Are there dynamic externalities from direct foreign investment? Evidence for Morocco

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1993

INDUSTRY AND ENERGY DEPARTMENT WORKING PAPER
INDUSTRY SERIES PAPER NO. 48

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December 1991

The World Bank Industry and Energy Department, OSP

ARE THERE DYNAMIC EXTERNALITIES FROM DIRECT FOREIGN INVESTMENT?

EVIDENCE FOR MOROCCO*

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December 1991

Abstract

Many developing countries now actively solicit foreign investment, offering income tax holidays, import duty exemptions, and subsidies to foreign firms. One reason for subsidizing these firms is the positive externalities as foreign technology is transferred from foreign to domestic firms. This paper employs a unique firm-level dataset to test for such dynamic externalities in the Moroccan manufacturing sector. We find no evidence of positive externalities, although the dispersion of productivity is smaller in sectors with more foreign firms. Using detailed information on quotas and tariffs, we also reject the hypothesis that the lack of such dynamic externalities occurs because foreign investors are attracted to protected domestic sectors.

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I. INTRODUCTION

1.01 The disappearance of non-equity sources of foreign capital in the 1980s has created a renewed interest in direct foreign investment (DFI). Despite the controversies surrounding the benefits and costs of DFI, a number of developing country governments have now changed their policies from restricting towards promoting foreign investment. Some countries have actually tilted the balance towards foreign firms by offering special incentives: in Mexico, the macquiladora firms pay no income taxes; in much of the Caribbean, foreign firms receive income tax holidays, import duty exemptions, and subsidies for infrastructure. Are these subsidies justified? One benefit often cited in the literature on the gains from DFI, apart from the enhanced capital inflows and increased employment, is the positive externalities generated to domestic firms from the new technology or additional know-how brought in by foreign firms. If foreign firms introduce new products or processes to the domestic market, domestic firms may benefit from the more rapid diffusion of new technology. In some cases, the demonstration effect may be sufficient to stimulate technology diffusion. In other cases, diffusion may occur from labor turnover as domestic employees move from foreign to domestic firms. If this positive externality is not completely captured by the incoming firms, it could justify some type of subsidy. This may be the rationale for government policies in economies as diverse as Taiwan and Bulgaria, which target special treatment for foreign firms in high technology sectors.

1.02 Despite the voluminous literature on DFI in the 1960s and 1970s, the empirical evidence on dynamic externalities from foreign sources of equity investment remains slim. Although a number of descriptive case studies have documented the importance of foreign investment for domestic technology development (see, for example, Rhee and Belot (1989)), few researchers have attempted to measure these effects empirically. In an early study, Caves (1974) tested for the impact of foreign presence on value-added per worker in Australian domestically-owned manufacturing sectors. Caves found that the disparity between (higher) foreign and domestic value-added disappears as the foreign share of sectoral labor rises, which is consistent with positive externalities from foreign presence.

However, this relationship could also be observed if foreign firms invested more in capital-intensive sectors, leading to higher value-added per worker in foreign-dominated sectors.

1.03 Globerman (1979) replicated Caves' findings (1974) using sector-level, cross-section data for Canadian manufacturing industries in 1972. Globerman, however, was able to control explicitly for capital intensity in his estimation of value-added per worker. The results indicate only a weak effect--none of the proxies for foreign presence in the sector are significant at the 5 percent level. These results should call into question the positive effects identified by Caves (1974), who did not control for capital intensity.

1.04 Even if no positive effects were identified in Canada or Australia, it is still possible that dynamic externalities from foreign investment do occur in industrializing countries. Most of the empirical work on dynamic externalities from foreign investment in developing countries has focused on Mexico, which gathers manufacturing data by ownership type. Blomstrom and Persson (1983) reproduce Globerman's study using 1970 census data for 215 Mexican manufacturing industries. Controlling for capital intensity, scale effects, and worker quality, Blomstrom and Persson find that labor productivity is significantly higher in sectors where foreign firms employ a higher share of the labor force. Blomstrom (1986) and Blomstrom and Wolff (1989) extend the analysis of Mexican data to examine the impact of foreign presence on the dispersion of productivity and on the growth rate of total factor productivity (TFP).[1] Using sector-level data, Blomstrom (1986) finds that an increase in foreign presence fails to increase productivity growth, while Blomstrom and Wolff (1989) find faster productivity growth and faster convergence of productivity levels in sectors with higher levels of foreign ownership.

1.05 This paper, which examines the impact of foreign investment on firms in Morocco's manufacturing sector from 1985 through 1989, contributes to this existing

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1/ Blomstrom (1989) provides a synthesis of his previous work on the impact of foreign investment in Mexico.

literature in two respects. First, this is the only study that employs data at the level of the individual firm over several years. Consequently, we are able to compare explicitly the behavior of foreign and domestic firms by sector, controlling for firm-specific attributes such as size. The panel nature of the data (which combines cross-section and time series) allows us to go beyond cross-section analysis comparing partial productivity measures (such as labor productivity) across different firms Our results suggest that foreign firms exhibit higher levels of total factor productivity, but their rate of productivity growth is lower than that for domestic firms. At first glance, this would appear to support the catch-up hypothesis--domestic firms, at lower initial levels of productivity, are able to increase efficiency at a faster rate. However, our tests on the presence of any dynamic externalities from foreign presence show that although domestic firms exhibit higher levels of productivity in sectors with a larger foreign presence, they do not exhibit higher productivity growth in those sectors.

