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Effects of Foreign Presence in a Transition Economy: Regional and Industry-Wide Investments and Firm-Level Exports in Ukrainian Manufacturing

by

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Effects of Foreign Presence in a Transition Economy: Regional and Industry-Wide Investments and Firm-Level Exports in Ukrainian Manufacturing*

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We investigate the effects of regional and industry–wide foreign presence and direct investment (FDI) on export volumes of Ukrainian manufacturing firms, using unpublished panel data from 1996–2000. Foreign presence through FDI may have negative competition effects on domestic firm's performance while domestic firm's productivity may be increased by technology transfer or through training and demonstration effects. From a Cournot competition model including negative competition and positive technology-spillover effects, we derive the hypotheses that foreign presence and foreign investment might positively affect domestic firms' output and exports. Our estimation results support these hypotheses and suggest in particular that large firms and durable–goods producers benefit most from foreign presence and investments.

Keywords: transition, foreign direct investment, spillovers, firm performance.

JEL classification: F14, F23, L60

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1 Introduction

Foreign direct investment (FDI) is a general element in today's global economy and in particular for countries in transition to market economies.[1] It is also true for Ukraine, the second-largest economy of the former Soviet Union and a direct neighbor of the European Union with roughly the size and population of France. The research presented here focuses on FDI in Ukrainian manufacturing.

In 2002, Procter & Gamble established a distribution center in Lviv in Western Ukraine. At the time, it was the first distribution center of an international enterprise in Ukraine and the second of its kind in Eastern Europe. In the following year, Procter & Gamble announced plans to close one of its factories in the United Kingdom and move production of Tampax tampons to Kyiv, Ukraine, and Budapest, Hungary.[2] In the meantime, Procter & Gamble has become just one of many foreign firms to successfully penetrate the Ukrainian market. However, several questions arise: What has happened to Ukrainian companies in the same industry? Have other firms in the same region been affected? Do domestic firms profit from new technologies introduced by foreign firms such as Procter & Gamble or do they exit the market, unable to compete?

We address these questions by utilizing a large, five-year panel of Ukrainian manufacturing firms.[3] Our analysis is based on a few main concepts concerning the transfer mechanisms and effects of foreign presence in a domestic market. Foreign presence may have direct effects. In the case of foreign direct investment by building a new plant or by acquisition of a pre-existing domestic firm, foreign investors may introduce their own technology,

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[1] For a general overviews of recent developments, see, e.g., Markusen (2002); UNCTAD (2000) provides a focus on global cross-border mergers; Moran (1998) reviews FDI in developing and transition economies; Dyker (1999) focuses on FDI and technology transfer in the former Soviet Union.

[2] See, e.g., http://www.ukraineinfo.us/business/investment.html.

business practices, and labor force. The same investment activities also "spill over" within the same industry or region and lead to indirect effects on other domestic firms in the same industry or region. Competitors may be negatively affected by foreign firms' market share, while at the same time being positively affected by the possibilities of copying production processes or product designs from them

From earlier empirical studies, the evidence on presence and direction of the indirect effects is rather mixed. The *competition effect* is found to have both positive and negative impacts. Positive spillovers are found in Canadian and Australian manufacturing industries (Caves, 1974), and in Indonesian banks (Cho, 1990). However, negative effects are observed in Aitken and Harrison (1999) for a panel of 4000 Venezuelan firms between 1976 and 1989. Higher FDI is associated with lower productivity for wholly domestically owned firms in the same industry. Negative effects are also observed in Belgian manufacturing industries (De Backer and Sleuwagen, 2003). Konings (2001) using firm–level panel data from Poland, Bulgaria and Romania finds that only in Poland foreign firms outperform domestic firms, while there is evidence for negative (Bulgaria and Romania) or no (Poland) spillovers of FDI. He concludes that during earlier stages of transition (Bulgaria and Romania) the positive technology spillover effect seems to be dominated by the negative competition effect of FDI, as inefficient domestic firms will lose market share to foreign firms. In later stages of development (Poland), when domestic firms have started restructuring, and market competition has increased, the competition effect seems to disappear. The *technology transfer* channel has received some justification both theoretically (Blomström, 1987; Blomström and Kokko, 1997) and empirically for the case of Indonesia (Sjöholm, 1999).[4] However, highly convincing con-

[3] So far, very little empirical research about Ukrainian manufacturing has been forwarded in the literature. For some of this, see e.g. Aleksynska, et. al. (2003) and Lutz and Talavera (2003).

[4] Some preliminary evidence for Russia has also been presented in working papers by Ponomareva (2000) and by Yudaeva et al. (2001).

trary evidence has also been presented. Aitken and Harrisoin (1999) introduce controls for local technology spillovers by including foreign-employment shares per industry and per region. They argue that previous studies found unambiguously positive effects for local technology spillovers overstated positive spillovers, because multinationals are likely to invest into more productive sectors and firms. When this bias is addressed by including proxies for exogenous productivity differences between regions (real wage of skilled workers, price of energy), no evidence for technology spillovers to domestic firms is found. Furthermore, foreign presence within industrial sectors does not have any significant effects on productivity of Czech manufacturing firms (Kinoshita, 2000) or similar firms in the Wroclaw region, Poland (Hardy, 1998).

If a multinational firm establishes new business relations between upstream suppliers and downstream firms, this can establish *backward and forward linkages* leading to the transfer or spillover of technological know-how. Without very detailed data on industry classifications, these effects may not easily be distinguished from technology transfer effects. So when we refer in our model and in the data interpretation to positive spillovers due to technology transfer, we cannot rule out the possibility that any effects we find are due to backward and forward linkages.[5]

Other possible spillover channels affecting domestic firms' cost functions may include *training effects*[6] or *demonstration effects*[7]. In addition, domestic firms' *proximity to multi-*

[5] FDI–induced *backward and forward linkages* can push industrial development, especially with regard to the formation of small businesses. FDI creates backward linkages, for instance, by foreign firms purchasing local services and subcontracting with domestic firms. Javorcik (2004) analyzes a panel of most Lithuanian firms between 1996 and 2000 and finds evidence for backward linkages. Observing small businesses along the border of Mexico, it is found that the linkage approach reasonably describes the development of small business employment (Brown, 2002). On the other hand, there is little evidence for both backward and forward linkages for the German–owned manufacturing sector in the north–east of England (Kirchner, 2000) and for Korean FDI in Southeast Asia, (Lee 1994).

