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FDI and Macroeconomic Policies in Central and Eastern European Countries

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Abstract: Central and Eastern European countries have turned to external sources, foreign direct investment (FDI), in the hope of enhancing their economic growth. Has it worked? The purpose of this paper is to estimate the effects of FDI and domestic investment on economic growth, along with the effects of fiscal and monetary policy. A production function approach is employed with panel data over the 1992-2007 period, which extends the time period relative to other studies. The results, using various estimating techniques, indicate that both FDI and domestic investment are statistically significant determinants of economic growth; as well as prudent fiscal and monetary policy.

Keywords: economic growth, production function approach, foreign direct investment, panel data, fixed effects.

JEL Classification: 016 and O40

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Introduction

The countries of Central and Eastern Europe recently have experienced wide swings in economic growth. When the economic transition to more western-type economies began, during the early 1990s, almost every country experienced negative per capita growth, often in double-digits. By the mid-1990s the economies in this region started to stabilise. Between 1997 and 2007, the average country's real per capita GDP growth was a remarkable 68.5 percent (calculated by authors using data from

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the World Bank, World Development Indicators (WDI)). The countries included in this study are: Albania, Bulgaria, Croatia, Czech Republic, Hungary, Estonia, Latvia, Lithuania, Macedonia, Poland, Romania, Slovak Republic, and Slovenia.

Along with the growth in GDP, this region experienced a dramatic increase in foreign direct investment (FDI). In 1993, FDI inflow was $5.7 billion, but increased to $67.7 billion by 2007; the stock of FDI also increased rapidly from $15.4 billion in 1993 to $580.8 billion by 2007. As a share of the region's GDP, the flow of FDI more than doubled rising from 2.2 percent in 1993 to 5.6 percent in 2007; the stock of FDI increased dramatically from only 6.1 percent in 1993 to 47.6 percent in 2007 (calculated by authors using data from the United Nations Conference on Trade and Development (FDI-STAT)).

FDI, however, can have both benefits and costs. One important benefit is the transferring of resources – capital, new technology, and modern management practices – from the home country to the host country. Another benefit is increased employment, if the foreign investor chooses to hire and train host country workers. A third benefit is increased competition between the foreign firm and domestic firms producing similar products. In order to compete, domestic firms must become more efficient which improves national output.

These benefits, however, do not come without certain costs. Sometimes, for example, FDI only creates low-level jobs for host country workers, while the foreign firm places its nationals in decision-making positions. The competition that FDI intended to stimulate may not materialise because local firms are not placed on a level playing field when the government provides only the foreign firm with tax benefits or various other subsidies. In addition, FDI may alter a country's social structure by introducing behaviors that run counter to its culture (Ram and Zhang, 2002). Nevertheless, most studies of FDI have found that, on balance, the positive effects of FDI outweigh the negative effects.

The purpose of this paper is to examine the effects of FDI on Central and Eastern European Countries using a dynamic growth model and panel data over the 1992-2007 time period. In addition to FDI and domestic investment, we attempt to capture the effects of fiscal and monetary policy. The estimates over various estimation techniques remain stable, indicating a significant role for both FDI and domestic investment as well as highlighting the importance of prudent fiscal and monetary policy. The next section reviews the literature, both the economic growth literature and the literature on FDI. Section three describes the growth model, section four presents the empirical estimates, and the final section provides conclusions.

Literature Review

The economic growth literature, dating back to the 1950s, offers various models to analyze the determinants of growth. None of these initial models considered FDI separately as a determinant, although investment is clearly an important factor. By the early 1990s, researchers had decomposed investment into human and physical capital, with results that strongly support the theoretical model. Around this same time other researchers introduced FDI specifically into their models. Recent contributions to the growth literature have focused less on modifications to existing models and more of exploring the data with newer estimation techniques, such as those used in analyzing panel data.

