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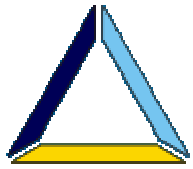

Working Paper No.14

Stefan H. Lutz and Oleksandr Talavera

The Effects of FDI on Ukrainian Firms' Labor Productivity and Exports

May 2002

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The Effects of FDI on Ukrainian Firms' Labor Productivity and Exports[1]

Stefan H. Lutz and Oleksandr Talavera[2]

Abstract

All countries are eager to attract as much foreign investments as possible. At the same time FDI may have not only positive, but also negative economic effects for receiving countries. Positive effects are associated with technology transfer, efficient allocation of resources, and training of domestic workers. But the entry of foreign firms could, e.g., lead to a decrease of labor productivity at domestic firms, which is a negative effect. The main purpose of this paper is to estimate direct and indirect effects of FDI. First, we test for direct influence of foreign direct investments on firms' performance, where the latter is estimated alternatively as labor productivity and as exports. FDI notably increases both labor productivity and export volumes. Second, we look for spillover or indirect effects. There is statistical evidence that the levels of FDI in certain regional industries are associated with higher performance indicators of firms' not receiving FDI in those same regional industries.

1 Introduction

Attracting Foreign Direct Investment (FDI) is one of the most essential issues in the transformation and development of the Ukrainian economy. Because of substantial technological lags in comparison to developed countries, Ukraine could benefit from foreign capital inflows and the resulting international cooperation. This cooperation, in turn, could provide new technologies, new methods of management, and could also promote the development of domestic investments. Experiences of developed countries suggest, that often a domestic investment boom starts with the adaptation of new technologies, brought on with foreign capital.

Currently however, the Ukrainian level of FDI per capita is far below that of most other transition countries, in particular that of the Czech Republic,

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1 This work is based on Talavera (2001).

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Hungary or Poland. For example, the USA only invested ten times more into the Polish economy than into the Ukrainian one[3]. Such negligible volumes of FDI could be explained by the discouraging investment climate, presently prevailing in Ukraine. This is also represented by suspicious attitudes towards foreign investors displayed by both government officials and Ukrainian industry managers. To many international investors, it might seem that Ukraine, ex-ante, does not want to attract any FDI.

On the other hand, Ukraine has a substantial economic potential, which is not yet utilized adequately. With a population close to that of France, the domestic market is large. Both skilled and unskilled labor is relatively inexpensive, while the general level of education and skill is high. Finally, domestic firms do not yet pose a high level of competition.

Despite these advantages, foreigners are reserved about investing in Ukraine. Nowadays, the Ukrainian economy really needs inflows of foreign capital, because of suspension of investment financing from government budgets and the lack of enterprises funds. Among other problems the following should be emphasized: poor legislative framework, unanticipated changes in taxation, equipment deterioration and political instability. All of the reasons mentioned above lead to Ukraine being ranked "B-2"[4] by Moody's Company, which is one of the lowest rankings among European countries.

While attracting FDI is an important issue in itself, international investments may also lead to different externalities. As a rule, FDI to a particular firm in a particular industry may give rise to positive effects on the performance of other firms that entertain business relations with the FDI-recipient. However, we cannot unambiguously assert these effects of FDI in transition economies, and in Ukraine in particular. As a rule, transition changes the way economy operates and may lead to unexpected results. Therefore FDI can bring both positive and negative externalities. Negative spillovers could occur in the form of raised monopoly power of MNCs. These MNCs may have a strong incentive to acquire and close Ukrainian competitors.

Using unpublished Ukrainian micro data, we examine the effects of the presence of FDI on the performance of individual Ukrainian firms receiving that FDI. Performance may be measured as sales or as exports. These direct effects may indicate technology transfer taking place in addition to capital investment. Secondly, we investigate the effects of the presence of FDI on the performance of firms not receiving FDI in the same industry or the same region. These indirect effects, if present, would indicate spillovers. We would anticipate positive, but low, direct and indirect effects on both sales and exports of Ukrainian firms. We would also expect that foreign-owned establishments have comparatively higher levels of performance and domestic establishments exhibit significant benefits from spillovers.

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3 From the presentation of the US Ambassador Steven Pifer in NaUKMA, 2000.

4 According to Moody's Investors Service, http://www.bisnis.doc.gov/bisnis/country/020124MoodysUkr.htm

2 Data description

The data used in this research consist of two EERC Research Center datasets. The first includes micro-level information on fixed assets, labor force, sales, export, import, barter operations, and industry-region information. The second contains information on FDI presence in certain firms.

Alternative estimations of fixed assets are used in the literature. Following Ponomareva (2000), our study uses the balance sheet value of fixed assets as proxy for capital, since this is the best available measure of real capital capacities of the firm. All data are at constant 1998 prices, converted using the producer price index from the UEPLAC (2000) web site[5] (See Table 1).

Our data contains 292 observations of manufacturing firms for the years 1998 and 1999. 25 per cent of these firms have received FDI. A firm is assumed to be a recipient of FDI if:

- the firm is under foreign ownership or
- the firm reported a change in the level of FDI received during last period.

The data set covers four regions: Lviv, Kyiv, Odesa and Kharkiv. These regions represent West, Center, South and East of Ukraine, respectively. The regional distribution with frequencies and percentages is described in Table 2. As can be seen from the Table 2, the share of Kyiv, Lviv and Kharkiv regions is 30% each, while the share of Odesa region is 10%. This may be explained by the fact that the Ukrainian South is less industrialized than the central or eastern areas.