[6] Training spillovers result from foreign firms investing in human capital. In Mexico, many managerial people start their careers in foreign companies and are later employed in domestic firms (Blomström, 1989). Moreover, domestic firms are afraid of loosing their market shares and they too invest in training their workers and managerial personnel (Kinoshita, 1998). Generally, human capital is an important determinant of the distribution of

national enterprises[8] *or to other exporters*[9] may provide another source of productivity enhancement. Lastly, highly productive firms may be a-priori more likely to export: *productivity leads to exports*[10]. Our data do not allow us to distinguish between all of these different sources of productivity improvements. However, since our firm panel analyzed only includes exporters, we can isolate the effects of foreign presence (and investments) regardless of the transmission channel this presence utilizes.

In summary, based on previous literature discussed we assume that there are two counteracting effects working in opposite directions with respect to a domestic firm's incentive to produce or export. But our literature discussion does not allow us to draw a clear conclusion about which one of these two effects at work will be dominant. In order to answer this question, we present a simple oligopolistic model with technological spillover effects and derive the hypotheses that increases in foreign investments or increases in the number of foreign firms present will increase domestic firms' exports if technological spillover effects are large enough. Our dataset consists of an unbalanced panel of all manufacturing firms in Ukraine over the 1996–2000 period. On average, we have annual data on 8,500 manufacturers including 2,400 exporters. Our estimation results support the model hypotheses for Ukrainian manufacturing and suggest in particular that large firms and durable–goods producers benefit most from foreign presence and investments.

The following section presents the Cournot competition model. The data are described

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foreign direct investment in developing countries (Noorbakhsh, et. al., 2001).

[7]Demonstration effects are potentially very important for many countries and industries according to Blomström/Kokko (1998). De Backer/Sleuwagen (2003) present an analysis of Belgian manufacturing firms and show evidence of positive long-term demonstration effects.

[8] See Javorcik (2004) for Lithuanian manufacturing. Aitken/Hanson/Harrison (1997), analyzing a panel of 2100 Mexican manufacturing firms between 1986 and 1990, present evidence that the probability of a domestic firm being an exporter is positively correlated with its proximity to multinational firms.

[9] Proximity of domestic firms to other exporters has been shown to have a positive effect on the probability to export for firms in Colombia, Mexico and Morocco (Clerides/Lach/Tybout, 1998).

[10] Bernard/Jensen (1999, 2004)present evidence that productivity leads to exports by analyzing an unbalanced panel of about 60000 US firms each year from 1984 to 1992.

in section 3 and section 4 discusses the empirical results. Finally, Section 5 concludes with a summary and discussion.

2 Augmented Oligopolistic Competition Model

2.1 The Model

We present an oligopolistic-competition model with spillover effects in the cost functions. Due to cost-reducing spillovers, domestic firms will increase production and export levels in response to increased foreign presence in their industry or their region of residence.[11]

In the home country economy there are located n_H domestic firms and n_F foreign-owned firms[12]; both foreign and domestic firms offer their products in the home market as well as in the foreign market. There are no trade costs and firms produce heterogeneous goods and compete in quantities. We assume that the inverse demand, P_i, for a good produced by either a domestic or a foreign firm *i (i = H, F)* in market *k (k = H, F)* is of the form:

$$P_i = \alpha - (\beta - \gamma)q_i - \gamma Q \quad (1)$$

In this specification, total demand in each of the two identical markets is $Q = n_H\, q_H + n_F\, q_F$, where q_H is a representative domestic firm's output per market and q_F is a representative foreign firm's output per market.[13] Marginal production cost of firm i is denoted as c_i. Every firm faces variable cost, but also spends j_i for R&D investment. Investment j_i reduces variable cost by $\delta_i \sqrt{j_i}$.

The firm cannot fully protect its stock of knowledge, and the investment spills over to other firms. We denote θ_H as a spillover coefficient for funds invested by (n_i - *1*) other domestic firms and ψ_H as a spillover coefficient for funds invested by n_F foreign firms (FDI). We as-

[11] See for example models by Siotis (1999), Leahy and Pavelin (2002).

[12] Both domestic and foreign (-owned) firms are located in the home country only. This could be the result of high labor cost in the foreign country or other locational disadvantages.

sume that the more other firms invest, the lower marginal costs of the representative domestic firm are. Spillover parameters for foreign firms, θ_F and ψ_F are defined analogously.[14]

$$c_H = w - \delta_H \sqrt{j_H} - \theta_H (n_H - 1) j_H - \psi_H n_F j_F \tag{2}$$

$$c_F = w - \delta_F \sqrt{j_F} - \theta_F (n_F - 1) j_F - \psi_F n_H j_H \tag{3}$$

Representative domestic and foreign firms maximize their profits per market:

$$\max_{q_i} P_i (q_i - c_i) \tag{4}$$

Assuming symmetry we receive the following first order conditions:

$$\alpha - w + \delta_H \sqrt{j_H} - 2(\beta + (n_H - 1)\gamma) q_H - \gamma n_F q_F + \theta_H (n_H - 1) j_H - \psi_H n_F j_F = 0 \tag{5}$$

$$\alpha - w + \delta_F \sqrt{j_F} - 2(\beta + (n_F - 1)\gamma) q_F - \gamma n_H q_H + \theta_F (n_F - 1) j_F - \psi_F n_H j_H = 0 \tag{6}$$

Solving this system we receive the optimal export[15] quantity, q_H, for the domestic firm:

$$q_H = \frac{k_{2H} + k_{3H} j_H + k_{4H} j_F + \delta \sqrt{j_H}}{k_{1H}} \tag{7}$$

where $k_{1H} = 2\beta + (n_H - 2)\gamma$, $k_{2H} = \alpha - w$, $k_{3H} = ((n_H - 1)\theta - 1)$, $k_{4H} = \psi n_F$.

