DETERMINING FACTORS AND EFFECTS OF FOREIGN DIRECT INVESTMENT IN AN ECONOMY IN TRANSITION: Evidence from Czech Manufacturing in 1991-97

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A B S T R A C T

The paper is based on an econometric model for 15 manufacturing industries. It analyses the causes and the effects of FDI in a small open economy in transition during 1991-97. The model comprises of panel data with 1050 potential observations (10 variables x 15 industries x 7 years). The hypotheses tested are derived from the theory of investment location for a small open economy where comparative advantages, industrial organisation and market structure form the basic determining factors of the industrial structure of FDI inflows.

The experiments with our models indicate that the key variable on the side of determining factors of the industrial structure of FDI was the capital per labour ratio. It is evident that after 1994 the role of capital was overshadowing the role of labour in attracting the FDI. The new FDI ventures into the Czech economy are biased in favour of capital intensive industries. As a variable of minor significance there was observed the role of increasing returns to scale. We cannot confirm that there were other significant "causes" determining the FDI during the whole studied period because a part of them could have been correlated with effects of FDI.

On the side of effects of FDI on firms, there were several variables that were statistically significant: the level of profits, total factor productivity and the development in prices measured by producer price index. The latter factor has been universal to all patterns of Czech incoming FDI flows both in time and space (industries). From the very onset, foreign investors into the Czech manufacturing were strongly biased to investments into those industries where the index of inflation was higher than average. This is a classical explanation of location activities built into the foundations of comparative advantages and shared by both the Ricardian and the Stolper-Samuelson models. Natural resources or human capital endowment in industries were not among the factors that influenced significantly the decision-making about FDI.

The facts revealed in this paper are of a crucial importance for the policy-making. We have found that there are only very weak causal links in the Czech economy for the attraction and the success of FDI. The majority of phenomena distinguishing the firms (industries) with FDI from indigenous firms can be derived from the effects of FDI. As a consequence, we cannot expect that indigenous firms would enjoy the same natural "comparative advantages", which were observed to have been developing in firms with FDI. If this trend would continue, the gap between the foreign and the indigenous enterprises would be widening. The benefits of FDI could be then internalised exclusively in recipient enterprises and the indigenous firms would fall out off the competition. Having been singled out as outsiders, they would sink

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down to a group of other indigenous firms competing among themselves at the margin of survival.

1. FDI as an Engine for Survival

Czech economic transformation had its ups and downs. In 1990 it commenced in a hind position, with hardly any experience from entrepreneurship under its "reformed" central planning and with households lacking capital for the initiation of large-scale investments. With these adverse endowments being given, betting on FDI would be a very promising strategy for securing the future growth. Nevertheless, Czechoslovak government opted at that time for a very different strategy in the large-scale businesses. By giving priority to the voucher privatisation scheme and the scheme of sales to Czech owners (Mejstrik [1996]) it set forth for a highly unorthodox avenue of self-reliance. The ensuing intransparent ownership and perverse objectives of the quasi-owners had a long-term impact on the performance of firms and the Czech society. Though still accepted as an important means of privatisation, the FDI remained a less-favoured child that was assumed to be strong enough to care for himself.

Without doubt, the stress on one's own capacities was a dire undertaking, which was at first criticised by IMF and the World Bank, but very soon it became the Czech most admired achievement. Unfortunately, in 1996 there were first signals that indigenous Czech firms lagged behind the firms with foreign capital [1]. Czech privatisation strategy was a bet on odds that it could be possible to build capitalism without capital. This was an impossibility theorem, which had to fall down on the new Czech capitalists-to-be. The accumulation of capital was a necessity and the indigenous firms had to act in such a way that instead of concentrating on the restructuring of production, they had to cope with corporate property control, equity transfers and the acquisition of assets under their own management. Many of these acts were illegal [2] and their effects on the firms were negative.

The necessity to close the widening trade balance deficit during 1994-97, the government had to proceed with restricting both the monetary and the fiscal policies. That brought the frail Czech firms to a test of survival during 1997-98. In the same period there was a sharp change in the views on ownership. The openness to FDI became the most-favoured policy for not only all liberal parties, but also for the trade unions and Socialists. Unfortunately, foreign investors became very cautious and the changeover to a new strategy remained to a large extent without practical response.

Now it looks evident that those firms that succeeded in attracting FDI were those more lucky ones where the growth of production was combined with high wages and high profits. Since only a minority of firms succeeded in that, the Czech economy was slowly progressing into a system of dual set of firms distinguished by speed. On one hand there are the indigenous firms that press for low wages, government bailout schemes and the soft legislation. On the other hand there are firms with foreign capital that can withstand appreciating exchange rate and still increase its market competitiveness and capital returns.

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[1] The first studies in this respect were by Benacek, Zemplinerova [1996] and Zemplinerova, Benacek [1996] and [1997]. These studies covered the full sample of firms with employment over 24 employees (altogether over 3000 enterprises) and their conclusion was less optimistic than what was found in the study by Djankov and Hoekman [1998] who used a selected pattern of 513 firms.

