital according to a change in the average size of an organization. In the following sections on dynamic specification, the size of the firm will have a high explanatory power. In general, we assume that the presence of small and medium enterprises increases as capital intensity per worker decreases. A measure of human capital could also be used to explain the increased participation of small businesses. When there is a higher ratio of white collar to blue collar workers, a greater proportion of small and medium enterprises are anticipated in the production structure (Álvarez *et al.*, 2001).

Additionally, we include the productivity variable X_2 to explain k given the causality between profitability and investment decisions. Among other requirements, a project must generate revenues in excess of costs to be approved. The productivity variable we employ is related to two aspects. On the one hand, productivity is positively related to revenue due to production increases and, on the other hand, it is negatively related to costs due to efficiency gains. Therefore, we expect the variable X_2 to provide information on new capital investment induced

by productivity gains. We expect θ_2 to be positive. It could approach zero if marginal profits do not induce new investments.

We use a balanced panel constructed of 128 observations from the last four census years—1993, 1998, 2003, and 2008—from the 32 federal states of Mexico. Means and standard deviations indicate high levels of dispersion, except in the case of X_1 (Table A1 in the appendix). An interesting property of the sample is obtained by analyzing the correlation matrix in which the dependent variable k itself is correlated with the exogenous and control variables. An early positive result is that the latter variables are not correlated with each other (Table A2 in the appendix). This situation is desirable to achieve consistent, unbiased, normal, and efficient estimators.

Before proceeding to estimation of the panel, we performed a partial correlation analysis to examine the interaction of data, i.e., we recalculated the correlation between k and the other variables using the control variables. The control variable X_2 has a higher effect on the correlation between k and k_f . The variable X_1 does not substantially affect the results of the simple correlation. By contrast, X_2 increases the significance and the correlation coefficient between k and k_f (Table A3 in the appendix). The evidence indicates that the variable X_1 is redundant and would not further explain k . The redundancy hypothesis is contrasted in the estimation of the panel.

The estimation of the panel was performed, and different specifications were explored. A first test in the panel specification was whether fixed effects should be incorporated into the estimation. The high significance level of the test allows for rejection of the hypothesis that fixed effects are redundant (Table 2). In addition, three estimations were performed: with one of the control variables, with the two variables, and with none. The set of estimates provides different values for the parameter of interest β for the variable k^f and demonstrates that the CO effect, or potentially a neutral effect, prevails in the relationship between total and foreign capital.

To select the final specification of the panel, the redundant variable and omitted variable hypothesis tests were used to decide which control variables were to be included. The high levels of significance obtained for both tests indicated that both control variables should be incorporated in the panel estimation. The final specification is provided in Equation [2] in Table 2. Comparatively, the estimation with fixed effects provides a lower value of β than that without (0.641 vs. 0.472), although both cases yield evidence of a CO effect.

Table 2. Crowding-out effect of FDI in Mexico

	Without fixed effects	With fixed effects			
	[1]	[2]	[3]	[4]	[5]
Constant	-255.6 (-0.1)	-21321 (-7.8)	16,997 (7.0)	-29,891 (-3.9)	4,675 (1.9)
k_f	0.641 (6.1)	0.472 (6.7)	1.004 (5.6)	0.594 (9.1)	0.827 (4.6)
X_1	1112 (2.7)	5607 (10.1)		9,752 (5.4)	
X_2	0.684 (21.1)	0.679 (21.6)			0.71 (19.9)
$\bar{X}^2$	0.799	0.871	0.31	0.57	0.81
F (prob)	169.1 (0.00)	26.2 (0.00)	2.8 (0.00)	6.0 (0.00)	17.4 (0.00)
Redundant fixed effects test		3.364 (0.00)			
H_0 : redundant variable			$p = 0.0000$	$p = 0.0000$	$p = 0.0000$
H_0 : omitted variable			$p = 0.0000$	$p = 0.0003$	$p = 0.0000$
Note: t -values in parentheses. Cross-sectional weights were used in the estimation. Observations = 128; entities = 32. Source: Based on data from the National Institute of Statistics and Geography (INEGI) and the National Registry of Foreign Investment (RNIE), Mexico.					

