Foreign Direct Investment and Growth in Transition Economies

Aleksynska, Mariya and Gaisford, James and Kerr, William

Economics Education and Research Consortium, University of Calgary, University of Saskatchewan

June 2003

FOREIGN DIRECT INVESTMENT AND GROWTH

IN TRANSITION ECONOMIES

Mariya Aleksynska
Economic Education and Research Consortium
National University "Kyiv-Mohyla Academy"
Kiev, Ukraine

James Gaisford
Department of Economics
University of Calgary
Calgary, Canada

and

William Kerr
Department of Agricultural Economics
University of Saskatchewan
Saskatoon, Canada

November 2003

Abstract:

Recent studies of developing countries have suggested that the effectiveness of foreign direct investment (FDI) as spur to economic growth depends on the availability of "human capital" or skilled labour in a host country. In other words, it is primarily the synergy between FDI and human capital — rather than FDI itself — that acts as a strong stimulant to growth. Since many transition economies such as Ukraine have abundant human capital, this implies that policies that encourage FDI may be very beneficial in facilitating economic restructuring and stimulating growth. This paper provides a thorough empirical investigation of this issue by examining the experience of Ukraine and other transitional economies.

The paper provides an overview of Ukraine's experience with FDI and growth before systematically analyzing the connection between these variables for a panel of transition economies. While the paper finds deficiencies in earlier work examining the synergy between FDI and human capital, it finds interesting evidence that is consistent with the synergy hypothesis for transition economies. Further, the analysis also suggests that there is a complementary — rather than substitute — relationship between FDI and domestic investment. Thus, the presence of FDI may provide new learning opportunities for those making domestic investments and *visa versa.* The possibility that it is not large flows of FDI that cause high economic growth rates, but strong growth that acts as a magnet for FDI is also investigated. While the paper shows that there is little empirical evidence of such reverse causation in transition economies, it also reveals that there is little evidence that FDI stimulates economic growth beyond the current year. This lack of persistence in the benefits of FDI in transition economies suggests that there may be room for policy initiatives to increase the efficacy of FDI.

FOREIGN DIRECT INVESTMENT AND GROWTH IN TRANSITION ECONOMIES*

1. Introduction

The purpose of this paper is to provide an empirical examination of the linkage between Foreign Direct Investment (FDI) and economic growth in transition economies. For virtually all these countries, and for Ukraine in particular, the issue of economic growth is paramount. Recent theoretical developments in the area of economic growth suggest that successful developing countries were able to grow in a large part due to the "catch-up" process arising from acquiring more modern technology (Borenzstein et al, 1998). One of the major channels of access to advanced technologies appears to have been foreign direct investment. Despite a seemingly positive association between FDI and growth, however, the empirical literature has not reached a consensus on whether growth leads to FDI or FDI leads to growth. Campos (2002, pp. 398) warns that:"…a closer examination of the attendant empirical evidence disappoints all but the most fervent believer." Similarly, de Mello (1999, 148) cautions that: "whether FDI can be deemed to be a catalyst for output growth, capital accumulation, and technological progress seems to be a less controversial hypothesis in theory that in practice." Aside from Campos (2002), however, little research has yet been done on the FDI-growth connection for transition economies.

There are several ways that FDI can stimulate economic growth. First, through capital accumulation, FDI is expected to be growth enhancing in that more new inputs are incorporated into production (Buckley, 2002). Output growth may additionally result from a wider range of intermediate goods in FDI-related production (Feenstra and Markusen, 1994). Second, FDI is considered to be an important source of technological change and human capital augmentation (Buckley, 2002). Further, FDI leads to *technology diffusion* through the transmission of ideas and new technologies, productivity spillovers, sharing and implementation of know-how, and knowledge transfers (Borensztein *et al*.,1998). Technological change occurs not only within the

FDI-recipient firm, but also in the economy overall, due to the spillover effects or positive externalities. Some studies (Schoors et al, 2002) find that whenever firms in open sectors are owned domestically, they tend to compete on the basis of cheap labour because productivity is not very high. This is in contrast to the foreign-owned firms in the same sectors, which hire more expensive labour, but benefit from higher productivity. Cross-sector, or indirect, effects are also present. Whenever labour migrates and or knowledge is transmitted from sector to sector, technology diffusion occurs. In addition, highly productive foreign firms may stimulate healthy competition in the domestic market. Further, since the foreign-owned firms typically produce high-quality products, they require their domestic partners to comply with this quality, eventually driving up production standards of firms from different sectors of the economy (Blomstrom *et al*.,1998). The resultant increase in economic activity may increase growth either directly or indirectly by stimulating increased domestic investment (de Mello, 1997).

FDI is believed to be especially important for transition economies. At the onset of transition, all countries were far from the international best-practices technological frontier, but unlike many developing countries, they did not start from the scratch. Campos (2002) has argued that economies in transition had a so-called "enabling environment", which should allow them to realize large potential gains from FDI. Despite the unarguable fact that most transition economies were highly endowed with human capital, market institutions and infrastructure were lacking. Much of the infrastructure, as well as the capital stock more generally, embodied antiquated technologies and was in a state of disrepair. In this context, FDI would seem to offer access to both modern technology and additional physical capital. Since transition requires a very thorough retooling of the capital stock, the speed of the transition itself may be related to the ability of a country to stimulate capital inflows (Garibaldi *et al*., 2002). Balatsky (1999) suggests that a significant foreign-owned sector may even help a transition economy ward off temporary shocks or minor recessions because they are less vulnerable to domestic multiplier effects. Calvo *et al*. (1996) conjecture that significant capital inflows to one or more of the more advanced countries in the region such as Hungary, Czech Republic, and Russia may generate externalities for the

neighboring countries. Other potential benefits of FDI include: increased consumer choice; consumption smoothing by households; support for pension funds and retirement accounts; and improved tax collection on the local and state levels (see Calvo *et al*.,1996)).

Not all researchers are so sanguine with regard to the impact of FDI on growth prospects a host economy. Some authors such as Schoors *et al*. (2002) and Blomstrom *et al*. (1998) argue that at least in the initial stages of development or transition, FDI could have a negative impact on the recipient economy. If domestic firms are so unproductive in comparison with foreign-owed firms, the former may be driven out of business leading to a so-called "market stealing" effect. While the empirical findings of Schoors *et al*. (2002) for Hungary, indicate that the positive effects of FDI on growth dominate, this result does not necessarily extend to other transition economies. Calvo *et al*., 1996, 124) identify other potentially harmful macroeconomic effects of large FDI inflows such as: "…rapid monetary expansion, inflationary pressures, real exchange rate appreciation and widening current account deficits." They also warn that FDI may lead to "booms and busts in capital inflows", and, consequently, to economic upswings and downswings in the host country. Therefore, policies that reduce the vulnerability to cyclically based FDI decisions may be warranted.

Borensztein *et al*. (1998) examine the empirical connection between growth and FDI. They examine 69 countries, consisting of OECD, Latin American and several African countries, over two decades, 1970-79 and 1980-89. While they consistently find that FDI has significant positive impact on economic growth in host countries, their main conclusion is that human capital and FDI display complementarily effects. Further, there is a threshold level of human capital, which is needed for FDI to contribute to growth. The impact of FDI on host economies, therefore, may be very different, depending on level of human capital development, and may even be negative in a country where this level is low. This finding is corroborated by de Mello (1997), who also concludes that an increase in the growth can only be achieved provided there is sufficient human capital in an economy.

Campos (2002), on the other hand, finds no empirical evidence of a threshold level of human capital in transition countries. Campos explains this difference by speculating that in transition economies the level of human capital is above the minimum threshold level. Campos's principal hypothesis is that transitional economies have the necessary level of physical and human capital, but are behind developed countries in terms of technology. Another important study in the field, which focuses on the FDI-growth relationship at a regional level for provinces of China, was conducted by Buckley *et al*. (2002). While the authors find a positive relation between FDI and growth, again there is no evidence of a threshold level of human capital after which FDI becomes more effective.

2. Overview of Foreign Direct Investment in Transition Economies

Many transition countries, including Ukraine, have attempted to stimulate economic activity through various means, including policies aimed at promoting FDI and technology transfer. To this end, transition countries have abandoned socialistic and inflationary policies, moved away from discriminatory taxation and restrictive legislation, and attempted to establish a record of respecting private property and maintaining free markets. In many countries, these free-market policies eventually stimulated both foreign and domestic investment. Further, in recent years there has been a tendency for macroeconomic stability to improve and for increased rates of economic growth. Hence, it is important to establish whether the observed growth can be systematically linked to an increased inflow of FDI over the period of transition. Prior to that, however, it is helpful to review the aggregate data on FDI inflows to transition economies.