[2] The word "tunnelling" became a synonym for ingenious schemes of asset stripping and rent-seeking, which have left the majority of indigenous corporations and banks in debts. On top of its inefficient acquisition, the extracted "authentically private" capital was often either sent abroad or spent on imports of consumer goods.

Under this "division of roles" in entrepreneurship there is a rising danger that the gap between these two groups will even deepen and thus perpetuate the existing split.

Thus in 1999 approximately a half of the firms in the Czech economy were firms able to stand on their own with a prospect for gaining profits. The majority of these were firms with foreign capital. The remaining half (or a third, in the better case) of all firms is now challenged by either pending restructuring or liquidation. Since it is not very likely that the weakened indigenous Czech corporate sector would be able to recover with the help of their own means, there are two alternatives left which may do the job. The first one is the government bailout. Because the Czech propensity to save is extremely high and also the taxes are very high, the means so available are substantial. The present Czech government thinks that there may be a hope for chance. Their problem is only managerial: who are those clerks and entrepreneurs who will administer and use these means productively? With the lack of them one can have doubts there may be anything perspective in this scheme.

The other chance left to the ailing indigenous enterprises rests in their association with the foreign capital, either in joint-ventures or by their direct takeovers by foreign firms. Unfortunately we can doubt that the FDI entry into Czechia would change its strategy and, instead of concentrating on green-field investments (as was clearly the situation since 1996), it would return back to acquisitions and mergers. If this would not be the case, the only possibility then remains that **the FDI firms, which have now become leaders in the Czech economy, would have positive spillover effects on the rest of the economy.** So, at this stage of development, the Czech economy would be helped more by means of externalities spinning off from foreign to indigenous firms than by direct effects on productivity in the firms under foreign control. It is the aim of this study to analyse more closely how the foreign investors behaved in the past, what were the determining factors for their activity, what were the industrial patterns, which attracted their attention and how was it with their effects on the economy.

2. The Data and the Variables Used in this Study

This study builds on the experience we developed during our empirical tests from the previous paper (see Benacek and Visek [1998]). The data in the former study were based on a single year 1994 and comprised 91 industries. The problem was that we lacked the time dimension and the picture we have received was generally static. Nevertheless, we have discovered that the industries with a massive presence of FDI behaved to a large extent differently than the industries without that financial support.

In this paper we have grouped the manufacturing data into 15 industries classified according to NACE 2-digit nomenclature. We have clustered some industries because we did not have the FDI data for all industries in the required structure. The intensity of FDI in the given industry *i* (as the endogenous variable) was measured by the volume of foreign capital per value added (i.e. FDI_{it} / VA_{it}) in the given industry *i* in time *t*. Data cover the period t = 1991, 1992, …, 1997.

The list of explanatory variables in our basic equation was selected on grounds of main theories of location in an open economy [3] and industrial organisation (market power and increasing returns to scale). The list of exogenous variables is as follows:

[3] The allocation of resources in an open economy is explained primarily by the pure theory of trade. The dynamics of industries that produce traded commodities depends to a large extent on comparative advantages (defined as factor proportions in endowments and production intensities) and/or comparative costs. A great deal of growth in both traded and non-traded commodities depends also on the potential for scale economies and the market power.

a) Labour per unit of net production (i.e. value added) L/VA. There is a general assumption that the abundance of relatively skilled labour is post-Communist countries is a comparative advantage that attracts FDI: the higher is the labour intensity of production, the more competitive is the production on international markets and the higher is the FDI.
b) Physical capital per unit of net production (i.e. value added) K/VA. As a substitute for labour intensity we should expect its statistically significant parameter with a negative sign. Capital is not only a scarce (and thus too expensive) factor in Czechia but it is also risky to invest in a transition country before it is structurally stabilised. Whenever FDI can become a sunk cost (what is assumed to hold for economies in transition) it is more advantageous to invest into labour intensive industries.
c) Capital per labour (K/L): as a combination of variable no. 1 and 2, it becomes an alternative to them. This should result in its high statistical significance with a negative sign, provided the assumption that the post-Communist economies in Central Europe have comparative advantage in labour is valid.
d) Total factor productivity (TFP). We have used it as a proxy for the technical efficiency of factor usage: the higher is TFP, the lower volume of factors is necessary to produce a unit-value of output. Thus a positive sign associates a high efficiency of factor usage with high foreign investment. Total factor productivity (TFP_i) was therefore used as an inverse proxy for costs. Its estimation was as follows:
e) $TFP_i = \frac{VA_i}{K_i^{\,a} L_i^{\,1-a}}$,
f) where the coefficient *a* was set to 0.3 in accordance with the coefficients estimated from Czech aggregate production function of the Cobb-Douglas type. The variable TFP_i is thus equal to the constant A_i assigned to the Cobb-Douglas unit-value isoquant of industry *i*, provided its real values of L_i, K_i per output VA_i are fitted into the above equation.
g) Increasing returns to scale (IRS): a dummy variable derived from CES production functions. It is expected that high intensity of FDI is positively correlated with the use of increasing returns (a feature ascribed to multinationals).
h) Concentration ratio (CR3): it is a characteristics related either to market power (with an orientation to large domestic market) or to increasing returns. CR3 was calculated as a share of three largest firms in a given industry on the total output of the industry.
i) Change of nominal producer prices in time (PPI): it is assumed that the difference in indices of the industrial inflation in 1991-1994 reflects the narrowing of the gap between the world prices and former prices under central planning. The index of PPI reflects how the domestic relative prices changed after opening up to the West. This is also closely related to the improvements in the terms of trade. The higher is the imported "inflation" in the given industry, the higher is the potential for its growth and investments. The Stolper-Samuelson and the Haberler theorems for a location of trade and growth are consistent with this hypothesis.
j) Human capital (HK/VA): the employment of university educated employees per value added is an indicator of the competitiveness in quality that should attract FDI. In case Czechia does not have a comparative advantage in human capital, this factor should have a negative sign.
k) Profits per labour (π/L) was a proxy variable for general competitiveness. Is sign is expected to be positive.