1.06 Second, we are able to use detailed information on the level of quota and tariff protection to test whether the lack of any dynamic externalities stems from a tendency of foreign firms to move towards protected sectors. We do not find evidence of such positive externalities in either the protected or unprotected sectors.

1.07 Section II discusses the trade and foreign investment policies in Morocco before and during regulatory reform in the 1980s. Section III examines the relative performance of domestic firms and foreign firms. Section IV measures the positive externalities of foreign presence on the level, growth rate, and dispersion of productivity for domestically-owned firms. This section also extends the analysis to examine whether dynamic technology externalities are related to the degree of import protection. Section V concludes with a discussion of the implications of these findings for policies towards multinationals.

II. THE REGULATORY FRAMEWORK: FOREIGN INVESTMENT AND TRADE POLICY

2.01 Foreign investment policies. The first major action against foreign investment in Morocco took place in 1973, when the government passed the Morocconization Decree, which restricted foreign ownership of certain industrial, commercial, and service activities to no more than 49 percent. The main purpose of this policy was political rather than economic--to reduce the dominant role of French firms in the Moroccan economy. Activities falling under the Morocconization law included textiles, clothing, footwear, leather products, travel goods, toys, and wine. Most important, the law extended to such export-oriented branches of manufacturing as leather tanning and finishing, fish canning and preserving, fertilizers, edible oils, vegetable fibers, and processed fruits and vegetables. The negative impact of this law on foreign investment is evident from the fact that even enterprises not subject to the law voluntarily handed over their capital share to their Moroccan partners.

2.02 A major reform of the investment code was undertaken in 1983. It allowed full foreign ownership of Moroccan companies in certain sectors (especially manufacturing), eased restrictions on the repatriation of capital and dividends, and introduced fiscal and other incentives for direct foreign investment. The code guaranteed (i) foreign investment against the risks of nationalization and expropriation; (ii) unlimited transfer of dividends and profits to foreign investors; and (iii) the repatriation of foreign investors' capital and related capital gains. By 1985, the Moroccan majority-ownership restriction no longer applied to any segment in the industrial sector, which meant that foreign firms could have an equity participation of more than 49 percent. The investment code was further liberalized in 1988, administrative procedures governing the approval of direct foreign investment were simplified, and rules similar to those granted nonresident foreigners were extended to nonresident Moroccans.[2]

2/ The following types of foreign investment became permissible without the prior authorization of the Exchange Office: participation in the equity of capital of a company being established; subscription to the capital increase of an existing

2.03 Trade policies. Following independence in 1956, Morocco's economic development strategy was primarily based on import-substituting industrialization and agricultural self-sufficiency in a highly protected domestic market. For more than two decades, trade and industrial policies in Morocco were based on high tariffs and on quantitative restrictions on imports. Furthermore, during the 1970s, the Moroccan government expanded growth through high levels of public spending, financed through foreign borrowing and rising receipts from phosphate exports. This culminated in a major payment crisis in 1983. As a result, the government introduced outward-oriented structural adjustment measures designed to eliminate the bias against export activities, liberalized the import regime, and enhanced the allocative role of the financial sector.

2.04 The trade reform introduced in 1983 called for the eventual elimination of the Special Import Tariff (SIT), a uniform tariff levied on the c.i.f. value of imports, the lowering of the maximum customs duty from 400 percent in 1983 to 60 percent in 1984 and 45 percent in 1985, and the reduction in quantitative restrictions. Changes in the industrial code were also undertaken to promote exports. In January 1988, the SIT and the customs stamp duty were merged into what was called a fiscal levy on imports, set at 12.5 percent. Contrary to the declining maximum tariff trend observed since 1983, the fiscal levy actually

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company; purchase of Moroccan securities; non-interest-bearing contributions to partnership current accounts; purchase of real property; self-financing of construction projects; creation or purchase of sole proprietorship; and operations to increase capital through the capitalization of reserves, carry-overs, reserve provisions that have become available, or the consolidation of partnership current accounts. Similarly, operations involving the transfer of investments between foreigners no longer requires the authorization from the Exchange Office. In addition, the banks were authorized to transfer to nonresident foreign persons, without limit as to the amount or timing, the income generated by the investments in Morocco, as well as the capital invested. For further details, see IMF (1991).

In December 1989, the Morocconization Decree of 1973, which imposed a 49% limit on foreign ownership of local enterprises, was eliminated for all sectors. Limits on the share of foreign participation would, however, continue to apply in a few sectors outside of manufacturing.

exceeded the sum of the two abolished taxes. This was intended to generate additional fiscal revenue rather than to provide protection.

2.05 Quantitative restrictions, the principal instrument of protection for domestic goods until 1984, were progressively dismantled. Many (but not all) goods were gradually transferred from List B (imports requiring prior authorization to be imported) to List A (imports requiring no prior authorization) beginning in 1983. List C, which included all prohibited import items, was formally abolished in 1986.[3/]

2.06 In both its foreign investment and trade policies, Morocco took major steps towards liberalization from 1984 through 1988. These changes in policy allow us to use the relatively short time series available in the data to analyze the impact of foreign investment on domestic firms across protected and unprotected sectors.

