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SPEED OF CONVERGENCE AND RELOCATION: NEW EU MEMBER COUNTRIES CATCHING UP WITH THE OLD****

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ABSTRACT: Economic convergence of the new member countries (NMCs) of the EU towards the incumbent EU countries (EU-15), not only in terms of real income, but also in nominal terms, is of paramount importance for both partners. We build a dynamic CGE model, starting from the Balassa-Samuelson two-sector framework, but modify and enlarge it with, i.a., endogenous capital formation, consumption behaviour and labour mobility to address several other issues like uncertainty, welfare and sustainability in terms of foreign indebtedness. At the same time we evaluate, by endogenising FDI flows, what impact convergence has on the EU-15 and what is the interaction between the two regions through FDI. We find that in a general equilibrium setting fears of adverse effects of a relocation of EU-15 manufacturing to the NMCs are not well founded.

KEY WORDS: Convergence, New Member Countries, EU-15

JEL codes: F15, F21, F43

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TIIVISTELMÄ: EU:n uusien jäsenmaiden taloudellinen konvergenssi kohti vanhoja EU-15 -maita, ei ainoastaan reaalisen tulotason, vaan myös hintojen ja palkkojen osalta on tärkeä molemmille osapuolille. Rakennamme kahden tuotantosektorin dynaamisen yleisen tasapainon mallin lähtien liikkeelle Balassa-Samuelson -kehikosta, jota muunnamme ja laajennamme mm. endogeenisilla investoinneilla, kulutuskäyttäytymisellä ja työvoiman liikkeillä, ja tarkastelemme useita kysymyksiä, kuten epävarmuutta, hyvinvointia ja konvergenssiprosessin vakautta ulkomaisen velkaantumisen osalta. Samalla arvioimme endogenisoimalla suorat sijoitukset sitä, mikä on näiden kahden alueen keskinäinen riippuvuus suorien sijoitusten välityksellä ja mikä vaikutus konvergenssilla on EU-15 -maihin. Tulokseksi saamme, että yleisen tasapainon mielessä pelot tuotannon uudelleensijoittamisen kielteisistä vaikutuksista EU-15 -maille eivät ole kovinkaan perusteltuja.

ASIASANAT: Konvergenssi, uudet jäsenmaat, EU-15 -maat

1 INTRODUCTION

The focus in research on European integration has shifted from the effects of EU enlargement to the evaluation of convergence of the new member countries (NMCs) towards the incumbent EU-15 countries, which is of paramount importance to the NMCs. It is also important for the homogeneity of the Union and thereby of substantial significance to the EU-15 as well, where a concern has recently emerged that industry relocation to the new member countries, where production costs are much lower, may pose a threat to the EU-15.[1]

It is straightforward and common to make basic mechanical calculations of the catching-up process of the new member countries towards the EU-15. More analytical approaches attempt to evaluate the role of trade and integration on growth and, consequently, convergence of the NMCs income levels towards incumbent countries. In this line of studies there is, on the one hand, purely empirical literature that is usually based on ad hoc cross-country growth regressions where the integration and trade effects are usually captured by different dummy variables or openness measures (e.g. deMelo et al. 1993, Dollar 1992, Edwards 1993, Harrison 1995, Sachs and Warner 1995 or Henrekson et al. 1996). The conclusion on the role of regional economic integration behind growth is in this literature somewhat ambiguous but in general trade openness and economic growth are in a positive relationship with each other. Moreover, there is also evidence that trade openness contributes to income disparities. Ben-David and Kimhi (2000) and Ben-David (1996) provide evidence that changes in the extent of trade among groups of countries tend to decrease intra-group income disparities and affect positively the speed of convergence. Moreover, by breaking up the groups into pairs, David and Kimhi find that exports from a poorer country to a richer one and imports from a richer country to a poorer one boosted convergence. This result is relevant also in the context of European integration especially after Eastern enlargement.[2]

The studies listed above are, however, normally made in terms of real income per capita only. But of equal significance for EU-15 and firms outsourcing their activities to the new member countries is nominal convergence in terms of relative wages and prices. The inflationary development in the new member countries is also vital, e.g., from the point of view of ECB monetary policy and the future entrance of the new member countries into the Economic and Monetary Union. See Figures 1 and 2 on convergence to date.