Conventionally, economies in transition are divided into three sub-groups: the countries of Central Europe (Albania, Bulgaria, Czech Republic, Croatia, Hungary, Macedonia, Slovak Republic, Slovenia, Romania, Poland), the countries of the Commonwealth of Independent States or CIS (Armenia, Azerbaijan, Belarus, Moldova, Ukraine, Russia, Georgia, Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, Uzbekistan), and the Baltic states (Estonia, Latvia, Lithuania). Figure 1 summarizes FDI inflows to these three groups of countries over the period from 1992 to

1999. In the subsequent analysis, we use data for the years 1991 and 2000, but because of incomplete data for several countries, the graph reflects only the truncated period. The data for Croatia, however, only begins in 1993, and that for Macedonia only in 1994. The largest share of FDI went to Central European countries but FDI inflows were generally increasing to all three groups of countries over the period of study.

Figure 2 presents time trends for FDI. There are several important reasons for separating Russia and the remainder of the CIS. The size of the Russian economy represents 30 to 40 percent of the entire transition group, in terms of both GDP and population (Garibaldi *et al*., 2002). Moreover, Russia is the only net exporter of capital over the period of study (Hirvensalo, 2000). Overall, FDI seems to exhibit similar patterns across country groups, following an upward trend, with Central European (CE) group attracting by far the largest inflows of FDI and Russia experiencing large fluctuations in 1997-1998.

Figure 3 presents the FDI inflow into Ukraine in aggregate and in per capita terms over the period 1992-2000. The large decline in FDI in 1999 appears to be directly linked with the financial crisis that occurred in the second half of the year. The situation improved rapidly, however, and by 2000 FDI was increasing again. Figure 4, shows the cross-country distribution of FDI for 18 transition countries. The FDI attracted by various transition economies shows marked differences with Ukraine near the bottom whether FDI is measured relative to GDP or population. The left-hand panel, which presents FDI as a percentage of GDP, may be somewhat misleading. By this criterion, Estonia and Kazakhstan are the leaders in attracting FDI and countries such as the Kyrgyz Republic, Armenia, and Moldova outperform several countries in Central Europe. While the high inflows for Kazakhstan can be, in part, attributed to its rich natural resource endowment, Garibaldi *et al*. (2002) suggest that the puzzling results may be due to problems with measuring GDP and its conversion to US dollars. To reduce this source of confusion, one of the remedies recommend by Garabaldi *et al*. (2002) is to use population as the adjustment factor. Thus, the right-hand side of the Figure 4 shows the result of this normalization: Central European and Baltic countries now occupy leading positions, whereas Kazakhstan leads the CIS group.

While the raw data on FDI in transition economies such as Ukraine is clearly interesting in its own right, it is vitally important to consider how, and indeed whether, FDI is linked to economic growth. We now turn to this question, first by considering the underlying theory and then by embarking on an empirical analysis.

3. Key Variables in Growth Theory

The development of endogenous growth theory by Romer (1990, 2001) and others has provided a theoretical context that has stimulated research on the impact of FDI on growth. It is now conventional to derive empirical estimating equations for economic growth from an augmented production function in which FDI enters as one of the inputs. It is frequently postulated that aggregate output measured by real Gross Domestic Product (GDP) depends on:

- the current state of technology
- physical capital (domestic capital stock)
- foreign capital (foreign direct investment)
- labour
- a series of ancillary variables including policy variables

Borensztein *et al*. (1998) suggest a version of the production function in which the primarily inputs are human and physical capital. They treat foreign capital differently from domestic capital because the latter may expand the variety of intermediate and/or capital goods and because FDI may act as an important conduit for technology transfer. They also allow for the possibility of synergies between human capital and FDI, so that a higher level of human capital in a host economy makes FDI more effective in stimulating economic growth. Consequently, economic growth, which is measured as the percentage change in real per-capita GDP over the preceding year, depends on:

- initial level of per-capita GDP
- human capital
- physical capital (domestic investment)

- the direct effect of foreign capital (FDI)
- the synergy between FDI and human capital
- a series of ancillary variables including policy variables

This list of causal factors drives the choice of explanatory variables for our empirical analysis.

The first explanatory variable that we incorporate is the natural logarithm of the purchasing-power-parity (PPP) per-capita GDP for 1989 as calculated by de Mello *et al*. (1997). The initial level of purchasing-power-parity (PPP) adjusted GDP per capita is consistently included as an explanatory variable in endogenous growth theory because it incorporates the possibility of a *convergence effect*. The initial level of real per-capita GDP is expected to be negatively related to growth, since economies with lower levels of per capita income will tend to grow faster in per capita terms (Barro and Sala-i-Martin, 1995).

Our second explanatory variable is the ratio of secondary school enrolment to the school-age population in 1989 as presented by Fisher and Sahay (2000). Following Mankiw *et al*. (1992), it has become conventional to use the secondary school enrollment ratio as a proxy for human capital investment. However, as pointed out by Temple (1999), there are some conceptual difficulties with the use of school enrolment data. These rates were once regarded as one of the most robust and satisfactory variables in the growth literature, but in fact, they only rarely correspond to the human capital variables highlighted in theoretical models. Further, it is not always clear whether rates of school enrollment are intended to represent a flow of investment in human capital or the stock. Due to data limitations, initial school enrolment ratios are still widely used as a proxy for human capital, and are used here as well.

In part, the economic transition process in the countries of Central Europe and the former USSR has been characterized by their so-called initial conditions. While the initial levels of per-capita GDP and human capital are likely to be important in this respect, other variables may also be relevant for transition economies. These additional candidate initial conditions include agriculture's share in GDP, indices of natural resource endowment, years under communism, distance from Duesseldorf, and foreign debt at the onset of transition. In this paper, we do not

include these additional conditions for two reasons. First, Fisher and Sahay (2000) do not find that the additional initial conditions are significant explanatory variables. Second, with the panel data that we use, the additional initial conditions simply turn into an extended set of time-invariant constants for each country.

The third explanatory variable is FDI, which is measured as the ratio of gross capital formation to GDP, and the fourth is domestic investment, which is measured as the ratio of the gross inflow of FDI to GDP. As suggested by de Mello (1997), it is important to be consistent by using the flows of both domestic and foreign investment, or the stocks of both domestic and foreign capital. Balasubramanyam *et al*. (1996) approximate the rate of growth of the domestic capital stock by the share of investment in GDP. Accordingly, they replace the rates of change in domestic and foreign capital inputs by the share of domestic investment and foreign direct investment in GDP. Following this proposition, FDI, domestic investment and other variables will also be defined in similar terms in this paper. The ratio of FDI to GDP, thus, represents the direct effect of FDI on economic growth in our analysis.[1] To explore possible synergies and or crowding this FDI variable is also interacted multiplicatively with the human capital variable and, also, with domestic investment.

The list of explanatory variables that may be determinants of growth also includes a series of ancillary variables including policy-related variables. In the original work of Borensztein *et al*. (1998), this set of variables encompasses government consumption as well as foreign exchange and trade distortions (e.g., a black market premium and a parallel foreign exchange market premium). They also suggest regional dummy variables. Due to data limitations, our analysis will include only the ratio government consumption to GDP and the initial black market premium. According to Barro and Sala-i-Martin (1995), the black-market premium proxies government induced distortions in markets and it is expected to affect growth rates negatively. The coefficient on government consumption may be of either sign. In the short run, an increase in government expenditures can lead to an increased economic activity and greater growth. In the long run, a negative association with growth is expected because government consumption does not have

direct impact on private productivity and it can lower savings via the distortionary effects of taxation or government expenditure (Barro, 1991). Another variable that is frequently included in growth equations is the terms of trade, or, alternatively, the ratio of the current account balance to GDP. In this paper, we use the latter. Since a larger current account balance typically provides a short-run macroeconomic stimulus to economic activity, any effect on growth is expected to be positive.

Other policy variables that attempt to reflect the economic and political situation and the progress of reforms include various indices computed mainly by international organizations such as European Bank for Development and Research. In the estimations, we considered indices of trade liberalization, banking reform, freedom, and market perceptions of "country risk" (the latter being borrowed from Garibaldi *et al*. (2002)). However, these variables did not to perform well in estimations. The final set of variables used in the empirical part of this paper is summarized in the Appendix in Table A1.

4. Empirical Analysis

The empirical analysis, which uses data on 17 transition economies, is based closely on Borensztein *et al*. (1998).[2] The data is discussed further in the Appendix. Our analysis focuses primarily on three specifications of the empirical model. The first examines the direct effect of FDI on growth, the second investigates synergies between FDI and human capital, and the third allows for interactions between FDI and domestic investment. While we consider different specifications, we keep all other explanatory variables the same to make the results more comparable. After some specification search and following a "general-to-specific" approach, we retain the three variables suggested by theory: domestic investment, initial human capital and initial GDP. Most of the policy variables, and especially transition and structural indices did not perform well. These variables turned out to be insignificant and/or affected the signs or significance levels of other variables. The only policy variables that seemed to have a statistically

significant impact on growth were the black market premium, government consumption and the trade variable. Thus, these variables were left in the final specifications.

For each of the three general specifications of the model, three different methods of estimation are used to check the robustness of the results in response to potential econometric problems arising from the empirical estimation. These econometric issues are discussed in the Appendix. In Tables 1-4, column 1 shows the results of robust Ordinary Least Squares (OLS) estimation treating the sample as pooled data. Column 2 shows the results of Generalized Least Squares (GLS) estimation treating the sample as panel data with random effects. Finally, Column 3 shows the results of Instrumental Variables (IV) estimation.

