

## **DYNAMIC ECONOMIC EFFECTS OF EU MEMBERSHIP FOR POST SOCIALIST COUNTRIES OF CENTRAL AND EASTERN EUROPE**

*YURIY BILENKO\**

### **INTRODUCTION. TRADE LIBERALIZATION AND DYNAMIC EFFICIENCY**

Openness and economic liberalization stimulate the effective allocation of resources based on comparative advantage, enabling knowledge and technological progress to spread between countries and enhancing competition in domestic and international markets. Standard trade theory interprets the benefits of international trade as a movement in the direction of the upper limit of production capacity.

Modern growth theory complements this process by increasing returns to scale and also by constant increasing returns to physical and human capital.<sup>1</sup>

R. Wacziarg and K. Welch<sup>2</sup> conducted a study of the dynamic effects of trade liberalization episodes in 136 countries over almost 50 years, from 1950 to 2000, which shows that countries that liberalized their trade regimes achieved economic growth 1.5 percentage points higher than before liberalization, while investment growth rates were 1.5–2 percentage points higher. The accumulation of physical capital was the main factor behind this intensification of economic growth.

J. Sachs and A. Warner analyzed the dynamic effects of external trade by developing a model of specialization in extractive industries related to natural resources<sup>3</sup> which restrict the movement of the country towards technological progress, which in turn limits the prospects for continued

---

DOI: 10.2478/wrlae-2013-0045

\* Associate Professor, Ivan Franko National University in Lviv, Head of the Department of International Economic Analysis and Finance.

<sup>1</sup> Paul Romer, 'Increasing Returns and Long-Run Growth' (1986) 94 *Journal of Political Economy* 1002-1038; S Rebelo, 'Long-Run Policy Analysis and Long-Run Growth' (1991) 99(3) *The Journal of Political Economy* 500-521.

<sup>2</sup> Richard Wacziarg and KH Welch, 'Trade Liberalization and Growth: New Evidence' (2008) 22(2) *The World Bank Economic Review* 187, 222.

<sup>3</sup> Jeffrey D Sachs and Andrew Warner, 'Economic Reform and the Process of Global Integration' (1995) 1 *Brookings Papers on Economic Activity* 1-118.

economic growth. The exploitation of natural resources makes it possible to gain quick profits which are then assigned to certain groups in society.

It should be noted that there are a number of negative effects of international trade liberalization. In particular, the existence of market and institutional distortions can lead to the under-utilization of human and physical capital, while concentrating on mining and other raw materials industries or specializing in non-dynamic industries which do not allow technological progress make it impossible to obtain the effects of rising incomes. Trade liberalization can therefore lead to countries suffering technological backwardness if appropriate reforms are not carried out to overcome institutional and market strains.

D. Rodrik and F. Rodriguez have considered theoretical arguments that suggest that an open economy and the liberalization of foreign trade is detrimental to developing countries.<sup>4</sup> Liberal trade policy is a suboptimal policy that merely serves as a temporary lever of economic recovery, while market and institutional weaknesses are constant factors in the economic life of these countries.

Low productive sectors are washed out by foreign competitors, but the resulting capital and labour are not able to be used more efficiently because of low factor mobility and a lack of financial development. Appropriate institutional reforms to the banking sector and labour market must accompany the liberalization of foreign trade.<sup>5</sup>

R. Chang, L. Kaltani and H. Loayza's research<sup>6</sup> into the implementations of liberal trade regimes in more than 80 countries over the period 1960–2000 concluded that the removal of barriers to trade should be accompanied by complementary reforms in the non-trading sectors in order to achieve production efficiency and economic growth. Liberalization must be accompanied by increasing investment in human capital and infrastructure, and by increasing labour market flexibility through simplifying mechanisms for companies to enter and exit the market. Only an educated, highly-skilled workforce and developed financial markets will enable the economy to efficiently adapt to a liberal trade regime.

The above analysis of literature which considers some elements of the mechanism of economic growth through trade liberalization is very valuable for identifying specific channels linking trade liberalization to economic growth within the post-socialist countries of Central and Eastern Europe (CEE) which have accessed the EU and removed barriers to trade between them.