The basic tool for such a comprehensive evaluation of convergence is the seminal Balassa-Samuelson model (or the Scandinavian model of inflation, see Mihaljek and Klau, 2003), which divides the economy into two sectors, the open (tradable goods and services) and closed sector (non-tradable goods and services). This is also the starting point in our paper. We, however, modify and extend the basic model in several ways. Our first modification is to combine the basic Balassa-Samuelson model with the key result in empirical growth literature, which states that GDP growth rate is not constant over time, but that it is positively related to the initial gap in income levels so that poorer countries grow faster than wealthier ones (see e.g. Barro 1991). This basic insight is neglected in mechanical catching-up scenarios, but taking this fact into account has a major impact on our view on the speed of future convergence. The second extension to the basic framework is the explicit recognition that there is considerable uncertainty related to projections of long-run convergence.

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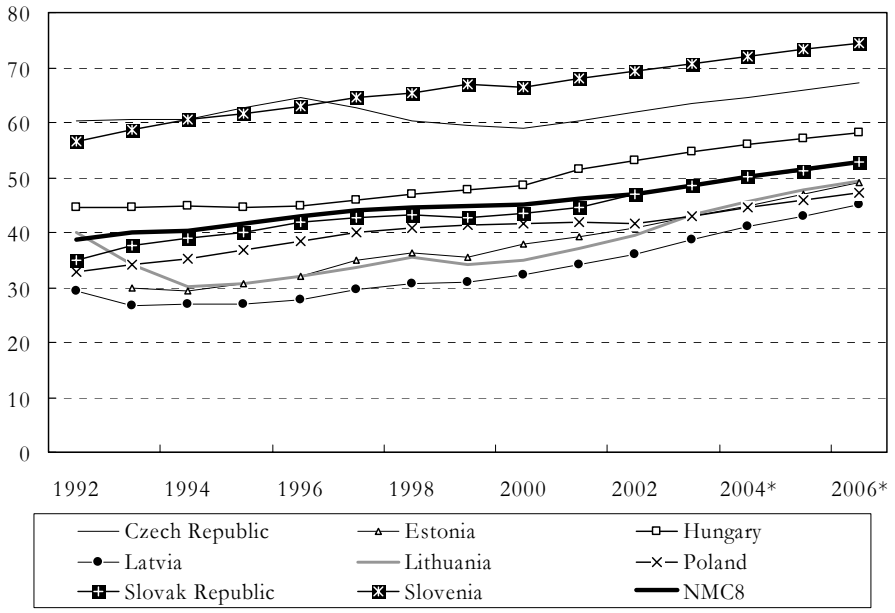
1 See Euroframe (2005) for recent surveys on relocation.

2 For an extensive survey on theoretical and empirical convergence literature, see de la Fuente (2000) and more in the context EU-integration Kaitila (2003).

But altogether, this basic framework is deficient in discussing many important issues of convergence. Capital accumulation is an important element to consider. It is financed through foreign direct investment (FDI) and national savings. FDI inflow has been an important channel for the NMCs in financing their often large current-account deficits. This has meant that the new member countries have not themselves had to finance the whole burden of their capital accumulation and the current-account deficit, which has delivered a marked welfare gain to them. Accordingly, we shall endogenise cross-border factor flows, both capital flows through FDI and labour flows through migration, and allow for spillovers on total factor productivity through FDI from the EU-15 to the NMCs. Related to this, Baldwin and Seghezza (1996a, 1996b) discuss about and analyze trade-induced investment-led growth, which combined old growth and new trade (imperfect competition) models, and trade induced productivity-led growth, which combines new growth and new trade (imperfect competition) models. These papers argue that there is strong evidence on the former, having the Iberian enlargement as an example, but do not find strong evidence or obvious examples on the latter. Eastern enlargement and the development in NMCs fits potentially to the former as well.