Remark: Unfortunately we were not able to collect all required observations (potentially 15 industries times 7 years) i.e. 105 rows, each containing 10 variables. Due to missing data we could work effectively with 100 rows only.

3. Results of the Estimation by Ordinary Least Squares (OLS)

The first test was based on explanatory variables characterising the comparative advantages and the economies of scale. The model "A" was specified in the following way:

$$FDI_{it} / VA_{it} = a_0 + a_1*(K_{it} / L_{it}) + a_2*(\pi_{it} / L_{it}) + a_3* IRS_{it} + a_4* PPI_{it} + \varepsilon_{it} \quad \text{[model A]}$$

Its results, based on OLS analysis, were more than disappointing (see Table 1). The only statistically significant variable was the matrix of PPI deflators.

Table 1: Estimation of regression coefficients by using OLS technique - Model A

Variables	Estimated coefficients	Estimation of standard error	t-value	P-value
Intercept	-1.3518	1.1295	-1.1968	0.234374
K / L	0.0298	0.1290	0.2314	0.817499
π / L	-0.0166	0.0207	-0.8049	0.422895
IRS	0.2228	0.1831	1.2164	0.226843
PPI (deflators)	2.3927	0.9974	2.3989	0.018398
σ^2	= 2.2193			
R^2	= 0.1325			

Though the economic interpretation of PPI based on Stolper-Samuelson price effect after the opening-up might be acceptable, the explanatory power of the model for the whole period of 1991-97 was problematic even in that case. The problem is that for the PPI we cannot be certain about the causes and effects of FDI. On one hand the inflation "premium" could have been an autonomous factor causing FDI to be attracted in the given industry. On the other hand, the rising prices in this case could have been **the effect of FDI** (and not a cause), as the foreign investors influenced the rising quality in the given sector. Then both the terms of trade and the domestic prices for products of the given industry could rise ex- post.

The best R-squared we have received was 0.133 and the variable behind this result (i.e. the PPI) was most probably an effect of FDI. We could therefore conclude that FDI in the Czech economy had no standard causes (i.e. those causes expected theoretically for a small highly open economy). The effects of FDI were also rather week, what the estimated low P-value and the R^2 could propose.

By further experimenting with our model, we could provide a slightly more successful specification based on retaining only two from the previous variables representing comparative advantages (i.e. profits representing the competitiveness and the capital per labour representing the Heckscher-Ohlin intensities). At the same time we have deleted IRS and PPI that were replaced by the variable of total factor productivities. In fact, all three of the used variables represent some aspect of comparative advantages.

At the same time we have to advise that experiments with the variables representing modern factors for the location of production, such as the human capital, intensity of concentration or increasing returns of scale, were not significant in our estimation by OLS.

This finding is again consistent with our conclusions from model A concerning problems in finding standard determining factors for the location of FDI. The final specification of our model "B" is as follows:

$$FDI_{it} / VA_{it} = b_0 + b_1*(K_{it} / L_{it}) + b_2*(\pi_{it} / L_{it}) + b_3* TFP_{it} + \varepsilon_{it} \qquad \text{[model B]}$$

Table 2: Estimation of regression coefficients by using OLS technique - Model B

Variables	Estimated coefficients	Estimation of standard error	t-value	P-value
intercept	-6.3094	1.0162	-6.2089	0.000001
K/L	0.2240	0.0722	3.1042	0.002507
π / L	-3.3233	1.8663	-1.7807	0.078126
TFP	6.7332	2.1459	3.1377	0.002262
σ^2	= 2.1229			
R^2	= 0.1614			

From the estimation of models A and B we can conclude that it seems apparent that the decisions about the location of FDI into the Czech economy in 1991-97 were generally associated with comparative advantages. The influence of comparative advantage in costs was unveiled by the statistical significance of TFP and the comparative advantage in factors, as is shown by the significance of variable K/L. Surprisingly, the sign of the latter was not negative but positive. That indicates a reversal of our original hypothesis concerning the role of labour and capital in the Czech economy. It is not the efficient and cheap labour that attracts FDI but the (locally) expensive and scarce capital. It is a surprising new finding that was not known from any previous studies that were based on data until 1994. It is a matter of further analysis to see if there was a point in time when the importance of labour for the location of FDI was replaced by the importance of physical capital.

