INWARD FOREIGN DIRECT INVESTMENTS IN THE US: AN EMPIRICAL ANALYSIS OF THEIR IMPACT ON STATE ECONOMIES

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ABSTRACT

In the present study we analyze the effects of FDI inflows in local economies across US states. Overall, FDI inflows have a positive and in most cases statistically significant impact on local employment and wages. However, these effects vary across US states. In some states, such as California, New York and Pennsylvania, FDI inflows appear to expand both employment and wages while in others, like Connecticut and Florida, appear to depress both employment and wages. These results apparently are due to the industry composition of FDI inflows across states. FDI inflows in Printing and Publishing, Transportation Equipment and Instruments have positive employment and wages effects, while FDI inflows in Apparel, Leather and Stone/Clay/Glass have negative effects. Finally, we suggest that the diverse results across industries might be due to the labor bias introduced by FDI in different industries.

1. Introduction

The recent explosive growth in foreign direct investment (FDI) globally has produced a parallel proliferation of scholarly efforts to examine the quantitative dimensions of this phenomenon. Two major streams of empirical work have emerged in the literature, designed to test the hypotheses that theoretical studies have generated. One stream focuses on those economic factors/conditions in either host or target countries that push or pull FDI overseas in an attempt to uncover root causes, whereas the second stream is designed to measure effects. It is the purpose of our research to add to this latter literature. Typically, studies designed to measure the impact of FDI focus on the effects on growth, employment and wages in both investing and host countries. Because the global spurt in FDI is a relatively recent phenomenon, empirical work has been affected by data limitations and has barely scratched the surface of the potential for important research in this area, and research results, to date, have been mixed and often contradictory.

On the positive side, several studies have demonstrated that FDI has the potential for promoting growth, creating stable jobs and elevating wage rates in both developing and developed countries [Fitzgerald and Mavrotas [1997], Lall [1995], Poon and Thompson [1998], Elahee and Pagan [1999], Kahley [1990] and Andersen and Hainaut [1998]]

Other studies, however, reveal negative or, at best, mixed results. Fung, Zeng and Zhu [1999], for example, show that FDI can affect the host country's dynamics and national welfare either positively or negatively depending on the intersectoral mobility of capital, the destination of FDI, the elasticities of substitution and the factor intensities of

the final goods production. Similarly, in analyzing the effects of FDI on a Harris-Todaro economy, Gonzalez [1998] demonstrates that FDI inflows in the manufacturing sector may either decrease or increase unemployment, depending on industry conditions and on the quality and direction of FDI. Although de Mello [1999] did conclude in a study of OECD and non-OECD countries from 1970-1990 that FDI boosted long-term growth, the extent of the growth-enhancing effects of FDI depended on the degree of complementarity and substitution between FDI and domestic investment.

Feenstra and Hanson [1997] in a study of FDI in Mexico concluded that the labor market effects of FDI can be both positive and negative. Rising skilled labor wages are linked to foreign capital inflows but a major consequence has been rising wage inequality throughout the country. In a related study, Zhao [1998] found that some of the favorable effects of FDI on aggregate unemployment in both industrialized countries and in LDCs are offset by the tendency of FDI to reduce union employment.

Although the conventional wisdom holds that the U.S. has benefited greatly as the world's largest importer and exporter of FDI capital [Graham and Krugman, 1995], there are dissentors on this issue. For example, Glickman and Woodward [1989] demonstrated that outward USFDI in the 1970s and 1980s produced a large net job displacement effect (2.7 million jobs) eroding the country's manufacturing base and affecting most severely those at the bottom of the wage ladder, such as blue-collar workers and minorities. Finally, in a paper designed to test the relationship between inward FDI and economic growth in the U.S., Kasibhatla and Sawhney [1996] concluded that growth inducement is not supported by U.S. data for the 1970s, 1980s and early 1990s.

Several researchers, in an effort to evaluate the effects of FDI inflows on local economies, study the impact on employment and wages of foreign companies operating either in the US or in other countries. Hownstein and Zeile [1994] find that foreign affiliates in the US are larger, more capital intensive and pay higher wages than domestic plants. Globerman, Ries and Vertinsky [1994] find qualitatively similar results for foreign establishments operating in Canada. Doms and Jensen [1996] support these findings even when they control for industry and location characteristics, the plant age and the plant size.

Extending this literature, researchers study possible spillover effects between the higher wages paid by foreign plants and the wages paid by domestic plants. Aitken, Harrison and Lipsey [1996] find that, in the US, a higher level of foreign ownership in an industry and location is associated with higher wages in domestically-owned plants. Also, Feenstra and Hanson [1997] reveal that FDI in Mexico accounts for more than half of the increase in skilled labor share that occurred in the country in the late 80s.

However, very little has been done in evaluating the effects of the operation of foreign plants on the local economies of the US states receiving the FDI flows. Fliglio and Bloningen [1999] focus on South Carolina, and, by using county level data, find that manufacturing employment by foreign plants has a strong positive impact on county and industry specific wages. Also, the addition of an average-sized new foreign company increases real wages for all workers in the specific county and industry by much more than a similar domestic company does.

Our study extends this literature in several dimensions. First, we focus on the effects of FDI inflows on industry and state-specific wages and employment (labor

market effects) in several US states. Second, our sample includes all twenty 2-digit SIC industries in manufacturing operating in each of the ten US states that were the top recipients of FDI inflows for the period between 1974 and 1994. Third, our data allow for a direct evaluation of the impact FDI has on some crucial aspects of economic activity in the local economies in the US states.

The paper is structured as follows. Section 2 provides a theoretical foundation for testing empirically the impact of FDI on employment and wages; section 3 describes the data in use; section 4 presents our empirical analysis; section 5 analyzes the empirical findings in detail; and section 6 concludes the study.

2. FDI and the Labor Market

Net investment on fixed capital, either in terms of establishing new plants or in expanding existing ones, represents a shifting factor for labor demand. A net investment, either in a domestic or a foreign-owned plant would increase demand for employment at a plant level. However, it is far from certain that the labor demand in the industry would increase. If this happens, and given the elasticity of labor supply, industry wages and employment will increase. Consequently, the fact that foreign-owned plants tend to pay higher wages than domestic ones, as some researchers have found, does not necessarily imply that FDI will boost overall industry wages and employment.