4.1. The Direct Effect of FDI on Growth

Table 1 shows the results of the specification that allows for direct effects of FDI on economic growth but does not include possible synergies with human capital. The key variable of interest, FDI, has a positive effect on economic growth that is statistically significant in both the OLS and IV estimations, but statistically insignificant with GLS estimation. When interpreting the magnitude of the direct effect of FDI on growth, one should bear in mind the measurement units of the variables. The dependent variable, growth, was measured in decimal form, as the ratio of the change in GDP to the level of GDP, in order to be compatible with the dependent variables. FDI, domestic investment, and government consumption were each measured as a ratio with respect to the GDP in the corresponding year. Thus, the coefficient on FDI in the OLS (robust) estimation indicates that an increase in FDI as a proportion of GDP by one percentage point would increase the growth rate by almost 0.51 percentage points. In the IV estimation, growth increases even more dramatically by 1.6 percentage points.

For all three methods of estimation, the sign on the initial GDP variable is negative, as expected. This reflects the convergence effect where countries with lower initial per-capita incomes are expected to grow faster. This variable was significant at least at the10% level in all three versions of this specification. The initial black-market premium has a highly significant

negative effect on growth in all versions, while government consumption has a positive effect, which is statistically significant in the first OLS and GLS versions. As discussed earlier, the positive sign of the coefficient on government consumption is quite acceptable in a short-run context. Although human capital and domestic investment are not statistically significant at conventional levels, we retain them in the model as theoretically important variables. Domestic investment has a negative effect on growth in the IV estimation, but this is not statistically significant. While the coefficient on the current account to GDP ratio also bears a counter-intuitive negative sign for the first two methods of estimation, this variable has a statistically insignificant effect on growth regardless of the method chosen.

4.2. FDI and Human Capital: are there Synergies?

The positive direct effect of FDI on growth may arise because we have omitted synergies with human capital from the first specification. Consequently, in the second specification shown in Table 2, the direct effect of FDI on growth is replaced with the product between FDI and initial human capital in order to capture possible synergies between the two variables. Once again, all three different estimation methods convey a similar message, indicating the overall robustness of the results. Quite strikingly, only two variables are persistently significant in all estimations: the synergy term and the black market premium. Under OLS, government consumption and initial per-capita GDP would also be significant at the 11% and 12% levels respectively. While domestic investment remains statistically insignificant in all three versions of this specification, it does have the expected positive sign in the OLS and GLS versions.

The significance of the interaction term is an important result since it implies that FDI and human capital exhibit synergies or complementary spillover effects in transition economies, which were not found by Campos (2002). The positive interaction between FDI and the level of human capital indicates that FDI will have a stronger positive effect on economic growth when the existing stock of human capital is high. As suggested by theory, the benefits of the flow of advanced technology associated with FDI in a recipient economy may be dependent on its stock of

human capital or "absorptive capability". In Ukraine, where the proxy for initial human capital is a 91% high-school participation rate for 1989, an increase in FDI as a proportion of GDP by one percentage point would raise the growth rate quite substantially. In both the OLS and GLS versions, the growth rate would rise by 0.49 percentage points and in the IV version it would rise by 0.40 percentage points.

4.3. FDI and Domestic Investment: Crowding out or Further Synergies?

The potential synergy with human capital points to the possibility of further complementary or substitute interactions involving FDI. In the third model shown in Table 3, we consider whether FDI crowds out the positive effect of domestic investment on growth. Following Buckley *et al*. (2002), a negative coefficient on the interaction term given by the product of domestic investment and FDI would indicate crowding out between the two variables, while a positive coefficient would indicate a synergy or complementary effect. While the domestic investment variable on its own remains insignificant with all three methods of estimation, the interaction term in OLS and IV estimations turns out to be statistically significant and has a positive sign. This is additional evidence that the flow of FDI has a stronger impact on economic growth if a host economy has greater absorptive capacity, which is now represented by investment in physical rather than human capital. Moreover, in this case the magnitude of the synergy is large. In Ukraine, domestic investment measured by gross capital formation was on average 22% of GDP over the sample period. Given this ratio of domestic investment to GDP, an increase in FDI as a proportion of GDP by one percentage point would increase the growth rate by 0.45 percentage points in the OLS regression and by 0.36 percentage points in the IV regression. Hence, FDI does *not* crowd out domestic investment and, further, the two types of capital investment seem to exhibit strong complementary effects on growth.[3] Other variables in this specification generally have the expected signs, though most of them are insignificant.

4.4. The Direct Effects of FDI versus Synergies

Borensztein *et al*. (1998) suggest the inclusion of a direct effect of FDI on growth in addition to the synergy term on FDI and human capital. The significant positive sign on the synergy term in Table 2, for example, may simply be an artifact of the omission of FDI itself. Unfortunately, the data is such that discriminating between the models in this way is problematic as shown by the specification of the model in Table 4. In all three versions, both the direct effect of FDI and the synergy between human capital and FDI are statistically insignificant and, paradoxically, the synergy has a negative impact on FDI. In the OLS and GLS specifications, however, the direct and effect and the synergy are jointly significant at 5% and 10% respectively. Even for a country such as Ukraine with a high 91% secondary-school participation rate, we emphasize that the combined effect of an increase in FDI on economic growth through both channels is positive in all three specifications. Nevertheless, there are strong statistical reasons for being wary of the results of this variant of the model.

There is a very high degree of correlation between the FDI and the interaction between FDI and human capital (i.e., the correlation coefficient is 0.99), which leads to the statistical problem of *multicollinearity* in the estimation results. The high degree of correlation is not surprising. Since human capital variable is defined as *initial* school enrollment, it is invariant with respect to time and quite similar across most countries in the sample. Further, the patterns of FDI across time are also similar across countries. In presence of high multicollinearity, the estimated coefficients remain consistent and unbiased, but their variances become very large. This leads to a lack of precision in the estimates such that the coefficients may have the wrong signs or implausible magnitudes (Greene, 2000; Kennedy, 1998). Consequently, neither the lack of significance of the direct effect and synergy effect nor the paradoxical sign on the synergy effect should be particularly surprising.

Similar statistical problems arise if we attempt to discriminate between the direct effect of FDI and the synergy between FDI and domestic investment. Although current domestic investment, unlike initial human capital, varies over time, the correlation between FDI and the term

that reflects the interaction between FDI and domestic investment is still very high (i.e., the correlation coefficient is 0.96). This suggests that multicollinearity will again be problem. Consequently, standard inference tests would be invalid and precise conclusions about the effect of any variable could not be drawn. For this reason, we leave the results of this specification to Table A4 in the Appendix. Of course, it would also be possible to estimate a specification that would nest all of the outlined specifications and include both interaction terms simultaneously. Since such specification would again suffer from multicollinearity, these results are once more relegated to Table A4 in the Appendix. In both of the extra specifications reported in the Appendix, the coefficients on all variables of primary interest are statistically insignificant.

The multicolinearity problem is quite important in the light of the debate present in the economic literature about the existence of a threshold level of human capital in a host economy after which FDI becomes effective. For example, Borensztein *et al*. (1998) find evidence in favour of a synergy between FDI and human capital in developing countries because the interaction term is positive and significant whenever it is included. They also go on to claim that there is a threshold level of human capital because they find a significant positive coefficient on the interaction term and a negative but insignificant coefficient on FDI when both terms are included. Meanwhile, in a similar regression for transition economies, Campos (2002) finds that the interaction term is insignificant, but the FDI term is positive and significant. Consequently, Campos hypothesizes that the initial human capital endowments in transition economies easily exceed any threshold level that is required before FDI has a positive impact on growth. Nevertheless, the results of both these studies appear to be questionable since neither accounts for the potential problem of multicollinearity. In our empirical work, and quite possibly the Borensztein *et al*. (1998) and Campos (2002) studies as well, it is not possible to discern the relative importance of the direct and synergy effects. Consequently, it is not possible to determine whether there really is a threshold level of human capital, after which FDI becomes effective. Although the channels remain in doubt, the evidence from Tables 1-3 very strongly indicates that, in transition countries such as Ukraine, FDI has a positive overall impact on growth that is substantial in magnitude.

4.5. Reverse Causality and Persistence

The possibility that FDI is endogenous suggested the use of Instrumental Variables (IV) estimation and, as discussed in the Appendix, the conventional test results shown in Tables 1-4 generally support the use of this method over OLS. This suggests that the possibility of reverse causation exists where news about rapid growth in a transition economy could provide a sufficiently strong impetus for foreign investors to relocate significant amounts of their capital. Granger (1980, 1987) has argued that it is possible to obtain further evidence on whether changes in a variable such as economic growth cause changes in another variable such as FDI. This can be done by considering whether lagged or previous values of growth add to the explanation of current FDI beyond what is explained by lagged values of FDI itself. The results of Granger causality testing reported in the Appendix do *not* support the notion that past growth acts as a magnet for current FDI. In other words, there is evidence that reverse causality is *not* a significant issue. Clearly, it is also possible to provide an analogous test on linkages between past levels of FDI and current economic growth. The results of Granger causality testing in the Appendix also show that the FDI inflow in the previous period does *not* add significantly to growth in the current period.