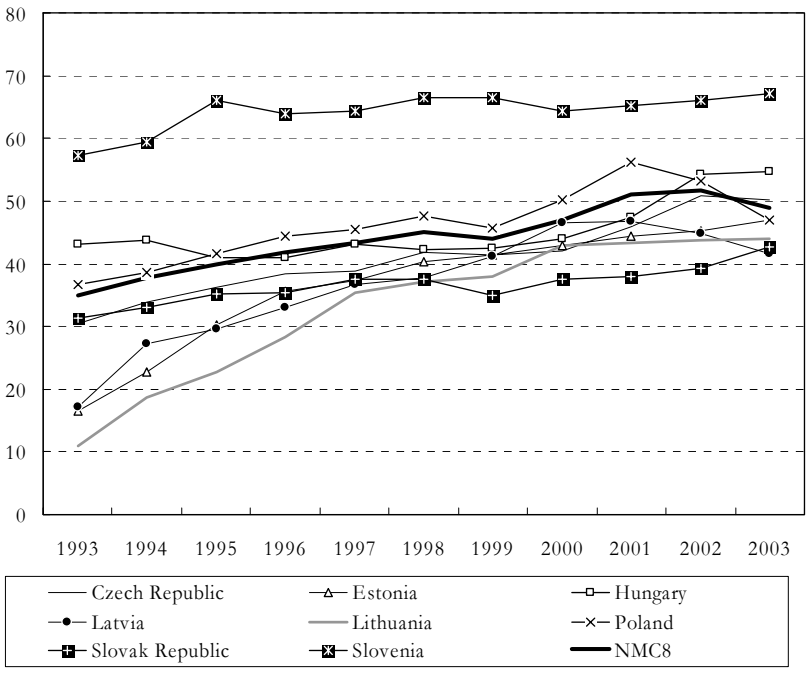
In the next extension to the basic framework, we consider not only the income path, but also the consumption behaviour of the new member countries by introducing a forward-looking consumption function. This is important in the sense that a part of the consumers in the new member countries discount the future path of real wage rise in their consumption behaviour already today, which leads to initial current account deficits. This way we are able to tackle the important sustainability issue of convergence in terms of foreign indebtedness.

Figure 1 **Real convergence: GDP per capita (PPP) in the NMCs, EU-15 = 100**



Source: European Commission.

Figure 2 **Nominal convergence: Price level (ratio of current exchange rate to PPP exchange rate) in the NMCs, EU-15 = 100**



Source: International Monetary Fund, World Economic Outlook Database.

It is true that the future EMU entrance of the new member countries will remove one side, namely the macroeconomic and monetary aspects of the foreign imbalance, by merging it with the overall external balance of the Euro Area. But it is still important to be aware of this issue, because GDP, national income, and welfare measured by consumption may diverge from each other,[3] not only because of the return on FDI, but also due to the cost of foreign borrowing and transfers through the EU budget.

Our final extension is to build an aggregative framework to evaluate the impact of convergence on the growth of the EU-15 countries. There are three channels which we will consider in this respect. First, there will be reduced capital accumulation as such in EU-15 because of outward FDI to the NMCs. Second, there will be a rise in the EU-15 countries' national income as investment in the new member countries will yield, at least initially, a higher rate of return than an investment in the home country. And third, there is an effect through increased competitiveness caused by outsourcing a part of EU-15 production to the lower-cost countries, because the overall cost of producing will thereby decrease.

Altogether, a dynamic two-region CGE model is built with elements of endogenous growth, as FDI inflow boosts TFP in the NMCs. The impact of eastern enlargement of the EU on the EU-15 and the NMCs has been evaluated in computable general equilibrium framework earlier in Keuschnigg and Kohler (2002), Heijdra et al. (2004), Baldwin et al. (1997), Sulamaa and Widgrén (2004) and Vaittinen (2000, 2004). Keuschnigg and Kohler and Heijdra et al. build a dynamic model, and Vaittinen uses a dynamic version, whereas Baldwin et al. and Sulamaa and Widgrén use a static version of GTAP model developed at University of Purdue in Global Trade Analysis Project. A common conclusion in all these studies is that the incumbent EU countries obtain

[3] The difference between gross domestic product and gross domestic income is particularly large in Ireland, where sizeable FDI inflows have taken place.

relatively small gains even in the long run, but the NMCs obtain considerable gains especially in the long run and when all integration effects, i.e. trade liberalization, increasing foreign investments, EU budget transfers and migration, have been taken into account. In Vaittinen (2004), the long run deviation in NMCs' GDP that is due to the three first effects is +15 per cent. Migration decreases the impact to 8-13 per cent depending on the intensity to migrate. From the EU-15's point of view the figures are −0.2 percent and 0.2 - 1.5 per cent respectively. The study thus indicates GDP convergence between the EU-15 and NMCs although that is not the prime purpose of this study.