To empirically examine the impact of FDI on industry real wages and employment, it is important to control for other factors that can also shift the labor demand. Since the labor demand is an induced demand, an increase in the products

market demand would stimulate also the labor demand. Therefore, in our analysis we control for market demand fluctuations.

Labor productivity is also an important factor in labor market. An increase in labor productivity increases the marginal product of labor and *ceteris paribus*, exercises an upward pressure on wages and employment.

Fluctuations in exchange rates have been identified recently as an important driving force in the labor market. An appreciated local currency makes the products of local companies less competitive with respect to foreign products in either in domestic or foreign markets, and results in a decrease in labor demand in the local market.[1]

The focus of this study is to examine the net impact of FDI on industry and state specific wages and employment by controlling for all other factors that may cause changes in the local labor market.[2] All twenty 2-digit SIC manufacturing industries that received FDI from 1974 to 1994 and a selected group of states are included in the study. Our analysis allows us to identify the effects of FDI inflows in the local labor markets of the hosting US states. Based on our empirical results, policy recommendations for selectivity in receiving FDI inflows will be made in conclusion.

3. Data

A detailed data set on US FDI inflows recorded in the publication "Foreign Direct Investment in the United States" is used in the study.[3] The data set reports FDI

[1] See Revenga [1992], Campa and Goldberg [1998], Goldberg and Tracy [1998], Goldberg, Tracy and Aaronson [1999] and Gourinchas [1998].

[2] Notice that in this paper a "market" is referred to the operation of each 2-digit SIC manufacturing industry in each state in the sample.

[3] These data were maintained by the International Trade Administration (ITA), the US Department of Commerce, and were discontinued after 1994.

transactions in the United States of foreign companies that possess at least ten percent of the ownership of their US subsidiary where the investment is placed. Every FDI transaction is classified according to the 4-digit SIC system and the data set records the nominal value of the transaction along with the US state that received the FDI inflow.[4] The data set in use spans twenty-one years (from 1974 to 1994).

After aggregating appropriately the FDI data, we include all FDI inflows $\left(FDI_{ijt}\right)$ in each 2-digit SIC manufacturing industry (index *i*) for ten US states (index *j*) that received the most FDI inflows in the period of 1974-1994 (index *t*) based on the ITA data set.[5] Tables 1 and 2 present a break down of FDI inflows across states and industries. The state of New York received 24% of the total FDI in the sample, and along with California and Ohio, with 13% of the total each, account for half of the total FDI that was received by the ten states in the sample. Industry-wise, Chemicals (SIC 28) and Electrical Machinery top the list of industries in terms of receiving FDI (with 30% and 13% of the total respectively). Also, as table 2 reveals, the industry allocation of FDI across states is not homogeneous. In some states, a single industry plays a dominant role in receiving FDI inflows, like Chemicals in New York and Pennsylvania (with respectively 43% and 64% of the state's total), and Stone, Clay and Glass in Florida (with 40% of the state's total).

The employment and wages data (in annual frequencies) are from the Bureau of Labor Statistics. The number of employees in each 2-digit SIC manufacturing industry in

[4] For some transactions the amount of FDI was not made available and therefore not recorded. We dropped these transactions from our data set.

[5] The states in the sample received approximately 63% of all FDI inflows in US manufacturing that recorded by the ITA in the period between 1974 and 1994.

each state of the sample is used as employment, while their average hourly earnings are used as the wage rate in the analysis.[6] The rest of the data is described in Appendix A.

4. Empirical Results

Our empirical analysis focuses primarily on the impact of FDI flows on industry employment $\left(L_{ijt}\right)$ and real wages $\left(W_{ijt}\right)$ of the respective state that receives the FDI inflows. In estimations, we also control for several other factors that influence employment and wages across industries or across states as discussed in section 2.

Specifically, we construct an industry-specific real exchange rate $\left(EOPEN1_{it}\right)$ based on the log de-trended trade-weighted real exchange rate of the US dollar $\left(E_t\right)$ adjusted by the share of exports to domestic shipments for each 2-digit SIC manufacturing industry in the US. Campa and Goldberg (1998) construct industry and state-specific exchange rates using the ratio of average exports (for the years between 1989 and 1994 that the exports data are available) of a given industry in a given state to the total product of the same industry in the given state. Since Goldberg and Tracy (1998) report that the industry and state-specific real exchange rates are strongly correlated with trade-weighted real exchange rates, we use just the industry-specific exchange rate in our analysis. To control for the detrimental effects of exchange rate fluctuations through import penetration on employment and wages (Revenga, 1992), we also calculate an industry specific real exchange rate $\left(EXG_{it}\right)$ weighting it by the ratio of industry imports to industry shipments. The reported empirical results in next section

[6] Both the employment and wages data have been aggregated at the 2-digit SIC level to match our FDI

only include the coefficients for (EXG_{it}) since this variable is usually statistically significant, while $(EOPEN1_{it})$ is not statistically significant.

We also use various proxies to control industry-specific market demand, since Bernard and Jensen (1999) find that labor markets are not well integrated across regions and industries. Following Goldberg and Tracy (1999), we construct a time series $(CYCLE_{it})$ that indicates industry-specific business cycle fluctuations with respect to the aggregate business cycle fluctuations. First, we linearly de-trend the log of real domestic industry shipments (DEM_{it}) and the log of the real US GDP ($GDPRES_{it}$). The industry business cycle with respect to the aggregate business cycle is defined as $CYCLE_{it} = DEM_{it} - GDPRES_{it}$. Finally, the annualized growth rate of the log of real domestic industry shipments $(DSHIP_{it})$ and a three-year moving average $(DSHIP3_{it})$ of $(DSHIP_{it})$ are used as alternative proxies of market demand fluctuations.

In the study, we also control for labor market tightness in the specific state and industry. Again, we linearly de-trend the log of industry and state-specific employment $(LRES_{ijt})$ and the log of employment in US manufacturing ($LRESM_t$). The labor market tightness in the specific state and industry is defined as $LDEM_{ijt} = LRES_{ijt} - LRESM_t$.