3/ Nevertheless, Morocco is still far from being an open economy. The tariff structure remains complicated despite the lowering of the maximum tariff and the dispersion of the tariff rates remains high, although significantly reduced in recent years. Morocco's tariff structure is such that tariffs rise with the stage of processing, resulting in effective rates of protection that are considerably higher than nominal rates. This effect is reinforced by the prevalence of quantitative restrictions (List B) on products at a higher stage of processing.

III. COMPARATIVE BEHAVIOR OF DOMESTIC AND FOREIGN FIRMS

3.01 Data for this paper are taken from the Moroccan manufacturing census, which annually surveys all manufacturing firms with at least 10 employees or with sales revenue exceeding 100,000 dirhams (for a description of the dataset used for this paper, see Appendix I). The share of foreign investment in manufacturing for 1985 through 1989 is shown in Table 1. Foreign investment averaged 15 percent of total assets during the second half of the 1980s. This average hides significant differences across sectors. In 1989, for example, 35 percent of the electronics sector was foreign owned, compared to only 4 percent for basic metals. In addition, there were significant changes in foreign ownership between 1985 and 1989. The share of foreign ownership in some sectors doubled (such as in chemicals) while in other sectors it fell by as much as 50 percent (beverages and tobacco).

3.02 Table 2 compares the relative performance of foreign and domestically-owned firms. Foreign firms are initially defined as all firms with foreign equity that exceeds 5 percent of the firm's assets. (We will examine alternative definitions of foreign ownership later and find the results unaffected.) Relative performance is measured using the following indicators: output per worker, exports as a percentage of total sales, real wages, deviation from overall norms in the sector for multi-factor productivity, and total factor productivity growth (TFPG). Output per worker is derived from total value of output divided by the ratio of total value of labor remuneration to minimum wage, instead of dividing by the number of workers. This approach allows us to adjust at least partially, for a different skill composition among employees across firms. For example, if a foreign firm has very few workers but pays them much more, due to their greater skill, this will show up in a greater number of "efficiency" workers for that firm. Real wages are computed as the total value of remuneration to workers divided by the number of employees. The derivation of multi-factor productivity and TFPG are discussed in greater detail below.

3.03 Table 2 reports all performance measures using the ratio of foreign-firm performance to domestic-firm performance. In column 1, the value of 2.0 for food products

shows that output per worker for foreign-owned firms was twice as high as for domestic firms. The difference in performance is statistically significant at the 5 percent level. The first set of figures gives relative performance using the ratio of unweighted means for domestic and foreign firms in each sector. Across all sectors, the unweighted means suggest that foreign firms exhibited higher labor productivity, paid their workers higher wages, and exported a higher share of their output as well.

3.04 One shortcoming with these unweighted averages is that they may simply reflect the superior performance of foreign firms due to their size. Most foreign firms in Morocco tend to be large and capital intensive, leading to higher observed levels of labor productivity. Since larger firms, in general, are more likely to export a higher share of output, we are also likely to observe that foreign firms are more export oriented. On the other hand, the majority of domestically-owned firms are smaller--so they are less likely to export a high share of their output. In other words, using unweighted means leads to an inappropriate comparison of larger foreign firms with smaller domestic firms. If we re-calculate the figures in Table 2 to produce weighted means--with the weights given by total sales--this allows us to compare domestic and foreign firms of similar sizes.

3.05 The weighted means--shown in parentheses in Table 2--reveal a different story. After controlling for firm size, foreign firms do not exhibit higher levels of labor productivity or a greater outward orientation for most sectors, although they do continue to pay higher real wages than domestically-owned firms pay. On average, foreign firms exhibited levels of labor productivity and export shares in total sales that were only 70 percent of what was achieved by domestic firms of similar size. We repeated the comparison between domestic and foreign firms by explicitly dividing the sample into different size categories, but the results did not change and, consequently, are not reported here.

3.06 One problem with using labor productivity is that it is at best a partial measure of overall multi-factor productivity--which takes into account the combined productivity of the firm when all inputs are included. How could such a measure be computed? Using

techniques available for panel datasets (which combine data across firms and over time), Appendix II shows how it is possible to compute a firm-specific measure of multi-factor productivity within each sector. As shown in Appendix II, such a measure is essentially the remainder from a regression of value-added on labor and capital inputs.

3.07 The level of multi-factor productivity is usually examined relative to the level achieved by the most efficient firm in each sector j. Given N firms, there will be N estimated productivity measures within each sector j, given by $\hat{\alpha}_{1j},....\hat{\alpha}_{Nj}$. We can now define relative efficiency for a firm i as given by z_{ij}, where

(1) $\hat{\alpha}_j = \max(\hat{\alpha}_{ij})$

$z_{ij} = \hat{\alpha}_{ij} - \hat{\alpha}_j, \qquad i = 1,2,.....,N$ for each sector j.

3.08 A high value of z_{ij} (in absolute value) indicates that firm i is very inefficient relative to the most efficient firm in sector j. Table 2 gives the ratio of z_{ij} for foreign firms relative to domestic firms. A ratio less than unity indicates that foreign firms are relatively more productive than their domestic counterparts--since the deviation z_{ij} from the best-practice firm is low. Using both the weighted and unweighted means for the z_{ij}'s of foreign and domestic firms shows that, on average, foreign firms have achieved a higher level of productivity.