Table 1
Statistic characteristics of variables used in this research

Indicator	All firms		FDI firms	
	Mean	Std. Dev.	Mean	Std. Dev.
Balance value of fixed assets, thou. UAH 1998	17324.32	54366.9	5904.55	12853.74
Sales, thou. UAH 1998	5026.05	15245.07	3353.26	7379.38
Imports, thou. UAH 1998	902.15	3525.32	1548.95	3914.26
Production, thou. UAH 1998	5169.32	15474.25	3948.94	10837.29
Labor force, # of employees	457	1019	255	508
Exports, thou. UAH 1998	852.12	3801.31	1136.95	4246.77

Table 2
Region distribution of firms

Region	All firms		FDI firms	
	Frequency	Percentage	Frequency	Percentage
Kyiv region	88	30.14	22	30.14
Lviv region	90	30.92	26	35.62
Kharkiv region	89	30.48	22	30.14
Odesa region	25	8.56	3	4.10

[5] Available at http://www.ueplac.kiev.ua

The data set covers seven industries. Most of the firms are involved in food industry (25 per cent) or in metal processing (20 per cent). However, a large number of firms do not identify themselves as belonging to any particular industry (22 per cent). The industry distribution of firms is summarized in Table 3.

Table 3
Industry distribution of firms

Industry	All firms		FDI firms	
	Frequency	Percentage	Frequency	Percentage
Metallurgy	24	8.22	5	6.85
Metal processing	58	19.86	8	10.96
Wood and Paper	15	5.14	5	6.85
Construction materials	26	8.90	5	6.85
Light	30	10.27	9	12.33
Food	74	25.34	18	24.66
Others	65	22.26	23	31.51

Table 4
Ownership distribution of firms[6]

Ownership	Frequency	Percentage
Workers	49	16.78
Managers	13	4.45
Government	7	2.40
Other physical entities	27	9.25
Other Ukrainian companies	29	9.93
Other foreign companies	61	20.89
Other	106	36.30

The ownership structure of available data is depicted in Table 4. A significant share of firms (36%) did not report their form of ownership. Workers own 17% of firms in the sample. Other physical entities are either retired persons or those who bought shares during certificate auctions.

3 The econometric models employed

The main aim of this paper is to estimate the influence of FDI on firms' performance and to identify region-industry spillover effects.

In order to estimate the former effect, we develop the following analytical model:

$$P_{it} = f(K_{it}, L_{it}, Industry_i, REGION_i, FDI_i, OWNERSHIP_i, Scale_{it}) \qquad (1)$$

where

i – index for firm, and t – index for year;

P_{it} – firm performance, estimated as labor productivity or export volume;

L_{it} – labor, i.e. the number of workers in the firm;

K_{it} – capital stock or the balance value of fixed assets;

[6] On the basis of major ownership.

$Scale_{it}$ – proxy for economies of scale, estimated as the ratio of a firm's production to the average production in the industry;

$INDUSTRY_i$ – industry, one of the seven industries according to the specification of the EERC Research Center;

$OWNERSHIP_i$ – type of ownership, one of types of ownership according to the specification of the EERC Research Center;

$REGION_i$ – region, where the firm is situated;

FDI_i – a dummy variable that shows the existence of FDI.

The dependent variable, i.e. performance, could be estimated in various ways. The ideal representation would be value added or value added per worker. However, due to data restrictions, only the variables sales, production, barter, export and import were available to us for that purpose. The Hausman specification test was used to identify the correct econometric specification[7].

The econometric specifications selected are shown below.

Model 1

Labor productivity is assumed to be a performance indicator and our model is:

$$\ln\frac{Y_{it}}{L_{it}} = const + \alpha_1 \ln\frac{K_{it}}{L_{it}} + \alpha_2 FDI_i + \sum_{\rho=1}^{3} R_\rho REGION_{\rho i} + \sum_{\sigma=1}^{6} S_\sigma INDUSTRY_{\sigma i} + \sum_{\delta=1}^{6} O_\delta OWN_{\delta i} + \varepsilon_{it} \quad (2)$$

where

FDI_i, is a dummy variable taking the value 1 if the firm has ever received foreign direct investments, and 0 otherwise.

$REGION_i$, $INDUSTRY_i$ are dummies, which specify an industry and region, respectively. For the regional dummies, the Odesa region is the base, and R_1 denotes Kyiv, R_2 – Lviv, and R_3 - Kharkiv. The unspecified industry category is the base for the industry dummies, and the other dummies are: S_1 – metallurgy, S_2 – metal processing, S_3 – wood and paper, S_4 – construction materials, S_5 – light industry and S_6 – food industry.

OWN_{oi} – are dummies that determine the type of ownership. The unspecified ownership category is the base for the ownership dummies. We denote O_1 – workers ownership majority, O_2 – management, O_3 – state, O_4 – other physical entities, O_5 – other Ukrainian companies and O_6 – other foreign companies.

Our hypotheses for model 1 are as follows:

[7] More information about Hausman specification tests can be found in Green, Econometric Analysis.

$H1_0$: $\alpha_2=0$: Receiving FDI does not affect labor productivity of the receiving firm.

($H1_1$: $\alpha_2>0$: FDI has a significant influence on labor productivity).

As is customary, we anticipate the rejection of our null hypothesis.