After demonstrating that the relationship between foreign and total capital produced a CO effect, the impact on wages was evaluated. In particular, a dynamic panel estimate was performed using quarterly data. This second exercise complements the structural results of this section and extends the information from 2008 to 2010.

5. FOREIGN CAPITAL AND WAGES:
A DYNAMIC APPROACH

There are several ways to assess the impacts of increased capital formation on wages. The approximation that we use in this study employs a profit function, as in Leamer *et al.* (2000). The assumption is that the firm’s goal is to maximize the present value of profits. We assume that there are no adjustment costs or intertemporal elements in the firm’s maximization problem regarding the acquisition of capital or labor services, and the firm maximizes profits at each point in time (Barro and Sala-i-Martin, 2003). The representative firm’s flow of net income or profits at a given moment in time is given by:

$$\pi = F(K, L, T) - (r + \delta)K - wL$$

(3)

that is, gross income from product sales $F(K, L, T)$ minus the cost of the factors, comprising capital gains $(r + \delta)K$ and workers' wages wL . Solving for w , we have:

$$w = f(k) - (r + \delta)k - \pi/L \quad (4)$$

where $k \equiv K/L$ is worker capital and the function $f(k)$ equals $(K/L, 1, T)$. As in Barro and Sala-i-Martin, we assume that T is constant as an implicit parameter in the definition of $f(k)$. This expression indicates that there are three important determinants of wages: production level ($y = f(k)$), capital intensity per worker, and expected profits. However, to achieve a complete description of the relationship between FDI and wages, the basic formulation should be complemented with the known results regarding the presence of multinationals.

The extensive review by Lipsey (2004: 345) categorically states that an MNC always pays more than a local private firm, which can be explained because wage levels are almost always positively related to firm size and the MNC has a larger scale of production. Thus, theory predicts that the increased presence of foreign companies should increase the demand for labor, thereby placing upward pressure on average wages. However, the debate continues. Lipsey himself (2004) has argued that foreign companies can pay higher wages without affecting local businesses. In turn, Aitken *et al.* (1996) argue that under certain conditions, the impact of FDI on wages could be zero, e.g., because the labor pool does not change, although they recognize that there could be cases in which the increase in labor demand is indeed converted into wage increases.

Empirically, there are few strategies to reliably compare the effect of FDI on wages. The alternative that we selected consists of observing changes in productivity. The accumulated evidence is that the only characteristic of the firm that seems to be important is the productivity gap, i.e., the higher the productivity gap, the lower the wage spillover (Lipsey 2004: 352). Therefore, to capture changes in productivity it is appropriate to examine not only existing businesses at a point in time but also the companies that enter and exit the market (Lipsey 2004: 354).

In particular, FDI has a crowding-out effect on the creation of new companies, which means that FDI reduces the entry of local enterprises and increases exit of these new enterprises from the market (Backer and Sleuwaegen, 2003). The crowding-out effect of FDI arises in the form

of direct competition in the market for goods, but competition also occurs in the labor market. The assumption in the analysis of Backer and Sleuwaegen (2003: 71-2) is that the wage paid by multinationals (W_{MNE}) is greater than the wage paid by local businesses (w), and also may be greater than some entrepreneurs' income (I_{own}); therefore, these individuals would abandon their personal projects to obtain more income as employees of a multinational, compared to the income that they could earn as entrepreneurs: $I_{own} \equiv F(\cdot) - rK - wl < W_{MNE}$. Thus, in the short term, the presence of FDI generates negative effects on local enterprises; however, it remains to be determined whether the balance continues to be negative in the long run.

To incorporate the wage-firm size link into the analysis and capture aggregate changes, we assume that companies pay fair wages $\hat{w}$ because worker effort decreases below this level. Following Egger *et al.* (2009), the reference wage is determined by taking the geometric mean of two components. The first reflects the productivity ρ of the firm where the workers are employed. The second component is associated with the average wage income ($\bar{w}$) and the employment rate ($1 - U$), where U is the unemployment rate. Thus, the wage in the economy can be expressed as:

$$\hat{w}(\rho) = w = \rho^\lambda \cdot [(1 - U)\bar{w}]^{1-\lambda} \quad (5)$$

where $\lambda \in [0,1]$ can be interpreted as a rent-sharing or justice parameter. In the case that $\lambda = 0$, all companies pay the same wage, and if $\lambda > 0$ wages would depend only on the companies. An attribute of the reference wage equation is that it incorporates both the particular conditions of the firm and the impact of unemployment on the market wage. For estimation purposes it is convenient to specify this wage equation using the frequency and availability with which the unemployment indicators are published.