This equation relates presence of foreign firms in the industry to the export volume of the representative domestic firm. Taking the derivatives of equation (7) with respect to the number of foreign firms in the industry and the level of investment by foreign firms, we receive:

$$\frac{\partial q_H}{\partial n_F} = \frac{\partial q_H}{\partial j_F} = \frac{\psi j_F}{2\beta + (n_H - 2)\gamma} > 0 \tag{8}$$

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[13] Symmetry among domestic firms and symmetry among foreign firms are assumed. However, domestic firms technologies are different from foreign firms' ones.

[14] So far w is the same for both firms domestic and foreign. Later we relax this assumption allowing for different marginal costs.

[15] Due to symmetry between the foreign and domestic markets, domestic sales are equal to exports and total production is 2 q_H. Without the symmetry assumption, the export/output ratio changes but the qualitative results

Entrance of an additional foreign firm will have an unambiguously positive effect. When the foreign firm enters the market it invests j_F so the marginal effects of additional foreign firms or of increased investment by foreign firms are identical.

2.2 Model Parameterization

Equation (7) is not linear in n_F, n_H, j_H, j_F or w, and in Appendix 1[16], we transform it into the following linearized form:

$$\hat{q}_{H,it} = \phi_0 + \phi_{n_F}\hat{n}_{F,it} + \phi_{n_H}\hat{n}_{H,it} + \phi_{j_H}\hat{j}_{H,it} + \phi_{j_F}\hat{j}_{F,it} + \phi_w \hat{w}_{it} \quad (9)$$

$\hat{w}_{it}$ is parameterized as a linear function of the regional spillovers, scale variables and export volume at the previous period.[17] The reasoning for this parameterization is the following. Every firm has its specific marginal cost, which depends not only on firm characteristics but also on the firm's environment. Marginal cost is higher if the number of potential customers is low or transaction costs are high. Thus, if a firm is surrounded by a richer variety of other firms who also invest in R&D or have some experience of selling the product, then its costs will be lower.

$$\hat{w}_{it} = \xi_{0i} + \xi_{SC} Scale_{it} + \xi_{x_F}\hat{x}_{F,it} + \xi_{x_H}\hat{x}_{H,it} + \xi_{y_F}\hat{y}_{F,it} + \xi_{y_H}\hat{y}_{H,it} + \xi_q \hat{q}_{it-1} + \varepsilon_{it} \quad (10)$$

where ξ_{0i} is the firm–specific level of marginal cost, which enters as the firm fixed effect, $Scale_{it}$ is the size of the firm, $\hat{x}_{F,it}$ is the number of foreign firms in the region, $\hat{x}_{H,it}$ is the number of domestic firms in the region, $\hat{y}_{F,it}$ is the volume of FDI for a firm in the region, $\hat{y}_{H,it}$ is the volume of domestic investment for a firm in the region, $\hat{q}_{it-1}$ is the volume of exports in the previous period and ε_{it} is an error term.

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of foreign entry and/or FDI remain unaffected.

[16]The coefficients are described there.

[17]We parameterize $\hat{w}_{it}$ because we do not have any data on firms' costs.

Substituting equation (10) for $\hat{w}_{it}$ in equation (9), we receive our econometric model specification:

$$\begin{aligned}\hat{q}_{H,it} = \phi_{0t} + \phi_w \xi_{0i} + \phi_{n_F} \hat{n}_{F,it} + \phi_{n_H} \hat{n}_{H,it} + \phi_{j_H} \hat{j}_{H,it} + \phi_{j_F} \hat{j}_{F,it} + \phi_{sc} + Scale_{it} \\ + \phi_w \xi_{x_F} \hat{x}_{F,it} + \phi_w \xi_{x_H} \hat{x}_{H,it} + \phi_w \xi_{y_F} \hat{y}_{F,it} + \phi_w \xi_{y_H} \hat{y}_{H,it} + \phi_W \xi_q \hat{q}_{i,t-1} + \phi_w \varepsilon_{it}\end{aligned} \tag{11}$$

The data on firms' investment is not present in our dataset and we transform our model into the final model specification[18]

$$\begin{aligned}\hat{q}_{it} = \phi_0 + \phi_w \xi_{0i} + (\phi_{n_F} - \phi_{j_F}) \hat{n}_{F,it} + (\phi_{n_H} - \phi_{j_F}) \hat{n}_{H,it} + \phi_{j_H} \hat{J}_{H,it} + + \phi_{j_F} \hat{J}_{F,it} + \phi_w \xi_{sc} Scale_{it} \\ + \phi_w (\xi_{x_F} - \xi_{y_F}) \hat{x}_{F,it} + \phi_w (\xi_{x_H} - \xi_{y_H}) \hat{x}_{H,it} + \phi_w \xi_{y_F} \hat{Y}_{F,it} + \phi_w \xi_{y_H} \hat{Y}_{H,it} + \phi_W \xi_q \hat{q}_{i,t-1} + \phi_w \varepsilon_{it}\end{aligned} \tag{12}$$

where (the natural logarithm of) the volume of export is the dependent variable, J_H is the total volume of domestic investment in the industry, J_F is the total volume of foreign investment in the industry, Y_H is the total volume of domestic investment in the region and Y_F is the volume of foreign investment in the region. Because of our data restrictions we investigate the spillover effect only for exporting firms.[19]

We would expect a positive sign on ϕ_{n_F} if higher levels of export are associated with a higher number of foreign firms in the industry, and a negative sign on ϕ_{n_H} if higher levels of export have a negative correlation with a higher number of domestic firms in the industry. The scale effect is proxied by the number of workers in the firm.

According to our model, the competition effect is captured by industry spillover variables.[20] This can be explained by the fact that increased foreign presence in the industry forces local firms to act more efficiently, improve the quality of their product, decrease the primary cost of production, and to start exporting the goods. However, it is possible to receive

[18] For this transformation, we utilize the approximate relationship $\hat{y} \approx \hat{Y} - \hat{x}$.

[19] We made an attempt to employ sales as a dependent variable but received strong misspecification of our model.