3.09 What about the growth rate of productivity? Do foreign firms also dominate in this respect? The last column in Table 2 shows the difference between total factor productivity growth (TFPG) [4/] in foreign and domestic firms. TFPG is not higher among foreign firms. Nor is this particularly surprising. While we could expect foreign firms to exhibit higher levels of productivity, their rate of growth of productivity is likely to be lower, as domestic firms catch up to the higher level of productivity of their foreign counterparts.

4/ TFPG has been calculated here using the standard approach.

3.10 One question that arises is: to what extent does minority-versus-majority foreign ownership affect relative performance? Table 3 compares the relative performance of firms whose foreign participation exceeds 50 percent to firms with minority foreign participation--defined as from 5 to 49 percent. The results in Table 3 suggest that firms with majority foreign ownership generally behave in the same way as firms with minority foreign ownership. Majority-owned firms do not exhibit higher levels of productivity, although they do pay their workers somewhat higher wages and are slightly more outward oriented than firms with minority foreign ownership.

3.11 In summary, Tables 2 and 3 suggest that there are some differences in behavior and performance between domestically-owned and foreign-owned firms. Although foreign firms do not generally exhibit higher levels of labor productivity or export orientation, once we control for size of firm, foreign enterprises do pay higher wages and generally exhibit lower deviations from best-practice multi-factor productivity. It is interesting to observe that the share of foreign equity participation does not seem to affect performance as much: firms with less than 50 percent foreign equity participation do not behave much differently from majority-owned foreign firms.

IV. PRODUCTIVITY DYNAMIC EXTERNALITIES

4.01 If the knowledge or new technology embodied in foreign firms is transmitted to domestic firms, we would expect to see evidence in the form of higher productivity levels and growth rates for domestically-owned firms in sectors with a large foreign presence. This section examines two different possibilities through which foreign presence could have a positive externalities effect on domestic firm productivity. First, we examine the influence of foreign presence on the dispersion of productivity levels, using a modified version of the z_{ij} 's defined in (1). Second, we examine the influence of foreign presence on the growth of productivity for domestically-owned firms.

4.02 Externalities in terms of productivity levels. The productivity levels calculated earlier for each firm are only comparable across firms within the same sector, but not across different sectors. Consequently, we cannot directly measure the impact of foreign presence on the level of productivity across sectors. However, we can compare the deviation of firm productivity from each sector's best-practice frontier. To normalize these residual productivity terms requires one more step. Given N firms, there will be N estimated intercepts within each sector j, given by $\hat{\alpha}_1,....\hat{\alpha}_N$. We can now define

$$(2) \quad \hat{\alpha}_j = \max(\hat{\alpha}_{ij})$$
$$\hat{u}_{ij} = (\hat{\alpha}_{ij} - \hat{\alpha}_{j}) / \hat{\alpha}_j \quad i = 1,2,.....,N.$$

4.03 Table 4 examines the impact of foreign investment (controlling for firm size) on the dispersion of productivity according to the following equation

$$(3) \quad \hat{u}_{ij} = f(DFI\_Firm_{ij}, DFI\_Sector_j, SIZE_{ij})$$

4.04 The $\hat{u}_{ij}$'s defined above are used as the dependent variable--the deviation of firm-level productivity from the sector's best practice frontier. We include, as independent

variables, the share of foreign assets in each firm's total assets, the share of foreign firms in the sector (as measured by firm assets), and a measure of firm size, proxied by the ratio of firm sales to total sales for the largest firm in each sector. The positive and statistically significant coefficient for the share of foreign investment in firm assets supports the earlier results (see Table 3) that suggested that foreign firms exhibit less deviation from best-practice productivity levels than do domestic firms. The positive and significant coefficient on size also suggests that larger firms are more likely to achieve higher levels of productivity. Finally, the sector-level foreign investment variable measures the impact of foreign presence on the deviation of productivity levels from the best-practice frontier. The positive and significant coefficient on sectoral foreign investment suggests a smaller deviation from maximum productivity levels in sectors with a large foreign presence. One reason may be that foreign firms induce greater competition, causing firms that cannot approach the best-practice frontier to exit the industry.

4.05 To determine whether the lower dispersion of firm productivity in sectors with a high foreign presence is due to increased competition or the more rapid diffusion of new technology (or both) would require a more fully specified model. Nevertheless, we can gain some insight by separating the sample into "high" technology and "low" technology sectors and re-estimating the equations in Table 4. We defined the high technology sectors to include machinery, transport equipment, electronics, scientific instruments, and chemicals.

4.06 The results, which are given in Table 5, show that the influence of foreign investment in reducing the dispersion of productivity was greatest in the low technology sectors. This suggests that competition due to foreign investment was more important in pushing firms towards the best-practice frontier than for the transfer of advanced technology.