Model 2

Here, performance is measured by export volume. If a firm exports more, this may be interpreted as a sign of comparative advantage. This model has basically the same structure as model 1, but a proxy for economies of scale, estimated as the ratio of firm's production to the average production in industry, was added. Furthermore, separate variables for capital and labor were used instead of the labor productivity variable.

$$\ln Exp_{it} = const + \alpha_1 \ln K_{it} + \alpha_2 \ln L_{it} + \alpha_3 FDI_i + \sum_{\rho=1}^{3} R_\rho REGION_{\rho i} + \sum_{\sigma=1}^{6} S_\sigma INDUSTRY_{\sigma i} + Scale_{it} + \sum_{\delta=1}^{6} O_\delta OWN_{\delta i} + \varepsilon_{it} \quad (3)$$

Our null hypotheses now takes the form:

$H2_0$: $\alpha_3=0$: Receiving FDI does not affect export volumes of the receiving firm.

Both models presented above may be affected by endogeneity. A priori, we might expect that firms receiving FDI will have higher labor productivity as a result, and firms with higher labor productivity attract more FDI. The same links can be traced between FDI and export. FDI results in many cases in higher export volumes, and conversely, large export volumes attract FDI.

To correct for this endogeneity problem, we applied the following two-stage methodology. While FDI is highly correlated with exports, the latter, in turn, is not closely correlated[8] with labor productivity. Therefore, as a first step, we constructed the following measure:

$$probit(FDI_i) = const + \alpha \ln EXP_{it} + \varepsilon_{it} \quad (4)$$

and as a second step, using GLS in order to avoid heteroscedasticity, we estimated:

$$\ln \frac{Y_{it}}{L_{it}} = const + \alpha_1 \ln \frac{K_{it}}{L_{it}} + \alpha_2 \widehat{FDI_i} + \sum_{\rho=1}^{3} R_\rho REGION_{\rho i} + \sum_{\sigma=1}^{6} S_\sigma INDUSTRY_{\sigma i} + \sum_{\delta=1}^{6} O_\delta OWN_{\delta i} + \varepsilon_{it} \quad (5)$$

8 R^2 =0.15.

Thus, we estimated the real effect of FDI on labor productivity. Similarly, estimations were performed with exports as indicator of firm performance:

$$probit(FDI_i) = const + \alpha \ln \frac{Y_{it}}{L_{it}} + \varepsilon_{it} \quad (6)$$

$$\ln Exp_{it} = const + \alpha_1 \ln K_{it} + \alpha_2 \ln L_{it} + \alpha_3 \widehat{FDI}_i + \sum_{\rho=1}^{3} R_\rho REGION_{\rho i} + \sum_{\sigma=1}^{6} S_\sigma INDUSTRY_{\sigma i} + Scale_{it} + \sum_{\delta=1}^{6} O_\delta OWN_{\delta i} + \varepsilon_{it} \quad (7)$$

We anticipate that FDI has a positive effect on firm's performance estimated as labor productivity or export.

In **models 3-4**, we investigate whether a firm that does not directly receive FDI benefits indirectly from FDI in other firms in its industry-region. In other words, we want to estimate the influence of FDI intensity, which is represented as a share of investment in a certain region-industry, on performance of firms that do not themselves receive FDI.

When estimating these indirect effects, there is less potential for endogeneity[9], as we do not expect the productivity of firms that do not receive any FDI to be affected by the proportion of FDI in other firms in their industry-region. It is not likely that FDI in the industry-region should somehow be correlated with the labor productivity of firms that do not get any FDI. To control for unobserved heteroscedasticity we again use GLS for these three models.

Model 3

Using labor productivity as a measure of firm performance, our model becomes:

$$\ln \frac{Y_{it}}{L_{it}} = const + \alpha_1 \ln \frac{K_{it}}{L_{it}} + \lambda SPIL_{\sigma\delta i} + \sum_{\delta=1}^{6} O_\delta OWN_{\delta i} + \sum_{\sigma=1}^{6} S_\sigma INDUSTRY_{\sigma i} + \varepsilon_{it} \quad (8)$$

Regional dummies have been dropped in this specification, because their coefficients turned out to be insignificant. The spillover variable is defined as the percentage of FDI in the particular region multiplied by the percentage of FDI in the industry of the particular non-FDI-receiving firm.

Thus, the null hypothesis for model 3 becomes:

$H3_o$: $\lambda>0$: Receiving FDI does not increase labor productivity of other firms in the same region and industry.

[9] We thank Inessa Love from Columbia University for clarifying this point.

Model 4

Here, we use exports as a proxy for firms' performance. The model takes the form:

$$\ln Exp_{it} = const + \alpha_1 \ln K_{it} + \alpha_2 \ln L_{it} + \lambda SPIL_{\sigma\delta i} + \sum_{\delta=1}^{6} O_\delta OWN_{\delta i} + \sum_{\sigma=1}^{6} S_\sigma INDUSTRY_{\sigma i} + \varepsilon_{it} \quad (9)$$

The corresponding null hypothesis is then:

$H4_o$: λ≤0: Receiving FDI does not increase export volumes of other firms in the same region and industry.

We anticipate that FDI received by firms in a particular region and industry has a positive, possibly small effect on the performance of other firms in the same region and industry. Again, performance is measured by labor productivity and alternatively by exports.

4 Results

In order to test all four hypotheses, we estimated and tested all four models. Our findings for the hypotheses testing are shown below for one representative specification each. More complete estimation results are presented in Tables 5-8 in the Appendices.

Model 1 is estimated as variations of equation 5. We test for and estimate the FDI impact on labor productivity of the receiving firm.