---

<sup>4</sup> D Rodrik, F Rodriguez, 'Trade Policy and Economic Growth: A Skeptics Guide to the Cross-National Evidence' in B Bernanke and K Rogoff (eds), *NBER Macroeconomics Annual* (NBER 2000) 261-325.

<sup>5</sup> A Banerjee, A Newman, *Notes for Credit, Growth and Trade Policy* (Mimeo MIT 2004).

<sup>6</sup> R Chang, L Kaltani, N Loayza, 'Openness can be good for Growth: The Role of Policy Complementarities' (2005) 3763 World Bank Policy Research Working Paper.

## I. EVOLUTION OF THE PROCESS OF TRADE LIBERALIZATION IN CENTRAL AND EASTERN EUROPE

Closure to the outside world was a key principle of administrative and planning control in the socialist economy. The process of transforming the socialist economies began with the opening of the market to trade with developed countries and liberalizing national currency convertibility for current account transactions.

Liberalization or decentralization involves the weakening of state control to overcome the state monopoly in the economy at both the macro and micro levels. Another important external tool for the decentralization of transition economies and their macro stabilization is the liberalization of foreign trade, as pointed out by O. Blanchard and G. Kolodko.<sup>7</sup> Some indisputable benefits of liberalized foreign trade include the fact that it restrains prices on imported goods, and hence inflation, it raises living standards, stimulates foreign investment and, for the countries of Eastern and Central Europe, it also paves the way to accession to the European Union. This package of measures includes the release of prices for most goods and services; the lifting of restrictions on the establishment of private companies, providing them with access to world markets; and the transfer of power from the central government to local government authorities and the private sector. In Table 1, we represent the dynamics of liberalization of the external market due to the methodology of the European Bank for Reconstruction and Development.<sup>8</sup> The success of structural reforms is evaluated using a point scale (the highest point being most successful): 1, 2, 3, 4, and 4.3.

Reforms in foreign trade and the liberalization of foreign exchange markets are evaluated by criteria that are associated with the level of quantitative and administrative restrictions on export and import operations and currency convertibility. The highest rates in this field (4 + or 4.3) signify the achievement of the standards and performance of advanced industrial countries, the removal of most tariff barriers and membership in the World Trade Organization.

Countries	Index of liberalization of foreign trade and foreign exchange market	
	1995	2003
Bulgaria	4.0	4.3
Hungary	4.3	4.3
Slovakia	4.0	4.3
Czech Republic	4.0	4.3

<sup>7</sup> O Blanchard, *The Economics of Post-Communist transition* (Oxford University Press 1998) 15-35; Г Колодко, *Глобалізація і перспективи розвитку постсоціалістичних країн* (Основні цінності 2002) 248.

<sup>8</sup> European Bank for Reconstruction and Development, *Transition Report 2003 - Integration and Regional Cooperation* (EBRD London 2003) 208-209.

Poland	4.0	4.3
Romania	4.0	4.0
Estonia	4.0	4.3
Latvia	4.0	4.3
Lithuania	4.0	4.3
Croatia	4.0	4.3
Slovenia	4.0	4.3
Ukraine	3.0	3.0
Russia	3.0	3.3

Table 1. Progress in liberalizing foreign markets in Central and Eastern Europe in the period 1995–2003.

Source: European Bank for Reconstruction and Development, *Transition Report 2003 - Integration and Regional Cooperation* (EBRD London 2003) 209.

Table 1 shows that very rapid trade liberalization took place within Central and Eastern European new member states of the European Union, unlike in Ukraine and Russia, where liberal reforms were carried out slowly and partially.

Synchronicity and the pace of trade liberalization are different in every country, but they have all introduced a unified exchange rate and introduced a convertible currency, provided the private sector with full autonomy to operate in international markets and lifted export controls.

Institutionally, trade liberalization in CEE countries comprises three stages: WTO membership in 1995, participation in the free trade zones of CEFTA and EFTA, and accession to the European Union in 2004. Thus, progress from unilateral liberalization to participation in multilateral regional integration associations can be observed. The countries of the Central European region, in rejecting export restrictions and choosing a liberal import regime, thereby affirmed their desire to join the European Economic Community which, to some extent, accelerated the integration process.