4.07 Externalities in terms of productivity growth. To examine whether foreign presence affects the rate of productivity growth, we begin with a production function, with value-added Y a function of two inputs, capital and labor:

(4) $Y_{ijt} = A_{ijt}F(L_{ijt},K_{ijt})$

The level of productivity is given by A_{ijt}, which is assumed to vary across firms within each sector j and across time t. If we totally differentiate this, take logs, and use the fact that the value of the marginal product for each factor equals its cost, we now have

(5) $dlogY_{ijt} = dA_{ijt}/A_{ijt} + \alpha_l dlogL_{ijt} + \alpha_k dlogK_{ijt}$

where Y is value-added, dA/A is productivity growth, and L and K are labor and capital, respectively. The coefficients on the growth of labor and capital are simply their share in value-added. We test the hypothesis that productivity growth is affected by the share of foreign investment both at the firm level and at the sector level by assuming that productivity growth can be decomposed into the following components:

(6) $dA_{ijt}/A_{ijt} = a\ DFI\_Firm_{ijt} + b\ DFI\_Sector_{jt} + c\ C_j + d\ D_t$

where C_j and D_t are sector and time dummies, respectively. Productivity growth varies across sectors (j) and time (t) and also varies as a function of the level of foreign investment in both firms and sectors. The coefficient on DFI-Sector measures the so-called "positive externalities" effect--the extent to which the presence of DFI increases the rate of productivity growth, after accounting for other factors. Combining (5) and (6) yields

(7) $dlogY_{ijt} =$
$a\ DFI\_Firm_{ijt} + b\ DFI\_Sector_{jt} + c\ C_j + d\ D_t + \alpha_l\ dlogL_{ijt} + \alpha_k\ dlogK_{ijt}$

4.08 The results are given in the first three columns of Table 6. Column (1) excludes time and industry dummies, while column (2) only excludes industry dummies. The results are not significantly affected by the inclusion of time or industry effects. At the firm level, the impact of foreign investment is negative but statistically insignificant--indicating that

firms with foreign investment did achieve lower growth rates of productivity, although not significantly different from domestically-owned firms.

4.09 If domestic firms are increasing their productivity at a faster rate than foreign-owned firms, could this catch-up be due to dynamic externalities from DFI? Table 6 provides various alternative specifications to test for evidence of positive externalities. The share of foreign assets in total assets at the sector level is included as a right-hand side variable: if foreign presence positively affects productivity growth for domestically-owned firms, then the coefficient on DFI_Sector should be positive and statistically significant. The sign on DFI_Sector is in fact negative in almost all specifications, although it is insignificant. Columns (4) through (6) exclude all firms with foreign investment from the sample and test for positive externalities from sector-level foreign investment on wholly domestically-owned firms. Again, there is no evidence for positive externalities in terms of productivity growth.[5]

4.10 The lack of evidence on positive dynamic externalities from foreign investment could be due to distortions in the trade policy regime. If foreign firms are attracted to highly protected domestic markets--seeking to exploit the rents from protection--then the results presented above could suffer from the classic problem of omitted variable bias.

4.11 To examine the impact of protection on potential dynamic externalities from foreign investment, the sample was split into two groups. Using three different measures of protection, a "low" protection and a "high" protection group of sectors was identified. The first measure of protection used was the average tariff level by 3-digit sector for those years where it was available--1984, 1987 and 1988. The second measure of protection used was the share of production under List A: the share of production not subject to quantitative restrictions in each sector. The third measure was the change in the coverage of List A

5/ We also separated the sample into "low" technology and "high" technology sectors to test whether spillovers might be concentrated only in high technology areas such as electronic machinery, automobiles, etc. The results remained unchanged and, consequently, are not reported here.

between 1984 and 1988--i.e., the reduction in quotas on a sector-by-sector basis over the period of trade reform.

4.12 The results are given in Table 7. The positive externalities--indicated by the coefficient on DFI_Sector--remain insignificant and generally negative. However, the coefficient does switch from negative (and statistically significant at the 15 percent level) to positive (but insignificant) for sectors that had a large reduction in quota coverage. At the firm level, one interesting result emerges. Using the level of tariffs and quotas as a measure of protection, the results in columns (3) and (4) suggest that foreign firms only exhibited lower productivity growth relative to domestic firms in protected sectors. In sectors with a high level of quotas (column (4)), foreign firms exhibited lower and statistically significant growth in productivity than domestic firms. Yet in sectors with low quota coverage (column (3)), their rate of productivity growth became positive (but insignificant).

V. CONCLUSION AND IMPLICATION OF FINDINGS

5.01 **Comparisons of performance between domestic and foreign-owned firms reveal that, on average, foreign firms tend to be more export oriented and to pay higher wages. Much of the differential in outward orientation between domestic and foreign firms is due, however, to the fact that foreign firms tend to be relatively large. If size is controlled for, we find that the difference in average outward orientation between foreign firms and domestic firms of the same size is much reduced.**

5.02 The results also show that foreign firms exhibit higher levels of overall multi-factor productivity. However, the rate of growth of productivity is higher for their domestic counterparts. The results show that this is due in part to the distortionary effects of protection--foreign firms lag behind domestic firms in productivity growth primarily in protected markets.

5.03 One major benefit often attributed to direct foreign investment is the positive externalities of knowledge or new technology transfer from foreign to domestic firms. Using a production-function approach, we test the hypothesis that foreign presence is associated with increased productivity in domestica y-owned firms. We find evidence of dynamic externalities from foreign investment that result in a smaller dispersion of productivity levels across firms, making them move closer to the efficiency frontier. However, the evidence of positive externalities from firms with foreign equity to wholly domestically-owned firms in terms of productivity growth is weak at best. Although domestic firms do exhibit faster productivity growth, it cannot be attributed to dynamic externalities from foreign investment. Nor is this conclusion affected when we explicitly control for variations in protection--often a source of distortionary foreign investment.