The statistically most significant variable from model B (i.e. TPF) is that one which superseded the variable PPI in model A. They seem to be mutually exclusive variables, even though their "explanatory power" was relevant to a small portion of variations in FDI inflows only. The vast majority of variations remained unexplained by our model.

The technique of OLS has a general weakness – it is designed to uncover "regularities" that are supposed to be invariant (uniform) for all variables simultaneously [4]. That condition need not be always satisfied. For example, in the relationships between FDI and some variable determining the FDI location need not be valid for the whole duration of the time series or need not be relevant for all industries. The reason can rest in the very nature of economic transition: the relationships between variables can be reversed in time or some industries can be influenced in their behaviour by different objective functions. In such cases the collection of data into one data set may become a mistake caused by an insufficient recognition of qualitative anomalies determining the relationships between them. Since in our case we cannot exclude such a situation in the analysis of FDI, we could inquire into the behaviour of foreign investors by means of a more sophisticated econometric technique than is the method of OLS.

[4] That means, the behavioural patterns in an economy are assumed to be stationary. At least the signs in a linear regression are supposed to be known in advance. For example, it is assumed that the supply curve is upward sloping. But we know that under increasing returns this need not be true. In a panel data analysis there can be a situation that some firms produce under decreasing and others under increasing returns to scale. Or one firm can experience both cases at different time spans.

4. The Robust Method of Estimation

When looking for determinants of some (response) variable, econometricians frequently considered (linear) regression model and they employed typically all available data, in the sense that they selected some variables from the available ones but they used all available cases [5] (observations). In other words, when searching for factors, which have significant influence on a response variable, we were prepared to accept only a model, which is valid for all observations simultaneously. Any interference with the "natural distribution" of the data is usually taken by economists as "data mining", and thus a practice worth the deepest contempt. Surprisingly, this purism in the belief of immaculate data is not shared by natural scientists.

It is evident that in the real life we may be challenged more than often with situations when a part of our data will represent either a **contamination** or our data can be **a mixture of two (or more) different populations**. To distinguish between them by means of an intuitive clustering may be rather difficult, especially if there are more explanatory variables than one. This situation can be of a special importance in transforming economies where a multi-speed development of various segments may become a rule. The asymmetric **qualitative changes** can result in a situation where the economy is subject to heterogeneous behavioural patterns.

An example of a contaminated data will be given bellow. Examples of a data set split into heterogeneous populations can be found in Benáček and Víšek (1999) where the population of 92 industries of the Czech economy appeared to consist of two segments. The first segment contained industries in which the majority of firms behaved already like in a functioning market economy. For example, they had the capital and the labour in reciprocal relationship allowing a Pareto-efficient substitution between factors. The second segment contained industries, where its firms behaved still like under socialist paternalism. For example, their labour was directly proportional to capital with all ensuing inefficiency notwithstanding [6]. The estimations based on data composed of heterogeneous subpopulations result in a failure to uncover the true relationship inside the subpopulations.

Robust methods of estimation of regression coefficients have been recently designed especially for solving the problems of heterogeneous patterns in data sets. The extreme requirements of the method on both the memory and the speed of computers gave the reason why these methods were not much used in the past. Even now, when the Pentium processors offer a great computing comfort, the speed of estimation prolongs to approximately 20 minutes. In the paper we have applied our own variant of a robust technique, namely the least trimmed squares. The corresponding estimator allows to adjusting breakdown point[7] and hence it is flexible for the pre-processing of data, as well as for their final study. First of all,

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[5] From now on, the expression "case" will mean a list of data observations in an array of rows that come for all tested variables (as specified in our equation to be tested) for given industry and year.

[6] These studies discovered that in both cases (the analysis of FDI and the EXPORT behaviour) there were present two groups of industries with different patterns of correlation and with different coefficients. Moreover, the decompositions of the subpopulations of 92 industries of the Czech economy were in both cases nearly the same.

[7] The breakdown point is a characteristic of statistical estimators which indicates how large part of data may represent contamination without breaking the estimator, i.e. without causing a very large (or in the case of estimating the scale, very small) value of estimator. E.g. using arithmetic mean as the estimator of location we would assume that it gives a value somewhere at the centre of the cloud of data. Nevertheless, it is easy to see that a single (very) large value among the data may cause an arbitrary large deviation of the arithmetic mean from the centre of (the bulk of) data. We can compare this behaviour with the behaviour of median.