Model 1[10]: Effect of FDI on labor productivity

$Ln(Y_{it}/L_{it}) = 3.36^{***} - 0.04\ Ln(K_{it}/L_{it}) + 0.77FDI^{***} + 0.07R_{1i} - 0..32R_{2i} +0.16R_{3i}+$

$+0. .10I_{1i} - 1.10I_{2i}\ ^{***} + 0\ .06I_{3i} -1.84I_{4i}^{***} -1.12\ I_{5i}^{***}+.88\ I_{6i}^{***}+$

$+.53O_{1i} +0.66O_{2i} + 0\ .04O_{\ 3i} +0.41\ O_{\ 4i} -0.37\ O_{\ 5i}+0.57\ O_{\ 6i}^{**}$

It could be concluded for all model variations, that FDI has a positive and significant impact on the labor productivity of the receiving firm. Consequently, we reject our null hypothesis $H1_0$. Regional dummies are not significant, suggesting that there are no significant differences in the effects of FDI among the Kyiv, Kharkiv, Odesa and Lviv regions. As for differences between industries, labor productivity turns out to be relatively low in metal processing (S_2), the construction materials industry (S_4), and the light industry (S_5), but relatively high in the food industry (S_6). Among ownership dummies, only the foreign-ownership dummy is significant and has a positive impact. Foreign-owned firms have higher labor productivity. So, we could suggest that our zero hypothesis is rejected statistically.

[10] *, **, *** mean 10%, 5% and 1% significance level respectively.

Model 2: Effects of FDI on exports

In order to test our second hypothesis, we estimated the model from equation 7. Again, we show one representative specification below, and present more complete results in Table 6 in the Appendices. The FDI dummy is significant and positive, which suggests that $H2_0$ is econometrically incorrect. Expansion in the export volume depends on labor. Regional variables are again not significant, which suggests the absence of regional differences. Light industry (S_5) firms have higher export volume. This could indicate that the light industry is more export-oriented than others, because it is labor intensive and Ukraine has relatively inexpensive and high-skilled labor. The coefficients of other industry dummies are not significant.

$$Ln(EXP_{it}) = 844.63^{***} + 0.09Ln(K_{it}) + .95Ln(L_{it})^{***} + 52.22FDI^{***}$$
$$- 0.14R_{1i} - .48R_{2i} - .45R_{3i} - 0.01Scale +$$
$$+ 0.32I_{1i} + 0.78I_{2i} + 0.31I_{3i} + 0.72I_{4i} + 1.41I_{5i}^{**} - 0.80I_{6i}^{*} +$$
$$+ 0.01O_{1i} + 0.07O_{2i} + 1\ 13O_{3i} + 0.52\ O_{4i} + 0.97O_{5i} + 2.08O_{6i}^{***}$$

With respect to ownership effects, we note that only two of our dummy variables are significant; these are the state (O_3) and foreign ownership (O_6) dummies. Export orientation of foreign owners can be explained by the fact that production in Ukraine is less expensive than in some other countries due to inexpensive, high-skilled labor and tax privileges. The significance of state ownership could be a result of direct and implicit government subsidies. Implicit subsidies typically take the form of lower prices for gas, electricity and utilities, which are all either still owned or subsidized by the government.

Model 3: Spillover effects on labor productivity

This model, as well as the next and last one, tests for spillover effects of FDI given to firms in a specific industry and region on other firms' performance in that same industry and region . Model 3 is described by equation 8 and illustrated below. More complete results are presented in Table 7 in the Appendices. This specification estimates the FDI-intensity effects (or spillover effects) on non-FDI firms' labor productivity.

$$Ln(Y_{it}/L_{it}) = 0.80^{***} + 0.22Ln(K_{it}/L_{it})^{***} + 0.002spil^{***} +$$
$$+ 0.58I_{1i}^{*} - 0.77I_{2i}^{***} + 0.87I_{3i}^{**} - 0.05I_{4i} - 0.41I_{5i} + 0.72I_{6i}^{*} +$$
$$- 0.15O_{1i} + 0.12O_{2i} + 0.45O_{3i} + 0.03O_{4i} - 0.59O_{5i}^{**} + 0.07O_{6i}$$

According to our results, the spillover variable (FDI intensity) is positive and significant at the 1% level. This suggests that positive FDI spillovers exist, but their quantitative effect is comparatively low. We may conclude

that this is partly the result of generally low volumes of FDI in Ukraine. Furthermore, firms owned by other Ukrainian companies (O_5) perform worse than firms with other ownership types. This may be explained by a specific type of competitive behavior among Ukrainian firms. Business rivals buy shares of each other in order to have better access to raw materials. Non-FDI firms have lower labor productivity in metal processing (S_2) and wood industries (S_3). On the other hand, the metallurgy industry (S_1) experiences positive externalities.

Model 4: Spillover effects on exports

This final model stems from equation 8. It is again illustrated below, and more complete results are presented in Table 8 in the Appendices. This specification estimates the FDI-intensity effects (or spillover effects) on non-FDI firms' export volumes.

$$Ln(EXP_{it}) = -2.58 + 1.22ln(L_{it})^{***} + 0.003spil^{***} +$$
$$+ 0.47I_{1i} - .60I_{2i} + 1.24I_{3i} - 1.14I_{4i} + 0.53I_{5i} - 0.55I_{6i}$$
$$+0.37O_{1i} + 0.74O_{2i} + 1.32O_{3i}^{*} + 1.23O_{4i}^{*} + 1.12O_{5i}$$

The spillover variable is positive and statistically significant, which implies the rejection of the null hypothesis for model 4. The coefficient of the spillover variable, however, is very small. The coefficient of the labor variable is positive and significant. None of the industry dummies are significant. But state-owned firms (O_3) and other physical entities (O_4) do exhibit higher exports than firms with other types of ownership.