5.1. Dynamic panel estimation

Section 3 demonstrated the relationship between FDI and the capital stock. In this study, we evaluate the impact of FDI on the average general wage. To perform the statistical comparison, we use a dynamic panel analysis with fixed effects. The fixed effects model is more appropriate than the random effects model for two reasons. First, the panel data estimators allow for consistent estimation of the effects of the observed explanatory variables, although our dependent variable depends on

an unobserved variable correlated with the observed explanatory variables. Second, it is also likely that the typical macroeconomic panel is integrated by entities that are not random but are rather selected by the researcher (Judson *et al.*, 1999).

Dynamic panel models include the lagged dependent variable and unobserved individual effects in their specifications. These models are powerful tools that allow us to do the empirical modeling of dynamics and account for the heterogeneity of each cross-section. Dynamic panel models explicitly include variables for analyzing past behavior and invariant individual specific effects (time-invariant), thereby permitting us to better understand what factors promote behavior over time and differentiate between true dynamics and factors that vary between cross-sections and those factors that do not vary within these cross-sections, although such factors are not observable.

The basic equation to be estimated is:

$$w_{i,t} = \alpha_i + \gamma w_{i,t-k} + \beta k_{i,t}^f + \varphi_1 y_i + \varphi_2 E_i + \varphi_3 U_i + \epsilon_{it} \quad (6)$$

where w is the logarithm of the wage, α_i is a fixed effect, k^f is the foreign capital per worker, y is the logarithm of the economic activity index, which is a proxy for the quarterly gross domestic product at the subnational level (GDP data not available), E is the logarithm of the number of microbusinesses with establishments (a permanent place of business), U is the unemployment rate $U6$, which is the official unemployment rate $U3$ plus total employed part-time for economic reasons, which permits a more accurate valuation of unemployment in Mexico, and $\epsilon_{it} \sim N(0, \sigma_\epsilon^2)$ is a random error term; $i = 1, \dots, N$; $t = 1, \dots, T$, where N is the number of federal entities in the panel and T is the number of observations over time. We assume that:

$$\sigma_\epsilon^2 > 0$$

$$E(\epsilon_{it}, \epsilon_{jt}) = 0 \quad i \neq j \text{ or } t \neq s$$

$$E(\alpha_i, \epsilon_{jt}) = 0 \quad \forall i, j, s$$

$$E(k_{it}^f, \epsilon_{js}) = 0 \quad \forall i, j, t, s$$

We used a balanced panel constructed with 992 observations from the 32 federal states of Mexico for the period 2003Q2-2010Q4. The means and standard deviations are reported in Table A4 in the appendix.

5.2. Panel unit root tests and cointegration tests

To perform the panel data analysis, we use the Levin, Lin, and Chu (LLC) and Im, Pesaran, and Shin (IPS) tests for the stationarity of the series and to verify that all series are of the same order of integration. It is worth noting that the IPS test solves the problem that the LLC test has regarding serial correlation of the treatment of heterogeneity between units in a dynamic panel. Once the order of integration has been defined, the Pedroni tests are applied to account for heterogeneity using specific parameters that vary between individual units in the sample, which is more realistic than assuming that the cointegrating vectors are identical across panel units. The seven Pedroni tests propose non-cointegration as a null hypothesis. The first four tests focus on the within dimension, and the three remaining tests are based on the between dimension. To reject the null hypothesis of absence of cointegration, the calculated statistics must be less than the tabulated critical values.

The results of the LLC and IPS panel unit root tests show that the null hypothesis of unit roots in level for the panel data on wages [$\log(w)$] and cumulative FDI inflows per worker (k^f) cannot be rejected. Nevertheless, the hypothesis is rejected when the series are in first differences (Table A5 in the appendix). These results indicate that the variables are non-stationary in level and stationary in first-differences. Therefore, we can implement a test for panel cointegration in $\log(w)$ and k^f . Regarding the complementary variables, $\log(y)$, $\log(E)$, and $U6$ were also found to be stationary in first-differences, although there is weak evidence that $\log(y)$ and $U6$ can be non-stationary series under certain combinations of trend and intercept in the specification of the unit root test.