While these double causation results are broadly consistent with the literature, (de Mello, 1997; Kholdy, 1995; Campos, 2002), it is worthwhile to carefully consider the implications. On the one hand, the results of our previous modeling suggest that *current* FDI tends to have positive direct and/or indirect effects on *current* growth in a host economy. On the other hand, Granger causality analysis indicates that *past* FDI does not have a significant persistent effect on *current* growth. While these two findings are clearly mutually consistent, it seems reasonable to be less than sanguine with respect to the latter result. The lack of persistence in the effect of foreign direct investment on growth begs the question of whether policy changes might stimulate on-going benefits through greater learning arising from FDI.

5. Conclusion

Many countries, including developing and transition economies, have changed their attitude towards foreign direct investment over the past decade. Countries have liberalized their policies to attract rather than repel investment from multinational enterprises (MNEs), and they routinely compete against one another by offering generous incentive packages. This study is an effort to further the understanding of the impact of foreign direct investment on economies in transition, and in particular, on their economic growth. The paper examines the impact of FDI in 17 transition economies and considers potential channels through which this impact occurs. The study also exposes econometric problems that may have biased the conclusions of earlier research.

The paper provides strong empirical evidence that FDI promotes growth on an overall basis, but it suggests that it is not possible to discern the relative importance of direct effects and synergies. It should be emphasized that the data *is* compatible with the hypothesis that the so-called "absorptive capacity" of host economies for FDI is important. For example, the empirical evidence is consistent with a synergy between FDI and human capital. Workers with a higher level of education may be able to take greater advantage of the technology transfer occasioned by FDI. The empirical evidence is also consistent with a positive synergy between FDI and domestic investment and is strongly against the contrary hypothesis that FDI crowds-out or reduces the impact of domestic investment on growth in transition economies. Further, positive synergy with domestic investment appears to be of a much larger magnitude. This synergy may arise because FDI stimulates competition in the host country or because nationals are exposed to successful practices, made aware of modern technologies, and shown new profitable opportunities. Moreover, the empirical evidence of a synergy between FDI and domestic investment in transition economies appears to be highly consistent with the positive spillovers between different types of intermediate and capital goods in many theoretical models of endogenous growth.

Empirical analysis also shows that past FDI has a negligible persistent effect on current economic growth and *visa versa*. This somewhat disturbing result suggests that nationals may be able to make a better use of transferred resources and adopt practices that would allow foreign

investment to be more long-lived. Further, it is somewhat puzzling that past growth does not seem to induce foreigners invest in transitional economies. Plausibly, this result may have arisen because growth was very sporadic over the period of study in many transition countries. It is also possible that investors were primarily driven by other transition considerations such as economic and political reforms, stabilization policies, and the creation of a good investment climate.

Our results strongly suggest that countries should avoid policies that directly or indirectly deter FDI. Further, the presence of synergies indicates that policies aimed at encouraging FDI may be warranted. As emphasized by Blomstrom *et al*. (2003), "… incentives should ideally not be of an *ex ante* type that is granted and paid out prior to the investment, but should instead promote those activities that create a potential for spillovers. In particular, they include education, training, and R&D activities, as well as linkages between foreign and local firms" (p. 19). When incentives are based on the performance, they may affect not only the flow of new investment, but also the entire stock of investment. Taking into account their broad scope, Blomstrom *et al*. (2003) suggest that such investment incentives should be considered part of the economy's innovation and growth policies rather than a policy area that is only of relevance for foreign investors.

Designing efficient incentive program may not be easy. For example, policies such as subsidies to inward FDI are usually justified on the ground that significant spillover benefits arise in terms of technology and skills transferred. Other examples of government policy targeted at attracting FDI include fiscal incentives, such as tax holidays and import duty exemptions to investment allowances, and accelerated depreciation (Morisset, 2003). If such policies are pursued in isolation, however, various distortions may arise. These include: favoring primarily short-term investment; rewarding the founding of new firms rather than investment in existing firms; and discriminating against investment that relies on capital that depreciates slowly. Moreover, such policies may result in favoring foreign investors at the expense of the state and the welfare of domestic citizens. Further, the potential spillover benefits can only be realized by domestic firms if they have ability and incentives to invest in absorbing these foreign technologies and skills. Hence, to encourage FDI spillovers, it is frequently advisable support education, banking, transportation

and communications infrastructure, and investment by local firms as well. With such an multi-faceted approach, a country will not only be more attractive to MNEs, but it is also "likely to be rewarded with increasing *overall* investment as well as with more capital inflows"(Hausmann *et al.*, 2000; emphasis added).

References

Balatsky, E., 1999. Foreign Direct Investment and Domestic Investment Activity". *Journal of World Economy and International Relations*. No 11, pp. 83-89.

Balasubramanyam, V., Salisu, M., Sapsford, D., 1996. "Foreign Direct Investment and Growth in EP and IS Countries". *The Economic Journal*. Vol. 106. Issue 434. January, pp. 92-105.

Barro, R., 1991. "Economic Growth in a Cross Section of Countries". *The Quarterly Journal of Economics*. Volume 106. Issue 2. May, pp. 407-443.

Barro, R.J., Sala-i-Martin. 1995.Economic Growth. *New York: McGraw-Hill.*

Blomstrom M., Kokko A., 1998. "Multinational Corporations and Spillovers". *Journal of Economic Surveys.* No 12. pp. 247-277.

Blomstrom M., and Kokko A., 2003. "The Economics of Foreign Direct Investment Incentives". *NBER Working Paper Series.* Working Paper 9489.

Borensztein E, de Gregorio J., and Lee J., 1998. "How Does Foreign Direct Investment Affect Economic Growth?". *Journal of International Economics*. Vol. 45, pp.115-135.

Buckley P., Clegg J., Wang, C., and Cross A., 2002. "FDI, Regional Differences and Economic Growth: Panel Data Evidence from China". *Transnational Corporations.* Vol. 11. No. 1, April, pp. 1-28.

Campos N., 2002. "Foreign Direct Investment as Technology Transferred: Some Evidence From The Transition Economies". *The Manchester School Paper*. Vol. 70 No.3. June, pp. 398-412.

Calvo Guillermo, Leiderman Leonardo, Reinhart Carmen. 1996. "Inflows of Capital to Developing Countries in the 1990s". The Journal of Economic Pespectives. Vol 10. Issue 2. Spring, pp. 123-139.

Coelli T., Rao D.S.P., and Battese G. E. 1998. "Introduction to Efficiency and Productivity Analysis". *Kluwer Academic Publishers.*

Garibaldi P., Mora N., Sahay R., Zettelmeyer J., 2002. "What Moves Capital to Transition Economies?" *IMF Staff Paper.* Vol. 48, Special Issue.

Granger, C. W. J. 1987. "Causal Inference". *New Palgrave:Econometric.* New York, W.W. Norton.

Granger, C. W. J. 1980. "Testing for Causality". *Journal of Economic Dynamics and Control*. 2. pp. 32-55.

Greene, W.H. 2000. Econometric Analysis. *Prentice Hall, New Jersey.*

Hausmann, R., Fernandez-Arias, E., 2000. "Foreign Direct Investment: Good Cholesterol?". *Inter-American Development Bank Working Paper* No. 417 (Washington).

Mankiw, N. Gregory, David Romer, David N. Weil. 1992. "A Contribution to the Empirics of Economic Growth". *Quarterly Journal of Economics.* 107:2. pp. 407-37.

de Mello, Luiz R., Jr., 1997. "Foreign Direct Investment in Developing Countries and Growth: a Selective Survey". *The Journal of Development Studies*. 34 (1), pp.1-34.

de Mello, Luiz R., Jr., 1999. "Foreign Direct Investment-led Growth: Evidence From Time Series and Panel Data". *Oxford Economic Papers* 51. pp. 133 – 151.

de Mello, Denizer, Gelb and Tenev. 1997. *World Development Indicator; World Economic Outlook*. World Bank Working Paper 1866.

Morisset, J., 2003. "Using Tax Incentives to Attract Foreign Direct Investment". *The World Bank Group. Private Sector and Infrastructure Network*. Note No. 253.

Fisher and Sahay. 2000. "The Transition Economies After Ten Years." IMF Working Paper.

Feenstra, R., Markusen, I., 1994. "Accounting for Growth with New Inputs". *International Economic Review*. pp. 429-447.

Hirvensalo, Inkeri. 2001. "Foreign Direct Investment around the Baltic Sea. Is there Competition among the Counties in Attracting FDI?" *Paper of the Center for Markets in Transition.* July.

IMF World Economic Outlook. October, 2000. Focus on Transition Economies. World Economic and Financial Surveys.

IMF Yearbook. 2000.

IMF Yearbook 2000.

Kennedy, P., 1998. *A Guide to Econometrics.* MIT Press.

Kholdy, S., 1995. "Causality between Foreign Investment and Spillover Efficiency". Applied Economics, 27. pp. 745-9.

