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Sectoral Productivity – FDI Allocation Nexus in Bulgaria after the 2008 Global Crisis

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Abstract: Foreign direct investment (FDI) influx in Bulgarian economy has been studied comprehensively since the start of market transition in early 1990s. FDI were expected to be a major driver of the resurrection and restructuring of Bulgarian post-communist economy. Fifteen years after obtaining full EU membership of Bulgaria, this topic continues to receive an extraordinary degree of interests by economists especially in the enhancing processes of business globalization during the last decade. The major aim of this study is to suggest some preliminary results of an empirical analysis of the links between sectoral labor productivity and the intensity of foreign direct investment allocated to various sectors of Bulgarian economy. For this purpose, several specifications of an econometric model are estimated by panel data for the period 2008-2021. Annual data is used for the economic sectors defined in the framework of the International Standard Industrial Classification of economic activities (ISIC-2008). Statistically significant results are obtained for various effects of the sectoral allocation of FDI in the Bulgarian economy on the level of sectoral labor productivity.

Keywords: foreign direct investment; sectoral allocation; sectoral dynamics; Bulgaria

JEL Classification: O40; F21

1. Introduction

Research interest on FDI inflows and operation issues in Bulgaria date back to the 1990s – a decade frequently called "early transition period" – when such investments were exceptionally needed for the goals of economic resurrection and restructuring of Bulgarian post-communist economy. Such expectations were kept at a high level during a period of active economic development induced of the EU accession process (2001-2006) when a significant FDI influx has been observed. Currently, over thirty years after the start of economic reforms and market transition the interest in this topic did not weaken especially in conditions of enhancing globalization of the European economy where the Bulgarian one needs to integrate.

An overview of FDI influx in Bulgaria during the middle of that decade showed no substantial interest by strategic foreign investors unlike the one observed in Central European countries (Koparanova, 1998). Using firm-level panel data Konings (2001) investigates FDI effects on productivity performance of domestic firms in Bulgaria, Romania and Poland as CEE transition economies applying GMM techniques. Taking into account any potential endogeneity of the ownership, this analysis found no evidence of positive spillovers to domestic firms but indications for negative ones in Bulgaria and Romania. The author infers for "a negative competition effect that dominates a positive technology effect" (Konings, 2001).

At the end of the 1990s an increase of FDI inflows was observed, especially by EU based international companies, that were oriented mainly towards industry, financial sector, and to some extent the trade. Using panel data for 11 manufacturing sectors for 1998-2001 about the distribution of FDI in Bulgarian manufacturing sectors, Mintchev et al (2002) provide evidence that resource-intensity based motivation is a factor of increased foreign investments in manufacturing sectors, irrespective of the branch size. Moreover, the export potential of these sectors was identified as a stimulus for EU investors' interest in Bulgarian industry. Further advancing to the period of EU accession, an analysis of the spatial variation of GDP per capita in Bulgaria for the period 1999-2005 provides empirical evidence for a significant positive net effect of the spatial concentration of FDI on the regional income level (Boshnakov, 2008).

Radulescu et al. (2016) have studied the influence of political and economic institutional factors as well as the quality of labor force on the level of foreign direct investments in Bulgaria and Romania. Noting that the two countries succeeded to attract large amounts of FDI only for a short period of time during the mid-2000s (displaying a very friendly investment climate, e.g. low corporate tax rates), the analysis – utilizing yearly data for 16 years (1999-2014) – reveals that other circumstances hindered the sustainable interest of foreign investors, like political and fiscal instability, low quality of the infrastructure, weak governance and corruption spreads (Radulescu et al., 2016). Using nonlinear autoregressive distributed lag models with annual data for the period 2000-2018 Kurtovic et al. (2021) found evidence for an asymmetric impact of FDI stock on the mean wage levels in Bulgaria and Slovenia. Ultimately, this analysis leads to the conclusion that the growth of net average wages in South East European countries, as a result of enhancing the economy competitiveness and increasing productivity, "depends on policies and measures to attract FDI".