Both within-group and between-group tests were performed to verify cointegration in the panel data. In general, the results of the Pedroni cointegration tests allow for rejection of the null hypothesis of no cointegration at the 1% significance level under the assumption of no deterministic intercept or trend. The tests produce inconclusive results regarding cointegration when an intercept or trend is included (Table A6 in the appendix). Nevertheless, the evidence is sufficient to assert that there is cointegration between $\log(w)$, k^f , $\log(y)$, $\log(E)$, and $U6$. The presence of a long-term relationship in the panel reveals the impact of FDI in determining wages in the country, even in the presence of the control variables.

The estimated coefficients in the dynamic panel reveal a negative effect of the ratio of foreign capital per worker (k^f) and the unemployment rate on wages. In contrast, product growth (y) and microbusinesses (E) positively affect wages (Table 3). Specifications [1] and [2] were used to obtain values that would allow for a comparison with the estimated coefficients produced by the full equation [3]. In the first specification, only k^f was included as a regressor, and the results indicate that it allows us to explain the variability of wages. In fact, an increase of \$1,000 US dollars ($3/8$ of the average k^f) reduces wages by -0.50% in the short term and by -8.5% in the long term.

The results of the full specification [3] are believed to be more plausible than those obtained in [1]. A \$1,000 increase in k^f decreases wages by 1.2% in the short term and by 3.7% in the long term. In line with standard models, the unemployment rate is highly significant. Unlike in Pissarides (2009), a broader measure of unemployment was used ($U6$ instead of $U3$) that best describes the reality in Mexico. Comparatively, the estimates from [3] are similar to the international estimates of the wages of changers or movers that Pissarides presents (2009: 1357-8).

The final specification [3] achieves its estimated adjustment between wages, foreign capital, and the unemployment rate by incorporating a key variable that Lipsey (2004: 354) terms the productivity gap and suggests can be operationalized by recording firm entry and exit. In our case, due to data availability, we used the number of microenterprises with establishments (E); this variable was highly significant. We believe that the number of microenterprises is fundamental for the analysis because it reflects changes in the production structure. This result is important because a greater number of microenterprises means a smaller relative average firm size and is expected to decrease the capital intensity per worker (Álvarez *et al.*, 2001).

Empirically, we find that an increase in microenterprises has a positive effect on wages, which is consistent with the negative effect of k^f on wages. Quantitatively, a variation in the number of microenterprises generates an impact of similar magnitude to that of product growth. This finding indicates the importance of supplementing the attraction of foreign investment with the emergence of a base of local companies such that the combined effect protects the purchasing power of wages. This evidence from the Mexican case contradicts the theoretical prediction advanced by Backer and Sleuwaegen (2003).

Instead, partial support is found in the evidence on Mexico reported in Dussel (2007) that the impact of FDI varied by state; in certain cases, there were increases in wages, and in others, the impact of FDI was negative. The dynamic panel methodology employed in this section and the specification that we used allows us to conclude convincingly that foreign capital has a negative impact on wages.

6. RECONCILING STATIC AND DYNAMIC ESTIMATES

This section integrates the estimations reported in sections 3 and 4 that were obtained in two panel estimates for Mexico, one static and another dynamic, into a joint explanation. The main reason for linking these estimates is the desire to understand the implications that the CO effect of FDI on capital has for wages in Mexico. In Figure 1, all variables employed in the analysis are listed with the signs of their estimated coefficients.

Figure 1. Two adverse effects of k^f : capital crowd out and wage inhibition

Note: X_1 is the average firm size as measured by the number of workers, X_2 is the average productivity of labor, and E is the logarithm of the number of microenterprises.

The figure presents the static estimation on the left and the dynamic equation on the right. The productivity indicators appear at the extremes. On the left side, the productivity variable is reported directly and has the expected positive sign, i.e., more productivity induces greater investment and capital accumulation. On the right, productivity appears implicitly through the relationship between production and unemployment. This effect is known as Okun's law, which, while theoretically contested, remains empirically useful (Blinder, 1997).