Romer, David. 2001. Advanced Macroeconomics. *McGraw-Hill Companies Inc*.,

Romer, Paul, 1990. "Endogenous Technological Change". *Journal of Political Economy.* Vol.98. October, pp. S71-S102.

Schoors, Koen, van der Tol, and Bartoldus. 2002. "The Productivity Effect of Foreign Ownership on Domestic Firms in Hungary". *EEA Venice Conference Paper*.

Temple, J., 1999. "The New Growth Evidence". *Journal of Economic Literature.* Vol. XXXVII. March, pp. 112-156.

Endnotes

---

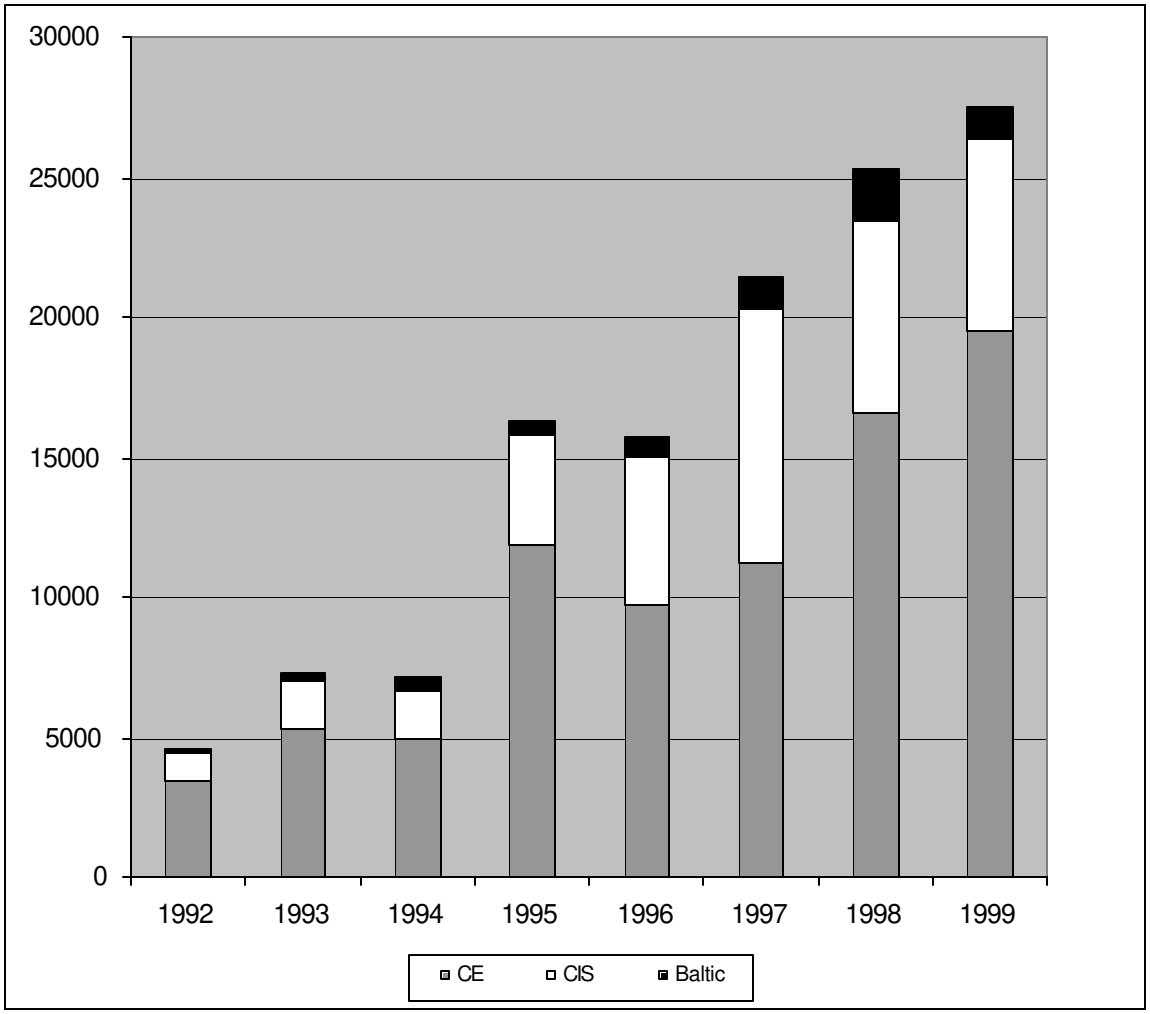
* The authors gratefully acknowledge the helpful comments and suggestions of Professors Peter Kennedy, Magdalena Sokalska and Tom Coupe on previous versions of this project. The authors, however, are responsible for any shortcomings in the current paper.

1 There is a potential deficiency with the measure of FDI, which is available in the balance-of-payment statistics. Since a part of a multinational enterprise's investment may be financed through debt or equity issues raised in the host-country's capital market, the FDI may be understated and the associated coefficients may be overestimated. Given that the bias is relatively uniform across the countries in this sample, the qualitative results are not likely to be greatly affected.

2 The 17 countries in the unbalanced panel are: Belarus, Bulgaria, the Czech Republic, Estonia, Latvia, Lithuania, Hungary, Macedonia, the Slovak Republic, Slovenia, Romania, Poland, Moldova, Ukraine, Russia, Kazakhstan and the Kyrgyz Republic.

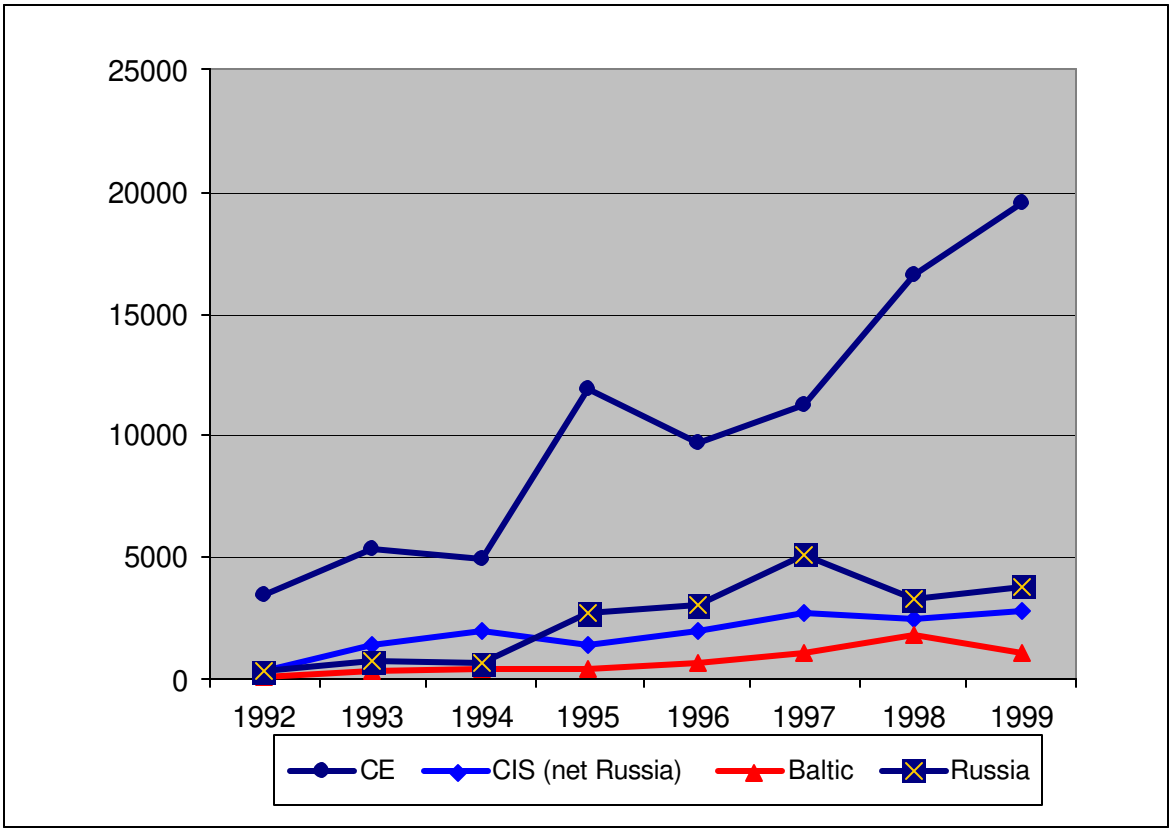
3 The fact that the interaction term is not statistically significant in the IV estimation raises a potential concern regarding the robustness of the results. In theory, GLS estimation would produce the best linear unbiased estimates. As implementation of GLS requires the use of the estimated rather than the true variance-covariance matrix of disturbances, the estimates obtained through GLS in practice may be inefficient although they remain unbiased. Meanwhile, robust OLS estimation has, as its end result, the White heteroscedasticity-consistent estimator (Greene, 2000), which is efficient. Consequently, the estimate of a single coefficient produced by robust OLS tends to be more powerful than that for GLS.