5.04 Recent attitudes towards foreign investment in developing countries have shifted as sources of debt financing have diminished. Some countries provide subsidies to foreign investors through tax holidays, import duty exemptions, provision of infrastructure,

and other policy instruments. One rationale for special treatment stems from the dynamic technology externalities that benefit domestic industry--dynamic externalities that are not internalized in the foreign firm's rate of return. In the Moroccan case, the findings related to the level and growth of productivity suggest that foreign presence has caused a one-time increase in firms' efficiency, and therefore, the findings do not appear to support special treatment.

Table 1: SHARE OF FOREIGN DIRECT INVESTMENT IN MANUFACTURING a/

Year	Annual shares of FDI (percent)
1985	13
1986	15
1987	14
1988	15
1989	15

Sector	Sectoral shares (percent) 1985	1989
Food products	5	5
Other food	10	15
Beverages, tobacco	20	11
Textiles	11	13
Apparel	21	23
Leather	16	21
Wood products	16	12
Paper products	27	18
Non-metallic minerals	16	17
Basic metals	4	4
Metal products	22	22
Machinery	18	21
Transport equipment	23	25
Electronics	32	35
Scientific instruments	13	17
Chemicals	8	15
Rubber	17	14
Other manufactures	30	10

a/ Foreign share computed as a means of foreign share in total assets, weighted by firm assets.

Table 2: COMPARISON OF PRODUCTIVITY, OUTWARD ORIENTATION, AND WAGES BETWEEN DOMESTIC AND FOREIGN-OWNED ENTERPRISES IN MANUFACTURING
(Values using weighted means in ())

	Output per worker[a]		Export as percent of sales[a]		Real wages[a]		TFP deviation[b]		TFPG foreign -TFPG domestic
Food products	2.0*	(0.9)	15.2*	(4.5)	2.3*	(1.2)	0.7*	(0.7)	-6.4
Other food	0.5	(0.5)	2.0*	(2.7)	1.2	(1.1)	1.0	(1.3)	-7.3
Beverages, tobacco	1.4*	(0.6)	10.8*	(9.6)	2.2*	(1.4)	0.9	(4.0)	-7.0
Textiles	1.1	(0.5)	1.5*	(0.7)	0.9	(0.2)	0.9	(1.0)	0.0
Apparel	0.8	(1.1)	1.8*	(1.1)	1.3*	(1.4)	0.9	(1.0)	-12.3*
Leather	1.1	(0.6)	2.3*	(1.4)	2.0*	(1.8)	1.0	(1.0)	0.3
Wood products	1.2	(1.0)	8.5*	(6.3)	1.6*	(1.0)	0.8*	(0.8)	-64.7
Paper products	1.5*	(0.6)	11.7*	(30.7)	1.7*	(1.3)	0.9*	(0.4)	14.0
Non-metallic minerals	2.3*	(2.2)	6.1*	(1.6)	1.9	(2.2)	0.7*	(0.5)	4.4
Basic metals	1.0	(0.3)	0.2*	(0.1)	1.9*	(1.2)	1.3	(21.2)	-0.3
Metal products	0.6	(0.5)	4.0*	(2.3)	1.1	(1.1)	1.0	(0.8)	-1.5
Machinery	1.1	(2.2)	5.0*	(0.2)	0.8	(1.8)	0.9	(0.7)	-1.8
Transport equipment	1.6*	(2.0)	1.6	(0.4)	2.0*	(2.1)	0.8*	(0.7)	9.7
Electronics	1.5*	(1.3)	4.5*	(3.9)	2.1*	(2.0)	0.8*	(0.8)	0.3
Scientific instruments	1.3*	(1.7)	0.3	(0.1)	1.7*	(1.8)	1.0	(1.1)	16.2
Chemicals	2.0*	(0.6)	1.9*	(0.0)	2.6*	(1.8)	0.7*	(1.9)	1.1
Rubber	0.9	(1.8)	4.2*	(3.6)	1.5	(3.8)	0.9*	(0.8)	-1.3
Other manufactures	0.9	(0.8)	0.6	(0.5)	0.6	(0.8)	1.1	(1.0)	-21.3
All sectors	1.2	(0.7)	2.0*	(0.7)	1.7*	(1.3)	0.9*	(0.9)	-6.7*

a. Ratio of enterprise performance for firms with at least 5 percent foreign ownership to firms with less than 5 percent foreign ownership. A "*" indicates difference in means is statistically significant at 5 percent level for the unweighted means only.

b. Average deviation of foreign firm productivity from best practice frontier/ to average deviation of domestic firm productivity. A value of less than one indicates less deviation from best practice among foreign firms.

Table 3: COMPARISON OF PRODUCTIVITY, OUTWARD ORIENTATION, AND WAGES BETWEEN MAJORITY- AND MINORITY-OWNED FOREIGN FIRMS
(Values using weighted means in ())