Economic Growth Literature

Solow's (1956) neoclassical economic growth model spawned numerous studies as researchers attempted to quantify how various economic factors affected growth. Solow posited an aggregate Cobb-Douglas production function

$$Y(t) = K(t)^{\alpha}(A(t)L(t))^{1-\alpha} \quad 0 < \alpha < 1 \tag{1}$$

where Y = aggregate output (GDP), K = capital, L = labor, and A = level of technology. Both L and A were assumed to grow exogenously at rates n and g

$$L(t) = L(0)e^{nt} \tag{2}$$

$$A(t) = A(0)e^{gt}. \tag{3}$$

Initially, the empirical estimates produced elasticities of output with respect to capital that were substantially larger than the theoretic model would predict (de Mello, 1997). Some researchers argued that the larger than predicted magnitude provided evidence of endogenous growth leading to the conclusion that other explanatory (omitted) variables should be included in the model. One solution, proposed by Mankiw, Romer and Weil (1992), was to include human capital in the production function. They found that not only was human capital a significant explanatory factor, but also that its inclusion lowered the elasticity of output with respect to physical capital to the theoretical predicted level.

Another proposed solution, which is subsequently used in this present paper, was based on the idea that certain country-specific variables (e.g., technology, production processes, socio-economic factors, economic policy) had been omitted. Since those variables are largely unobserved but imbedded in the A(t) term, researchers changed the econometric model from a pooled ordinary least squares regression (OLS) to a more sophisticated panel data model that accounted for country-specific fixed effects. Islam (1995) reformulated the growth equation into a dynamic panel data model and obtained estimated output elasticities with respect to capital that were lower than Solow's (1956) and similar to Mankiw, Romer and Weil, (1992) without including a human capital measure. In addition, Islam's results provided evidence of conditional convergence, i.e., controlling for convergence when countries exhibit different steady states; and suggested that country officials could improve growth with active policy intervention that affected the A(t) term. Bassanini, Scarpetta, and Hemmings (2001) extended the panel data approach by specifically incorporating measures of fiscal and monetary policy. They found, inter alia, that high variability of inflation (capturing monetary policy) reduced growth, but the size of government variable (capturing fiscal policy) changed signs in different specifications of the model.

Foreign Direct Investment

Various approaches have been used to assess the role of foreign direct investment (FDI) in the economic growth of countries. These include the (i) aggregate production function framework, (ii) intertemporal utility maximization framework, and (iii) case study approach.

Ram and Zhang (2002) employed an aggregate production function and derived a Solow-type growth equation, where the dependent variable was the growth of real GDP. Along with labor (measured as population growth), and capital (investment as a share of GDP); they included a term to test for convergence (initial income); and a term for human capital (mean years of education). To explore the effect of FDI, each regression contained a different proxy measure for FDI: the growth rate of FDI, the growth rate of FDI as a share of GDP, and the level FDI as a share of GDP. The annual average over the period 1990-1997 was calculated for each variable, so the coefficients are group mean estimates of the 85 countries in the sample. In the various estimated versions of the OLS regression, FDI was always positive and almost always significant. They concluded that a measure of FDI is an important explanatory factor of economic growth. They also conducted a joint test for the null hypothesis of no specification error and homoskedasticity and found that their parsimonious model did not have any major specification problems. They did not control for unobserved differences among countries.

Neuhaus (2006), however, did take into account unobserved country differences using a similar Solow-type aggregate production function in a dynamic panel data model. His dependent variable was the change in the log of real per capita GDP. As explanatory variables he included a convergence term (the lagged dependent variable); the log of the inward stock of FDI; the log of domestic investment after netting out FDI inflows; and various policy variables such as the size of government (log of government expenditures as a share of GDP) and inflation volatility (the standard deviation of inflation over a moving three-year period). Instead of using pooled OLS to estimate the model, Neuhaus employed a panel data estimation technique – pooled mean group estimator, which addresses concerns of heterogeneity and omitted variable bias. The variants of the estimated equation, on 13 Central and Eastern European countries over the period 1990-2002, all produced positive and significant coefficients on both the FDI variable and the domestic investment variable. Because Neuhaus's estimation approach used up substantial degrees of freedom, he only estimated one policy variable per specification, then focused primarily on the benchmark equation without the policy variables.