We consider two scenarios of convergence with the aid of our CGE model: One where the FDI stock of EU-15 in the NMCs remains at the level where it was in 2000 throughout the period 2001-2030; and a second one, where we allow the FDI stock to grow in response to the higher rate of return in the NMCs. The key results of this exercise are that a vigorous inflow of FDI leads to a higher growth rate in the NMCs for over a decade. It also leads to a sustained welfare rise in terms of consumption. In this case, convergence of the new member countries will be more rapid than in the basic Balassa-Samuelson framework. In the EU-15 relocation of production to the NMCs leads to a small decrease in GDP, but gross national income will expand by around one per cent. This will not be sustainable in the very long run, however, as the rate of return on FDI in the NMCs will gradually decline.

The paper is organised as follows. In Section 2 we present the modification of the Balassa-Samuelson model and then add the evolution of the uncertainty related to such projections. In Section 3 we formulate a more complete model with endogenous capital accumulation, forward-looking consumption behaviour, and labour mobility. In Section 4, we will combine the EU-15 countries into the model by considering what effects FDI outflows to the new member countries will have on the former. Section 5 presents the key results of the convergence simulations.

2 MODIFIED BALASSA-SAMUELSON MODEL AND ITS STOCHASTIC VERSION

2.1 A Modified Basic Framework of Convergence

The Balassa-Samuelson model is the standard tool to analyse both real and nominal convergence as it links them neatly together. Assume that labour is the only factor of production in the NMCs (capital will be added in the next Section). Real output in sector *i* is given by

$$Q_i = A_i L_i , \tag{1}$$

where A_i is labour productivity and $i = T, N$ is the sector in question (T = tradables, open sector and N = non-tradables, closed sector). Labour input in the two sectors is $L_T = bL$, $L_N = (1-b)L$, 0 < b < 1, where L is the total labour force in the economy. The wage level in the new member countries is determined by the competitiveness norm (zero profit condition) in the open sector of the economy:

$$W = P_T A_T , \tag{2}$$

where P_T is the international price level of tradable goods, exogenous to the area concerned. Assume in a standard way a homogeneous labour market, which implies that wages are uni-

form within a country: $W_N = W_T = W$. The price level in the closed sector is then based on unit cost:

$$P_N = \frac{W}{A_N}. \tag{3}$$

Real output per unit of labour (per capita) q is then

$$q = \frac{bP_T A_T + (1-b) P_N A_N}{P}, \tag{4}$$

where $P = P_T^b P_N^{1-b}$ is the price of domestic output (GDP). Note that real output per head q is equal to the average real product wage, i.e. W/P.

However, this framework, although allowing for treatment of both real and nominal convergence, is deficient in many respects, which we try to overcome below. That is, it is not reasonable to assume that the growth rates of productivities, and thereby that of GDP, are fixed over the whole convergence path. The recent literature on growth and convergence starts from the key notion that the growth rate is not a constant, but an increasing function of the initial gap in the per capita income levels, i.e. we have so-called β-convergence. Consequently, poorer countries will grow faster than wealthier ones. The basic empirical result reached in this literature is that 2 per cent of the initial gap in income levels is closed every year. In the case of the new member countries of the EU, Kaitila (2004) has reached a result using pooled mean group estimation and fixed effects that the speed of unconditional convergence towards the EU-15 was much higher in 1993-2002, on average 8 per cent per year. Anyway, this implies that we cannot set the convergence speed to be a constant over the whole catching-up phase.

Let g_t be the growth rate of GDP per head in NMCs in year t. We specify the convergence process to be, as in the β-convergence specification,