Wages are also influenced by shifts in labor demand due to changes in labor productivity. Labor productivity $(PROD_{it})$ is defined as the ratio between the value-added in an industry and the number of production workers' hours in the same industry. A de-trended value of the log of $(PROD_{it})$ is used in the estimation.

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data.

Finally, to control for possible discrepancy of labor markets due to the trade orientation of industries, we include a dummy variable $\left(TRADE_i\right)$ that takes the value of one for each industry with an export share of its output above the average export share of production in manufacturing.

4.1 FDI Effects on Employment

The estimations with the Fixed and Random Effects model controlling for individual industry and state effects are first performed. However, using the Hausman test, only the results from the appropriate model among the two are reported.

The following reduced form equation is estimated (table 3 includes the results):

$$L_{ijt} = f\left(FDI_{ijt}, TRADE_i, EXG_{it}, EOPEN1_{it}, DPROXY_{it,}\right) \qquad (1)$$

where, $DPROXY_{it}$ = a proxy for product market demand fluctuations

It is expected that FDI inflows have a positive effect on local employment. Product market demand fluctuations should also have similar effects on local employment. Yet, an exchange rate appreciation depresses employment, especially in industries that are open to foreign competition.

In the four model specifications reported in Table 3, the estimated coefficient for $\left(FDI_{ijt}\right)$ is positive and statistically significant in only one specification, while marginally insignificant in the other three specifications. The estimated coefficient ranges between 0.0169 and 0.0193. The results indicate that a 10% increase in FDI inflows to a specific state and industry will cause an overall employment increase in the

same state and industry by approximately 0.17% to 0.19%. These employment effects, however, include employment in both domestic and foreign owned establishments.

It is also found that an appreciation in the industry-specific US dollar $\left(EXG_{it}\right)$ depresses employment in industries with high import penetration. All proxies for market demand are positive and two out of four are also statistically significant. Finally, the dummy variable for industry export orientation $\left(TRADE_{i}\right)$ is, as expected, positive and statistically significant in all specifications.

4.2 FDI Effects on Wages

Since researchers have found that foreign-owned subsidiaries in the US tend to pay higher wages than domestic establishments, it is important to inspect the impact of FDI inflows on the average level of wages for both foreign-owned and domestic companies. The spillover wages effects of FDI across all establishments in a specific state and industry are examined. Other control variables such as labor productivity, product market demand fluctuations, relative tightness in local labor market, and exchange rates are also included in the regression analysis. The following reduced form equation is estimated, and results are reported in Table 4.

$$W_{ijt} = f\left(FDI_{ijt}, TRADE_{i}, PROD_{it}, EXG_{it,}, EOPEN1_{it}, LDEM_{it}, DPROXY_{it}\right) \quad (2)$$

The estimated coefficient for $\left(FDI_{ijt}\right)$ is positive and statistically significant in all specifications. A 10% increase in FDI inflows in to a specific state and industry increases real wages in the same state and industry by approximately 0.035% to 0.082%. The results show that FDI inflows through foreign-owned affiliates boost the average

wage rate in the entire local market, including domestic companies. That is, the foreign-owned subsidiaries not only offer higher wages than their domestic competitors, as other researchers have documented, but also represent a market-wide driving force for overall higher real wage.

Finally, labor productivity, the tightness of the local labor market and product market demand fluctuations all increase real wages, while currency appreciation decreases real wages.

Overall, the empirical results confirm that the US states in our sample seem to benefit from FDI inflows in manufacturing both in terms of employment and real wages. FDI inflows increase both local employment and real wages although the magnitude of the results is rather small. In the remaining part of the study we explore further our results.

4.3 Employment and Wages Effects of FDI in Specific US States

In all our estimations so far, several of the state and industry dummies were statistically significant. Therefore, we investigate further the employment and wages effects of FDI across states and industries.

First, for each state an interaction variable between a state dummy variable (STi) and $\left(FDI_{ijt}\right)$ is created. The reduced forms (1) and (2) are estimated with FDI_{ijt} being replaced by ten interaction variables, one for each state in the sample. All other control variables remain the same. The results are reported in Table 5.[7]

[7] The numbering of the US sates in our sample comes from the alphabetic ranking of these states, with California being #1 and Texas #10. See also Appendix A.

In California, FDI inflows have strong positive effects both on employment and wages. In Connecticut, FDI inflows reduce employment but increase real wages. In Florida, FDI inflows have detrimental effects on both employment and real wages. In Illinois, Ohio and Pennsylvania, FDI inflows have positive and statistically significant effects on both employment and real wages. In Massachusetts and New Jersey, FDI inflows decrease employment but have a statistically insignificant impact on wages. In New York, FDI inflows have positive effects on employment but statistically insignificant effects on wages, while in Texas the results are exactly the opposite. Consequently, the FDI effects on employment and wages are not robust across US sates. Some states seem to benefit from FDI inflows while others do not. The heterogeneity of the FDI effects on labor markets across states can explain to some extend why the estimated coefficients for FDI_{ijt} for the full sample of states were rather small and in some cases statistically insignificant.

To further investigate the impact of FDI inflows on local labor market, another dummy variable is created that takes the value of one for the states where FDI has a positive and statistically significant effect on employment $(ST19)$, a negative and statistically significant impact on employment $(ST26)$, a positive and statistically significant effect on wages $(ST210)$, and finally a negative and statistically significant effect on wages $(ST3)$. Then interaction variables between FDI_{ijt} and the appropriate dummy are constructed. Equations (1) and (2) are estimated again including the appropriate interaction variable in each specification. Table 6 presents the results.

In Model 1, the coefficient of the interaction variable $\left(ST19 * FDI_{ijt}\right)$ indicates the difference of employment effects between California, Illinois, New York, Ohio and

Pennsylvania and the rest of the states in the sample. It is found that the FDI effects on employment in this group of states are almost four times stronger (0.079 versus 0.0193) than in the entire sample of states. Similarly, for a subgroup of states that include Connecticut, Florida, Massachusetts and New Jersey, FDI has negative employment effects while in the rest of the states positive effects (Model 2).