5 Conclusions

Foreign direct investments to transition countries such as Ukraine are a highly appealing empirical research topic for several main reasons. For a poor transitional economy, foreign direct investments promise growth potential far beyond that available through domestic savings. Secondly, foreign direct investments could lead to several effects, both positive and negative. And, lastly, there exists little research of this type about Ukraine yet.

The effects of FDI may be grouped into direct and indirect impacts. Direct FDI effects measure differences in firm indicators between firms with and without FDI. Indirect (or spillover) effects are spread to firms that not themselves receive FDI, mostly through interactions between foreign and domestic firms. There are five main types of effects discussed in the relevant literature: technology transfer, catch-up, competition effect, foreign linkage effect and training effect.

Using unpublished micro-level annual data for 292 firms for the years 1998-99, we tested for statistical significance of FDI impacts on labor

productivity (model 1) and export volume (model 2). Furthermore, we investigated spillover effect in models 3-4.

The results reported in the paper imply that the presence of FDI has a positive influence on both labor productivity and exports. The for regions investigated, i.e. Kyiv, Kharkiv, Odesa and Lviv, did not exhibit significant differences. In addition, we found small, positive spillover effects on both labor productivity and export volumes of firms that did not themselves receive FDI.

Our results also imply some differences across industries. According to model 1, firms from metal processing, construction materials and light industry exhibit relatively low balor productivity, while enterprises in the food industry enjoy a relatively high labor productivity. We can suggest from model 2, that light industry companies export more then firms from other industries. According to Model 3, firms not receiving FDI in the metal processing and wood industries have lower labor productivity than others industries. At the same time, the metallurgy industry enjoys relatively high positive externalities.

Either foreign ownership or state-ownership present advantages for both labor productivity and export volumes, according to our results from models 1 and 2. A greater export orientation of foreign owners may be the result of several factors giving the foreign owner advantages in exports markets. The significance of state ownership with respect to labor productivity could be a result of Ukrainian government subsidies, tax privileges and similar policies. According to Model 3 results, firms not receiving FDI and owned by other Ukrainian companies perform worse than other firms with other ownership types.

While some empirical work on FDI has been done for several other transition countries, this is not the case yet for Ukraine. One might assume, that main reasons are problems related to data availability. Similar problems have constrained this research to a data set of less than 300 firms as well as only qualitative data on FDI. Consequently, we plan to work with larger data sets and more complete information on FDI volumes in the future. It would also be informative to estimate the effects of industry and regional spillovers separately. Finally, we would want to explore the effects of FDI on alternative indicators of firm's performance, such as value added and value added per worker.

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Appendices

Regression results for Model 1

Table 5
Effect of FDI on labor productivity

	$\ln\frac{Y_{it}}{L_{it}}$	$\ln\frac{Y_{it}}{L_{it}}$	$\ln\frac{Y_{it}}{L_{it}}$	$\ln\frac{Y_{it}}{L_{it}}$
constant	3.110221 *** (.3798949)	3.36888*** (.6094581)	3.797782*** (.5813996)	3.361068 *** (.6017184)
$\ln\frac{K_{it}}{L_{it}}$	-.0321387 (.0954852)	-.0958973 (.0990565)	-.0777378 (.0874039)	-.0483727 (.0878096)
FDI	.7544024*** (.1440682)	.7314491*** (.1436722)	.8042352*** (.137226)	.7737273*** (.1398052)
Kyiv region		.1963453 (.4919964)	.0382721 (.4099749)	.0755219 (.4087269)
Lviv region		-.5243072 (.5092676)	-.3578108 (.4218442)	-.3236778 (.4304532)
Kharkiv region		-.00652 (.5054732)	.0584154 (.4184861)	.1697789 (.420667)
Metallurgy industry			-.0532733 (.3458821)	.1002837 (.3539814)
Metal processing			-1.2091*** (.2727451)	-1.105147*** (.2791934)
Wood and paper			.2423589 (.5650992)	.069621 (.5597583)
Construction materials			-1.748438*** (.6451326)	-1.8427 *** (.661591)
Light industry			-.9461021*** (.3357283)	-1.122641*** (.3374742)
Food industry			.8116791*** (.3107219)	.8844425 *** (.3141468)
Workers ownership				(.5302774)
Managers				.3298891 .6611196 (.4943387)
State				.0459265 (.4322602)
Physical entities				.4110196 (.3146988)
Ukrainian companies				-.371814 (.3498654)
Foreign companies				.5729147 ** (.2739975)
R^2	0.0671	0.1121	0.4654	0.5010

In parentheses are standard errors; *, **, *** mean 10%, 5% and 1% significance level respectively.