let us recapitulate the method of the estimator. We shall consider the following linear regression model:

$$Y_i = X_i^T \beta^0 + \varepsilon_i, \qquad i = 1,2,....,n$$

where Y_i is the value of response variable for the i-th case, $X_i \in R^p$ is the vector of factors (alternatively we can call them explanatory variables for the i-th case), β^o is the vector of regression coefficients and finally ε_i is the random fluctuation (for the i-th case). Then for an arbitrary $\beta \in R^p$ we shall denote by $r_i(\beta) = Y_i - X_i^T \beta$ the i-th residual at β. Further, we shall use $r_{(i)}^2(\beta)$ for the i-th order statistics among the squared residuals, i.e. we will have $r_{(1)}^2(\beta) \le r_{(2)}^2(\beta) \le .... \le r_{(n)}^2(\beta)$. Finally, let us define the least trimmed squares estimator of regression coefficients by the extremal problem:

$$\beta^{\{LTS\}} = \arg\min\{\sum_{i=1}^{h} r_{(i)}^2(\beta)\} \qquad (1)$$

where $n/2 \le h \le n$ and the minimisation is performed over all $\beta \in R^p$ (see e.g. Rousseeuw and Leroy [1987]). In other words, in this extremal problem we are looking for such an argument $\beta \in R^p$ for which sum of *h* smallest squared residuals is minimal. However, it is given only implicitly which indices have been taken into account. In a similar way, i.e. by an appropriate extremal problem, practically all robust estimators with high breakdown point (as the *least median of squares* ($\beta^{\{LMS\}}$), *S-estimator*) are defined . We shall, however, restrict ourselves on $\beta^{\{LTS\}}$. It follows immediately from (1) that $\beta^{\{LTS\}}$ takes into account only h observations and the rest of them come into the game only through the fact that they have to have the squared residuals larger or equal to $r_{(1)}^2(\beta^{\{LTS\}})$. Under rather general conditions $\beta^{\{LTS\}}$ is consistent and asymptotically normal (see Rousseeuw and Leroy (1987) or Víšek (1999)).

It is intuitively clear that carrying out the minimisation in (1) is possible only in some (simple) cases, e.g. when the number of observations is approximately less than 20. In all other cases we would have to find an approximation to the precise solution of (1). The initially proposed algorithm, which was based on deriving this approximate solution over the residuals of $\beta^{\{LMS\}}$ [8] , need not give good results [9]. We have developed an algorithm for evaluation of $\beta^{\{LTS\}}$ which proved to be more reliable. Moreover, it allows to create an idea how much the structure of data is intricate (see again Víšek (1996)). Of course, there is a question how to select *h*. Rousseeuw and Leroy (1987) showed that putting $h = \lfloor (n+1)/2 \rfloor + \lfloor p/2 \rfloor$ [10], we obtain maximal breakdown point, namely $(\lfloor (n-p)/2 \rfloor + 1)/n$. However, in practice it appears that we do not need maximal breakdown point and we can select *h* (much) larger. We usually select *h* ``sufficiently'' small to reach acceptable determination of model (say R^2 about 60%).

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[8] In accordance with Rousseeuw and Leroy (1987) and program PROGRESS or *S*-PLUS (which was for a long time assumed to be efficient),

[9] See Hettmansperger and Sheather (1992) and Víšek (1994) and (1996). For more information about the applications see Visek (1999a) and (1999b).

[10] Here the brackets [ ] denote the integer part of the value inside them; p is the number of exogenous variables.

Sometimes, the situation is such that when we deal with scale estimations for different values of h, we notice that rapid decrease of scale estimation for decreasing h at one point stops, or the decrease becomes mild with respect to the initial steep one. If, moreover, the h_0, which was selected according to these two rules, is such that for h's nearby this h_0 the model is stable in coefficients, we can assume that we have separated data into two parts. On one side there is the "proper" part and on the other side there remains the "rest", which may be considered to be a contamination or an another population, governed by a different model. Of course, the boundary is only exceptionally sharp.

5. The Robust Estimation - Model B'

After trying a number of variants of possible model of determinants for foreign direct investment, we have selected the following specification:

$$FDI_{it} / VA_{it} = \beta_0 + \beta_1*(K_{it}/L_{it}) + \beta_2*(\pi_{it}/L_{it}) + \beta_3* TFP_{it} + \varepsilon_{it} \quad \text{[model B']}$$

The estimation was taken from data ordered into a matrix containing 105 rows (i.e. 15 industries, each broken down into 7 years). The variables comprising observations were contained in columns (thus 5 columns in the above model B'). Five rows were not complete (some of its values were not available) and therefore we could work with 100 rows only. The estimated coefficients are shown in Table 3. In the first row of the caption we see the number of "cases", i.e. the rows that were included into the robust regression. We can see that the robust technique rejected at least 9 rows, i.e. the cases when the relationship between FDI in one industry and the list of explanatory variables (for the given year) was very different from the remaining body of observations. We can treat this as a "deletion of outliers". Table 3 also shows how the regression would change if the number of cases would decrease from 91 to 84. Of course, the R^2 statistics would be improving. However, what matters is the stability of coefficients.