For the group of states where FDI inflows seem to increase real wages (California, Connecticut, Illinois, New Jersey, Ohio, Pennsylvania and Texas), the estimated FDI elasticity is approximately 0.014 and almost twice as large as for the entire sample (Model 3). It is also found that only in Florida FDI depresses real wages (Model 4).

In conclusion, some US states, such as California, Illinois, Ohio and Pennsylvania benefit significantly both in terms of employment and wages from FDI, while Florida does not do so. In the next section we explore a plausible explanation for this heterogeneity in labor market effects of FDI inflows across US states.

4.4 Employment and Wages Effects of FDI in US Manufacturing Industries

Manufacturing consists of a very diverse group of industries that produce durable and non-durable products, with wide variation in capital intensity, openness to exports and import penetration. Consequently, it is expected that FDI inflows would have a wide range of diverse employment and wages effects across industries in this sector.

To focus our analysis on the specific 2-digit SIC industries in our sample we create dummy variables for each industry (for example $(S20)$ is the dummy variable for Food (SIC 20)). Twenty interaction variables of the dummies and FDI_{ijt} are constructed

(one for each 2-digit SIC industry in manufacturing) to replace FDI_{ijt} in equations (1) and (2).[8] Each estimated coefficient of the interaction variables measures the elasticity of employment and wages to changes in FDI inflows for the corresponding 2-digit SIC industry across the ten states in the sample. The same controlled variables are used in estimating equations (1) and (2) as before. The results are reported in Table 7.

As expected, the employment and wages effects of FDI inflows vary widely across industries. In terms of employment, FDI inflows have positive effects in Printing and Publishing, Chemicals, Petroleum, Electrical Machinery, Transportation Equipment and Instruments. FDI inflows, however, have negative effects in Apparel, Leather and Stone/Clay/Glass. For wages, FDI increases overall industry wages across US states in Printing and Publishing, Transportation Equipment and Instruments, but decreases wages in Leather, Stone/Clay/Glass and Electrical Machinery. FDI increases both employment and wages in Printing and Publishing, Transportation Equipment, and Instruments but decreases both employment and wages in Leather and Stone/Clay/Glass.

To investigate further this heterogeneity across industries, we construct, as before, dummy variables for those groups of industries that have either positive or negative effects on employment and wages in an effort to contrast them with the rest of the industries in manufacturing.

Dummy variable $(S2738)$ corresponds to the group of industries that show positive FDI effects on employment, while $(S2331)$ to the industries with negative employment effects. Similarly, $(S278)$ covers the industries with positive FDI effects on wages while $(S3136)$ is for the industries with negative wage effects. Equations (1) and

[8] Tobacco (SIC 21) has been dropped from these estimations since the FDI data for this industry is

(2) are estimated again with the addition of the appropriate interaction variable between $\left(FDI_{ijt}\right)$ and the above-mentioned dummies in the corresponding specification. The results are reported in Table 8.

Model 1 highlights the importance of a group of industries in terms of the positive employment effects of FDI inflows. The estimated coefficient of the interaction variable $\left(S2738 * FDI_{ijt}\right)$ shows that the group of industries that have positive effects on employment expands local employment by almost 4.5 times more than all manufacturing industries together (estimated elasticities 0.0193 versus 0.089 respectively). Also, the estimated employment elasticity with respect to FDI inflows for the rest of the industries, 0.0017, is not statistically significant. The finding indicates the importance of industries such as Transportation Equipment and Instruments in driving the employment results of FDI in manufacturing.

In Model 2 the estimated employment elasticity with respect to FDI inflows in the group of industries where FDI depresses employment is negative, while the one for the rest of the industries is positive. Also, the latter elasticity is almost 3 times higher than the one for the full sample of industries, indicating that the weak employment effects of FDI reported in table 3 are also due the group of industries where FDI inflows depress employment.

Model 3 compares the wages effects of FDI between the group of industries where FDI has positive wages effects and the rest of the industries in manufacturing. The estimated wage elasticity for this subgroup of industries is more than 4 times larger than the one estimated for the full sample (0.0349 versus 0.0082). The FDI elasticity of wages

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extremely scarce across states (table 1).

for the rest of the industries is also positive but statistically insignificant. Obviously, some of the positive FDI effects on local wages, reported in table 3 for the full sample, are due to FDI inflows in the subgroup of industries where FDI expands local wages.

Model 4 demonstrates the negative wages effects of FDI inflows in industries such as Leather and Stone/Clay/Glass. The estimated wage elasticity for this group is negative while the estimated elasticity for the rest of the industries is positive.

Overall, FDI inflows have mixed labor market effects across industries in manufacturing. In some industries, such as Printing and Publishing, Transportation Equipment, and Instruments, FDI inflows increase both employment and wages while, in Leather and Stone/Clay/Glass, FDI decreases employment and wages. The sub-groups analyses also explain the rather weak employment effects reported in Section 4.1 for the full sample of industries in manufacturing.

5. What Has Been Learned from the Empirical Results?

Section 4.3 highlights the very diverse labor market effects of FDI in manufacturing across US states. A plausible explanation for this phenomenon is the industry composition of FDI inflows across states. For instance, FDI inflows depress both employment and wages in Florida. A better look at the industry composition of FDI in Florida shows that approximately 40% of it is in Stone/Clay/Glass (Table 2), an industry in which FDI inflows have detrimental effects on both employment and wages (section 4.4). Similarly, FDI inflows depress employment in Massachusetts. It is again the Stone/Clay/Glass industry, which received 20% of all FDI inflows in the state that drives the results.

On the other hand, California benefits from FDI inflows both in terms of employment and wages. However, approximately 38% of total FDI inflows in the state are shared by two industries that have positive effects on employment: Industrial Machinery (SIC 35) and Electrical Machinery (SIC 36). Also, FDI inflows in Leather and Stone/Clay/Glass account for only 2% of the state's total FDI.

FDI also expands local employment and wages in Pennsylvania, since 64% of the state's FDI is concentrated in Chemicals (SIC 28), an industry where FDI inflows boost both employment and wages. At the same time, only 3% of the state's FDI are in Leather and Stone/Clay/Glass.