Instead of the aggregate production function framework, Borensztein, De Gregorio, and Lee (1998) used an intertemporal utility maximizing approach to derive a growth equation where the dependent variable was output growth and all the independent variables were levels. These variables included a convergence term – initial GDP, FDI flow, human capital (measured by years of schooling), an interaction term of FDI and human capital, and various other terms to capture country specific circumstances. The model was estimated for 69 developing countries over the 1970-1989 period using the seemingly unrelated regression technique (SUR). They found that FDI generally had a negative effect on growth, but that the interaction term had a positive effect. They interpreted this result as showing that all countries with a level of schooling higher than the average benefited from FDI while those without sufficient human capital do not benefit from FDI. Various versions of their model consistently confirm the complementarity of FDI and human capital.

Nair-Reichert and Weinhold (2001) estimated the effects of FDI for 24 developing countries over the 1971-1995 period using both a level model and a dynamic model. Their results with respect to FDI were mixed depending on the estimating technique and the specific interaction term included (human capital or the openness of the economy). They proposed using a mixed fixed and random effects estimator to address the issue of heterogeneous long-run coefficients.

Several researchers have analyzed how FDI affects individual countries. For example, Tytell and Yudaeva (2006) focused on four transition countries – Russia, Ukraine, Poland and Romania – to explore whether FDI has positive or negative spillover effects on domestic investment. They began by estimating a Cobb-Douglas production function, using firm data, for each country over the period 1998-2003. They constructed an FDI density variable – a measure of weighted labor employed in firms with FDI (by sector and region) relative to total labor (by sector and region). The weights varied from 0.1 to 1 depending on the share of foreign ownership. Equations for output, total factor productivity, and the capital to labor ratio were estimated. They concluded that the effect of FDI is mixed depending on the institutions of the country, the amount of FDI received, and importantly the region of the country. In general, the spillover effects on domestic firms were positive as these firms responded to increased competition by becoming more productive, albeit with a lag of at least one year.

Hunya and Geishecker (2005) employed a gravity model for an unbalanced panel of 27 bilateral reporting and partner countries to explore the effects of FDI on individual countries in Central and Eastern Europe. Their results indicated that workers in the non-manufacturing sector benefited more than workers in the manufacturing sector. Further analysis using a Tobit model for low-, medium-, and high-skilled workers indicated low- and high-skilled workers benefited from FDI, while the demand for medium-skilled workers was reduced, particularly in Latvia and Romania.

When the issue considered was whether FDI crowds out domestic investment, two papers have used a cointegration approach, which estimates the specific effects of FDI over time for each country. One paper by de Mello (1999) analyzed data from 1970-1990 for 32 countries; the other paper by Apergis Katrakilidis and Tabakis (2006) analyzed 30 countries over the 1992-2002 period. Both papers found the results to be mixed with more technological advanced economies showing that FDI appears to be substitutable with domestic (old) capital; whereas FDI in less technological advanced countries exhibits some degree of complementarity with domestic capital. The issue of substitutability versus complementarity is beyond the scope of this paper.

The various approaches to estimating the effects of FDI generally confirmed the significance of FDI, but results varied by the sample of countries analyzed.

The Model

The model employed in this paper follows the neoclassical production function approach and the work of Newhaus (2006) along with Bassanini, Scarpetta, and Hemmings (2001). Consider the production function

$$Y(t) = K_d(t)^{\alpha}\, K_f(t)^{\beta}\, (A(t)L(t))^{1-\alpha-\beta} \tag{4}$$

where Y(t) is real aggregate output at time t, $K_d(t)$ and $K_f(t)$ are domestic investment and foreign direct investment, respectively, L(t) is labor, and A(t) is divided into two components reflecting the state of the economy (see below): P(t) measured by different government policy variables, and (t) the level of exogenous technological progress.

This production function can be rewritten in real per capita (labor) terms as

$$y(t) = A(t)^{(1-\alpha-\beta)}\, k_d(t)^{\alpha}\, k_f(t)^{\beta} \tag{5}$$

where $y(t) = Y(t) / L(t)$, $k_d(t) = K_d(t) / L(t)$, and $k_f(t) = K_f(t) / L(t)$.