[20] In our paper these effect are described by the number of foreign firms in the industry and the volume of foreign

negative effects, namely when foreign firms penetrate the domestic industry in order to buy the exporting firms and capture their shares in third-country markets.[21]

Forward-backward linkages effect can appear through regional spillovers.[22] Foreign-owned firms usually require high quality input materials, which leads to an improvement of local material supplies. For instance, Oleh Strekal, spokesman for McDonald's Ukraine Limited, said in his interview „.... the fast food monolith has pumped some 70 million USD into its Ukrainian ventures, with most of the funds flowing into the local economy. McDonald's has kept 50 Ukrainian construction companies busy building outlets across Ukraine. Domestic vendors Chumak, Galakton, Slavyansky Dom and the Vinnytsya meat processing plant supply products that find their way into McDonald's hamburgers and shakes. Ukrainian ingredients now account for about forty percent of McDonald's products. The company plans to increase that figure to ninety-five percent within two years."[23]

It is very difficult to distinguish the other spillover channels, due to data limitations. Identifying demonstration effect and training effect would require additional firm specific variables such as labor turnover, innovation, et cetera.

3 Data description

We used an unpublished dataset of Ukrainian manufacturing firms to create an unbalanced firm panel for the years 1996 to 2000.[24] The panel consists of 8,500 firms (on a yearly average). 2,400 of these firms export their products.[25] The firms are classified by a two–digit In-

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direct investment in the industry.

[21]It can be a case when a foreign firm wants to acquire the domestic company in the same industry in order to close the latter and capture a larger share of the market.

[22]We proxy regional spillovers by the number of foreign firms in the region and the volume of foreign direct investment in the region.

[23]Citation: http://www.artukraine.com/commercial/mcdonalds2.htm

[24] The data were obtained from the Economics Education and Research Consortium (EERC); ultimate source is the Statistical Committee of Ukraine.

[25]In our five-year panel, we have a total of 12112 export observations and a yearly average of 2422 observations.

dustrial Classification and represent sixteen industrial sectors: energy, fuel, coal, ferrous metallurgy, non-ferrous metallurgy, chemical, oil–chemicals, machinery, forest, construction materials, light, food, flavor, microbiology, medical equipment, printing and other. Firms are localized over twenty-seven geographical regions, covering Crimea Autonomous Republic, twenty-four „oblast", cities Kyiv and Sevastopil. We utilize EERC's data items „volumes of export", *Export* in our annotation, and "number of workers", *Labor* here.[26] Moreover, as a proxy for the number of firms in the industry or in the region we use the number of firms in our dataset.[27]

Several sample selection criteria are applied to the original sample. First, all negative values for volume of export and number of workers variables in the sample are dropped. Secondly, the firms with a volume of exports higher than the 99 percentile or lower than the 1 percentile are also excluded. We prefer to use the screened data to reduce the potential impact of outliers upon the parameter estimates. Table 1 presents descriptive statistics for firm specific variables.

In order to test the effects of spillovers on firms facing similar characteristics, the dataset is split into two categories: large and small firms. A firm is considered to be „large" if its number of workers is above the 75th percentile by year. If a firm's number of workers is below the 25th percentile by year, then it is classified as „small".[28] A two–sample paired t–test is used to test for the equality of means and we receive significant differences in the behavior of large and small firms.

Moreover, we investigate the spillover effect for „durable" and „non–durable" goods

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Export volumes are equal to zero for 40 of these observations. Export volumes for at least four (three) years are reported for 43% (57%) of the firms in the panel. Average export-output and export-sales shares were between 20% and 70% for the years 1996-1998.

[26]Export is estimated in 1,000 USD.

[27]Supposedly, the data cover all manufacturing production in Ukraine. However, some data might have been lost or withheld.

[28]A similar categorization is done by Baum et al. (2003).

producers. This classification is based on the dichotomy proposed by Sharpe (1994): First, we find the correlation between sales and nominal GNP. Second, firms with an average correlation higher than 60th percentile are considered as durable goods producers, while firms with correlation on average lower than 40th percentile are denoted as non–durable goods producers.

In order to control for agglomeration effects, we consider a subsample of „city“ firms located in regions where there are cities with population one million or more.[29] Compared to the rest of the country's average, all these regions are characterized by much higher volumes of FDI and a higher number of manufacturing firms receiving FDI. For example, on average 112 such firms are located in the Dnipropetrovsk region, which is more than the total of FDI firms in Kherson, Chernivtsi, Chernigiv, Kirovograd, and Volyn region. „Non-city“ firms are located in the remaining regions.

From the data distribution by industry (Table 4) we see that some industries are characterized by high levels of exports but low levels of FDI (e.g. non-ferrous metallurgy) while others are characterized by high levels of both exports *and* FDI (e.g. ferrous metallurgy).

4 Regional and Industry–Wide Spillover Effects

We estimated Equation (12) for all firms and several splits of firms, using ordinary least square, fixed-effect, one-step Generalized Method of Moments (GMM), and two-step GMM estimation.[30] The results are given in Tables 5-8. In all estimations, the dependent variable is the logarithm of exports. The independent variables are number of workers; the number of foreign/home firms in the region; the number of foreign/home firms in the industry; the loga-

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[29]„City“ firms are located in Lviv, Odesa, Kharkiv, Donetsk, Dnipropertrovsk, Zaporizhzhia regions and Kyiv city.

[30]We did not include the estimation using random–effect estimator because the results of the Hausman test strongly support the use of fixed–effects estimators.

rithm of investment of foreign/home firms in the region; the logarithm of investment of foreign/home firms in the industry and the lagged level of the logarithm of export.

Table 5, column (1) in the Appendix describes the results for OLS estimations. These are ex-ante biased and therefore only provided for comparison.[31] Fixed–effect estimation results correspond better to our theoretical anticipations (Table 5, column 2). They provide some evidence that there are positive regional spillovers from FDI, namely that there is a significantly positive impact of foreign presence on exports of firms in that region. This suggests significant linkage effects. There are also significant effects of the number of domestic firms on the volume of exports in the same region (positive) and industry (negative).