The discussion so far raises an interesting issue about the specific factors or conditions that produce labor market benefits for inward FDI in certain industries but negative effects in other industries. It is beyond the scope of the present paper to analyze thoroughly these factors. However, we intend to at least explore briefly a plausible explanation of our industry results, leaving for future research a more thorough discussion.

In many cases, an FDI brings along a new technology that may change the intensity in using labor in production. For instance, FDI might bring labor saving (using) technologies that decrease (increase) labor demand in the local market, depressing (boosting) local employment and wages. In the rest of the paper, we briefly address this issue, although a more thorough discussion using data on plant level is left for future research.

Table 7 shows evidence that FDI inflows have positive employment effects in Printing and Publishing (SIC 27), Chemicals (SIC 28), Electrical Machinery (SIC 36),

Transportation Equipment (SIC 37), and Instruments (SIC 38). FDI on the other hand depresses employment in Apparel (SIC 23), Leather (SIC 31) and Stone/Clay/Glass (SIC 32). In table 9 it is recorded that FDI inflows have similar effects on real industrial output $\left(Q_{ijt}\right)$.[9] Therefore the relative impact of FDI on industry employment and production across states provides some evidence of the labor bias of new technologies that are introduced through FDI. For instance, if FDI inflows boost production more than employment in a certain industry and state, this might be an evidence of labor saving technologies.

To examine the impact of FDI on output per worker, we regress the real output/employment ratio $\left(\frac{Q_{ijt}}{L_{ijt}}\right)$ on FDI inflows across industries. Table 9 presents the results. In Apparel, Leather and Stone/Clay/Glass, FDI decreases employment more than output and therefore increases output per worker $\left(\frac{Q_{ijt}}{L_{ijt}}\right)$, evidence that supports the premise of labor saving technologies introduced through FDI. Yet, in Printing and Publishing, Electrical Machinery, Transportation Equipment and Instruments, FDI inflows expands employment more than output and reduces output per worker $\left(\frac{Q_{ijt}}{L_{ijt}}\right)$ an indication of labor using technologies that boost labor demand. Finally, the results in Chemicals are very weak. Theoretically though we might expect that new technologies introduced through FDI inflows will have an impact on local labor markets with some

[9] In table 9 we report only the estimated elasticities of the dependent variables with respect to FDI inflows, and only for the industries in discussion. In these regressions we also use the same control variables as in the regressions reported in table 7.

time lag. To capture that, we regress again the current output/employment industry and state-specific ratio $\left(\frac{Q_{ijt}}{L_{ijt}}\right)_2$ on FDI inflows lagged by two years (last column in table 9). The evidence we discussed already of labor bias in technology brought through FDI become even stronger.[10]

Overall, labor-saving technologies introduced potentially through FDI can explain the negative impact of FDI inflows on employment in Apparel, Leather, and Stone/Clay/Glass, while labor-using technologies can explain the expanding effects on employment of FDI in Printing and Publishing, Electrical Machinery, Transportation Equipment, and Instruments.

Finally, in analyzing the effects of FDI on industrial wages a labor-supply proxy is constructed as the share of industry and state-specific employment out of total employment of manufacturing in the same state $\left(\frac{L_{ijt}}{\sum_{i=20}^{39} L_{ijt}}\right)$. Then we regress the labor-supply proxy on FDI inflows and some control variables, with the estimated coefficients of FDI across industries indicating the impact of FDI on the labor supply in the specific industry and state. [11]

In Apparel, Leather and Stone/Clay/Glass, FDI reduces the industry's employment share. Along with the labor-saving technology brought in by the FDI, the results can explain FDI's depressing impact on employment and wages in these

[10] The results are similar if in the regressions we use $\left(FDI_{ijt}\right)$ instead lagged only by one year.

[11] Due to space limitations we do not report the results from these regressions, but they are available upon request.

industries. In Chemicals, FDI increases the industry's labor share. Therefore it expands industry's employment but has a statistically insignificant impact on wages (Table 7). In Printing and Publishing, FDI increases the industry's employment share in addition to the labor-using technologies it brings in the industry, boosting local employment and wages. In Electrical Machinery, FDI mildly expands both employment share and labor use in production, and that can explain the overall increase in employment but a drop in wages (Table 7). In Transportation Equipment, FDI decreases the industry's employment share but strongly increases the use of labor pushing both employment and wages up. Finally, in Instruments, FDI increases both employment share and labor-using in production causing an overall increase in local employment and wages.

6. Conclusions

In the present study we analyze the effects of FDI inflows in manufacturing across US states. Overall, FDI has a positive and, in most cases, statistically significant impact on employment and wages. However, these effects vary across US states. In some states, FDI inflows expand both local employment and wages while in others depress employment and wages. It is found that these results are driven primarily by the industry composition of FDI inflows across states.

For states such as California and Pennsylvania, significant shares of FDI inflows are in industries that have positive employment and wages effects (e.g., Chemicals). There is very little FDI in these states in industries with negative employment and wages effects (e.g., Leather and Stone/Clay/Glass). For states such as Florida and Massachusetts, significant portions of FDI inflows are in Leather and Stone/Clay/Glass,

explaining the detrimental effects of FDI inflows on the state's labor markets. Overall, FDI inflows in industries such as Printing and Publishing, Transportation Equipment and Instruments have positive employment and wages effects while FDI inflows in Leather and Stone/Clay/Glass have negative effects.

The fact that different types of inward FDI have very diverse effects on local employment and wages should not be surprising. Analyzing in detail the factors and conditions that explain this phenomenon is well beyond the scope of the paper, but certainly worthy of future study. For example, its is expected that "green field" investment would more likely have positive employment effects than "takeovers", given the fact that the latter may be "zero sum" game with respect to labor demand.

In the paper we provide a plausible explanation for these diverse labor market effects of FDI inflows across industries; that of the specific labor bias of technologies that might be introduced in the local markets through FDI. Certain types of FDI that bring labor saving technologies will have more negative effects on local employment and wages. At the same time, FDI driven technologies might have stronger effects on labor productivity with respect to other technologies, and through productivity gains, on wages and employment. Also, it is quite interesting to know the links through which technology transfers through FDI spillover to the rest of the local economy. However, a more thorough analysis is necessary in the future for such important topics.