During the period of 1988 to 1994, the major groups of goods that were imported into the EU from CEE countries included energy, ores and metals, clothing, furniture and others. It should be noted that during this period the share of fuel imported into the EU from CEE countries decreased by 3 times, and the proportion attributable to mechanical devices and appliances increased by 1.5–2 times. Significant growth in the exports of CEE countries in 1995 was due to an increase in volume of output.<sup>9</sup> Output in the participating countries of the Agreement on Free Trade in Central Europe, CEFTA (which included the Czech Republic, Hungary, Slovakia and Poland), grew on average by 5–7%, based on growing domestic demand.<sup>10</sup>

Another important stage of economic reform comprises the liberalization of the import regime, setting the real exchange rate of the national currency and the completion of the privatization process. More specifically, this comprises the removal of import restrictions (within the

<sup>9</sup> P Guerriery, 'Trade patterns, FDI and Industrial Restructuring of Central and Eastern Europe' (1998) 124 BRIE Working Paper 39-42.

<sup>10</sup> European Bank for Reconstruction and Development, *Transition Report 1998* (EBRD London 1998) 50.

safety of the national economy) and full support for privatization, the liberalization and stabilization of domestic prices, creating a competitive environment, and weakening the power of the state monopoly by establishing common quality standards and new technologies. Thus, the foreign economic policy of transition countries should complement internal policies and vice versa. Only under these conditions can rapid and positive results in economic transformation be achieved.

Countries	Share of international trade in GDP, % (degree of openness of the economy)			Share of trade with non-transition economies, % of GDP		
	1995	2002	2010	1995	2002	2010
Bulgaria	80.6	82.1	81.0	65.4	76.4	72.5
Hungary	62.8	108.9	166.5	77.7	84.5	70.0
Slovakia	94.7	130.3	164.0	45.6	63.5	58.8
Czech Republic	89.4	113.2	132.5	68.1	80.7	73.0
Poland	40.0	40.5	85.7	82.3	81.3	74.3
Romania	49.0	66.9	53.2	88.8	84.0	66.1
Estonia	113.8	125.1	151.9	61.6	71.8	64.1
Latvia	75.1	78.5	109.0	49.5	67.7	47.8
Lithuania	98.6	97.2	138.2	43.0	61.5	46.0
Croatia	66.6	68.2	64.7	68.9	72.6	59.6
Slovenia	94.2	96.3	130.2	76.0	77.6	68.4
Ukraine	84.1	88.4	104.3	40.3	47.5	44.3
Russia	43.1	48.6	51.4	68.2	71.6	68.6

Table 2. The level of openness of the economy and structural reorientation of foreign trade in Central and Eastern Europe in the years 1995–2010.

Source: European Bank for Reconstruction and Development, *Transition Report 2003* (EBRD London 2003); European Bank for Reconstruction and Development, *Transition Report 2010* (EBRD London 2010).

Overall, analysis of the external trade of transition countries in CEE determines the growth of openness of the economy and the share of trade with non-transition economies (See Table 2).

In general, CEE countries are small, open economies with extremely high dependence on foreign trade. This dependency is highest in Slovakia, Hungary and the Czech Republic and slightly lower in Poland and the Baltic states. Changes in trade with non-transition economies takes the shape of a parabola with levels peaking at the time of direct entry into the European Union, after which the proportion of post-socialist countries began to increase as incomes in these countries and, consequently, the size of local markets have increased significantly in 2004-2010.

As mentioned above, structural institutional reforms are very important for successful trade liberalization and sustainable economic growth. Therefore, using the partial correlations method, we are able to chart the impact of structural reforms on the share of foreign trade of CEE

transition countries with non-transition economies during the transformation period.

Independent variables (structural reforms)	Dependent variable (share of trade with non-transition economies) Coefficient of correlation	P- value of correlation coefficient
Largeprivat	0.1322	0.1250
Smallprivat	0.0652	0.4506
Enterreform	0.2703*	0.0015
Pricelib	0.0903	0.2960
Forexlib	0.2417*	0.0046
Competpolicy	0.1822	0.0338
Bankref	0.2658*	0.0018
Infraref	0.5292*	0.0000

\* coefficient of partial correlation statistically significant at 1%

Table 3. Structural reforms and share of trade with non-transition countries (partial correlations).