	Output per worker[a]		Exports as percent of sales[a]		Real wages[a]		TFP deviation[b]		TFPG foreign -TFPG domestic
Food products	0.5*	(1.0)	0.1*	(0.2)	0.8*	(1.0)	1.3*	(1.7)	-6.3
Other food	1.2	(1.0)	0.9	(1.1)	1.2	(1.0)	0.9	(0.1)	-15.1
Beverages, tobacco	2.7*	(2.3)	-	-	3.6*	(3.3)	1.4*	(1.4)	-13.3
Textiles	1.1	(1.4)	1.3*	(1.0)	0.9	(1.1)	1.1	(1.0)	1.3
Apparel	1.0	(1.6)	0.8*	(0.9)	1.0	(1.1)	1.0	(1.2)	4.5
Leather	0.7	(0.6)	0.9	(0.7)	0.8	(0.9)	0.8	(0.9)	-72.4*
Wood products	0.9	(0.5)	1.0	(1.2)	1.2	(0.9)	1.0	(1.9)	2.6
Paper products	0.8	(0.9)	0.1*	(0.1)	0.9	(1.0)	1.1	(1.1)	-8.7
Non-metallic minerals	0.5*	(0.5)	1.1	(5.2)	0.7*	(0.8)	1.2	(2.2)	7.9
Basic metals	0.3*	(0.6)	-	-	1.0	(1.4)	1.6	(1.1)	-1.5
Metal products	0.9	(0.7)	1.3	(8.2)	1.1	(1.1)	0.9	(1.4)	0.5
Machinery	0.9	(1.1)	1.6	(0.9)	1.0	(1.2)	1.0	(1.8)	-13.3
Transport equipment	1.1	(3.0)	0.8	(2.0)	1.0	(1.3)	1.4*	(0.2)	12.8
Electronics	1.1	(0.9)	1.1	(1.6)	0.9	(0.9)	0.9	(1.6)	3.9
Scientific instruments	0.8	(1.2)	-	-	1.0	(1.2)	1.1	(0.7)	17.2
Chemicals	1.3*	(1.4)	0.8	(0.3)	1.4*	(1.2)	0.9	(0.9)	-0.9
Rubber	1.5*	(2.7)	1.5	(2.4)	1.4*	(2.7)	0.9	(0.8)	-9.4
Other manufactures	1.4	(1.2)	-	-	1.3	(1.1)	-	-	77.1*
Total	0.9*	(1.0)	1.1	(1.2)	1.1*	(1.2)	1.0	(1.1)	-2.5

a. Ratio of enterprise performance for firms with at least 50 percent foreign ownership to firms with less than 50 percent but more than 5 percent foreign ownership. A"*" indicates difference in means is statistically significant at 5 percent level.

b. Average deviation of foreign firm productivity from best practice frontier/ to average deviation of domestic firm productivity. A value of less than one indicates less deviation from best practice among foreign firms.

Table 4: IMPACT OF FOREIGN OWNERSHIP ON THE LEVEL OF FIRM PRODUCTIVITY, DEFINED AS THE DEVIATION FROM SECTOR-LEVEL BEST-PRACTICE PERFORMANCE

Dependent variable: u	All firms	Non-DFI firms
Intercept	-.441 (.004)	-.444 (.004)
DFI (firm)	0.030 (.008)	-
DFI (sector)	0.170 (0.019)	0.174 (.022)
Size of firm	0.002 (0.00001)	0.002 (0.0001)
N	3933	3105
R-square	.16	.12

Note: Standard errors in ().

Table 5: IMPACT OF FOREIGN OWNERSHIP ON THE LEVEL OF PRODUCTIVITY, BY HIGH TECHNOLOGY AND LOW TECHNOLOGY SECTORS

Dependent variable: u	Non-DFI firms	
	High Technology Sectors	Low Technology Sectors
Intercept	-.397 (.020)	-.448 (.004)
DFI (sector)	0.017 (0.082)	0.189 (.024)
Size of firm	0.002 (0.0003)	0.002 (0.0001)
N	410	2693
R-square	.06	.14

Note: Standard errors in ().

Table 6: TESTING FOR EXTERNALITIES FROM FOREIGN INVESTMENT FOR THE GROWTH OF PRODUCTIVITY

Dependent variable: Change in log Y

	All firms			Non-DFI firms		
	(1)	(2)	(3)	(4)	(5)	(6)
d (log L)	0.773	.772	.770	0.772	0.770	.770
	(.009)	(.009)	(.009)	(.010)	(.010)	(.010)
d (log K)	0.088	0.090	.088	0.105	0.108	0.106
	(.011)	(.011)	(.011)	(0.013)	(0.013)	(0.013)
DFI (firm)	-0.018	-0.019	-0.020	-	-	-
	(.023)	(.023)	(.023)			
DFI (sector)	-0.037	-0.029	-0.039	-.009	.001	-.011
	(.052)	(.052)	(.061)	(.063)	(.063)	(.073)
Time dummies	No	Yes	Yes	No	Yes	Yes
Industry dummies	No	No	Yes	No	No	Yes
R-square	.41	.41	.42	.42	.42	.42
N	11,772	11,772	11,772	9,629	9,629	9,629

Note: Standard errors in ().

DFI (firm) = share of firm's assets which are foreign owned.
DFI (sector) = share of DFI in each sector.

Table 7: TESTING FOR EXTERNALITIES FROM FOREIGN INVESTMENT FOR PRODUCTIVITY GROWTH UNDER VARYING TRADE REGIMES

All Firms

Dependent variable: Change in log Y	Tariffs		Quotas		Reduction in quotas	
	Low	High	Low	High	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)
d (log L)	0.753	0.764	0.723	0.777	0.781	0.761
	(.025)	(.016)	(.023)	(.016)	(.012)	(.013)
d (log K)	0.077	0.069	0.061	0.077	0.081	0.097
	(.035)	(0.019)	(.025)	(.022)	(.014)	(.018)
DFI (firm)	0.003	-.043	0.039	-0.091	-.027	-0.004
	0.053)	(.041)	(.044)	(.047)	(.028)	(.039)
DFI (sector)	-0.101	-0.034	-0.109	-0.086	0.014	-0.133
	(0.117)	(.111)	(.107)	(.113)	(.066)	(.085)
R-square	.38	.38	.33	.41	.42	.40
N	1585	4212	2154	3643	6402	5370

Note: Standard errors in ().