Figure 1. Foreign Direct Investment Inflows, 1992-1999 (USD millions)



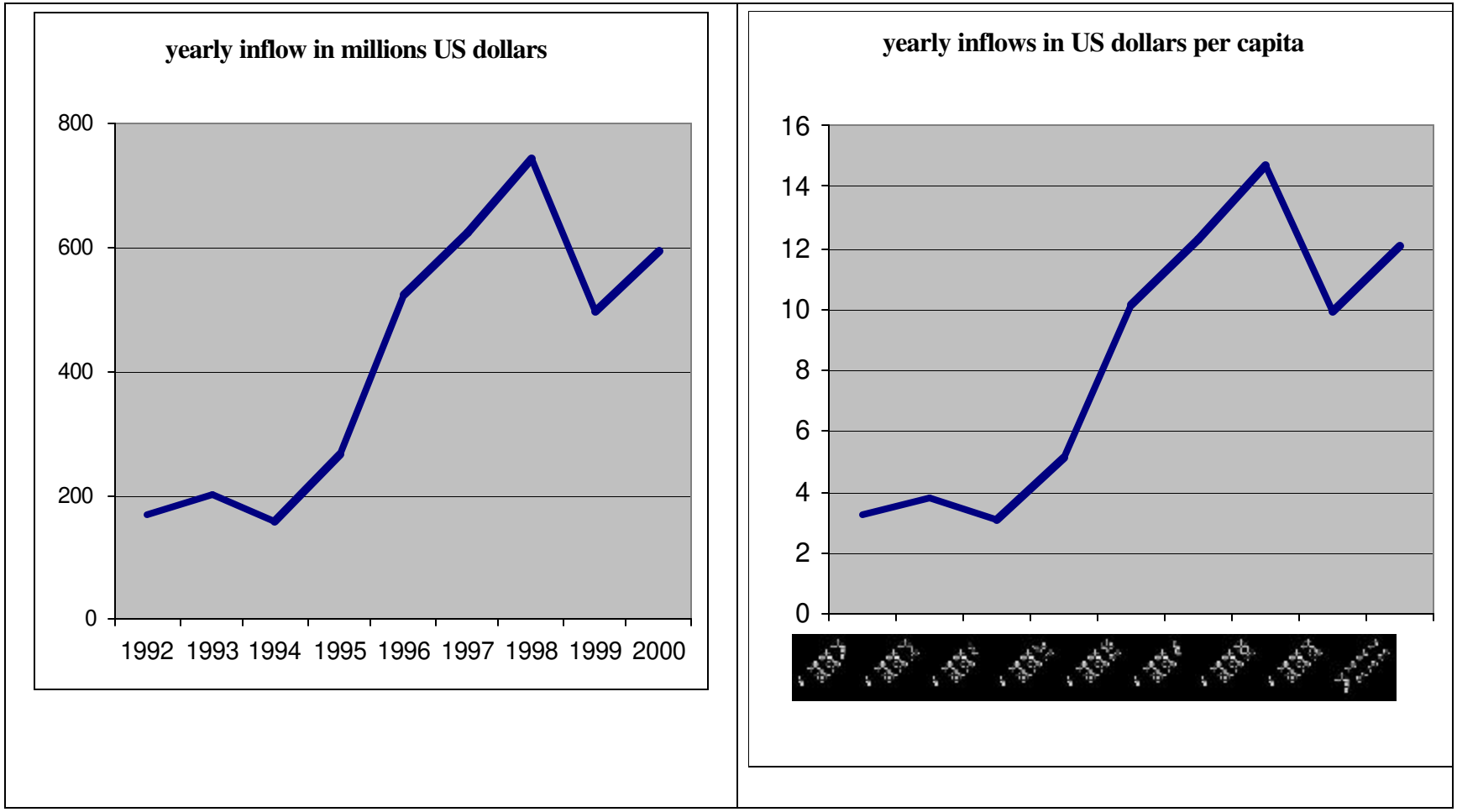
Data Source: Garibaldi et al. (2001)

Figure 2. ***FDI Flows by Groups of Countries, 1992-1999 (USD millions)***



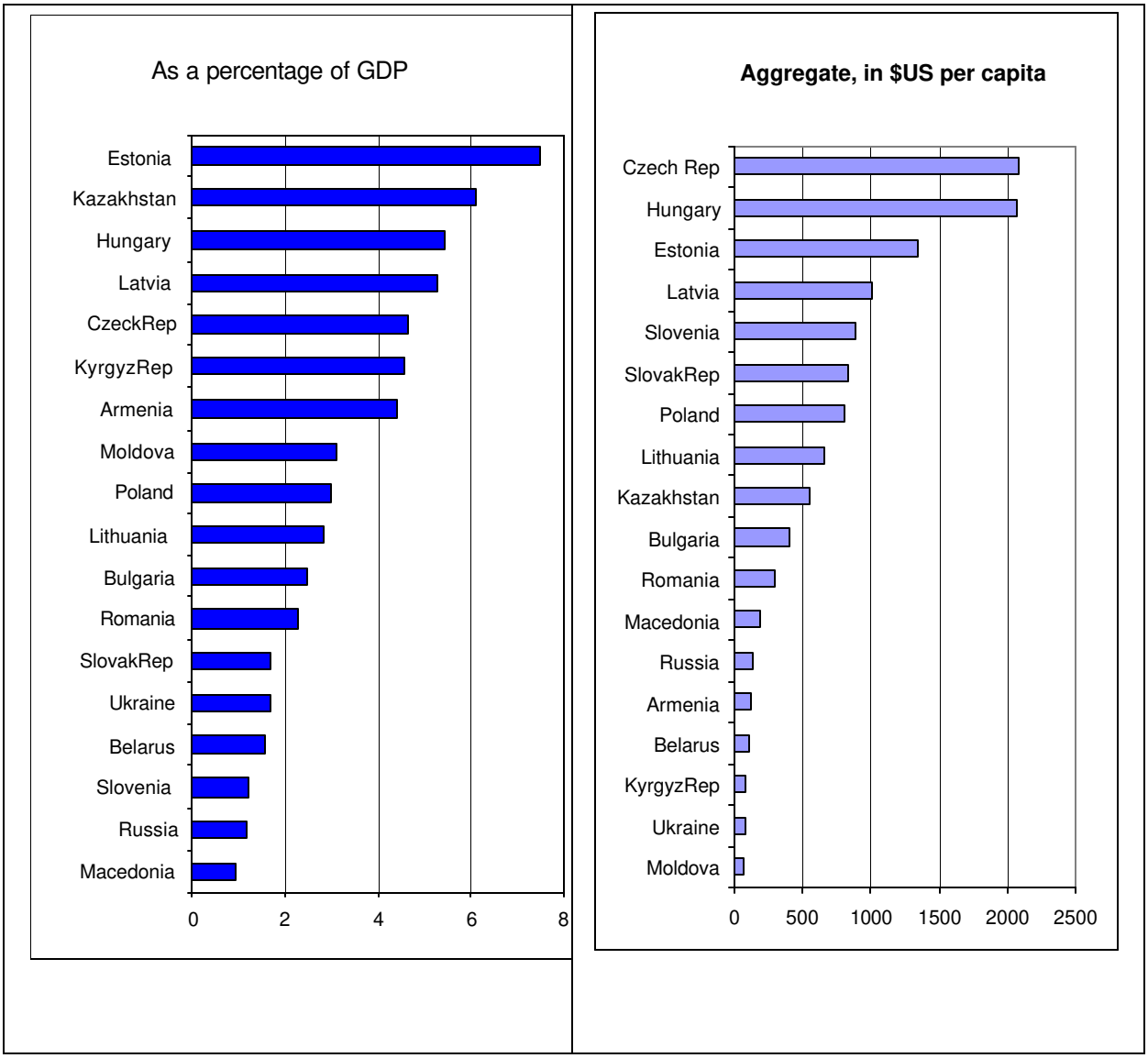
Data Source: Garibaldi et al. (2001)

Figure 3. ***FDI into Ukraine***



Data Source: IMF Yearbook (2000)

Figure 4. ***Cross-Country Distribution of FDI, 1992-1999***



Data Source: Garibaldi et al. (2001)

Table 1. ***The Direct Effect of FDI on Economic Growth***

Independent Variable	OLS for Pooled Data (robust)	GLS for Panel Data	IV for Panel Data
Initial (1989) Per-Capita GDP	-0.1361 (0.09)*	-0.0082 (0.02)**	-0.0644 (0.10)*
Initial (1989) Human Capital	0.1018 (0.27)	0.0209 (0.75)	0.1005 (0.36)
Domestic Investment	0.0483 (0.75)	0.0709 (0.51)	-0.0662 (0.72)
Foreign Direct Investment	0.5069 (0.02)**	0.1303 (0.47)	1.6152 (0.00)**
Government Consumption	0.3411 (0.05)**	0.1929 (0.09)*	0.0632 (0.76)
Current Account	-0.0288 (0.51)	-0.0225 (0.50)	0.0084 (0.81)
Black Market Premium	-0.0001 (0.00)**	-0.0001 (0.00)**	-0.0001 (0.01)**
Constant	0.1526 (0.74)	-0.0212 (0.94)	0.0453 (0.93)
Observations	138	138	121
F-test for common intercept: F(16, 117) = 1.13; P-value: 0.22			
Breusch and Pagan LM test for random effects: ?2(1) = 0.00; P-value: 0.97			
Hausman specification test: ?2(4) = 3.86; P-value: 0.43			
Cook-Weisberg test for heteroscedasticity: ?2(1) = 28.06; P-value: 0.00			
Hausman test: ?2(6) = 161.20; P-value: 0.00			