$$g_t = \beta_0 - \beta_1 \log \frac{q_{t-1}}{q^*_{t-1}}, \tag{5}$$

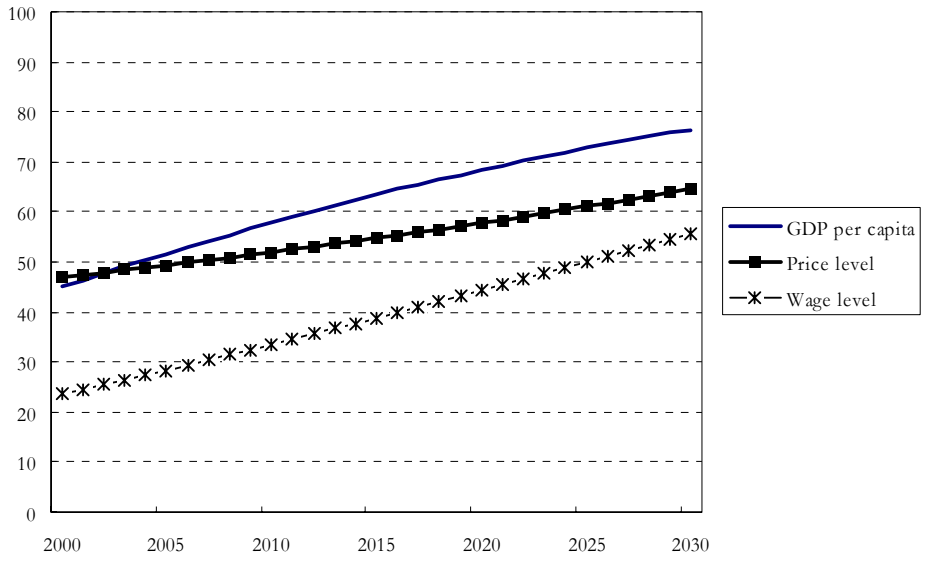
where q and q^* are the per-capita income levels valued at PPP in the new member countries and EU-15, respectively, and β_0, $\beta_1 > 0$. As a long-run condition, we specify that when catching up will finally be completed at time T, i.e. $q_T = q^*_T$, the growth rate of the new member countries will also have converged to that of EU-15, i.e. $g_T = g^*$. For simplicity, we will assume that the growth rate g^* in EU-15 will remain fixed all the time. This gives us the condition that in (5) $\beta_0 = g^*$, and we can calibrate the parameter β_1 from the condition that the initial growth rate g_0 of the new member countries is the actually realised one at the initial income gap. For example, if g_0 = 5 per cent p.a., the value of β_1 is 0.043 with an initial gap of 50 per cent in the income levels.

We assume that the deceleration of growth, as specified in (5), applies similarly to the rise of productivity in both the open and the closed sector, so that the initial positive mutual gap in the growth rates between the two sectors applies all through the convergence process.

Throughout the paper we will use the year 2000 as the starting year and as the year of calibration for the model and will extend the calculations to year 2030. An illustration of such a calculation for both real and nominal convergence is depicted in Figure 3 using the above

framework.[4] We see that due to specification (5), convergence is likely to be much slower than in technical calculations that are based on a constant growth rate over time. There would still exist a marked gap in the real and nominal variables after 30 years of convergence towards the EU-15. The average growth rate of real per capita income (GDP per head) of the NMCs is 3.7 per cent, rise in wages is 6.9 per cent and in the price level 3.1 per cent per annum.

Figure 3 **Basic real and nominal convergence scenario for the new member countries, EU-15 = 100**



2.2 Stochastic Convergence

Our assumption (5) and its calibration is crucial for the outcome of the convergence process and, in fact, it excludes the Irish "miracle" from being repeated, i.e. that at some time t $q_t > q_t^*$. But if we allow for uncertainty in the above version of the Balassa-Samuelson model and the β-convergence hypothesis, we can have a more multi-faceted picture of the convergence process, where also this possibility emerges. So, before proceeding with building a more articulated model of convergence, let us make a short digression and combine uncertainty into the basic Balassa-Samuelson model. This is done as follows.

Uncertainty emerges here through variability in the productivity growth rate. Let $a_i = \log A_i$, i = T,N. It evolves as follows

$$a_{it} = a_{i0} + \hat{a}_{i1} + ... + \hat{a}_{it}, \tag{6}$$

where $\hat{a}_{is} = a_{is} - a_{i,s-1}$. The gap in the income levels is

$$\log\left(q_t / q_t^*\right) = b a_{Tt} + (1-b) a_{Nt} - \log\left(q_t^*\right). \tag{7}$$

[4] The initial growth rate of productivity in the open sector is 6 per cent and the sheltered sector 4.5 per cent per annum and so g_0 = 5 per cent p.a. if the share of the open sector in the whole economy, b, is 30 per cent. The initial price level is given by purchasing power parity calculations, which are defined as the ratio between the current exchange rate and the PPP exchange rate against the USD, see Figure 2. The wage level is determined from the national accounts as the labour cost per hour. All variables in Figure 3 are expressed in ratio to the corresponding variables in EU-15. We will assume throughout that real GDP per head in EU-15 grows by 2 per cent, inflation is 2 per cent and the rise in the wage level is consequently 4.4 per cent p.a.