Columns (3) and (4) of Table 5 present dynamic panel estimations.[32] The models are estimated using an orthogonal transformation instrumented by all available moment restrictions starting from $(t-1)$.[33] Similarly, Tables 6–8 describe the results of testing our theoretical model using dynamic panel estimators for three different splits: durable–goods producers and non–durable–goods producers; small firms and large firms; city firms and non–city firms. Columns (1) and (3) of each table represent models using one–step estimation, while columns (2) and (4) describe two–step estimation.

The correctness of the respective model specification is checked using the Sargan test. We computed the Sargan test for each two–step GMM model and we do not receive rejection

[31]OLS results are upwards biased while fixed-effect model results are downward biased. The coefficient for the lagged value of the log of exports for the GMM estimation is between OLS and WITHIN estimators that supports appropriateness of GMM usage. For details, see Bond (2002).

[32] The specifications include firm fixed effects, time dummies, and industry dummies. Adding regional dummies, however, would lead to multicollinearity in our specifications.

[33] The orthogonal transformation uses

$$x^*_{it} = (x_{it} - \frac{x_{i(t+1)} + \ldots + x_{iT}}{T-t})(\frac{T-t}{T-t-1})^{1/2}$$

where the transformed variable does not depend on its lagged values. If we use first differences instead of an orthogonal transformation we will have to instrument with moment restrictions starting from $t-2$ which will lead to dropping an additional 20% of the available data.

for our overidentified restrictions.[34] In the analysis for the „all“ firms dataset (Table 5, columns (3) and (4)), we receive evidence for positive industry spillover effects. For instance, the entrance of a foreign firm in an industry increases the exports of a company in that industry by about 1.2 %. Similarly, entrance of a foreign firm in a particular region raises exports of domestic firms in that region by about 0.6 %. There is also significant evidence for regional spillovers from domestic investment.[35]

One interesting contrast is observed for the „durable“ and „non–durable“ goods producers split as described in Table 6. Results for non–durable firms find no significant spillover effects from foreign firms at all. On the other hand, the results are much stronger for durable–goods producers: Entrance of one foreign firm into the industry increases the level of exports of a domestic firm in that industry by 1.3 %, while entrance of one foreign firm in the region increases the level of exports of a domestic firm in the same region by about 0.8 %.

Comparing the results for „small“ and „large“ firms (Table 7), one can see that the number of foreign firms in the region does not seem to have any effect on small domestic firms' exports, while there are highly significant regional spillovers for large firms (at the 1% level): An increase in the number of foreign firms in the region by one increases a domestic firm's exports by about 1.3 %. Concerning industry spillovers, the number of foreign firms has a significantly positive effect (at the 5 %–level) on exports of large firms only. The effect of a domestic firms' presence in the region is positive and significant (at 1%) for large firms only: A one unit rise in the number of domestic firms in the industry raises domestic firms' exports by almost 0.8 %. Effects of the number of domestic firms in the industry are slightly

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[34]Note, we do not report Sargan test results for one–step GMM results. Sargan test has an asymptotic chi–squared distribution only in the case of homoscedastic error terms. Our dataset is very heteroscedastic that is why we receive rejection of overidentifying restrictions in most cases. Arellano and Bond (1991) also mention that the Sargan test on the one–step estimation often leads to rejection of the null hypothesis that the overidentifying restrictions are valid.

[35] We also reestimated the models in Table 5 using a smaller data set including only firms with at least four observations. The results appear to be robust with respect to foreign presence.

negative.

The results for „city“ and „non-city“ firms (Table 8) are also quite striking: Firms in the both categories are significantly affected by foreign firms’ activities. Entrance of one foreign firm in the region or in the industry leads to an increase of the level of exports by one to two percent. Similarly, both categories are negatively affected by more domestic competition in the industry. In contrast, the number of domestic firms in the region has a significant effect on volumes of export for “non-city” firms only. Nevertheless, spillover effects are generally larger (about double) for “city” firms.

In summary, we find support for the model’s predictions on the effect of industry–wide FDI spillovers for the „all firms“ data set of considered firms. For different categories of firms, we receive varying results. The results are stronger for large firms, “city” firms and durable-goods producers. For any specification, there is no evidence for negative competition effects. Large firms can more easily adjust the quality of their production to meet the requirements of foreign firms in the region or even export their products. Similarly, Sinani and Meyer (2002) argue that large firms have more resources to invest in absorbing new technology of foreign firms, or to attract better-qualified labor in order to cope with increased competition from foreign firms. Interestingly, Aitken and Harrison (1999) arrive at quite different results. In a study of 4000 Venezuelan firms, they concluded that only small firms’[36] productivity significantly benefits from FDI, while there is no significant effect on large firms. While we might have expected to see an advantage for firms located in urban area, our data does not give any evidence for that. Finally, spillover effects might be more significant for durable–goods producers because this type of production requires higher level of backward and forward linkages within the same industry.

5 Conclusions

We examined the effects of industry–wide and region–wide spillovers on the optimal level of exports. Based on a simple oligopolistic competition model augmented with spillover effects, we hypothesized that a domestic manufacturing firm's performance, measured by the volume of exports, responds both to industry–wide and region–wide spillover effects. If foreign presence in the industry increases, then the volume of exports of a representative firm should increase as well. To test this hypothesis we utilized a five-year panel-dataset of Ukrainian manufacturing firms including on a yearly average about 2400 exporters.

Our empirical findings show that large firms benefit more from foreign direct investment than small firms, because they have sufficient capacities to absorb foreign firms' technologies. Compared to non–durable goods producers, durable–goods producers are to a higher extent affected by industry–wide FDI spillovers, because production of a durable good is likely to require a larger number of backward and forward linkages within both the same industry and region. Finally, FDI also promotes exports due to regional spillovers. However, there is a threshold level of FDI, which seems to be necessary for indirect FDI effects to occur.