Regression results for Model 2

Table 6
Effects of FDI on exports

	$\ln Exp_{it}$	$\ln Exp_{it}$	$\ln Exp_{it}$	$\ln Exp_{it}$
constant	746.0346***	739.6532***	952.2325***	844.6346***
	(123.3835)	(128.3026)	(166.672)	(163.6355)
$\ln K_{it}$	-.065302	-.0754216	.0375476	.0927884
	(.1685712)	(.177256)	(.17749)	(.1679689)
$\ln L_{it}$	1.053925***	1.059116***	.8663591***	.9558322***
	(.2556936)	(.2603795)	(.2800036)	(.2707489)
FDI	46.0487***	45.65519***	58.7844***	52.22984***
	(7.622021)	(7.92957)	(10.30754)	(10.11333)
Kyiv region		.1402472	.0381235	-.1492532
		(.7403931)	(.734901)	(.6920088)
Lviv region		.00934	-.0672211	-.4810016
		(.7729364)	(.758352)	(.7283313)
Kharkiv region		.0473668	-.1459191	-.4511203
		(.7619232)	(.7497495)	(.7099927)
Metallurgy industry			.2150633	.3292866
			(.6217436)	(.6009516)
Metal processing			.7478811	.789942
			(.5235675)	(.4958547)
Wood and paper			.4667229	.315329
			(1.011058)	(.9461807)
Construction materials			.1945991	.725286
			(1.184627)	(1.143566)
Light industry			1.660828 ***	1.410261**
			(.6113901)	(.5931065)
Food industry			-.9703221 *	-.8042281
			(.5672528)	(.543708)
Scale			-.0026378	-.0159139
			(.0595256)	(.0576004)
Workers ownership				.0152263
				(.5693204)
Managers				.0744125
				(.8567416)
State				1.135162
				(.7350317)
Physical entities				.5281672
				(.5320371)
Ukrainian companies				.9791046
				(.5998799)
Foreign companies				2.082235***
				(.4919346)
R^2	0.3202	0.3215	0.4126	0.5036

In parentheses are standard errors; *, **, *** mean 10%, 5% and 1% significance level respectively.

Regression results for Model 3

Table 7
Spillover effects on labor productivity

	$\ln\frac{Y_{it}}{L_{it}}$	$\ln\frac{Y_{it}}{L_{it}}$	$\ln\frac{Y_{it}}{L_{it}}$	$\ln\frac{Y_{it}}{L_{it}}$
constant	.8387315 *** (.2503692)	.9339324 *** (.2723761)	.8037184 *** (.2917585)	.7770575 *** (.2837662)
$\ln\frac{K_{it}}{L_{it}}$	.1707783 ** (.0788923)	.17281 ** (.0795979)	.2292445 *** (.0755159)	.2267631 *** (.0753785)
spillover	.0029564 *** (.0007592)	.0029796 *** (.0007643)	.0022251 *** (.0007798)	.0023776*** (0007746)
Workers ownership		-.2742787 (.2454183)	-.155701 (.2276825)	
Managers		.0620174 (.4177473)	.1221477 (.3963747)	
State		-.2565311 (.5136659)	.4522285 (.4829886)	
Physical entities		.0554883 (.2879311)	.0297117 (.2631004)	
Ukrainian companies		-.5306005* (.3026857)	-.5987747** (.2797578)	
Foreign companies		.7990214 (.9661738)	.0781827 (.8985468)	
Metallurgy industry			.5885331 * (.3363792)	.5185387 (.334257)
Metal processing			-.7742763*** (.2774144)	-.8045659*** (.2710271)
Wood and paper			-.8716325** (.4409653)	-.8462005** (.4235343)
Construction materials			-.0539755 (.3273139)	-.1288253 (.3251478)
Light industry			-.4108193 (.3406818)	-.4664606 (.3348827)
Food industry			.7299265 (.2758278)	.6428868 (.2670187)
R^2	0.0898	0.1091	0.2734	0.2504

In parentheses are standard errors; *, **, *** mean 10%, 5% and 1% significance level respectively.

Regression results for Model 4

Table 8
Spillover effects on exports

	$\ln Exp_{it}$	$\ln Exp_{it}$	$\ln Exp_{it}$	$\ln Exp_{it}$
constant	-1.986797*	-2.522509 **	-2.167826**	-2.589027
	(1.081524)	(1.050605)	(1.012107)	(1.160966)
$\ln L_{it}$	1.174555***	1.169415***	1.164557 ***	1.22317 ***
	(.1607732)	(.1585468)	(.1541413)	(.1694424)
spillover	.0029216 *	.0028104**	.0028077 *	.0032366*
	(.0016981)	(.00142)	(.0014433)	(.0017117)
Workers ownership				.3753603
				(.610116)
Managers				.7417539
				(.9254058)
State		1.190222		1.324532*
		(.7258599)		(.7662441)
Physical entities		1.051411*		1.233253**
		(.5439513)		(.5864281)
Ukrainian companies		.8572546		1.129888
		(.6658557)		(.7260139)
Metallurgy industry	.7174181	.9029099	.9589779	.4705539
	(.7039667)	(.5839055)	(.5877421)	(.7169181)
Metal processing	-.3159037			-.6071945
	(.5702525)			(.5736704)
Wood and paper	.9759838			1.248586
	(2.033107)			(2.006702)
Construction materials	-1.185085			-1.144203
	(1.168831)			(1.191918)
Light industry	.7235154	1.064151*	.9691074	.5397828
	(.7583744)	(.6428224)	(.6497758)	(.7755485)
Food industry	-.283287			-.550465
	(.7596769)			(.7884481)
R^2	0.3659	0.3932	0.3535	0.4082

In parentheses are standard errors; *, **, *** mean 10%, 5% and 1% significance level respectively.