Vuckovic et al. (2020) explore the linkages between business environment and inward FDI for a sample of 5 European emerging economies: Poland, Slovenia, Bulgaria, Romania and Serbia. Implementing regression models the authors identified significant linkages between FDI inflows and some "Ease of Doing Business" indicators, controlling for macroeconomic performance, business regulations, taxation, and market capitalisation. Popescu and Brostescu (2022) studied the dynamics of FDI stock in Bulgaria and Romania in the period 1995-2018 when econometric evidence provides explanation for some determinants of FDI growth in these countries. Particularly for Bulgaria such determinants were found to be the increase in exports, trade balance and balance of payments. Additionally, higher levels of country economic freedom score (indicating enhanced freedom of the business environment), lower levels of taxation, and limited corruption practices were found to increase FDI inputs in Bulgarian economy.

The paper suggests some preliminary results of an econometric analysis of the level of labor productivity of the main economic sectors as a function of the sector allocation of FDI in Bulgarian economy. It is generally considered that the influx of FDI into a host economy contributes considerably to its development through a range of positive effects (e.g. technological renewal, know-how transfer, export facilitation, and other positive spillover effects) but could also induce some negative externalities as well. The analysis here covers the period since the start of the global crisis in 2008 till the global pandemic crisis of 2020-2021.

2. Data and Methodology

The econometric models in the current study are estimated using official data for the main economic sectors as provided by the Bulgarian National Statistical Institute (NSI) for the period 2008-2021 (data for 2021 are preliminary and subject to revision). After a medium-term period of accelerated growth during the EU accession (2001-2007) the FDI stock reached a level of about 20 bn EUR during the crisis of 2008-2009. This growth continued during the post-crisis revival so at the end of the second decade FDI stock level in Bulgaria reached 28 Bn EUR (about 40% of the GDP for 2021).

Data for the economic sectors are provided by Bulgarian NSI following the international standard according to the Classification of Economic Activities (CEA-2008), particularly in the framework of the so called "Structural Business Statistics" (NSI, 2022a; 2022b).

- B Mining and quarrying
- C Manufacturing
- D Electricity, gas, steam and air conditioning supply
- E Water supply; sewerage, waste management and remediation activities
- F Construction
- G Wholesale and retail trade; repair of motor vehicles and motorcycles
- H Transportation and storage
- I Accommodation and food service activities
- J Information and communication
- L Real estate activities
- M Professional, scientific and technical activities
- N Administrative and support service activities

(Sector K "Financial services" is omitted due to data limitations).

The data used for the analysis comprises of a panel of N=12 sectors with T=14 annual observations per each variable for each sector which provides a pool of 168 observations. However, when a lagged variable is entered as a predictor, the length of the time series shrinks to 13 so the panel data pool is restricted to 154 observations.

A linear specification of the multivariate regression model was used in the form:

$$Y_{i,t} = c_0 + c_1 X_{1i,t} + c_2 X_{2i,t} + c_3 X_{3i,t} + e_{i,t} \quad (1)$$

where: c_j are the coefficients (model parameters) to be estimated (j = 0, …, k); $Y_{i,t}$ is the dependent variable; $X_{j,i,t}$ are the independent variables (j = 1, …, k); $e_{i,t}$ is the disturbance term. However, due to the panel nature of the data this term is assumed to be a "composite error" variable that has the following structure: $e_{i,t} = a_i + b_t + u_{i,t}$, where a_i (I = 1, …, s) is an unobserved sector effect (time-constant sector-specific component), b_t (t = 1,… ,T) is an unobserved time effect (annual time intercept), and $u_{i,t}$ is an idiosyncratic error.