On the basis of our key formulation (5), we can write

$$\hat{a}_{Tt} = g^* - \beta_1 \log\left(q_t / q_t^*\right) + \left(\hat{a}_{T,0} - g_0\right) + \varepsilon_{Tt} \ , \tag{8}$$

where we have assumed that the initial gap in the growth rate of productivity in the open sector vis-à-vis the closed sector will remain fixed throughout the convergence process and ε_{it} is white noise with $E(\varepsilon_{it}) = 0$ and variance σ_ε^2. To simplify, we also assume that there is no uncertainty related to the difference between the increase in productivity in the open and closed sectors. Consequently, there is uncertainty only related to the overall rise in productivity, and the gap $\delta = \hat{a}_{Tt} - \hat{a}_{Nt}$ stays constant. Using equation (7), the gap in income levels evolves over time as

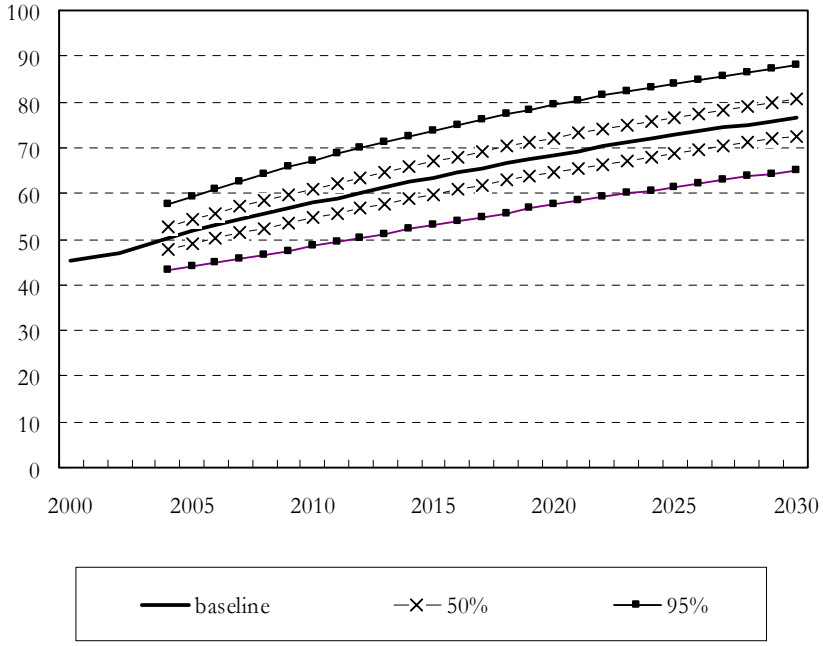
$$q_t^{rel} = \log\left(q_t / q_t^*\right) = \log\left(q_{t-1} / q_{t-1}^*\right) + \hat{a}_{Tt} - b\delta - g^* . \tag{9}$$

Combining (8) and (9), the variance V related to the income gap q^{rel} can be derived to evolve recursively (see also Barro and Sala-i-Martin 1995, 384) as follows

$$V(q_t^{rel}) = (1-\beta_1)^2 V(q_{t-1}^{rel}) + \sigma_\varepsilon^2 + \sigma_{g^*}^2 , \tag{10}$$

where $V(q_1^{rel}) = V(\varepsilon_1) = \sigma_\varepsilon^2$ and we have assumed that the uncertainty related to the EU-15 countries' growth path is uncorrelated with that in NMCs – another simplifying assumption. In a numerical evaluation, the stochastic projections are defined so that σ_ε is fixed at 1.3 percentage points (average standard deviation of the growth rate in the NMCs over 1994-2003) and σ_{g^*}, related to EU-15 growth, at 1.2 percentage points (average over 1980-2003).

Figure 4 **A stochastic version of the real catching-up process: Real GDP per capita at PPP in the NMCs and the confidence intervals, EU-15 = 100 (for explanations, see the text)**



The results are shown in Figure 4. The quite moderate rise over time in uncertainty related to convergence basically depends on the fact that the assumption of β-convergence dampens accumulation of uncertainty. Namely, if there is a positive impulse ε_t to growth in year t, this will dampen the growth rate from $t+1$ onwards, see (8) and (9) in combination to realise this. The other factor behind this result is that we consider the aggregate EU-15 and NMC areas, the uncertainty over their average growth rates being much smaller than that over the individual countries' growth rates. Anyway, the uncertainty in economic terms becomes quite large as the 95 per cent confidence interval in 2030 of the NMC income level is located between 65 and 90 per cent of the average income level in the EU-15.