We included the following types of reforms to the structural reforms outlined by the methodology of the European Bank for Reconstruction and Development<sup>11</sup>: price liberalization (*pricelib*), the liberalization of foreign exchange and foreign trade operations (*forexlib*), the privatization of large (*largeprivat*) and small enterprises (*smallprivat*), reform of the enterprise structure (*enterreform*), reforms in antitrust policy (*competpolicy*), reforms in the banking sector (*bankref*) and reforms in the infrastructure sector (electricity, roads, etc.) (*infraref*). The success of structural reforms is evaluated using a point scale (the highest point representing most successful): 1, 2, 3, 4, and 4.3; the data sample includes the period of 1991 to 2010. The results of the econometric estimation (Table 3) of these processes are the following: liberalization of the foreign exchange market, reform of the enterprise structure, reforms in the banking sector and reforms in the infrastructure sector have had a statistically-significant positive effect on the share of foreign trade with non-transition economies which, in our opinion, could be explained by an increase in imports from developed countries, including the European Union. Price liberalization and successful large and small scale privatization have had little effect and are statistically insignificant. On the close relationship between liberalization and economic reforms, J. Sachs and A. Warner opine that the ‘liberalization of foreign trade not only establishes powerful direct links between the economy and the world system, but also effectively forces the government to take actions on other parts of the reform program under the pressures of international competition.’<sup>12</sup>

<sup>11</sup> European Bank for Reconstruction and Development, *Transition Report 2012* (EBRD London 2012) 167.

<sup>12</sup> Jeffrey D Sachs and Andrew Warner, ‘Economic Reform and the Process of Global Integration’ (1995) 1 Brookings Papers on Economic Activity 1, 2.

## II. THEORETICAL MODEL OF DEFINING THE DYNAMIC EFFECTS OF ECONOMIC INTEGRATION

Analysis of the economic integration of the post-socialist countries of Central and Eastern Europe in the twentieth century with the structures of the European Union allows us to define a number of the static and dynamic effects of regional expansion of the movement of goods, services and factors of production, and institutional convergence.

We will concentrate on studying the dynamic effects of regional integration within the EU with regard to the achievements of the traditional and new schools of economic growth. R. Baldwin believes that dynamic effects are several times greater than static effects on the distribution of production factors.<sup>13</sup> The source of the dynamic effect of trade liberalization, *ceteris paribus*, is the growth of the marginal productivity of capital. This process is determined by the movement to a new stable position of capital per unit of labour and thus attracts new capital resources, which in turn is accompanied by increased production, but that the social rate of return on equity will be higher than private, although it may have only a short-term impact on the value of economic growth by the classical model R. Solow.<sup>14</sup>

Economic policy when entering into regional integration implies investment in one's own country rather than increasing the leakage of capital to other countries joining or beyond.

Baldwin R. and A. Venables developed an algorithm to determine the static and dynamic effects of regional integration,<sup>15</sup> which are defined in the analysis of the welfare of a representative consumer by the utility function of the form:  $V(p + t, n, E)$ , where  $p$  – a vector of prices border,  $t$  – a vector of trade costs, including tariffs,  $n$  – a vector of product diversity in each industry,  $E$  – total consumption expenditures, which are defined by the following formula:

$$E = wL + rK + X [(p+t) - a(w, r, x)] + \alpha m - I, (1)$$

where  $wL + rK$  – factor income determined by the amount of capital  $K$  multiplied by the interest rate  $r$  and by labour  $L$  multiplied by the wage rate;  $X [(p + t) - a(w, r, x)]$  determines the profit of companies, where  $X$  – vector of different industries;  $p + t$  – domestic prices with tariff,  $a(w, r, x)$  – average costs in every sector of the economy;  $\alpha m$  – tariff rent of the state, where  $m$  – vector of imports,  $\alpha = 1$  – with tariff rent,  $\alpha = 0$  – without tariff rent and  $I$  – investment. Differentiating  $V(p + t, n, E)$  and dividing by the marginal utility of expenditure equation we get:

$$V/V_E = \alpha dm - md[t - \alpha t] - mdp +$$

<sup>13</sup> R Baldwin, 'Measurable Dynamic Gains from Trade' (1989) 3147 NBER Working papers.