In order to check for a nonlinearity, double-log specification was also used in the form:

$$Ln(Y_{i,t}) = d_0 + d_1 Ln(X_{1i,t}) + d_2 Ln(X_{2i,t}) + d_3 Ln(X_{3i,t}) + e_{i,t} \quad (2)$$

In order to capture any eventual trend effects in the dynamics of the variables, time dummy variables have been introduced in the model. Since the sectors chosen cannot be considered as a random sample a fixed-effects panel regression model has been estimated involving sector dummy variables as well. This way, the model estimates have been obtained by the "least squares dummy variables" (LSDV) method. Here we cannot assume the independent variables to be uncorrelated with the unobserved sector-specific effect, so the chosen estimation method is recommendable in such a case. Moreover, in the current study the panel used is not only short (fixed T) but also N is small, so most of the diagnostic tests for panel regression are not valid. Also, the properties of the random effects estimator with small N, even if T is large, are generally unknown (Wooldridge, 2013, p. 494).

For the purposes of the current analysis two independent variables have been constructed in order to evaluate the impacts of the FDI allocation on the labor productivity of the economic sectors. They should capture any specifics of the "volume" and "intensity" effects of the FDI accumulation at the various sectors:

X1.1- FDI capital intensity of the sector (measured by the average FDI per one employed in the sector, recalculated from thousand EUR to thousand BGN).

X1.2- relative scale of FDI as compared to the accumulated Fixed Assets (FA) in the sector (measured by the ratio of the accumulated FDI to the FA);

Additional control variables have been introduced

X2- cost efficiency of the sector (measured by the production costs per 100 BGN of revenues in the sector);

X3- scale of the sector (measured by the number of employed in the sector).

The alternatives of the econometric model were estimated using a dependent variable that measures the annual level of labor productivity in the economic sectors:

Y- Annual revenues per employed in the sector (in thousand BGN).

Two hypotheses are tested in the sense that each of these alternative measures of FDI influx into the sectors has particular effect on the level of sectoral productivity.

3. Results

3.1. Estimated Model (1) with Main Regressor: "FDI per Employee"

Table 1 presents the results of the estimated linear specification (1) with all variables (independent and dummy) entered in the model. Very few diagnostic tests have been implemented as far as the dataset does not contain neither long time series ($T = 14$) nor large sample of panel units ($N = 12$).

The results of the partial F-tests show that the choice of fixed effects specification is correct, as much as the estimated LSDV group intercepts a[i] prove to vary significantly. The residuals showed significant serial correlation and heteroscedasticity, so robust (HAC) standard errors have been employed for the t-tests. This model provides evidence for a statistically significant net effect (at 5% level of significance) of the independent variable "FDI-per-employee" *ceteris paribus*, i.e. after isolating the sector- and time-specific effects as well as controlling for sectors scales and cost efficiency level.

Table 1. Estimated model (1), DV: Sectoral revenue per employed; Regressor: FDI per employee

	Coefficient	Std. Error*	t-ratio	p-value
Intercept	169.483	30.0658	5.637	0.0002
X1.1- FDI per employed	0.737	0.256	2.875	0.0151
X2- Cost per 100 of Revenue	−0.648	0.192	−3.366	0.0063
X3- Size (N.Employed)	−6.31e-05	0.00011	−0.571	0.5791

* Robust (HAC) standard errors
Joint test on named regressors – Test statistic: F(16, 11) = 5.586e+12
with p-value = P(F(16, 11) > 5.586e+12) = 1.167e-68
Robust test for differing group intercepts – Null hypothesis: The groups have a common intercept
Test statistic: Welch F(11, 61.1) = 53.1 with p-value = P(F(11, 61.1) > 53.1) = 4.56e-27

3.2. Estimated Model (1) with Main Regressor: "Ratio FDI / Fixed Assets"

Table 2 presents the results of the estimated linear specification with all variables (independent and dummy) entered in the model after replacing the first alternative for FDI intensity by the second one – the ratio of FDI to fixed assets in economic sectors.