Table 3: Estimation of regression coefficients (LTS technique)

No. of cases: →	82	83	84	85	86	87	88	89	90	91	OLS
Variable:											
Intercept	-7,74	-7,62	-7,57	-7,45	-7,48	-7,68	-7,72	-7,56	-7,40	-7,40	-6,31
π / L	5,88	6,06	6,35	6,27	6,18	6,03	5,92	6,14	6,57	5,94	-3,32
K/L	0,32	0,32	0,31	0,31	0,32	0,32	0,33	0,32	0,32	0,32	0,23
TFP	8,64	8,32	8,16	7,97	7,96	8,33	8,38	8,08	7,78	7,89	6,73

What becomes evident is that there was a change in the sign for the variable of profits per labour. Thus by applying the robust regression we have disposed of a bias caused, for example, by the presence of few important but untypical FDI cases that were targeted into industries that were highly unprofitable. It can be seen that if some 10% of observations are deleted from the data set, the coefficients become relatively stable and invariant to further deletion of "outliers". If we drop the number of observed cases from 91 to 82 the only important change is in the decreasing error of estimation (see Table 4).

Table 4: Estimation of variances of random fluctuations and coefficients of determination

No. of cases: →	82	83	84	85	86	87	88	89	90	91	OLS
σ^2	0.57	0.60	0.63	0.66	0.69	0.73	0.76	0.81	0.88	0.96	2.12
R^2 (%)	65.9	64.1	62.6	60.7	59.5	59.2	57.9	55.6	52.9	50.2	16.1

Moreover, as Table 5 shows, the cross-correlations of explanatory variables, as well as their quadratic and cubic powers, are not large and hence we may take into account also signs of explanatory variables. With the given specification it seems that we can give to the model a reasonable economic interpretation. The capital per labour variable plays the central role. It indicates that foreign investors were **not attracted primarily** by low Czech wages; thus they did not see much sense in investing into labour-intensive industries. Though a concentration on industries with top capital intensities (power plants, steel mills and general

chemistry) was not a typical strategy, the preference for technologies of the middle or upper middle rank of capital intensities was dominant. In fact this has been a strategy typical for the region of Central Europe for some 130 years. This variable can be interpreted as a primary "cause" of investment, consistent with the traditional economic theory of location based on factor endowments.

The positive sign of the K/L ratio is a paradox that is of major significance for both the present and the future FDI developments. It confirms that after 1994 there was a dramatic change in the outlook of foreign investors on investment opportunities in Czechia. As the acquisitions through privatisation were slowly depleting the stocks of viable firms, the investors concentrated more on green-field ventures. This caused another change in the investment strategy: instead of concentrating on labour intensive industries the investors preferred the investments into capital intensive firms and industries.

The parallel existence of TFP and the profit per labour, as remaining explanatory variables, support the hypothesis that the effective usage of both factors (capital and labour) is a phenomenon typical for industries with intensive presence of FDI. Just this criterion of efficiency, covering all factors, strikes the difference between the activities of foreign owners and domestic owners.

Table 5: Correlation matrix of explanatory variables

(Abbreviations in the table are as follows:
$\alpha = \mathrm{Pr}\,ofit / Labour$, $\lambda = Capital / Labour$, $\eta = Total\ \ factor\ productivity$)

Variable	α	α^2	α^3	λ	λ^2	λ^3	η	η^2	η^3
α	1	0.9	0.81	0.5	0.29	0.19	-0.06	-0.07	-0.08
α^2	0.9	1	0.98	0.45	0.23	0.12	-0.02	-0.03	-0.04
α^3	0.81	0.98	1	0.39	0.18	0.07	0	-0.01	-0.02
λ	0.5	0.45	0.39	1	0.92	0.85	-0.1	-0.1	-0.09
λ^2	0.29	0.23	0.18	0.92	1	0.99	-0.16	-0.15	-0.14
λ^3	0.19	0.12	0.07	0.85	0.99	1	-0.17	-0.15	-0.14
η	-0.06	-0.02	0	-0.1	-0.16	-0.17	1	1	0.99
η^2	-0.07	-0.03	-0.01	-0.1	-0.15	-0.15	1	1	1
η^3	-0.08	-0.04	-0.02	-0.09	-0.14	-0.14	0.99	1	1

Table 6: Results for LTS Robust Estimation – Selection of 82, 86 and 91 "cases"

Coefficient	Estimated coefficient	Estimated standard error	t-value	P-value
Model for 82 cases				
intercept	-7.7466	0.5587	-13.8655	0
π / L	5.8894	1.4252	4.1325	0.00009
K/L	0.324	0.045	7.2013	0
TFP	8.6429	1.1675	7.4032	0
Model for 86 cases				
intercept	-7.459	0.5957	-12.5224	0
PROF/L	6.2697	1.525	4.1112	0.000094
K/L	0.3159	0.0484	6.5296	0
TFP	7.9752	1.2422	6.4204	0
Model for 91 cases				
intercept	-7.4082	0.7037	-10.5282	0
PROF/L	5.9431	1.8142	3.2758	0.001514
K/L	0.3287	0.0579	5.6757	0
TFP	7.8897	1.4743	5.3514	0.000001