*Note: p-values in parentheses; * - significance at 10%; ** - significance at 5%.*

Table 2. ***Synergies between FDI and Human Capital***

Independent Variable	OLS for Pooled Data (robust)	GLS for Panel Data	IV for Panel Data
Initial (1989) Per-Capita GDP	-0.0148 (0.58)	-0.1279 (0.55)	-0.0727 (0.79)
Initial (1989) Human Capital	0.0880 (0.34)	0.0875 (0.32)	0.1358 (0.23)
Domestic Investment	0.0490 (0.75)	0.0501 (0.76)	-0.0465 (0.79)
FDI*Initial Human Capital	0.5422 (0.03)**	0.5427 (0.04)**	0.4445 (0.08)*
Government Consumption	0.3272 (0.07)*	0.3264 (0.07)*	0.0387 (0.85)
Current Account	-0.0292 (0.53)	-0.0291 (0.36)	0.0141 (0.66)
Black Market Premium	-0.0001 (0.00)**	-0.0001 (0.00)**	-000.01 (0.01)**
Constant	0.0023 (0.99)	0.1505 (0.73)	0.0747 (0.90)
Observations	138	138	121
F-test for common intercept: F(16, 117) = 1.25; P-value: 0.24			
Breusch and Pagan LM test for random effects: ?2(1) = 0.00; P-value: 0.98			
Hausman specification test: ?2(4) = 5.89; P-value: 0.20			
Cook-Weisberg test for heteroscedasticity: ?2(1) = 27.90; P-value: 0.00			
Hausman test: ?2(6) = 481.75; P-value: 0.00			

*Note: p-values in parentheses; * - significance at 10%; ** - significance at 5%.*

Table 3. ***Synergies between FDI and Domestic Investment***

Independent Variable	OLS for Pooled Data (robust)	GLS for Panel Data	IV for Panel Data
Initial (1989) Per-Capita GDP	-0.1384 (0.51)	-0.0121 (0.93)	-0.0846 (0.77)
Initial (1989) Human Capital	0.1053 (0.25)	0.0202 (0.76)	0.1521 (0.18)
Domestic Investment	-0.0101 (0.95)	0.0618 (0.58)	0.0133 (0.68)
FDI*Domestic Investment	2.0044 (0.02)**	0.4412 (0.54)	1.6118 (0.09)*
Government Consumption	0.3318 (0.05)**	0.1927 (0.13)	0.0375 (0.85)
Current Account	-0.0299 (0.51)	-0.0207 (0.53)	0.0133 (0.68)
Black Market Premium	-0.0001 (0.00)**	-0.0001 (0.00)**	-0.0001 (0.01)**
Constant	0.1705 (0.71)	-0.0091 (0.97)	0.0989 (0.86)
Observations	138	138	121
F-test for common intercept: F(16, 117) = 1.26; P-value: 0.23			
Breusch and Pagan LM test for random effects: ?2(1) = 0.00; P-value: 0.97			
Hausman specification test: ?2(4) = 3.47; P-value: 0.48			
Cook-Weisberg test for heteroscedasticity: ?2(1) = 26.72; P-value: 0.00			
Hausman test: ?2(6) = 163.62; P-value: 0.00			

*Note: p-values in parentheses; * - significance at 10%; ** - significance at 5%.*

Table 4. ***Direct Effects versus Synergies with Human Capital***

Independent Variable	OLS for Pooled Data (robust)	GLS for Panel Data	IV for Panel Data
Initial (1989) Per-Capita GDP	-0.0183 (0.52)	-0.1582 (0.47)	-0.1111 (0.71)
Initial (1989) Human Capital	0.1430 (0.20)	0.1425 (0.20)	0.2077 (0.13)
Domestic Investment	0.0432 (0.78)	0.0446 (0.78)	-0.0541 (0.75)
Foreign Direct Investment	1.8369 (0.35)	1.8419 (0.42)	2.3234 (0.30)
FDI*Initial Human Capital	-1.4793 (0.50)	-1.4846 (0.59)	-2.1365 (0.39)
Government Consumption	0.3826 (0.06)*	0.3816 (0.04)**	0.0844 (0.69)
Current Account	-0.0280 (0.54)	-0.0279 (0.38)	0.0162 (0.62)
Black Market Premium	-0.0001 (0.00)**	-0.0001 (0.00)**	-0.0001 (0.00)**
Constant	-0.0249 (0.89)	0.1581 (0.72)	0.0881 (0.84)
Observations	138	138	121
F-test for common intercept: F(16, 116) = 1.38; P-value: 0.16			
Breusch and Pagan LM test for random effects: ?2(1) = 0.00; P-value: 0.85			
Hausman specification test: ?2(5) = 7.76; P-value: 0.17			
Cook-Weisberg test for heteroscedasticity: ?2(1) = 28.83; P-value: 0.00			
Hausman test: ?2(7) = 48.82; P-value: 0.00			
Tests for Joint Significance	F(2, 129) = 3.61 Prob>F = 0.03	?2(2) = 5.09 Prob> ?2 = 0.08	?2 (2) = 1.58 Prob> ?2 = 0.45

*Note: p-values in parentheses; * - significance at 10%; ** - significance at 5%.*

Appendix

Data

The data on macroeconomic variables for transition economies are obtained from international statistics, primarily the International Monetary Fund Yearbook. The overview of FDI and growth uses data on 25 transition economies in over a period of up to eight years, but the period of study is shorter for some countries due to data limitations. In the formal empirical modeling, it is only possible to use the data on 17 countries because the data on some variables of interest is missing. The variable descriptions and data sources are summarized in Table A1. Summary statistics for all variables are presented in Tables A1 and A2.

Estimation Procedures

The estimation of the results for each of the three general specifications, which are reported in the text in Tables 1-4, followed virtually the same pattern, and, thus, may be conveniently summarised.

Step 1. Despite the numerous advantages of the use of panel data, the estimation of the panel requires certain statistical justification. Thus, the estimation starts with performing the triplet of tests, which determine whether fixed effects on panel data, random effects on panel data, or simple Ordinary Least Squares (OLS) on pooled data should be preferred. The tests applied here are an F-test, Breusch and Pagan LM test, and Hausman test. Uniformly, the F-tests for all four specifications indicated the use of OLS on pooled data. The Breusch and Pagan LM tests also lead to the same conclusion. Consequently, we proceeded with simple OLS on pooled data.

Step 2. After carrying out OLS estimation, we conduct a Cook-Weisberg test for heteroscedasticity, using fitted values of the dependent variable (growth). The computed test statistics (chi-squared) for all specifications overwhelmingly reject the null hypothesis of constant variance. Thus, we proceed further using regressions with robust standard errors, that is, with "heteroscedasticity-consistent" variance-covariance matrix estimators. This corrects for the

influence of non-spherical errors and leads to more reliable inferences. The resulting OLS (robust) results are presented in first columns of Tables 1-4.

Step 3. The finding of the heteroscedasticity on the previous step suggests that the heteroscedasticity was also present in the Step 1. Since the inferences about the original tests results are called into question by the presence of heteroscedascticity, we may want to reconsider panel estimation, using General Least Squares. The GLS procedure produces more efficient estimators by minimizing the weighted sum of squared composite residuals. The results of GLS estimation for the panel data are presented in second columns of Tables 1 –4. These results are, actually, quite comparable to OLS robust estimation of the pooled data, producing qualitatively similar results.

Step 4. OLS and GLS estimations are not the end of the story, however. One important aspect of the growth model used in the estimations is the possible endogeneity of the FDI variable. To deal with this potential problem, we use the Instrumental Variables (IV) estimation. The instruments include the lagged value of FDI and two dummy variables: "FSU" (for the non-Baltic countries of former Soviet Union) and "Baltic" (for three Baltic states) being the instruments of choice for potentially endogenous FDI. In the IV estimation, the number of observations drops from 138 to 121 because of the use of lagged FDI as an instrument. The results of IV estimation for the panel data are presented in the third columns of the four tables.

Step 5. It is also important to note that the instrumental variable technique is not always a perfect remedy for the endogeneity problem. Although the estimates obtained through using the IV procedure are consistent, there is a price to pay for avoiding the asymptotic bias of OLS: the variance-covariance matrix of the IV estimator is larger than that of the OLS estimator. Thus, the final step is to use a Hausman test, which checks whether the IV estimation is to be preferred to "IV-free" estimation. The null hypothesis of the test is that the difference in coefficients obtained via two types of estimation is not systematic. For all estimations based on panel data, the null is rejected at conventional levels of significance and thus the use of IV procedure is justified.