Table 2. Estimated model (1), DV: Sectoral revenue per employed; Regressor: Ratio FDI to FA

	Coefficient	Std. Error*	t-ratio	p-value
Intercept	182.342	46.020	3.962	0.0022
X1.2- FDI / Fixed Assets	23.293	9.211	2.529	0.0280
X2- Cost per 100 of Revenue	−0.557	0.260	−2.142	0.0554
X3- Size (N.Empoyed)	−0.000148	0.000144	−1.030	0.3250

* Robust (HAC) standard errors
Joint test on named regressors – Test statistic: F(3, 11) = 13.53
with p-value = P(F(3, 11) > 13.53) = 0.000519847
Robust test for differing group intercepts – Null hypothesis: The groups have a common intercept
Test statistic: Welch F(11, 61.0) = 181.24 with p-value = P(F(11, 61.0) > 181.24) = 3.00e-42

The results obtained using the second alternative for the sectoral FDI intensity confirm those from the first one. Fixed effects specification proves to be an appropriate one (the null hypothesis for a common group intercept is strongly rejected). Implementing robust standard errors again, the model shows a significant net effect of the predictor "Ratio of FDI to Fixed Assets" on the sectoral labor productivity at 5% level of significance, other things equal.

3.3. Estimated Model (2)

Table 3 presents the results of the estimated log-log model, also including sectoral and time dummy variable. Both alternatives for the sectoral FDI intensity are used.

After checking for robustness of the specification, the nonlinear model confirms the statistically significant net effects of the FDI regressor for both of its alternative proxies. The effect of "FDI per employee" is found to be significant even at 1% level.

Table 3. Estimated model (2), DV: Ln(Sectoral revenue per employed)

	Coefficient	t-ratio‡	Coefficient	t-ratio‡
Intercept	6.144	3.896***	6.999	3.351***
Ln(X1.1)- FDI per employee	0.132	3.518***	–	–
Ln(X1.2)- FDI / Fixed Assets	–	–	0.140	2.627**
Ln(X2)- Cost per 100 of Revenue	−0.259	−1.623	−0.167	−0.7986
Ln(X3)- Size (N.Employed)	−0.0689	−0.7485	−0.133	−1.017
** Significant at 5%; *** Significant at 1%; ‡ Based on robust (HAC) standard errors.				

After checking for robustness of the specification, the nonlinear model confirms the statistically significant net effects of the FDI regressor for both of its alternative proxies. The effect of "FDI per employee" is found to be significant even at 1% level.

4. Discussion

After controlling for cost efficiency and scale of the sector, empirical evidence is observed (at acceptable level of significance) for a significant net effect of each alternative predictor of the sectoral labor productivity approximated by the revenue per employee, namely:

1. the FDI capital intensity of economic sectors (measured by the accumulated FDI per one employed in the sector);
2. the relative scale of FDI accumulated in economic sectors compared to the level of sectoral Fixed Assets (measured by the ratio of FDI to the Fixed Assets).

These results confirm a variety of effects of inward FDI on sectoral development identified by different studies – for example, Egger and Pfaffermayr (2001) use a small panel of Austrian manufacturing sectors to implement a CES production function by which evidence is provided for "productivity improving effects of inward FDI. Emako et al. (2022) also find that FDI boosts the sectoral labor productivity in developing countries for the period 1990-2018, however, by facilitating "structural change". Juda and Kudo (2020) utilize unbalanced firm-level panel data for the period 2000-2015 and estimate positive spillover effects of the presence of foreign firms on the labor productivity of local firms in the same industry. However, further investigation of more detailed effects is necessary as far as these authors find negative results for the "backward linkages" of FDI and labor productivity of domestic firms.

5. Conclusions

There is no doubt that the concentration of FDI in particular economic sectors is of certain importance for their stability in the turbulent period of post-2008-crisis and the following development after 2014-2015. As a small open economy Bulgaria is not an isolated case and the observed developments are similar to those at the other Eastern European countries that are new EU member states and need to operate in the common EU market place. Various analyses have been conducted on a range of issues concerning the effects of FDI influx in Bulgarian economy, however, rarely empirical evidence has been provided yet for effects evaluated using data at sectoral level. The current paper attempts to contribute to the

empirical analyses of foreign investment effects in a new EU member state during the second decade of the 21st century. Although such analysis could be performed in a more comprehensive econometric framework, its results – although of preliminary nature – are indicative about the significant interrelation between sectoral labor productivity level and the degree of FDI concentration in Bulgarian economic sectors.

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Conflict of interest: none

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