Ukrainian firms do benefit from foreign direct investment, and it seems desirable for policy makers to attract as much of it as possible. Our results suggest that policies to attract FDI might be too strongly concentrated on large firms in urban areas, as it is there that industry– and region–wide spillovers are mostly present. Instead, it might be desirable to also promote FDI inflows into those areas where spillovers are less present: non–urban areas with small, non–durable goods producing firms. This might create even stronger overall spillovers due to further backward and forward linkages, and therefore benefit the Ukrainian economy to a larger extent. The mechanisms to achieve this could include the creation of free-trade zones

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[36]Defined as firms with less than 50 workers.

in such areas as well as granting additional tax privileges to foreign firms investing there. In addition, it might be necessary to foster the learning and absorbing capacities of domestic firms, since technological spillovers are not an automatic consequence of FDI (see, e.g. Blomström/.Kokko, 2003).

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Appendix 1: Variables used in the paper

- EERC database
  - Volume of Export
  - Number of domestic firms in industry or region
- http://upop.irex.ru/eco.asp
  - Nominal Gross Domestic Product
  - Producer Price Index (PPI)
- Ukrainian statistic yearbooks, 1996-2000
  - Volume of domestic investment in industry and region
  - Volume of foreign investment in industry and region
  - Number of manufacturing firms with FDI in industry and region

Appendix 2: Linearization of the expression for optimal production level

Optimal quantity, q_H, for the domestic firm:

$$q_H = \frac{k_{2H} + k_{3H} j_H + k_{4H} j_F + \delta \sqrt{j_H}}{k_{1H}} \tag{7}$$

where $k_{1H} = 2\beta + (n_H - 2)\gamma$, $k_{2H} = \alpha - w$, $k_{3H} = ((n_H - 1)\theta - 1)$, $k_{4H} = \psi n_F$.

Taking the total differential of equation (7), expanding and linearizing, we receive:

$$\hat{q}_H = \phi_0 + \phi_{n_F} \hat{n}_F + \phi_{n_H} \hat{n}_H + \phi_{j_F} \hat{j}_F + \phi_{j_H} \hat{j}_H + \phi_w \hat{w}$$

where $\hat{q}_H = dq_H q_H$, $\hat{n} = dn/n$, $\hat{j} = dj/j$, and $\hat{w} = dw/w$. The coefficients are equal to:

$$\phi_{n_F} = \frac{\psi_H n_F j_F}{k_{2H} + k_{3H} j_H + k_{4H} j_F + \delta_H \sqrt{j_H}}$$

$$\phi_{n_H} = \frac{-\gamma n_H}{k_{1H}{}^2} + \frac{\theta_H n_H j_H}{k_{2H} + k_{3H} j_H + k_{4H} j_F + \delta_H \sqrt{j_H}}$$

$$\phi_{j_F} = \frac{k_{4H} j_F}{k_{2H} + k_{3H} j_H + k_{4H} j_F + \delta_H \sqrt{j_H}}$$

$$\phi_{j_H} = \frac{j_H (k_{3H} + \delta_H / (2\sqrt{j_H}))}{k_{2H} + k_{3H} j_H + k_{4H} j_F + \delta_H \sqrt{j_H}}$$

$$\phi_w = -\frac{w}{k_{2H} + k_{3H} j_H + k_{4H} j_F + \delta_H \sqrt{j_H}}$$

Every domestic firm i at time t has:

$$\hat{q}_{H,it} = \phi_0 + \phi_{n_F} \hat{n}_{F,it} + \phi_{n_H} \hat{n}_{H,it} + \phi_{j_H} \hat{j}_{H,it} + \phi_{j_F} \hat{j}_{F,it} + \phi_w \hat{w}_{it}$$

Table 1: Descriptive statistics for all, small and large firms

	μ	σ	*p25*	*p50*	*p75*
all					
Exports, 1000 USD	4199.46	18759.46	63.80	321.25	1674.90
Number of workers	776.23	1304.24	180.00	372.00	808.50
F firms in region	91.39	108.25	33.00	52.00	109.00
F firms in industry	167.79	94.91	107.00	178.65	222.82
H firms in industry	1184.95	734.61	531.00	1384.18	1849.00
H firms in region	242.28	130.81	192.00	237.00	314.00
small					
Exports, 1000 USD	741.50	2710.85	30.10	113.10	456.50
Number of workers	113.07	47.11	77.00	116.00	148.00
F firms in region	91.08	106.10	31.00	51.00	112.00
F firms in industry	175.03	104.59	89.00	178.65	224.00
H firms in industry	1273.95	773.83	568.00	1839.00	2009.00
H firms in region	238.13	121.35	190.00	237.00	310.00
large					
Exports, 1000 USD	7109.07	25912.78	82.00	506.65	2912.00
Number of workers	2181.39	2019.02	1090.00	1535.00	2438.00
F firms in region	90.05	108.79	33.00	52.00	105.00
F firms in industry	153.53	84.31	89.00	178.65	215.00
H firms in industry	1049.48	685.27	501.00	1384.18	1839.00
H firms in region	240.31	135.16	190.00	237.00	303.00

Note: (i) p25, p50 and p75 represent the quartiles of the distribution, while σ and μ represent its standard deviation and mean respectively, (ii) F denotes "foreign" and H stands for ``home".

Table 2: Descriptive statistics for durable, non—durable goods producers, city and non-city firms.

Variable	μ	σ	p25	p50	p75
durable					
Exports, 1000 USD	4756.43	22099.45	46.65	251.00	1612.25
Number of workers	691.28	1290.19	161.00	316.00	662.00
F firms in region	89.68	110.04	33.00	51.00	104.00
F firms in industry	164.41	92.31	107.00	178.65	222.82
H firms in industry	1140.18	731.79	531.00	1384.18	1849.00
H firms in region	236.13	128.62	190.00	237.00	303.00
non-durable					
Exports, 1000 USD	2782.76	10385.52	78.00	321.50	1297.00
Number of workers	801.15	1197.31	197.00	415.00	910.00
F firms in region	90.51	101.66	34.00	59.00	112.00
F firms in industry	171.02	97.39	89.00	203.00	222.82
H firms in industry	1233.71	737.15	568.00	1404.00	1849.00
H firms in region	250.37	128.50	193.00	243.00	329.00
city					
Exports, 1000 USD	5491.93	22794.02	76.15	425.70	2161.80
Number of workers	967.40	1638.95	201.00	426.00	1049.00
F firms in region	161.10	138.03	80.00	113.00	160.00
F firms in industry	159.41	95.09	59.00	203.00	222.82
H firms in industry	1133.77	739.53	489.30	1384.18	1848.00
H firms in region	270.61	187.59	240.00	297.00	390.00
non-city					
Exports, 1000USD	3314.32	15337.29	56.60	265.80	1369.40
Number of workers	635.93	965.35	170.00	345.00	694.00
F firms in region	43.65	33.02	24.00	35.00	51.00
F firms in industry	173.52	94.37	108.00	178.65	222.82
H firms in industry	1220.00	729.21	538.80	1384.18	1849.00
H firms in region	222.88	61.69	187.00	220.00	250.00

Note: (i) p25, p50 and p75 represent the quartiles of the distribution, while σ and μ represent its standard deviation and mean respectively, (ii) F denotes "foreign" and H stands for ``home".