The relationship found between production and wages was highly inelastic. We believe that this relationship is due to the CO effect of FDI on capital. The theoretical prediction establishes that changes in capital are positively related to changes in income. However, the CO effect implies that capital accumulation is lower compared to what would be found with less substitutability between foreign and local capital. In this analysis, we omitted other explanations regarding the wage-setting policies that are important in the concentrated markets of Mexico.

At the base of the figure, the size of the firm is shown to be a key indicator of the interaction between the substitutability of foreign and domestic capital and their impacts on wages. The results of the panel allow us to assume that the attraction of foreign capital implies a reorganization of the production structure and thus the importance of incorporating firm size indicators in the estimates. The theoretical prediction states that the higher the productivity gap between local and foreign companies, the lower the positive spillover of foreign investment in the recipient economy. The evidence obtained seems to indicate that the gap is sufficiently wide that a meaningful amount of profits derived from the presence of foreign companies fails to be observed in the system.

Instead, we find that general wages have increased as a result of an increasing number of microenterprises. Firm size within Mexico tends to decrease because the representative size of microenterprises is smaller than the average size of firms in the economy. This finding may seem counterintuitive, given that a decrease in the average size of the firm should be associated with wage decreases, rather than wage increases, as is actually the case. A plausible explanation is that investment in microenterprises has a multiplier effect on spending in the economy and thus generates a high capital acceleration effect.

7. CONCLUDING REMARKS

In this article, the effects of foreign direct investment were estimated for the entire Mexican economy beginning in 1993, the year that economic liberalization rebounded as a result of NAFTA. Using panel data on the 32 federal entities, the negative impacts of FDI on total capital and on general wages in the country were estimated. The negative effect of FDI could be due to a productivity gap wide enough to prevent FDI from having positive effects.

The panel estimates demonstrate that productivity or efficiency indicators are significant in explaining the interaction of FDI with the variables of interest. Additionally, firm size plays an important role in the calibration of the equations. In fact, we find coefficients of similar magnitude for the number of microenterprises and production volume, which reveals that the emergence of new enterprises does not have a minor or insignificant impact, as one might imagine, but rather is of a magnitude comparable to that of economic growth.

The evidence presented contrasts with the results of other studies that analyze the sectors receiving FDI and find an increase in wages, especially for skilled workers; however, the literature on Mexico documents regional wage dispersion due to differential access to FDI and a lack of wage convergence in Mexico compared to the U.S. In this sense, the results obtained here are consistent with the view that FDI does not positively affect the economy as a whole.

In general, the recommended policy is one that attracts FDI while seeking complementarities with the national economic structure, to avoid competition in the goods market that displaces (crowds out) local investment to the detriment of global efficiency. Such a policy should also avoid the unnecessary increase in the price of inputs, such as credit, rents in the commercial and industrial sectors, and skilled labor, which are necessary to create a productive platform in countries with low entrepreneurial development.

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APPENDIX A

Table A1. Panel descriptive statistics, 1993-2008

	k	k_f	X_1	X_2
Mean	20,349	3,339	4.9	18,200
Std. dev.	23,648	6,130	1.8	32,846
Source: Author's calculations using data from the National Institute of Statistics and Geography (INEGI) and the National Registry of Foreign Investment (RNIE), Mexico. Note: X_1 is the average firm size as measured by the number of workers and X_2 is the average labor productivity. The figures are expressed in dollars, except X_1 , which denotes the number of people.				

Table A2. Correlation matrix, 1993-2008

	k	k_f	X_1	X_2
k	1.000 —			
k_f	0.171 (0.054)	1.000 —		
X_1	0.213 (0.016)	0.067 (0.455)	1.000 —	
X_2	0.867 (0.000)	0.020 (0.819)	0.115 (0.196)	1.000 —
Source: Author's calculations using data from INEGI and RNIE. Note: P -values in parentheses.				

Table A3. Partial correlation with k , 1993-2008

	Simple correlation	Partial analysis controlling for		
	k	$k X_1$	$k X_2$	$k (X_1, X_2)$
k_f	0.171 (0.054)	0.161 (0.071)	0.308 (0.0004)	0.302 (0.0006)
X_1	0.213 (0.016)	— —	0.229 (0.010)	— —
X_2	0.867 (0.000)	0.868 (0.000)	— —	— —
Source: Author's calculations using data from INEGI and RNIE. Note: P -values in parentheses.				