<sup>14</sup> R Solow A, 'Contribution to the Theory of Economic Growth' (1956) 70 Quarterly Journal of Economics 65-94.

<sup>15</sup> RE Baldwin and AJ Venables, 'Regional Economic Integration' in G Grossman and K Rogoff (eds), *Handbook of International Economics* (Vol. III, Elsevier Science B.V. 1997) 1598-1644.

$$+[p+t-a] dX - Xa_x dx + (V_N/V_E)dn + (r \sim / \rho - 1) dI \quad (2)$$

The first line displays the effects of welfare under perfect competition:  $\alpha dm$  – change in trade volumes by removing trade barriers,  $m d[t-\alpha t]$  – the cost of trade and  $m dp$  – change in terms of trade. In the second line of the equation, three members show increasing profits from economies of scale and imperfect competition, in particular  $[p + ta] dX$  – output growth from increasing the price difference compared to the cost,  $Xa_x dx$  – economies of scale, which is due to the change in costs when changing the size of firms,  $(V_N/V_E)dn$  – changes in the amounts of certain varieties (diversity) of consumer goods. The third line of the equation depends on the accumulation of capital. We have discounted the social rate of return through a social discount rate  $r \sim / \rho$ , which must be greater than zero.

### III. EMPIRICAL ANALYSIS OF DYNAMIC ECONOMIC EFFECTS OF INTEGRATION CEE COUNTRIES TO THE EU

Given the already-sufficient medium term of CEE countries' presence in the EU, we will try to trace some of the effects of integration on the welfare of these countries. Poland, Hungary, Slovakia, the Czech Republic, Slovenia and the Baltic states increased their exports to the EU during the period of 2003 to 2010 2–2.5 times, thus significantly increasing the share of trade of these countries within the European Union (see Table 4).

Country- member of EU	Export		Import	
	1999	2010	1999	2010
Czech republic	38.3	56.4	36.2	47.9
Hungary	41.8	57.2	40.2	46.2
Poland	113.2	26.8	19.6	26.7
Slovakia	43.9	62.3	40.9	53.6
Slovenia	27.1	44.0	35.9	43.3
Estonia	36.1	41.9	43.9	51.4
Latvia	18.3	26.6	30.5	36.9
Lithuania	18.5	34.5	25.5	36.1
Bulgaria	16.6	26.3	17.6	31.1
Romania	13.9	21.6	18.9	27.2

Table 4. Indicators of foreign trade of the new EU members within the EU, 1999 and 2010, % of GDP.

Source: author's calculations based on data from

Eurostat<[http://epp.eurostat.ec.europa.eu/portal/page/portal/international\\_trade/data/main\\_tables](http://epp.eurostat.ec.europa.eu/portal/page/portal/international_trade/data/main_tables)> accessed 15 September 2012

Also of interest is the analysis of changes in trade and the price of exports, which is indicative of changes in the competitiveness of a country and also the static effects of economic integration. The data from Table 5 indicate strong growth in the unit value of exports in Latvia, Lithuania, Poland and the Czech Republic, although the terms of trade deteriorated



slightly in almost all countries, which led to a significant current account deficit in 2008.

Indicators	Index of unit value of exports in euros (2000 = 100)			Index terms of trade, in euros (2000 = 100)		
	2003	2008	2010	2003	2008	2010
Countries						
Slovakia	102.0	121.6	119.6	100.5	94.3	94.6
Poland	101.4	127.1	127.2	103.2	100.6	101.6
Hungary	97.3	100.2	104.5	99.5	92.4	97.5
Czech Republic	105.9	126.9	128.5	104.3	102.3	102.9
Latvia	100.0	134.3	131.2	104.2	104.5	106.9
Lithuania	98.8	134.2	129.6	103.5	96.1	95.3
Estonia	98.2	120.2	120.4	98.0	94.6	97.8
Slovenia	101.5	118.8	120.2	102.9	95.4	95.9

Table 5. Terms of trade and unit value of exports in new EU member states.