Hausman specification tests

Hausman specification test for Model 1

```
R-sq:  within  = 0.1875                         Obs per group: min =         1
       between = 0.4924                                        avg =       1.7
       overall = 0.5010                                        max =         2

Random effects u_i ~ Gaussian                   Wald chi2(17)      =    122.46
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000

------------------------------------------------------------------------------
       lny_l |      Coef.   Std. Err.       z     P>|z|       [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lnk_l |  -.0483727   .0878096     -0.551   0.582      -.2204764    .1237309
       fdi_n |   .7737273   .1398052      5.534   0.000       .4997141    1.047741
          r1 |   .0755219   .4087269      0.185   0.853      -.7255681    .8766119
          r2 |  -.3236778   .4304532     -0.752   0.452      -1.167351    .5199949
          r3 |   .1697789    .420667      0.404   0.687      -.6547133    .9942711
          i1 |   .1002837   .3539814      0.283   0.777      -.5935072    .7940745
          i2 |  -1.105147   .2791934     -3.958   0.000      -1.652356   -.5579379
          i3 |    .069621   .5597583      0.124   0.901      -1.027485    1.166727
          i4 |    -1.8427    .661591     -2.785   0.005      -3.139394   -.5460053
          i5 |  -1.122641   .3374742     -3.327   0.001      -1.784078   -.4612036
          i6 |   .8844425   .3141468      2.815   0.005        .268726    1.500159
          o1 |   .5302774   .3298891      1.607   0.108      -.1162934    1.176848
          o2 |   .6611196   .4943387      1.337   0.181      -.3077665    1.630006
          o3 |   .0459265   .4322602      0.106   0.915      -.8012879    .8931409
          o4 |   .4110196   .3146988      1.306   0.192      -.2057786    1.027818
          o5 |   -.371814   .3498654     -1.063   0.288      -1.057538    .3139096
          o6 |   .5729147   .2739975      2.091   0.037       .0358893     1.10994
       _cons |   3.361068   .6017184      5.586   0.000       2.181722    4.540415
-------------+----------------------------------------------------------------
     sigma_u |  .98669983
     sigma_e |  .29996958
         rho |  .91539557   (fraction of variance due to u_i)
------------------------------------------------------------------------------


Hausman specification test

             ---- Coefficients ----
             |      Fixed       Random
       lny_l |    Effects      Effects       Difference
-------------+----------------------------------------
       lnk_l |  -.3014501    -.0483727        -.2530774
       fdi_n |   .7501185     .7737273        -.0236089

Test:  Ho:  difference in coefficients not systematic

              chi2(  2) = (b-B)'[S^(-1)](b-B), S = (S_fe - S_re)
                        =     2.92
              Prob>chi2 =     0.2319
```

Hausman specification test for Model 2

```
R-sq:  within  = 0.0063                         Obs per group: min =         1
       between = 0.2132                                        avg =       1.8
       overall = 0.2009                                        max =         2
Random effects u_i ~ Gaussian                   Wald chi2(19)      =     71.78
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000

------------------------------------------------------------------------------
       exp_s |      Coef.   Std. Err.       z     P>|z|       [95% Conf. Interval]
-------------+----------------------------------------------------------------
         lnk |   -.034229    .038994     -0.878   0.380       -.110656    .0421979
         lnl |   .1006678   .0599572      1.679   0.093      -.0168461    .2181818
      fdi1_n |   3.592282   1.787189      2.010   0.044       .0894569    7.095108
          r1 |  -.0100571   .1532398     -0.066   0.948      -.3104016    .2902873
          r2 |   .1496963   .1549547      0.966   0.334      -.1540094     .453402
          r3 |  -.0783437    .146822     -0.534   0.594      -.3661096    .2094222
          i1 |  -.0429657   .1591218     -0.270   0.787      -.3548387    .2689074
          i2 |   .0285692   .1287305      0.222   0.824      -.2237378    .2808762
          i3 |  -.0286531   .1861884     -0.154   0.878      -.3935757    .3362695
          i4 |  -.0427706   .1515755     -0.282   0.778      -.3398531    .2543118
          i5 |   .6408093   .1502053      4.266   0.000       .3464123    .9352062
          i6 |  -.1661267   .1166942     -1.424   0.155      -.3948432    .0625898
       scale |  -.0368867   .0193662     -1.905   0.057      -.0748439    .0010704
          o1 |  -.1890413   .1168057     -1.618   0.106      -.4179762    .0398937
          o2 |  -.0783898   .2076067     -0.378   0.706      -.4852914    .3285118
          o3 |   .7473159   .2625794      2.846   0.004       .2326697    1.261962
          o4 |   .1578111   .1339226      1.178   0.239      -.1046724    .4202947
          o5 |   .0147235   .1367398      0.108   0.914      -.2532815    .2827286
          o6 |   .2566897   .1210695      2.120   0.034       .0193978    .4939816
       _cons |    58.1132   28.99299      2.004   0.045       1.287987    114.9384
-------------+----------------------------------------------------------------
     sigma_u |   .5100323
     sigma_e |  .42710261
         rho |  .58780519   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

```
Hausman specification test
                ---- Coefficients ----
             |      Fixed       Random
       exp_s |    Effects      Effects       Difference
-------------+----------------------------------------
         lnk |  -.1477823     -.034229        -.1135532
         lnl |   .0220697     .1006678        -.0785982
      fdi1_n |   4.420467     3.592282         .8281843
       scale |  -.0756615    -.0368867        -.0387748

Test:  Ho:  difference in coefficients not systematic

             chi2(  4) = (b-B)'[S^(-1)](b-B), S = (S_fe - S_re)
                       =     1.99
             Prob>chi2 =     0.7368
```

Hausman specification test for Model 3

```
R-sq:  within  = 0.0001                         Obs per group: min =         1
       between = 0.3081                                        avg =       1.9
       overall = 0.2734                                        max =         2

Random effects u_i ~ Gaussian                   Wald chi2(14)      =     83.51
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000