Table 7: List of Excluded Points

82:	**1,**	**2,**	**28,**	**31,**	**48,**	**49,**	**51,**	**59,**	**60,**	**67,**	**73,**	**76,**	**79,**	**82,**	**87,**	**90,**	**91,**	**100**
83:	1,	2,	28,	31,	48,	49,	51,	59,	60,	67,	73,	76,	79,	82,	87,	90,	91	
84:	1,	2,	28,	31,	48,	49,	51,	59,	60,	67,	73,	76,		82,	87,	90,	91	
85:	1,	2,	28,	31,	48,	49,	51,	59,	60,	67,	73,	76,			87,	90,	91	
86:	1,	2,	28,		48,	49,	51,	59,	60,	67,	73,	76,			87,	90,	91	
87:	1,	2,			48,	49,	51,	59,	60,	67,	73,	76,			87,	90,	91	
88:	1,	2,			48,	49,	51,	59,	60,	67,	73,				87,	90,	91	
89:	1,	2,			48,	49,	51,		60,	67,	73,				87,	90,	91	
90:	1,				48,	49,	51,		60,	67,	73,				87,	90,	91	
91:	1,				48,	49,	51,		60,	67,	73,				87,	90		

Remark: The first column indicates the number of rows in our data set (cases) used for estimation, the other columns then indicate the particular number of the row that was excluded from the given regression.

Table 8: Decoding of Deleted Rows into Industries and Years

Index	Industry	Year	Index	Industry	Year
1	Food, Tobacco	1991	2	Food, Tobacco	1992
28	Wood Processing	1991	31	Wood Processing	1994
48	Coke, Petrol.	1994	49	Coke, Petrol.	1995
51	Coke, Petrol.	1997	59	Rubber, Plastics	1991
60	Rubber, Plastics	1992	67	Build. Material and Glass	1992
73	Mechanical Machines	1991	76	Mechanical Machines	1994
79	Mechanical Machines	1997	82	Electrical Instruments	1993
87	Vehicles, Transport. Eq.	1991	90	Vehicles, Transport. Eq.	1994
91	Vehicles, Transport. Eq.	1995	100	Other Manufacturing	1997

As can be seen from comparing Table 8 with Table 11 (at the end of the paper), the majority of outliers that were dropped from estimation by LTS technique were of two kinds. Those where

the FDI was in one year either exceptionally large (especially in industries that are labour intensive) like into "vehicles" in 1991 and 1994, or exceptionally small (especially in industries that are capital intensive) like into "coke and petrol" in 1994, 1995 and 1997. The "exceptional" cases were determined by investment strategies different from the hypotheses tested. For example, the non-investment strategies into the coke and petrol industries were caused by one big investment in 1996 taking the control over the whole industry.

1. The Robust Estimation - Model A'

The alternative model, which we have estimated, was as follows :

$$\mathbf{FDI_{it} / VA_{it} = \alpha_0 + \alpha_1 * (K_{it} / L_{it}) + \alpha_2 * (\pi_{it} / L_{it}) + \alpha_3 * IRS_{it} + \alpha_4 * PPI_{it} + \varepsilon_{it}} \qquad \textbf{[model A']}$$

In its original estimation by OLS this was the only statistically significant specification - thanks to the correlation between FDI and the positive evolution in prices (PPI). For interpreting this relationship we can come out with two hypotheses. Firstly, we can presume that the foreign investors knew best where the potential for the terms of trade improvement was the highest. Secondly, that the presence of FDI caused improvements in quality (or market structure) what was instrumental in increasing the level of prices. The link between the FDI and the favourable price developments became one of the crucial characteristics revealed by our study. As to the other explanatory variables, we can see that the variable of profit per labour now has a positive sign that is compatible with an economic intuition.

A significantly more credible explanation of FDI, taken from the economic point of view, was received only by using the LTS technique. In our experiments we had to exclude 12 rows from the data set until we brought the estimation into a stable form. Then we continued in a stepwise manner by dropping another four rows, as we worked finally with 85 cases. During all these steps the profits become significant and the sign of their coefficient turned into positive. The increasing returns to scale became also statistically significant. A high correlation between the TFP and the price deflator (that is why we could not include both together) is a signal that the success of foreign investors in the efficient usage of both factors was primarily caused by improvements in quality and marketing techniques which pushed the prices up. Thus we have estimated not only the causes but also a part of the effects of FDI.