Source: <[http://epp.eurostat.ec.europa.eu/portal/page/portal/international\\_trade/data/main\\_tables](http://epp.eurostat.ec.europa.eu/portal/page/portal/international_trade/data/main_tables)> accessed 15 September 2012.

Overall, our study was covered the period of 1999 to 2008, so as not to distort the data resulting from the sharp shock of the global financial crisis on the performance of 2009. We analyzed the specific dynamic effects of the integration of Central and Eastern Europe countries into the European Union in the medium term, taking into account the five-year period before (1999–2003) and after (2004–2008) accession. In the study, we chose the following countries of Central and Eastern Europe: Slovakia, Poland, Hungary, the Czech Republic, Latvia, Lithuania, Estonia and Slovenia.

We considered dynamic effects to be the process of accumulation of capital through foreign direct investment and investment growth in fixed capital in these countries, as well as economic growth as an indicator of the efficiency of capital through market expansion and competition.

For the analysis of changes in the rates of foreign direct investment we estimated the cumulative FDI inflows in the five years before and after joining the EU, and the average annual growth rate of investment in fixed assets as well as the average rate of growth of real gross domestic product of these countries for five years before and after joining the European Union.

Indicators	FDI inflows, (millions USD)		Annual growth rate of investment in fixed capital, (%)		Annual growth rate of GDP, (%)	
	Before accession 1999-2003	After accession 2004-2008	Before accession 1999-2003	After accession 2004-2008	Before accession 1999-2003	After accession 2004-2008
Countries						
Slovakia	7069	16209	-2.3	8.5	3.3	7.4
Poland	23986	81416	-1.2	10.7	3.1	5.4
Hungary	15136	29204	6.2	2.4	4.4	2.8
Czech Republic	27715	39178	4.6	4.3	2.6	5.2

Latvia	1482	6650	8.0	11.5	6.4	7.4
Lithuania	2229	7612	1.7	12.5	5.3	7.1
Estonia	2457	10085	10.8	7.0	6.5	5.8
Slovenia	2708	5488	6.0	8.1	3.9	5.0

Table 6. Dynamic effects of integration of CEE countries into the European Union.

Source: author's calculations based on data from: Eurostat,

<<http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/>> UN Economic Commission for Europe <<http://w3.unece.org/pxweb/database/STAT/>>, European Bank for Reconstruction and Development

<<http://www.ebrd.com/pages/research/economics/data/macro.shtml#macro>>.

The results of our calculations are presented in Table 6, the analysis of which shows that in all countries, with the exception of Hungary, there was a rapid accumulation of capital, in particular over the five years of EU integration. Foreign direct investment increased significantly, especially in the Baltic States (almost by 3–4 times) as well as in Poland and Slovakia. However, if we exclude the data for 2008, in the Baltic states the average annual growth rate of investment in fixed capital and GDP would be two times higher than in the *ex ante* integration period.

I would like to draw attention to the record levels of FDI inflows to the Polish economy, more than 57 billion U.S. dollars, which reversed the trend of negative rates of investment in fixed assets. If we analyze the level of GDP per capita in the pre-accession period, the highest growth of FDI inflows was in countries with relatively lower levels of well-being, i.e. in countries where the marginal productivity of capital, according to the theory, should be higher.

The expansion of production in connection with entry into the European Union, which is caused by the expansion of the market and gaining access to external demand, prevailing in all integrated countries will lead to the acceleration of the process of capital accumulation and encourage investment-oriented growth. However, it should be noted here that the effect of the law of diminishing returns on capital may, with time, upon reaching a stable position, reduce the rate of return on capital. This reduction may be suspended by economies of scale that can be successfully achieved within the single market of European Union.

In accordance with the new endogenous-type growth theory, G. Grossman and E. Helpman in particular examine the circumstances in which physical and human capital and knowledge will not show decreasing yields, especially in economic openness and trade liberalization.<sup>16</sup> The basic mechanism of long-term growth in the integration process is the ability to intensify technological exchange and scientific cooperation as the result of an increase in foreign trade and income.