Based on Solow (1965), Mankiw et al. (1992), and more recent researchers, L and A are assumed to grow at rates n and g, respectively (see equations 2 and 3), then the growth in k over time can be written as

$$\dot{k}_d(t) = s_d(t)y(t) - (n(t) - \delta)k_d(t) \tag{6}$$

$$\dot{k}_f(t) = s_f(t)y(t) - (n(t) - \delta)k_f(t) \tag{7}$$

$$L(t) = L(0)e^{nt} \tag{8, same as 2}$$

$$A(t) = P(t)\ (t) \tag{9}$$

$$(t) =\ (0)e^{gt} \tag{10}$$

$$\text{Ln } P(t) = \rho_0 + \Sigma_j\, \rho_j \ln X_j \tag{11}$$

where s_d and s_f are the rates of domestic and foreign capital investment (saving), δ = the constant rate of depreciation, and the dot over a variable signifies a derivative with respect to time. This system of equations then can be solved to obtain the steady state growth path for domestic and foreign investment.

$$k^*_d(t) = A(t)\ [(s_d(t)^{(1-\beta)}\ s_f(t)^{\beta}) / (n+g+\delta)]^{1/(1-\alpha-\beta)} \tag{12}$$

$$k^*_f(t) = A(t)\ [(s_d(t)^{\alpha}\ s_f(t)^{(1-\alpha)}) / (n+g+\delta)]^{1/(1-\alpha-\beta)} \tag{13}$$

By substituting equations (12 and 13) into the per capita production function (5), the steady state growth path of y*(t) is derived.

$$y^*(t) = A(t)\ s_d(t)^{(\alpha/1-\alpha-\beta)}\ s_f(t)^{(\beta/1-\alpha-\beta)}\ (n+g+\delta)^{(-(\alpha+\beta)/1-\alpha-\beta)} \tag{14}$$

If all the countries in central and eastern Europe were in their steady state, this equation (14) would be appropriate. But it does not seem likely that countries are on their long-run steady-state growth paths, so the transitional dynamics have to be taken into account. Following Islam (1995) and Neuhaus (2006), equation (14) has to be written in "efficiency units" by dividing both sides by A(t), and implementing a Taylor Approximation. This step yields a linear approximation (in logarithms) of the transitional dynamics.

$$\begin{aligned} \ln y(t) - \ln y(t_0) = {} & -\phi \ln y(t_0) + \phi \ln A(t) + \phi\ (\alpha/1-\alpha-\beta)\ln s_d(t) + \phi\ (\beta/1-\alpha-\beta)\ln s_f(t) \\ & - \phi\ (\alpha-\beta/1-\alpha-\beta)\ln(n+g+\delta) + (1-\phi)[\ln A(t) - \ln A(t_0)] \end{aligned} \tag{15}$$

By substituting the policy variables, X_j, for A(t) and $A(t_0)$, combining all constants into one term, and renaming the coefficients, the growth path to a steady state under conditional convergence can be written

$$\Delta \ln y(t) = -\phi \ln y(t_0) + [(\gamma_1) \ln s_d(t) + (\gamma_2) \ln s_f(t) + (\gamma_3) \ln X_j(t) + (\gamma_4)(t-t_0) + (\gamma_0)] \quad (16)$$

where $\gamma_1 = \phi\ (\alpha/1-\alpha-\beta)$ and $\gamma_2 = \phi\ (\beta/1-\alpha-\beta)$.

The policy variables (X_j), introduced in the literature by Bassanini, Scarpetta, and Hemmings (2001), will attempt to capture monetary and fiscal policy. For fiscal policy, the level of government consumption relative to GDP will be used. In all but one country in the sample, the size of government declined during the period. Reduction in the size of government may foster economic growth by reducing the crowding out effects of government in economic activity, but targeted government spending may stimulate aggregate demand, having a positive effect on growth. For monetary policy, central bank control over the inflation rate will be used. Many of the transition countries experienced inflation in the early stages of transition. But the countries that have been able to stabilise prices are more desirable for foreign investors who do not want to deal with the additional costs that firms incur due to the uncertainties of inflation. Domestic investors also desire stable prices which facilitates procurement of long-term loans at reasonable real interest rates. Sound monetary policy can be indicated by relatively low volatility of inflation, which can be captured using the standard deviation of the inflation rate over a moving three year period (t-1, t, t+1). Both Neuhaus (2006) and Bassanti et al. (2001) used these measures as fiscal and monetary policy variables.