APPENDIX A

US States in the Sample: California, Connecticut, Florida, Illinois, Massachusetts, New Jersey, New York, Ohio, Pennsylvania, and Texas.

Foreign Direct Investment (FDI): FDI inflows in each 2-digit SIC manufacturing industry and in each state of the sample. (Source: ITA Data Set, US Department of Commerce).

Employment: Thousands of persons employed in each 2-digit SIC manufacturing industry and in each state of the sample. (Source: US Department of Labor, Bureau of Labor Statistics).

Wages: Average hourly earnings in each 2-digit SIC manufacturing industry and in each state of the sample (in current dollars per hour). (Source: US Department of Labor, Bureau of Labor Statistics).

Shipments: Total nominal value of shipments in each 2-digit SIC manufacturing industry. (Source: Eric J. Bartelsman, Randy A. Becker, and Wayne B. Gray: NBER-CES Manufacturing Industry Database).

Industry Value-Added: Nominal value-added in each 2-digit SIC manufacturing industry. (Source: Eric J. Bartelsman, Randy A. Becker, and Wayne B. Gray: NBER-CES Manufacturing Industry Database).

Total Capital Expenditure: Nominal expenditure on fixed assets in each 2-digit SIC manufacturing industry. (Source: Eric J. Bartelsman, Randy A. Becker, and Wayne B. Gray: NBER-CES Manufacturing Industry Database).

Investment and Shipments Deflators: Appropriate deflators for fixed investment and shipments. (Source: Eric J. Bartelsman, Randy A. Becker, and Wayne B. Gray: NBER-CES Manufacturing Industry Database).

Exports and Imports: Nominal exports and imports in each 2-digit SIC manufacturing industry. (Source: Robert Feenstra: U.S. Import and Export Data, NBER).

Exchange Rate: Trade-weighted real exchange value of the U.S. Dollar versus currencies of a broad group of major U.S. trading partners. (Source: Federal Reserve Board of Governors).

APPENDIX B

Table 1.
FDI Inflows Across Industries and States
(In Millions of Current Dollars, 1974-94)

Industry	Calif	Conect	Florida	Illinois	Mass	N.Jersey	N.York	Ohio	Pennsyl.	Texas	Total
20	4759.7	1208	1287.5	2750.3	63.7	57.7	1844.8	237.7	340.8	474.9	13025.1
21	0	0	0	0.9	0	415	0	0	0	5.2	421.1
22	74	0	15	2	20.5	34	217.4	32.5	42.5	0	437.9
23	30.4	0	0	30	0	13	216.9	228	2.9	0	521.2
24	330.1	0	0	0	0	0	4.8	10	0	0	344.9
25	15	0	0	8.8	0.9	0	19.2	38	10	0	91.9
26	705.6	0	130	784.6	1843.4	1.7	869.8	147.8	694.8	40	5217.7
27	487.5	705.6	179.5	1585.3	408.2	502.1	9131.1	810	170.3	340	14319.6
28	1748.01	4809.3	101.3	2816.5	1416.4	4896	19513.4	2025.5	13461.3	4829.3	55617.01
29	941	0.3	0	769	50	219	12.4	8291.6	420	4709.4	15412.7
30	163.1	260.5	67.5	44.3	129	113.1	271.3	5283.9	113	80.2	6525.9
31	0	0	0	0	63.2	1.9	17	0	7.8	0	89.9
32	724.8	701.1	1921.2	4.3	2004	135.6	395.7	643.9	673.4	2251.1	9455.1
33	1865.4	209	407	88.8	71.2	216.7	1126.8	1759.9	1704.6	568.8	8018.2
34	123.7	175.3	45.6	354.5	122.5	248.5	1329.1	815.6	325.7	64	3604.5
35	3433.9	2967.8	88.8	1803.8	1183.2	872.4	538.1	369.3	910.2	505.1	12672.6
36	6153.4	1552.5	429.7	2894.9	1583.8	821	7461.4	1501.3	804.2	1122.5	24324.7
37	1363.8	25.1	28.6	731	0	3.3	423.5	2166	966.6	29.3	5737.2
38	2172.9	60.4	74	349.5	1004.9	649.3	1349.2	248.7	352.5	840.5	7101.9
39	26.9	14.5	0	363	0.6	2043.4	198.8	3.3	41.7	0	2692.2
Total	25119.21	12689.4	4775.7	15381.5	9965.5	11243.7	44940.7	24613	21042.3	15860.3	185631.3

Table 2.
Industry Composition of FDI Inflows Across States (1974-94).
Percent of Total Per State

Industry	Calif	Conect	Florida	Illinois	Mass	N.Jersey	N.York	Ohio	Pennsyl.	Texas
20	0.189484	0.095198	0.269594	0.178806	0.006392	0.005132	0.04105	0.009657	0.016196	0.029943
21	0	0	0	5.85E-05	0	0.03691	0	0	0	0.000328
22	0.002946	0	0.003141	0.00013	0.002057	0.003024	0.004837	0.00132	0.00202	0
23	0.00121	0	0	0.00195	0	0.001156	0.004826	0.009263	0.000138	0
24	0.013141	0	0	0	0	0	0.000107	0.000406	0	0
25	0.000597	0	0	0.000572	9.03E-05	0	0.000427	0.001544	0.000475	0
26	0.02809	0	0.027221	0.051009	0.184978	0.000151	0.019354	0.006005	0.033019	0.002522
27	0.019407	0.055605	0.037586	0.103065	0.040961	0.044656	0.203181	0.032909	0.008093	0.021437
28	0.069589	0.379001	0.021212	0.18311	0.14213	0.435444	0.434203	0.082294	0.639726	0.30449
29	0.037461	2.36E-05	0	0.049995	0.005017	0.019478	0.000276	0.336879	0.01996	0.29693
30	0.006493	0.020529	0.014134	0.00288	0.012945	0.010059	0.006037	0.214679	0.00537	0.005057
31	0	0	0	0	0.006342	0.000169	0.000378	0	0.000371	0
32	0.028854	0.055251	0.402287	0.00028	0.201094	0.01206	0.008805	0.026161	0.032002	0.141933
33	0.074262	0.01647	0.085223	0.005773	0.007145	0.019273	0.025073	0.071503	0.081008	0.035863
34	0.004925	0.013815	0.009548	0.023047	0.012292	0.022101	0.029575	0.033137	0.015478	0.004035
35	0.136704	0.23388	0.018594	0.117271	0.11873	0.07759	0.011974	0.015004	0.043256	0.031847
36	0.244968	0.122346	0.089976	0.188207	0.158928	0.073019	0.166028	0.060996	0.038218	0.070774
37	0.054293	0.001978	0.005989	0.047525	0	0.000293	0.009424	0.088002	0.045936	0.001847
38	0.086504	0.00476	0.015495	0.022722	0.100838	0.057748	0.030022	0.010104	0.016752	0.052994
39	0.001071	0.001143	0	0.0236	6.02E-05	0.181737	0.004424	0.000134	0.001982	0