Table 3: Descriptive statistics by region.

Variable	Observa-tions	Export, 1000 USD	Labor	F Firms	FDI, 1000 USD
Crimea	255	4287.36	637.14	43.6	26285.25
Sebastopol	82	543.30	271.11	3.8	2828.23
Vinnitsa	527	3151.69	484.60	28.6	3319.25
Volyn	292	1613.33	600.40	22.2	9275.58
Dnipropetrovsk	702	12978.69	1557.10	111.8	22247.36
Donetsk	886	7182.00	1260.43	101.1	41995.08
Zhytomyr	552	1778.49	602.83	34.8	4762.37
Zakarpattia	610	2800.53	438.86	133.4	13981.86
Zaporizhzhia	485	8983.56	1175.71	46.8	41098.11
Ivano-Frankivsk	396	3563.93	621.58	67.8	4406.80
Kyiv-city	727	3568.15	664.04	468.0	202988.80
Kyiv-region	474	2459.85	495.66	64.8	43715.80
Kirovograd	256	1355.28	532.25	13.6	2551.80
Lugansk	488	6341.76	930.78	35.6	1532.92
Lviv	862	1795.17	598.26	170.0	21168.68
Mykolayiv	216	6575.36	1036.35	41.2	4933.74
Odesa	506	2136.08	433.98	113.6	25498.87
Poltava	463	5325.92	716.66	49.8	40003.81
Rivne	323	1930.70	540.50	23.8	6314.97
Sumy	410	4378.26	889.60	30.0	3702.03
Ternopil	256	1601.48	509.84	31.0	2532.29
Kharkiv	756	2630.41	966.15	72.8	15069.69
Kherson	151	2706.47	1097.91	48.2	6609.32
Khmelnytsky	414	2558.86	659.46	32.8	1675.11
Cherkasy	423	4888.08	605.59	48.2	2514.16
Chernivtsi	384	3115.57	563.14	17.2	5052.36
Chernigiv	218	1853.71	504.19	18.8	4379.49

Note: All variables are averaged over the period 1996-2000 for each region.

Table 4: Descriptive statistics by industry.

Variable	Observa-tions	Export, 1000 USD	Labor	F Firms	FDI
Energy	46	1203.42	2794.00	1.8	1944.17
Fuel	96	19364.66	1261.24	15.6	50235.07
Ferrous metallurgy	491	20923.36	2032.58	27.6	34991.29
Non-ferrous metallurgy	105	20593.62	1138.44	14.0	23.45
Chemicals	498	10272.15	1139.57	90.6	8794.23
Oil-Chemicals	103	4431.05	833.66	6.4	6131.91
Metal processing	4237	3304.07	1002.01	242.6	59189.58
Wood and Paper	1308	1258.62	458.67	122.0	9043.57
Construction materials	906	1463.32	608.27	59.8	1276.98
Light	1285	4173.12	617.87	150.4	3517.94
Food	2420	2920.44	380.23	320.6	125075.00
Flavor	193	728.40	205.89	2.8	4.67
Microbiology	43	736.07	345.71	19.4	1316.25
Medical equipment	178	1782.20	567.60	19.8	5056.05
Printing	79	891.11	302.63	28.4	1214.89
Others	126	7849.95	381.95	28.2	1885.76

Note: All variables are averaged over the period 1996-2000 for each industry.

Table 5: OLS, Within and GMM estimations for all firms.

Independent variable	OLS (1)	WITHIN (2)	ONE-STEP (3)	TWO-STEP (4)
$Export_{t-1}$	0.8888***	-0.0041	0.0803**	0.0516
	(0.0185)	(0.0509)	(0.0363)	(0.0387)
$Labor_t$	0.0807***	1.0419***	1.0061***	1.0409***
	(0.0249)	(0.1305)	(0.1268)	(0.1345)
F firms in $industry_t$	0.0037	0.0018	0.0129**	0.0117***
	(0.0031)	(0.0026)	(0.0046)	(0.0040)
F firms in $region_t$	0.0000	0.0042***	0.0056***	0.0061***
	(0.0003)	(0.0014)	(0.0014)	(0.0014)
H firms in $industry_t$	-0.0001	-0.0006**	-0.0008***	-0.0009***
	(0.0004)	(0.0002)	(0.0003)	(0.0002)
H firms in $region_t$	0.0001	0.0025**	0.0029**	0.0032**
	(0.0001)	(0.0012)	(0.0011)	(0.0012)
F investment in $industry_t$	-0.1845***	-0.0781	-0.0525	-0.0201
	(0.0543)	(0.0504)	(0.0408)	(0.0343)
F investment in $region_t$	0.0251	0.0395	0.0133	0.0199
	(0.0746)	(0.0551)	(0.0347)	(0.0345)
H investment in $industry_t$	-0.2067	0.0211	-0.2220**	-0.1327
	(0.2177)	(0.1461)	(0.1043)	(0.0935)
H investment in $region_t$	0.0005	0.5281*	0.7639***	0.8121*
	(0.0509)	(0.2818)	(0.2865)	(0.2807)
Sargan test	0.000	0.016	0.000	0.089
AR(1)	-5.787***	-7.417***	-6.091***	-5.685***
AR(2)	-0.6391	-12.52***	-0.1647	-0.1717
N. Obs.	6009	5244	3545	3545

Note. (i) Dependent variable: log of export; all independent variable, besides numbers of H/F firms in region/industry are in log form, (ii) all equations include industry dummies, time dummies and a constant, (iii) heteroscedastic consistent standard errors in brackets, (iv) *** denotes significant at the 1%, ** at the 5%, * at the 10% level, (v) instruments include some or all available moment restrictions of the endogenous explanatory variables, (vi) AR(2) is the Arellano-Bond test for second order autocorrelation, (viii) all estimations calculated using DPD package for Ox.