From equation (16), the regression equation for N countries, i = 1,…,N, and T time periods, t = 1,…,T can be written as

$$\Delta \ln y_{i,t} = -\phi_i \ln y_{i,(t-1)} - \gamma_1 \ln s^d_{(i,t)} - \gamma_2 \ln s^f_{(i,t)} - \gamma_3 \ln X_{j(i,t)} - \gamma_{4,i} t - \gamma_{0,i} + \varepsilon_{i,t} \quad (17)$$

Empirical Results

The earlier studies in the growth literature tended to be more cross sectional in nature than time series due to a lack of reliable annual data for many developing countries. As previously noted, Islam (1995) was the first researcher to introduce a dynamic panel data model. Others, for example Neuhaus (2006), applied Islam's approach to a model that included FDI. This paper extends the work of Neuhaus by lengthening the time period, incorporating more than one policy variable in the estimated equation, and using various estimation techniques to determine the robustness of the results.

The results are presented in Table 1 where the first column shows the pooled OLS regression, without any adjustments, for the 13 countries over the period 1992-2007. The R^2 for this regression is a modest 0.45. Lagged GDP per worker is significant and negative as the theory predicts, but the implication for convergence is a relatively long time period. The half way speed of convergence is calculated as follows: let $\lambda = -\ln(1-\phi)$, then solve for T using the formula $e^{\lambda T} = ½$, which implies for $\phi = -0.063$ a time of 10.7 years. The coefficients for both domestic investment and FDI are positive and statistically significant, indicating the role of investment in economic growth. Consistent with the production function approach, the implied output share for FDI, β, is 0.25; the output share for domestic investment, α, is of similar magnitude 0.28. The implied share for labor is 0.47, which presumably captures the affect of human capital, which could not be included due to lack of sufficiently diverse educational data. As Neuhaus (2006) noted, educational attainment in these countries is remarkably homogeneous.

The policy variables are also statistically significant. Government consumption is positive, similar to the findings of Bassanini, Scarpetta, and Hemmings (2001), who argue that government transfers (which is omitted from consumption) could have a negative effect on growth while the consumption part of government spending stimulates growth. In this case, the stimulative part of government spending offsets any negative effects of spending. Another measure of fiscal policy is the budget deficit, but data were not available for all the countries within the 1992-2007 time period. With respect to monetary policy, countries with higher inflation volatility (i.e., less effective monetary policy) experienced lower growth.

When the model controls for the fixed effects by including country dummy variables, the coefficients on domestic investment remains relatively stable, but the coefficient on FDI is slightly larger than domestic investment, and the convergence term is larger (less negative). The R^2 increases from 0.45 to 0.56, and the F test for no fixed effects is rejected, providing statistical evidence that fixed effects estimates are preferred over the pooled estimates. Controlling for both fixed country effects and fixed time effects produced slightly lower estimates for domestic and foreign investment, along with a lower implied α and β; significant policy variables; a higher R^2 of 0.66; and an F statistic indicating again that this estimation model is preferred over the pooled OLS regression.

Instead of controlling for fixed effects using dummy variables, there may be random effects in the error term. In the fourth column of coefficients in Table 1, the estimating procedure controlled for random group effects. The convergence coefficient is lower (more negative); the coefficients on domestic and foreign investment are significant and similar to the fixed group regression; and the policy coefficients are also significant. The Breusch Pagan (BP) test indicates that the random country effects model is preferred over the pooled OLS regression, but the Hausman test rejects the null hypothesis that the random country effects model is preferred over the fixed country effects model. These test results are similar when the random country and time effects model is used.