Table 3.
Employment Effects of FDI Inflows; All Data (1974-94).

Variables	Random Effects	Random Effects	Random Effects	Random Effects
$Cons\tan t$	4.849*	4.848*	4.616*	4.730*
	(24.7105)	(24.816)	(27.331)	(22.631)
$TRADE_i$	0.415*	0.417*	0.377*	0.413*
	(7.999)	(7.994)	(7.701)	(7.709)
FDI_{ijt}	0.0169	0.0169	0.0193**	0.0175
	(1.569)	(1.575)	(1.792)	(1.573)
EXG_{it}	-0.632*	-0.638*	-0.378*	-0.442*
	(-4.431)	(-4.431)	(-4.682)	(-4.431)
$CYCLE_{it}$	0.0041*			
	(2.142)			
DEM_{it}		0.0009*		
		(2.163)		
$DSHIP_{it}$			0.0076	
			(0.246)	
$DSHIP3_{it}$				0.0232
				(0.404)
$\overline{R}^2$	0.279	0.280	0.279	0.284
$SAMPLE$	1013	1013	991	935

Table 4.
Wages Effects of FDI Inflows; All Data (1974-94).

Variables	Fixed Effects	Fixed Effects	Fixed Effects	Fixed Effects	Fixed Effects
$TRADE_i$	0.0513*	0.0139	0.0144	0.0832*	0.104*
	(3.781)	(1.240)	(1.275)	(6.241)	(7.235)
FDI_{ijt}	0.0069*	0.0035**	0.0035*	0.0082*	0.0080*
	(2.733)	(1.640)	(1.651)	(3.144)	(3.013)
$PROD_{it}$	0.339*	0.241*	0.241*	0.293*	0.280*
	(10.295)	(8.834)	(8.835)	(8.891)	(8.243)
EXG_{it}	-0.142*	-0.034	-0.0358	-0.194*	-0.222*
	(-4.021)	(-1.147)	(-1.180)	(-5.409)	(-5.886)
$LDEM_{ijt}$	0.0521*				
	(6.923)				
$CYCLE_{it}$		0.159*			
		(20.745)			
DEM_{it}			0.158*		
			(20.660)		
$DSHIP_{it}$				-0.0199*	
				(-2.507)	
$DSHIP3_{it}$					-0.0461*
					(-3.189)
$\overline{R}^2$	0.333	0.511	0.517	0.303	0.313
$SAMPLE$	977	989	989	968	916

Table 5.
FDI Effects Per US State (1974-94).

Variables	State FDI Effects on Employment (Random Effects)	State FDI Effects on Wages (Fixed Effects)
$Cons\tan t$	4.848*	
	(25.501)	
$ST1*FDI_{ijt}$	0.155*	0.0077*
	(9.784)	(2.031)
$ST2*FDI_{ijt}$	-0.153*	0.0098**
	(-6.258)	(1.735)
$ST3*FDI_{ijt}$	-0.177*	-0.0319*
	(-6.314)	(-4.915)
$ST4*FDI_{ijt}$	0.0395*	0.0105*
	(2.024)	(2.365)
$ST5*FDI_{ijt}$	-0.0797*	0.0003
	(-3.505)	(0.066)
$ST6*FDI_{ijt}$	-0.0394**	0.0111*
	(-1.843)	(2.271)
$ST7*FDI_{ijt}$	0.0574*	0.0016
	(3.870)	(0.464)
$ST8*FDI_{ijt}$	0.0751*	0.0295*
	(4.039)	(6.965)
$ST9*FDI_{ijt}$	0.0466*	0.0134*
	(2.464)	(2.873)
$ST10*FDI_{ijt}$	0.0102	0.0102*
	(0.533)	(2.280)
$TRADE_i$	0.371*	0.0446*
	(7.013)	(3.285)
$LDEM_{it}$		0.0580*
		(7.765)
$PROD_{it}$		0.347*
		(10.374)
EXG_{it}	-0.6013*	-0.137*
	(-4.106)	(-3.811)
$CYCLE_{it}$	0.0036**	
	(1.837)	
$\overline{R}^2$	0.248	3.14
$SAMPLE$	1013	977

Table 6.
Employment and Wages Effects of FDI Inflows; Groups of US States (1974-94).

Variables	Employment Effects Model 1	Employment Effects Model 2	Wages Effects Model 3	Wages Effects Model 4
$Constant$	4.685*	4.718*		
	(25.318)	(25.412)		
$TRADE_i$	0.354*	0.366*	0.0430*	0.0458*
	(6.658)	(6.865)	(3.186)	(3.402)
FDI_{ijt}	-0.0699*	0.0695*	-0.0025	0.0094*
	(-4.966)	(6.044)	(-0.795)	(3.604)
$ST19 * FDI_{ijt}$	0.149*			
	(12.963)			
$ST26 * FDI_{ijt}$		-0.172*		
		(-13.563)		
$ST210 * FDI_{ijt}$			0.0163*	
			(6.079)	
$ST3 * FDI_{ijt}$				-0.0419*
				(-6.711)
EXG_{it}	-0.487*	-0.506*	-0.133*	-0.126*
	(-3.298)	(-3.431)	(-3.656)	(-3.486)
$CYCLE_{it}$	0.0028	0.0029		
	(1.472)	(1.512)		
$LDEM_{it}$			0.0652*	0.0596*
			(9.591)	(8.613)
$PROD_{it}$			0.333*	0.336*
			(9.953)	(10.110)
$\overline{R}^2$	0.173	0.186	0.281	0.286
$SAMPLE$	1013	1013	977	977

Table 7.
FDI Effects for US Manufacturing Industries (1974-94).