Table 6: GMM estimations for durable and non-durable goods producers.

	durable		non-durable	
	one-step	two-step	one-step	two-step
Independent variable	(1)	(2)	(3)	(4)
$Export_{t-1}$	0.0546	0.0224	0.1336**	0.1290
	(0.0475)	(0.0643)	(0.0626)	(0.0696)
$Labor_t$	0.4297	0.3866	0.7380***	0.6364***
	(0.4226)	(0.4464)	(0.1525)	(0.1571)
F firms in $industry_t$	0.0130**	0.0109	0.0008	-0.0007
	(0.0063)	(0.0072)	(0.0045)	(0.0044)
F firms in $region_t$	0.0052**	0.0080***	0.0022	0.0036
	(0.0022)	(0.0023)	(0.0022)	(0.0026)
H firms in $industry_t$	-0.001***	-0.001***	0.0001	0.0000
	(0.0004)	(0.0004)	(0.0004)	(0.0004)
H firms in $region_t$	0.0027	0.0049**	0.0005	0.0014
	(0.0020)	(0.0019)	(0.0017)	(0.0021)
Sargan test	0.000	0.140	0.157	0.299
AR(1)	-3.401***	-3.007***	-5.262***	-4.520***
AR(2)	-0.2261	-0.2177	-1.563	-1.540
N. Obs.	1469	1469	1219	1219

Note. (i) Dependent variable: log of export; all independent variable, besides numbers of H/F firms in region/industry are in log form, (ii) all equations include industry dummies, time dummies and a constant, (iii) heteroscedastic consistent standard errors in brackets, (iv) *** denotes significant at the 1%, ** at the 5%, * at the 10% level, (v) instruments include some or all available moment restrictions of the endogenous explanatory variables, (vi) AR(2) is the Arellano-Bond test for second order autocorrelation, (viii) all estimations calculated using DPD package for Ox.

Table 7: GMM estimations for small and large firms.

	small		large	
	one-step	two-step	one-step	two-step
Independent variable	(1)	(2)	(3)	(4)
$Export_{t-1}$	-0.159***	-0.154***	0.0080	0.0446
	(0.0546)	(0.0565)	(0.0634)	(0.0417)
$Labor_t$	0.5525	0.8980*	2.1450***	1.7116***
	(0.3797)	(0.4950)	(0.4467)	(0.4217)
F firms in $industry_t$	0.0075	0.0094	0.0174**	0.0179**
	(0.0056)	(0.0058)	(0.0084)	(0.0077)
F firms in $region_t$	0.0013	0.0034	0.0133***	0.0126***
	(0.0032)	(0.0037)	(0.0027)	(0.0027)
H firms in $industry_t$	-0.0008	-0.0008	-0.0007*	-0.0006*
	(0.0006)	(0.0007)	(0.0004)	(0.0003)
H firms in $region_t$	0.0016	0.0024	0.0074***	0.0079***
	(0.0028)	(0.0040)	(0.0020)	(0.0020)
Sargan test	0.050	0.755	0.851	0.384
AR(1)	-2.645***	-2.558***	-3.182***	-3.749***
AR(2)	-0.2365	-0.1926	-1.209	-1.095
N. Obs.	439	439	1059	1059

Note. (i) Dependent variable: log of export; all independent variable, besides numbers of H/F firms in region/industry are in log form, (ii) all equations include industry dummies, time dummies and a constant, (iii) heteroscedastic consistent standard errors in brackets, (iv) *** denotes significant at the 1%, ** at the 5%, * at the 10% level, (v) instruments include some or all available moment restrictions of the endogenous explanatory variables, (vi) AR(2) is the Arellano-Bond test for second order autocorrelation, (viii) all estimations calculated using DPD package for Ox.

Table 8: GMM estimations for city and non-city firms.

	city		non-city	
	one-step	two-step	one-step	two-step
Independent variable	(1)	(2)	(3)	(4)
$Export_{t-1}$	0.125***	0.102**	0.033	0.0399
	(0.0470)	(0.0518)	(0.0459)	(0.0488)
$Labor_t$	0.9341***	0.9804***	0.9844***	0.8817***
	(0.1834)	(0.1819)	(0.1594)	(0.1703)
F firms in $industry_t$	0.0127***	0.0104***	0.0125**	0.0186**
	(0.0034)	(0.0034)	(0.0059)	(0.0089)
F firms in $region_t$	0.0035*	0.0039*	0.0101***	0.0110***
	(0.0019)	(0.0021)	(0.0035)	(0.0036)
H firms in $industry_t$	-0.0007**	-0.0007**	-0.001***	-0.0006*
	(0.0003)	(0.0003)	(0.0004)	(0.0003)
H firms in $region_t$	0.0018	0.0019	0.0069***	0.0076***
	(0.0016)	(0.0018	(0.0023)	(0.0024)
Sargan test	0.112	0.602	0.000	0.068
AR(1)	-5.407***	-4.867***	-4.320***	-4.144***
AR(2)	-0.4248	-0.4207	-0.013	0.0000
N. Obs.	1670	1670	2007	2007

Note. (i) Dependent variable: log of export; all independent variable, besides numbers of H/F firms in region/industry are in log form, (ii) all equations include industry dummies, time dummies and a constant, (iii) heteroscedastic consistent standard errors in brackets, (iv) *** denotes significant at the 1%, ** at the 5%, * at the 10% level, (v) instruments include some or all available moment restrictions of the endogenous explanatory variables, (vi) AR(2) is the Arellano-Bond test for second order autocorrelation, (viii) all estimations calculated using DPD package for Ox.