We investigated the processes of accumulation of physical and human capital as the basis of dynamic effects of European integration of the countries of Central and Eastern Europe and long-term sustainable growth.

Physical capital was calculated based on the PIM method with a level of depreciation of capital of 5%, and for the period from 1990 to 2010 in USD PPP using a constant 2005 price. The quantity of capital for 1990

<sup>16</sup> GM Grossman and E Helpman, 'Trade, knowledge spillovers and growth' (1991) 35 European Economic Review 517-526.

was estimated according to a ratio of capital to GDP equal to 2.5. According to the PIM method, the quantity of capital in a given year is equal to the quantity of capital for the previous year, plus investment minus depreciation of initial capital for the year.

$$K_{t+1} = K_t + I_t - \delta * K_t \quad (3)$$

where  $K$  –the amount of capital,  $I$  –the investment rate and  $\delta$  –the rate of depreciation of capital.

We estimated human capital  $h$  according to the income method, where the function  $\varphi(E)$  (4) reflects the efficiency of a unit of labour with  $E$  years of education  $h = e^{\varphi(E)}$  (4) relative to one with no education ( $\varphi(0) = 0$ ). The derivative  $\varphi'(E)$  is the return to education estimated in a Mincerian wage regression, where an additional year of education raises a worker's efficiency.<sup>17</sup> The average years of education of an employed person were from Barro-Lee's database of educational attainment.<sup>18</sup> Returns to investment were from G. Psacharopoulos; the first four years of education rate of return is 13.4%, next four years' value of return is 10.1 % and for education beyond the 8<sup>th</sup> year it is 6.8 %<sup>19</sup>. The human capital of the whole economy  $H$  will be:

$$H = e^{\varphi(E)}L, \quad (5)$$

where  $L$  – the amount of labour force in the economy.

Indicators	Rate of growth of fixed capital, %		Rate of growth of human capital, %		Employment in medium and high technology industries, %	
	Before accession 1999-2003	After accession 2004-2008	Before accession 1999-2003	After accession 2004-2008	2003	2008
Slovakia	2.2	3.1	0.7	0.84	8.00	10.33
Poland	3.4	4.3	1.7	2.99	4.91	5.50
Hungary	2.3	2.7	7.69	2.59	8.27	9.26
Czech Republic	2.7	3.7	3.23	8.18	8.72	11.64
Latvia	1.2	5.8	9.9	3.9	1.85	2.40
Lithuania	1.2	5.0	3.15	9.49	3.03	3.02
Estonia	4.3	8.2	1.55	2.05	3.35	5.03
Slovenia	4.0	5.2	1.27	1.48	8.97	9.09

<sup>17</sup> J Mincer, *Schooling, Experience, and Earnings* (Columbia University Press 1974).

<sup>18</sup> Barro-Lee Data Set < <http://www.barrolee.com> > accessed 20 December 2012.

<sup>19</sup> G Psacharopoulos, 'Returns to Investment in Education: A Global Update' (1994) 22(9) World Development 1325-1340.

Table 7. Dynamics of accumulation of physical and human capital in the EU. Source: Author's calculation of indicators of physical capital based on PIM method, human capital indicators calculated according to Barro-Lee's database; employment in technological sectors, according to Eurostat:

<<http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&language=en&pcode=tsc00011&plugin=1>> accessed 20 September 2012.

The results of our estimations are presented in Table 7 and clearly show increasing rates of growth of physical capital, especially in Baltic countries and also more dynamic rates of growth of human capital in Czech Republic, Poland and Lithuania, as well as decreasing rates of human capital growth in Hungary and Latvia. In all CEE countries the share of employment in high-tech industry sectors significantly increased.