Table A4. Panel descriptive statistics, 2003-2010

	$\log(w)$	k^f	L	$\log(y)$	$\log(E)$	$U6$
Mean	8.381	2,665	1,309,425	4.70	11.40	10.2
Std. dev.	0.238	5,105	1,141,859	0.15	0.78	2.8

Source: Author's calculations using information from the National Institute of Statistics and Geography (INEGI) and the National Registry of Foreign Investment (RNIE), Mexico.
 $k^f = K^f / L$ in dollars. K^f is the cumulative flow of FDI in dollars; L is the number of people employed.

Table A5. Unit root tests

(probability in parentheses)

Level case				1st differenced case			
		Common unit root	Individual unit root			Common unit root	Individual unit root
Variable	Situation	LLC	IPS	Variable	Situation	LLC	IPS
$\log(w)$	a)	-5.417 (0.000)	-3.756 (0.000)	$\log(w)$	a)	-24.318 (0.000)	-27.739 (0.000)
	b)	-1.283 (0.100)	1.666 (0.952)		b)	-25.105 (0.000)	-28.606 (0.000)
k_f	a)	-0.689 (0.245)	5.486 (1.000)	k_f	a)	-17.045 (0.000)	-17.257 (0.000)
	b)	0.962 (0.832)	1.993 (0.977)		b)	-16.324 (0.000)	-15.603 (0.000)
$\log(y)$	a)	-3.4828 (0.0002)	-2.8204 (0.002)	$\log(y)$	a)	-17.882 (0.000)	-20.261 (0.000)
	b)	-4.980 (0.000)	-2.237 (0.0127)		b)	-14.765 (0.000)	-17.390 (0.000)
	c)	3.324 (1.000)	20.755 (1.000)		c)	-26.080 (0.000)	655.556 (0.000)
$\log(E)$	a)	-0.918 (0.179)	1.883 (0.970)	$\log(E)$	a)	-21.511 (0.000)	-30.404 (0.000)
	b)	-1.743 (0.041)	-5.763 (0.000)		b)	-18.520 (0.000)	-28.123 (0.000)
	c)	6.785 (1.000)	4.948 (1.000)		c)	-33.806 (0.000)	1152.520 (0.000)
$U6$	a)	-1.438 (0.075)	-1.061 (0.145)	$U6$	a)	-22.671 (0.000)	-27.219 (0.000)
	b)	-2.422 (0.008)	-4.624 (0.000)		b)	-20.243 (0.000)	-24.853 (0.000)
	c)	3.044 (0.999)	13.875 (1.000)		c)	-32.189 (0.000)	1030.690 (0.000)

Source: Author's calculations using data from INEGI and the RNIE, Mexico.

a) Individual intercept, b) individual intercept and trend, c) none.

Table A6. Pedroni residual cointegration test

Null hypothesis: no cointegration

Within-dimension (panel)	Trend assumption			
	No deterministic intercept or trend		Individual intercept + no deterministic trend	
	Statistic	Prob.	Statistic	Prob.
v-Stat	-1.83	0.967	0.90	0.185
ρ -Stat	-4.92	0.000	-3.78	0.0001
PP-Stat	-9.23	0.000	-8.24	0.000
ADF-Stat	-3.06	0.001	-0.35	0.363
Between-dimension (group)				
Group ρ -Stat	-3.53	0.0002	Statistic	Prob.
Group PP-Stat	-11.15	0.000	-1.91	0.028
Group ADF-Stat	-3.49	0.0002	-9.06	0.000
			-0.75	0.227
			Statistic	Prob.
			-1.025	0.847
			-2.154	0.016
			-9.152	0.000
			-1.021	0.154
			Statistic	Prob.
			-0.145	0.442
			-10.514	0.000
			-1.341	0.090

Source: Author's calculations using data from INEGI and RNIE, Mexico.

Series: $\log(w)$, k_f , $U6$, $\log(E)$, $\log(y)$.
At the top, calculated values of within-dimension statistics are shown that combine (pool) the self-regressive coefficients of the different federal entities for the unit root tests of the estimated residuals. At the bottom of the table, the estimated values of between-dimension statistics are shown that average the estimated coefficients for each federal entity.