Two other estimation techniques, suggested by Zhang and Vijverberg (2009), are the Panel Corrected Standard Errors (PCSE) and the Seemingly Unrelated Regressions (SUR). These techniques test the robustness of the coefficients. The PCSE estimation technique corrects for heteroskedasticity across cross sections (countries). The SUR estimation is a Generalised Least Squares (GLS) specification, which corrects for both cross-section heteroskedasticity and contemporaneous correlation (as described in the EViews Manual). The last two columns of Table 1 present these results, which show relatively high weighted R^2s, particularly the SUR estimate. The domestic and foreign investment coefficients are statistically significant and of similar magnitude to the other regressions, demonstrating the robustness of the estimates.

Conclusions

A diverse literature on economic growth and FDI formed the basis for this study, which has extended the recent work of Neuhaus (2006) by incorporating more than one policy variable into the analysis, lengthening the time period, and employing several estimation techniques. It has been confirmed that both domestic capital and FDI were statistically significant factors in producing the economic growth in Central and Eastern Europe during the 1992-2007 time period. In addition, fiscal and monetary policy contributed significantly to economic growth. Countries that used appropriate fiscal policy to support aggregate demand grew more rapidly than other countries; and countries that controlled inflation volatility better than other countries also experienced more rapid economic growth. One lesson to be drawn from this paper is that prudent macroeconomic policies provided a fertile environment for more rapid economic growth than the growth of similar countries that implemented weaker macroeconomic policies.

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Appendix

Table 1: Coefficient estimates from various econometric models. 1992-2007

The t-values are in parentheses; an * denotes the 95 percent confidence level. The specific country and time effects are not reported here, but are available from the authors.

		Pooled	Fixed	Fixed	Random	Random	Fixed	Fixed
		OLS	Country	Country	Country	Country	Country	Country
Dependent			Effects	and Time	Effects	and Time	PSCE	SUR
Variable	Δ lny			Effects		Effects		
		0.402	0.204	0.372	0.416	0.374	0.016	0.196
Constant		(4.41)	(0.88)	(1.02)	(4.15)	(3.47)	(0.081)	(3.72)
Ln Lagged		-0.063	-0.054	-0.060	-0.068	-0.060	-0.035	-0.054
GDP(pc)	y(t-1)	(-5.99)	(-2.30)	(-1.65)	(-5.96)	(-4.91)	(-1.65)	(-9.53)
Ln Domestic		0.033	0.033	0.021	0.034	0.029	0.029	0.033
Investment	s^d	(3.66)	(3.19)	(2.12)	(3.84)	(3.24)	(3.38)	(11.66)
Ln		0.037	0.041	0.022	0.039	0.037	0.037	0.041
FDI	s^f	(9.61)	(9.08)	(3.08)	(10.49)	(7.56)	(8.84)	(19.58)
Change in		-0.541	-0.615	-0.752	-0.550	-0.627	-0.693	-0.663
Labor Force	Δ lnL	(-3.48)	(-3.91)	(-5.03)	(-3.75)	(-4.30)	(-6.93)	(-17.64)
Government		0.029	0.062	0.053	0.036	0.034	0.066	0.062
Expenditures	ln(g/y)	(4.43)	(6.35)	(5.87)	(5.27)	(4.86)	(7.74)	(20.31)
Inflation		-0.002	-0.001	-0.002	-0.002	-0.002	-0.001	-0.002
Volatility	sd(π)	(-3.54)	(-2.79)	(-3.28)	(-3.53)	(-3.88)	(-2.80)	(-8.86)
Implied α		0.25	0.26	0.20	0.24	0.23	0.29	0.26
Implied β		0.28	.032	0.21	0.28	0.29	0.37	0.32
R^2		0.45	0.56	0.66	0.47	0.40	0.59 1/	0.93 1/
F		27.49*	13.14*	10.53*	30.13*	22.99*	15.21*	144.64*
BP-test					9.27*	9.27*		
Hausman					26.20*	21.40*		

Data Sources: World Development Indicators (WDI) and United Nations Conference on Trade and Development (FDI-STAT).
1/ The F and R^2 statistics are weighted rather than unweighted.