------------------------------------------------------------------------------
       lny_l |      Coef.   Std. Err.       z     P>|z|       [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lnk_l |   .2292445   .0755159      3.036   0.002       .0812361    .3772529
          i1 |   .5885331   .3363792      1.750   0.080      -.0707581    1.247824
          i2 |  -.7742763   .2774144     -2.791   0.005      -1.317999    -.230554
          i3 |  -.8716325   .4409653     -1.977   0.048      -1.735909   -.0073563
          i4 |  -.0539755   .3273139     -0.165   0.869      -.6954989     .587548
          i5 |  -.4108193   .3406818     -1.206   0.228      -1.078543    .2569047
          i6 |   .7299265   .2758278      2.646   0.008        .189314    1.270539
          o1 |   -.155701   .2276825     -0.684   0.494      -.6019505    .2905484
          o2 |   .1221477   .3963747      0.308   0.758      -.6547325    .8990278
          o3 |   .4522285   .4829886      0.936   0.349      -.4944118    1.398869
          o4 |   .0297117   .2631004      0.113   0.910      -.4859557     .545379
          o5 |  -.5987747   .2797578     -2.140   0.032       -1.14709   -.0504595
          o6 |   .0781827   .8985468      0.087   0.931      -1.682937    1.839302
        spil |   .0022251   .0007798      2.854   0.004       .0006968    .0037534
       _cons |   .8037184   .2917585      2.755   0.006       .2318822    1.375555
-------------+----------------------------------------------------------------
     sigma_u |  1.1252245
     sigma_e |  .50983428
         rho |  .82967198   (fraction of variance due to u_i)
------------------------------------------------------------------------------

. xthaus

Hausman specification test

            ---- Coefficients ----
           |      Fixed       Random
       lny_l |    Effects     Effects       Difference
-------------+-----------------------------------------
       lnk_l |   .0200656     .2292445        -.2091789

Test:  Ho:  difference in coefficients not systematic

             chi2(  1) = (b-B)'[S^(-1)](b-B), S = (S_fe - S_re)
                       =     1.78
             Prob>chi2 =     0.1815
```

Hausman specification test for Model 4

```
R-sq:  within  = 0.0550                         Obs per group: min =         1
       between = 0.4575                                        avg =       1.7
       overall = 0.4082                                        max =         2

Random effects u_i ~ Gaussian                   Wald chi2(13)      =     69.01
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000

------------------------------------------------------------------------------
        lexp |      Coef.   Std. Err.       z     P>|z|       [95% Conf. Interval]
-------------+----------------------------------------------------------------
         lnl |    1.22317   .1694424      7.219   0.000       .8910686    1.555271
          i1 |   .4705539   .7169181      0.656   0.512      -.9345799    1.875688
          i2 |  -.6071945   .5736704     -1.058   0.290      -1.731568    .5171789
          i3 |   1.248586   2.006702      0.622   0.534      -2.684478     5.18165
          i4 |  -1.144203   1.191918     -0.960   0.337      -3.480319    1.191913
          i5 |   .5397828   .7755485      0.696   0.486      -.9802645     2.05983
          i6 |   -.550465   .7884481     -0.698   0.485      -2.095795     .994865
          o1 |   .3753603    .610116      0.615   0.538       -.820445    1.571166
          o2 |   .7417539   .9254058      0.802   0.423      -1.072008    2.555516
          o3 |   1.324532   .7662441      1.729   0.084      -.1772786    2.826343
          o4 |   1.233253   .5864281      2.103   0.035       .0838747    2.382631
          o5 |   1.129888   .7260139      1.556   0.120      -.2930733    2.552849
        spil |   .0032366   .0017117      1.891   0.059      -.0001182    .0065914
       _cons |  -2.589027   1.160966     -2.230   0.026      -4.864479   -.3135745
-------------+----------------------------------------------------------------
     sigma_u |  1.5751417
     sigma_e |  1.1523955
         rho |  .65135595   (fraction of variance due to u_i)
------------------------------------------------------------------------------

. xthaus

Hausman specification test

            ---- Coefficients ----
            |      Fixed       Random
        lexp |    Effects      Effects       Difference
-------------+----------------------------------------
         lnl |    2.24936      1.22317         1.026191

Test:  Ho:  difference in coefficients not systematic

             chi2(  1) = (b-B)'[S^(-1)](b-B), S = (S_fe - S_re)
                       =     0.78
             Prob>chi2 =     0.3774
```

Ukrainian Industrial Enterprise Survey '2000

Questionnaire. Total information about enterprise

A. Ownership

1. Specify the ownership of your enterprises

State-owned enterprise

Non-state owned enterprise, but it was state-owned before (until (year))

Non-state owned enterprise, it has never been state-owned

2. Specify the legal form of your enterprise

Closed joint stock company

Open joint stock company

Cooperative

Partnership

Collective enterprises

Leased enterprise

Individual ownership

Joint venture

Other (please, specify)

3. If your enterprise is a joint stock company of any type, how are the shares distributed among the shareholders?

workers	%
managers	%
government	%
other physical entities	%
other Ukrainian companies	%
other foreign companies	%
other	%

B. Size of enterprise

1. What was the number of workers on floor in _____? _____
2. What was the number of workers on forced leave in _____? _____

C. Industry

What portion of your output belongs to the following sectors of industry?

1 _____ metallurgy, energy, chemical industry, coal industry

2 _____ machine building

3 _____ wood processing

4 _____ construction materials

5 _____ light industry

6 _____ food processing

7 _____ printing

8 _____ other

Please, mention four main types of output produced by your enterprise:

a._____

b._____

c._____

d._____

D. Average Per Cent of Capacity Utilization in 1999 _____%

E. How did FDI change in 2000 compared to 1999?

1.	increase	0.	The same	-1.	Decrease	4.	Never received FDI	5.	DK