Granger Causality

In Granger (1980, 1987) causality testing, the number of lags should be chosen such that white noise disturbance terms are obtained. Since our data comprise a rather short time period, a single one-year lag can reasonably be adopted, giving rise to the following system of equations:

$$g_t = \alpha + \gamma g_{t-1} + \phi F_{t-1} + u_t \quad \text{(A1)}$$

$$F_t = \beta + \delta\ g_{t-1} + \theta F_{t-1} + v_t \quad \text{(A2)}$$

where $g_{y\,t}$ and F_t are growth and FDI series respectively; *n* and *m* denote the number of lags chosen so that *u* and *v* are white noise disturbance terms. To test whether FDI *Granger causes* growth, we have to test whether ϕ ? 0, and, by analogy, to test whether growth *Granger causes* FDI, we have to test whether δ ? 0. Bi-directional *Granger causality* is obtained if ϕ ? 0 and δ ? 0.

In testing the first hypothesis that FDI Granger causes growth, we need only the first equation of the system; the second equation is irrelevant (Greene, 2000). Similarly, to test the second hypothesis that growth Granger causes FDI, the second equation alone is sufficient. The simple test for these separate cases is just a t-test. In order to draw conclusions about presence or absence of a bi-directional relationship, these one-sided estimates (where the only one direction at a time is tested) estimations may not suffice. Since we would like to test the joint hypothesis, that the causality is running in both directions, and that the coefficients f and d in both regressions are nonzero simultaneously, we need a more careful procedure. It involves estimating the system of two equations and then conducting the joint test on the coefficients jointly being different from zero. Thus, Granger causality is tested in the vector autoregressive (VAR) model.

The results of all three estimations are summarized in Table A5. From the Table it can be inferred that in the regression with growth being a dependent variable (column 1), lagged FDI is insignificant so that FDI does not Granger cause growth. In the regression with FDI being a dependent variable (column 2), the lagged value of growth is insignificant as well, implying that that growth does not Granger cause FDI. Finally, the results of the VAR system estimation (columns 3 and 4) support the results of independent estimations. The joint hypothesis that the coefficients f and d are each equal to zero is not rejected at conventional levels.

Table A1. ***Variable Definitions and Data Sources***

Variable	Definition	Source
Growth	GDP Growth rate, percentage	IMF Yearbook 2001
Initial (1989) Per-Capita GDP	Logarithm of the initial (1989) level of PPP adjusted GDP	de Mello *et al*., World Development Indicators, World Economic Outlook. 1997
Initial (1989) Human Capital	Initial (1989) ratio of secondary school enrollment to the school age population	Fisher and Sahay, "The Transition Economies After Ten Years." IMF Working Paper, 2000
Domestic Investment	Share of domestic investment in GDP, for a given year	IMF Yearbook 2001
Foreign Direct Investment (FDI)	Ratio of FDI to GDP	Garibaldi *et al*., IMF Working Paper 2002
Government Consumption	Ratio of government consumption to GDP (serves as a policy variable)	IMF Yearbook 2001
Current Account	Share of current account in GDP	IMF World Economic Outlook, 2000
Black Market Premium	Black market premium, initial data, 1990, in percents	IMF World Economic Outlook, 2000

Table A2. Summary Statistics

Variable	Observa-tions	Mean	Standard Deviation	Min	Max
Growth	144	-1.2667	8.4250	-35.2000	11.4000
Initial Per-Capita GDP	144	2.1439	.04304	2.0548	2.2357
Initial Human Capital	138	0.8707	0.0992	0.5700	1.000
Domestic Investment	144	0.2161	0.0542	0.1118	0.3799
Foreign Direct Investment	144	0.03145	0.0291	0.0001	0.1207
Government consumption	144	0.1794	.0422	0.0975	0.2881
Current Account	144	-0.1109	0.2205	-1.8116	0.5797
Black Market Premium	144	1116.6530	787.1757	27	1828
Structural Index	144	0.6849	0.1741	0.13	0.93
Transition Index	144	2.9542	0.5103	1.5	3.7

Table A3. ***Additional Summary Statistics on Growth and FDI***

Country	Observations	Period	Variables			
			GDP Growth %		FDI to GDP Ratio	
			Mean	St. Dev.	Mean	St. Dev.
Armenia	6	1994-1999	5.333	1.705	0.044	0.042
Belarus	8	1992-1999	-1.525	9.061	0.016	0.018
Bulgaria	9	1991-1999	-5.200	6.650	0.026	0.024
Czech Rep.	8	1993-2000	1.625	2.603	0.051	0.037
Estonia	8	1992-1999	-1.175	9.972	0.075	0.024
Hungary	10	1991-2000	0.870	5.195	0.053	0.023
Kazakhstan	6	1993-1998	-4.967	5.815	0.001	0.001
Kyrgyz Rep.	6	1994-1999	-0.450	10.941	0.052	0.024
Latvia	9	1992-1999	-3.222	13.917	0.053	0.023
Lithuania	8	1993-2000	-1.100	8.092	0.031	0.026
Macedonia	6	1994-1999	3.283	1.618	0.009	0.011
Moldova	8	1992-1999	-10.112	12.900	0.031	0.021
Poland	9	1991-1999	3.667	4.269	0.027	0.015
Romania	10	1991-2000	-1.750	6.416	0.022	0.019
Russia	9	1992-2000	-3.744	7.683	0.013	0.006
Slovak Rep.	8	1993-2000	3.712	3.559	0.029	0.036
Slovenia	8	1993-2000	4.238	0.857	0.018	0.004
Ukraine	8	1992-1999	-10.200	7.967	0.016	0.005

Table A4. Comparative Specifications using OLS (robust) Estimation on Pooled Data

Independent Variable	MODEL 1: Direct Effect of FDI on Growth without Synergies	MODEL 2: FDI-Human Capital Synergy without a Direct Effect	MODEL 3: FDI-Domestic Investment Synergy without a Direct Effect	MODEL 4: FDI-Human Capital Synergy with a Direct Effect	MODEL 5: FDI-Domestic Investment Synergy with a Direct Effect	MODEL 6: Both FDI Synergies with a Direct Effect of FDI
Initial GDP Per Capita,1989	-0.1361 (0.09)*	-0.0148 (0.58)	-0.1384 (0.51)	-0.0183 (0.52)	-0.1339 (0.56)	-0.1547 (0.53)
Initial Human Capital,1989	0.1018 (0.27)	0.0880 (0.34)	0.1053 (0.25)	0.1430 (0.20)	0.0998 (0.28)	0.1368 (0.25)
Domestic Investment	0.0483 (0.75)	0.0490 (0.75)	-0.0101 (0.95)	0.0432 (0.78)	0.0986 (0.61)	0.0669 (0.74)
Foreign Direct Investment	0.5069 (0.02)**	—	—	1.83689 (0.35)	0.8999 (0.31)	1.8561 (0.34)
FDI*Human Capital	—	0.5422 (0.03)**	—	-1.4793 (0.50)	—	-1.3100 (0.63)
FDI*Domestic Investment	—	—	2.0044 (0.02)**	—	-1.6984 (0.63)	-0.7389 (0.86)
Government Consumption	0.3411 (0.05)**	0.3272 (0.07)*	0.3318 (0.05)**	0.3826 (0.06)*	0.3491 (0.06)*	0.3803 (0.06)*
Current Account	-0.0288 (0.51)	-0.0292 (0.53)	-0.0299 (0.51)	-0.0280 (0.54)	-0.0279 (0.54)	-0.0276 (0.54)
Black Market Premium	-0.0001 (0.00)**	-0.0001 (0.00)**	-0.0001 (0.00)**	-0.0001 (0.00)**	-0.0001 (0.12)	-0.0001 (0.09)*
Constant	0.1526 (0.74)	0.0023 (0.99)	0.1705 (0.71)	-0.0249 (0.89)	0.1372 (0.76)	0.1507 (0.75)
Observations	138	138	138	138	138	138

*Note: p-values in parentheses; * - significance at 10%; ** - significance at 5%.*

Table A5. Granger Causality

	Dependent Variable			
	Growth	**FDI**	**Growth**	**FDI**
	Independent estimation		*System estimation*	
Lagged FDI	14.93 t= (0.83) P= (0.41)	0.63 t= (8.59) P= (0.00)	14.92 z= (0.84) P= (0.401)	0.63 z= (8.69) P= (0.00)
Lagged Growth	0.466 t= (8.21) P= (0.00)	0.0002 t= (1.27) P= (0.21)	0.46 z= (8.31) P= (0.00)	0.0002 z= (1.29) P= (0.19)
Constant	0.61 t= (0.81) P= (0.419)	0.14 t= (4.77) P= (0.00)	0.61 z= (0.82) P= (0.41)	0.014 z= (4.83) P= (0.000)
Number of observations	126	126	126	126
	F (2, 123): 36.36 (0.00)	F (2, 123): 40.91 (0.00)	*Joint Test:* [FDI] Lagged Growth = 0.0 [Growth] Lagged FDI = 0.0 $?^2(2) = 2.4$; Prob > $?^2$=0.3	