DFI (firm) = share of firm's assets which are foreign owned.
DFI (sector) = share of DFI in each sector.

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APPENDIX I: DESCRIPTION OF THE MOROCCAN INDUSTRIAL DATA

The empirical analysis of the Moroccan industrial performance is based on firm-level industrial survey data collected by the Moroccan Ministry of Commerce and Industry. The data cover the period 1985 to 1989. The surveys are exhaustive and include all enterprises with 10 or more employees, as well as enterprises with fewer than 10 employees and that realized a sales revenue greater than 100,000 dirhams (approximately US$11,000 at the average 1984-1989 official exchange rate). A firm's activity is described by a four-digit Moroccan nomenclature of economic activities (Nomenclature Marocaine des Activités Economiques, or NMAE), which is often referred to as the nomenclature of national accounting (Nomenclature de la Comptabilité Nationale, or NCN). Since intermediate inputs were not available, it was necessary to use value- added in the production function instead of total output. A capital stock measure was included only in 1988 as the total equipment goods assets owned by the firm and was used as the benchmark to construct capital stock for the remaining years using the perpetual inventory method forward and backward. Firms that were not available in 1988 (the benchmark year) had to be omitted from the productivity analysis. Labor input was expressed in terms of efficiency units (the total labor cost divided by the minimum wage).

Looking at the patterns of major economic variables, we compare them across different sectors in the manufacturing industry. In order to have a compliant analysis, the original firm-level data were aggregated into 18 two-digit-level industries. Characteristics of our sample are reported in Table A.1 for 1987. In terms of the number of firms (column 1) and the number for labor (column 2), the largest sectors are food products and textiles. However, in terms of the share in manufacturing revenue (column 7), the chemical products sector emerges as a major sector beside the other two. This is fully understandable given the importance of phosphate in Morocco.

Output per worker (column 6) is the highest in relatively capital-intensive (see the capital-output ratio in column 5) sectors such as basic metal and chemical products. By far,

the most export-oriented sector is clothing, which sells over 80 percent of its output abroad (column 8). The other sectors that export are chemical products, which include the derivatives of phosphate, and leather and shoes. As expected, import penetration (column 11) is high in intermediates and capital-goods producing sectors.

APPENDIX II: CALCULATION OF MULTI-FACTOR PRODUCTIVITY AT THE FIRM LEVEL

Imagine a production function, with value-added Y a function of two inputs, capital and labor:

$$(1) \quad Y_{ijt} = A_{ij}F(L_{ijt},K_{ijt})$$

An ideal measure of the level of productivity would be an estimate of A_{ij}, which is assumed to vary across firms within each sector j. Schmidt and Sickles (1984) have suggested a way to estimate these firm-specific productivity measures by modifying standard techniques used for panel data. We have the following model for each sector j (note that the subscript j is suppressed and the variables are now expressed in logarithms):

$$(2) \quad Y_{it} = \alpha_i + \beta'X_{it} + \epsilon_{it}$$

where i = 1, ... , N and t = 1, ... , T. Y_{it} is the value-added (in logarithm) for the i^{th} firm at time t, X_{it} is a 2xN matrix of inputs, β' is a 1x2 vector of constant parameters to be estimated, and α_i is a 1xN vector of intercepts representing the effects of the variables specific to the i^{th} individual and invariant over time. The α_i for each firm i is obtained by including i dummy variables that take the value 1 for the corresponding i and 0 otherwise. The error term ϵ_{it} represents the effects of the omitted variables that are both time and cross-sectional varying. We assume that ϵ_{it} is characterized by an independently and identically distributed random variable with mean zero and variance σ_ϵ^2. Given these properties of ϵ_{it}, the ordinary-least-squares (OLS) estimator of α and β in (3) is the best linear unbiased estimator (BLUE):

$$(4) \quad \hat{\alpha}_i = \bar{Y}_i - \hat{\beta}'\bar{X}_i$$

$$(5) \quad \hat{\beta} = [\Sigma_i\Sigma_t(X_{it}-\bar{X}_i)(X_{it}-\bar{X}_i)']^{-1} [\Sigma_i\Sigma_t(X_{it}-\bar{X}_i)(Y_{it}-\bar{Y}_i)']$$

where $\bar{Y}_i = (1/T)\Sigma_t Y_{it}$ and $\bar{X}_i = (1/T)\Sigma_t X_{it}$.

The computational procedure for estimating the slope parameters of this model does not require that the dummy variables for the individual effects actually be included in the matrix of explanatory variables. The variables can be transformed by subtracting from each cross-sectional unit the mean of its time-series observations and then applying the least-squares method without the intercept to the transformed data:

$$(6) \qquad (Y_{it} - \bar{Y}_i) = \beta(X_{it} - \bar{X}_i) + (\epsilon_{it} - \bar{\epsilon}_i)$$

The estimates of the N intercept parameters can then be obtained as the means of the residuals for each cross-sectional unit by using equation (4).

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