Variables	Industry FDI Effects on Employment (Fixed Effects)	Industry FDI Effects on Wages (Fixed Effects)
$S20 * FDI_{ijt}$	0.0582 (1.091)	0.0083 (0.878)
$S22 * FDI_{ijt}$	0.372 (0.770)	-0.049 (-0.585)
$S23 * FDI_{ijt}$	-0.948* (-2.079)	-0.0026 (-0.032)
$S24 * FDI_{ijt}$	-1.0159 (-0.001)	0.148731 (0.0008
$S25 * FDI_{ijt}$	-0.153 (-0.352)	0.0547 (0.710)
$S26 * FDI_{ijt}$	-0.0834 (-1.454)	-0.0047 (-0.452)
$S27 * FDI_{ijt}$	0.129* (2.949)	0.0236* (2.960)
$S28 * FDI_{ijt}$	0.0436** (1.642)	0.0048 (0.944)
$S29 * FDI_{ijt}$	0.123* (1.952)	-0.0151 (-0.379)
$S30 * FDI_{ijt}$	0.0924 (1.412)	0.0168 (1.450)
$S31 * FDI_{ijt}$	-0.424** (-1.845)	-0.108* (-2.506)
$S32 * FDI_{ijt}$	-0.174* (-2.973)	-0.0194** (-1.809)
$S33 * FDI_{ijt}$	-0.0309 (-0.642)	-0.0122 (-1.411)
$S34 * FDI_{ijt}$	0.0174 (0.3721)	0.0074 (0.888)
$S35 * FDI_{ijt}$	0.0366 (1.224)	0.0086 (1.611)
$S36 * FDI_{ijt}$	0.0922* (3.318)	-0.0089** (-1.791)
$S37 * FDI_{ijt}$	0.113* (2.892)	0.0475* (6.399)
$S38 * FDI_{ijt}$	0.140* (2.502)	0.0333* (3.141)
$S39 * FDI_{ijt}$	0.0047 (0.036)	-0.0222 (-0.917)
$TRADE_i$	0.0745 (0.315)	0.106* (1.998)
$CYCLE_{it}$	0.0068 (0.822)	
EXG_{it}	-0.311 (-0.487)	0.0178 (0.134)
$LDEM_{it}$		0.0003 (0.760)
$PROD_{it}$		-0.0117 (-0.087)
$\overline{R}^2$	0.323	0.614
$SAMPLE$	1013	977

Table 8.
Employment and Wages Effects of FDI Inflows; Groups of US Manufacturing Industries (1974-94).

Variables	Employment Effects Model 1	Employment Effects Model 2	Wages Effects Model 3	Wages Effects Model 4
$TRADE_i$	0.0667	-0.0565	0.186*	0.174*
	(0.373)	(-0.312)	(4.549)	(4.104)
FDI_{ijt}	0.0017	0.0614*	0.0007	0.0119*
	(0.098)	(4.703)	(0.282)	(4.757)
$S2738 * FDI_{ijt}$	0.0879*			
	(4.098)			
$S2331 * FDI_{ijt}$		-0.238*		
		(-4.198)		
$S278 * FDI_{ijt}$			0.0349*	
			(6.688)	
$S3136 * FDI_{ijt}$				-0.0225*
				(-4.929)
EXG_{it}	-0.939*	-0.972*	-0.186*	-0.271*
	(-2.499)	(-2.588)	(-2.406)	(-3.536)
$CYCLE_{it}$	0.0113**	0.0121*		
	(1.923)	(2.052)		
$LDEM_{it}$			0.0001	0.0005
			(0.278)	(1.282)
$PROD_{it}$			-0.0093	-0.192**
			(-0.079)	(-1.692)
$\overline{R}^2$	0.311	0.312	0.606	0.594
$SAMPLE$	1013	1013	977	977

Table 9.
Production and Employment Effects of FDI Inflows; A Sub-Group of US Manufacturing Industries (1974-94).

Industries	Dependent Variable			
	Q_{ijt}	L_{ijt}	$\frac{Q_{ijt}}{L_{ijt}}$	$\left(\frac{Q_{ijt}}{L_{ijt}}\right)_2$
Apparel (SIC 23)	-1.0895*	-0.948*	0.202	0.218**
	(-2.043)	(-2.079)	(1.551)	(1.645)
Printing (SIC 27)	0.182*	0.129*	-0.0219*	-0.0245*
	(3.550)	(2.949)	(-1.961)	(-2.0886)
Chemicals (SIC 28)	0.0705*	0.0436**	0.0001	0.0045
	(2.269)	(1.642)	(0.015)	(0.566)
Leather (SIC 31)	-0.442*	-0.425**	0.147*	0.203
	(-1.772)	(-1.845)	(2.917)	(3.894)
Stone/Clay/Glass (SIC 32)	-0.128*	-0.174*	0.0577*	0.0610*
	(-2.361)	(-2.973)	(3.478)	(3.556)
Electrical Machinery (SIC	0.0986*	0.0922*	-0.0135**	-0.0125
36)	(3.050)	(3.318)	(-1.732)	(-1.492)
Transportation Equipment	0.133*	0.113*	-0.0169	-0.0197**
(SIC 37)	(2.915)	(2.893)	(-1.517)	(-1.683)
Instruments (SIC 38)	0.164*	0.140*	-0.0245	-0.0313**
	(2.547)	(2.502)	(-1.530)	(-1.902)
$\overline{R}^2$	0.455	0.323	0.423	0.520
SAMPLE	1053	1014	1014	940

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