Finally, we have tried to examine economic growth in CEE countries according to R. Lucas's model of endogenous growth with human capital.<sup>20</sup> The production function takes the form:

$$y = A k^{\beta} h^{\gamma}, \quad (6)$$

where  $y$  – GDP per employee,  $k$  – capital per employee,  $h$  – human capital per employee,  $h^{\gamma}$  – an external effect which multiplies the productivity of a worker at any skill level according to R. Lucas's interpretation,  $\beta$ ,  $\gamma$  – parameters of production function. To estimate this function we used a panel GLS regression with random and fixed effects for CEE countries for the period 1990–2010. The dependent variable was the natural log of GDP per employee  $lgdemcee_{it}$ , and the following were independent variables: the natural log of capital per employee  $lkapemp_{it}$ , the natural log of human capital per employee  $lhumcap_{it}$  and also the dummy variable  $euaccess_{it}$  (1 for the period after 2003 and 0 for the period before 2004); indexes  $t$  and  $i$  mean year and country respectively.

	Dependent variable $lgdemcee_{it}$ (in USD PPP 2005)	
Independent variables	Specification of model	
	Random effects	Fixed effects
Constant <sub>it</sub>	4.75 (11.64)*	4.57 (10.75)
$lkapemp_{it}$	0.62 (9.01)	0.648 (8.87)
$lhumcap_{it}$	1.161 (6.58)	1.18 (6.45)
$euaccess_{it}$	0.135 (5.66)	0.126 (5.12)
Within R <sup>2</sup>	0,84	0,84
Between R <sup>2</sup>	0,65	0,65
Overall R <sup>2</sup>	0,72	0,71
Statistical tests	Wald $\chi^2$ 882.0	F-test 289
Number of observations	168	168

\* in parenthesis  $t$ - statistic.

<sup>20</sup> R Lucas, 'Why Doesn't Capital Flow from Rich to Poor Countries' (1990) 80(2) The American Economic Review 92-96.

Table 8. Economic growth and accession of CEE countries to the EU.

The results of estimating the coefficients of model (6) which are all significant at the level of 1% can be regarded as proof that these countries have developed according to the AK model of endogenous growth,<sup>21</sup> which involves constant or increasing returns on capital, and also decisively proves the external effects of human capital. More advanced countries do not have similar results. The economic growth of post-socialist Central and Eastern European countries which were members of the EU from 2003 to 2008 is a striking example of a new type of economic growth of an endogenous kind. The accession to the European Union led to an increase in output per employee from 12.6 to 13.5% in comparison to average productivity before 2004, according to our estimation. Thus, we confirmed the presence of technological spillovers and their intensification in expanding trade for CEE countries.

In addition, the sectors that create new products and knowledge operate under imperfect competition or oligopolistic competition, and therefore economic integration facilitates the strengthening of competition policy, which in turn helps to reduce the monopoly component in the operation of these sectors and increases their efficiency. Integration into the European Union also leads to the integration of capital markets, which reduces the value of credit, causing an increase in efficiency of investments.

## CONCLUSIONS

Regional integration affects economic growth by changing the return on investments in the formation of physical, human capital and the creation of new knowledge, which in turn leads to accelerated accumulation of capital resources. In connection with the law of diminishing returns on capital, increasing the effects of accelerating investment will eventually fade out. R. Solow's growth model implies a temporary or medium-term effect of changes in investment on economic growth.<sup>22</sup> Thus, regional integration may temporarily accelerate growth, but in the long run it will return to the average rate typical in the past of a given country before changes in trade policy.

How does integration stimulate investment processes? Regional economic integration affects the prices of the factors of production, including the rate of return on capital, many differentiating factors in the participating countries and regional associations beyond those associations. Our study confirmed that the relatively capital-intensive sector in member countries gained developmental momentum in connection with the expansion of the market, which causes increased demand for capital, and unification led to investment-oriented economic growth that is stimulated by

---

<sup>21</sup> S Rebelo, 'Long-Run Policy Analysis and Long-Run Growth' (1991) 99(3) *The Journal of Political Economy* 500-521.

<sup>22</sup> R Solow, 'Technical Change and the Aggregate Production Function' (1957) 39 *Review of Economics and Statistics* 312-320.

changes in the production structure of the trade sector. Additional capital will contribute to the constant changes in production and income.

In summary, we can conclude that dynamic effects are accompanied by the accumulation of physical and human capital, new technologies achieved through growing economies of scale and increased competition, and as a result there is an increase in the rate of economic growth and elimination of the effect of diminishing returns on all types of capital that are intensely accumulated. The performance of new CEE members of the EU confirms these ideas of endogenous economic growth.