Table 9 – Estimation of regression coefficients (LTS technique – model A')

No. of cases: →	84	85	86	87	88	OLS
Variable:						
Intercept	-2,04	-2,06	-2,07	-2,93	-2,87	-1,35
K/L	0,49	0,54	0,54	0,55	0,54	0,03
π / L	0,08	0,07	0,07	0,07	0.07	-0,02
IRS	0,37	0,43	0,44	0,46	0,43	0,22
PPI	3,36	3,47	3,51	3,43	3,30	2,39

Table 10: Results for LTS Robust Estimation – Selection of 84 and 88 "cases"

Coefficient	Estimated coefficient	Estimated standard error	t-value	P-value
Model for 84 cases				
intercept	-2.0425	0.6673	-3.0607	0.003016
K/L	0.4936	0.0956	5.1623	0.000002
π / L	0.0774	0.0155	4.9872	0.000004
IRS	0.3696	0.1215	3.0425	0.003184
D94	3.3602	0.5855	5.7396	0
Model for 88 cases				
intercept	-1.8743	0.7321	-2.5602	0.012272
K/L	0.536	0.1024	5.2355	0.000001
π / L	0.0748	0.0169	4.4184	0.00003
IRS	0.4352	0.1291	3.3695	0.001144
D94	3.3039	0.6393	5.1683	0.000002

Table 11: Estimations of variances of random fluctuations and coefficients of determination

Number of cases: $\rightarrow$	84	85	86	87	88	OLS
σ^2	0.7639	0.7149	0.6842	0.6565	0.6287	2.22
R^2 (%)	59.21	61.66	63.14	64.29	64.37	13.2

EPILOGUE

We have found in this study that there have been only very weak causal links in the Czech economy for the attraction and the success of FDI. The presence of FDI in a particular industry could have been explained only partially. There was a strong random (or here undisclosed) influence on the choice of investment ventures.

Contrary to the findings concerning the trade specialisation pattern before 1996, the FDI seems to be attracted more by capital intensive production. Most probably the stabilisation of the Czech economy after 1994 resulted in a break in the factor comparative advantages. Labour is no longer the dominant factor that offers an explanation of Czech economic (comparative) advantages. Its place was slowly replaced by physical capital. As was found in the analysis of determining factors of Czech trade (Benacek, Zemplinerova (1999)), there was yet emerging another important factor after 1995 – the human capital.

On the other hand, the majority of phenomena decisively distinguishing the firms (industries) with FDI from indigenous firms can be found on the side of effects of FDI. Generally the presence of FDI means higher efficiency (e.g. profitability, total factor productivity or, increasing returns to scale) and higher competitiveness (e.g. higher quality or terms of trade). If this trend would continue, the gap between the foreign and the indigenous enterprises would be further widening. As a consequence, we cannot expect that indigenous firms would enjoy the same natural "comparative advantages", which were observed to have been developing in firms with FDI. The benefits of FDI could be then internalised exclusively in recipient enterprises and the indigenous firms could fall out off the competition.

The fast growing importance of FDI in the Czech economy, their profitability and re-investment activities, can lead to a prediction that approximately in 2003 the foreign-owned enterprises will become the decisive actors in the Czech economy. This will be a final closure

of the "Czech way" of privatisation that dominated the domestic economic policy-making during 1990-96. It is already evident that the privatisation strategies, that were set for supporting the indigenous ownership, have failed in the majority of its objectives. It was generally believed in the local political circles that the prescriptions for bringing a transient economy into high growth and prosperity pivot around the macroeconomic stabilisation, liberalisation of trade and prices, and privatisation defined as a de-etatisation (i.e. the release of the capital assets out of the hands of the State). While the Czech macroeconomic policy was extremely successful throughout 1990-96, the poorly implemented privatisation brought an extremely heavy price on the whole economy.

The Czech approach to privatisation was based on the belief that any initial de-etatisation (redistribution) of property was a sufficient condition for finding final owners guaranteeing an optimal usage of given assets. It was argued theoretically, by using both the theory of factor location and the Coase theorem, that the initial misallocation of resources did not matter, once market negotiations and trade could lead to their more efficient redistribution. The desired outcome would require that the transaction costs be very low both in acquiring the liquidity and in the equity trading. It was somehow forgotten that there were two additional essential conditions: that the property rights are clearly defined and enforceable, and the capital markets are efficient. Once that was not achieved in both cases because the drive of economic actors for the re-distribution of property found it contrary to their objectives, the first two conditions became aggressively counter-productive. They headed to soft credits, debts and heavy government bailouts.

The crucial importance of the Government throughout the process of privatisation caused that the capital markets were not developed and the whole privatisation was dominated by the interaction with bureaucracy. The role of bureaucrats, either in semi-state banks or in public administration (ministries) became more important than the performance of markets. Then the restructuring became too demanding and uncertain, if compared with an easy alternative represented by asset stripping. A large part of the indigenous firms even switched in their objectives from redistributional aims to destructive aims.

As the Government was too heavily involved in the privatisation, both in orchestrating the deals and in guaranteeing the bailouts, the moral hazard prevailed at the level of decision-making. Under such arrangements also the privatisation of banks, introduction of strict bankruptcy laws and the state supervision over the capital markets would be a threat to the stability of the Government. That was why such decisions were constantly postponed until the break-out of the financial and economic crisis in April 1997.

Some important changes were introduced in the economic policy afterwards and some more are still pending (see Benacek (2000)). It is undisputed now that it is the foreign capital that became the engine of growth in the Czech economy. However, the FDI incentives schemes (implemented since 1998) are not the most important factor behind the acceleration of FDI inflows since 1999. What is more important is the stabilisation of the economy after 1999, though the country had to pay for it by a deep recession.

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