3 A DYNAMIC CGE MODEL OF CONVERGENCE

The above framework is fairly simple and does not allow for elaboration of several key aspects of convergence. For example, it does not explicitly deal with capital accumulation and foreign FDI flows, nor the internal resource allocation between the sectors. Although output is very important, welfare is more based on consumption. Also labour migration and the impact of convergence on EU-15 are ignored. These are all very important issues linked to the convergence of NMCs and justify the construction of a more articulated growth model for the two regions.

We build a model retaining the two sectors, open and closed, in the new member countries with all markets operating under perfect competition. Next we introduce capital as a factor of production and separate the sectors so that capital is used only in the open sector, while labour is used in both sectors.

Let us now define A_T to be the total factor productivity in sector T. We define a Cobb-Douglas production function for this sector

$$Q_{Tt} = A_{Tt} K_{Tt}^{\alpha} L_{Tt}^{1-\alpha}, \tag{11}$$

where $0 < \alpha < 1$.

Based on this and the interest rate i, determined exogenously in the world capital markets, together with the interest premium of the NMCs (see Section 5 below), the optimal capital stock is given by

$$K_t^{opt} = L_{T,t-1}\left(\left(i + d - p_{Tt}\right)/A_{Tt}\right)^{1/(\alpha-1)}, \tag{12}$$

where L_T is labour employed in the open sector, d is the rate of depreciation and p_T is the inflation rate in the open sector. This inflation rate in tradable goods stays fixed throughout at 2 per cent in the numerical simulations. We have also assumed in (12) that investment goods are produced in the open sector and therefore they have this price. The actual capital stock evolves through gradual adjustment so that

$$\frac{K_t}{K_{t-1}} = \left(\frac{K_t^{opt}}{K_{t-1}}\right)^{\varsigma}, \tag{13}$$

where $0 < \varsigma < 1$.

The internal resource allocation between the two sectors is important and takes place through the labour market as follows. The demand for labour in the closed sector is based on the demand for the domestic goods produced in this sector. The demand for the consumer goods produced by the open and closed sector is based on an instantaneous CES preference function, which implies that

$$Q_{Nt} = \tau_N C_t \left[\frac{P_{Nt}}{P_t} \right]^{-\sigma}, \tag{14}$$

where C is aggregate consumption, determined by intertemporal optimisation in (21) below, $0<\tau_N<1$ is the preference parameter, σ is the elasticity of substitution in consumption, and P is the aggregate price level. The labour input in the closed sector is then based on the demand for labour,

$$L_{Nt} = \frac{Q_{Nt}}{A_{Nt}}. \tag{15}$$

The remainder of the labour force is employed in the open sector. Countries can export the rest of their open-sector production, i.e. the part that is not consumed at home, at the going international (world market) price level P_T, which is not affected by convergence of the two regions concerned. The wage rate is determined, as above, by the marginal product of labour in the open sector, evaluated at the capital stock and the labour employed in the open sector in the previous year.

Labour mobility has been set aside so far. The labour available for the whole economy, i.e. affected by migration, depends on the relative consumption wage in the new member countries compared to that in the EU-15 countries. It is given by

$$L_t = L_{t-1} \left[\frac{W_{t-1}/P_{t-1}}{(1-u_t)W^*_{t-1}/P^*_{t-1}} \right]^{\upsilon}, \tag{16}$$

where $\upsilon > 0$, an asterisk again refers to the EU-15, and u_t is the tax rate imposed on EU-15 labour to finance the transfers to the NMCs paid through the EU budget.

Next we will specify forward-looking consumption behaviour, based on intertemporal optimization. This is important in the sense that consumers in the NMCs, or a part of them, discount the future convergence path of real income and use it already today in their consumption through borrowing. This has an impact on the current account and the sustainability of the convergence process.

The financial market in the model operates so that households see through the corporate veil in the sense that they both own that share of capital in the open sector firms that is not owned and financed by foreigners, i.e. $K - K_{fdi}$, where K_{fdi} is the inward FDI stock, and are also responsible for the debts of the firms. Consequently, their consumption behaviour is based on the aggregate national foreign debt, denoted B.

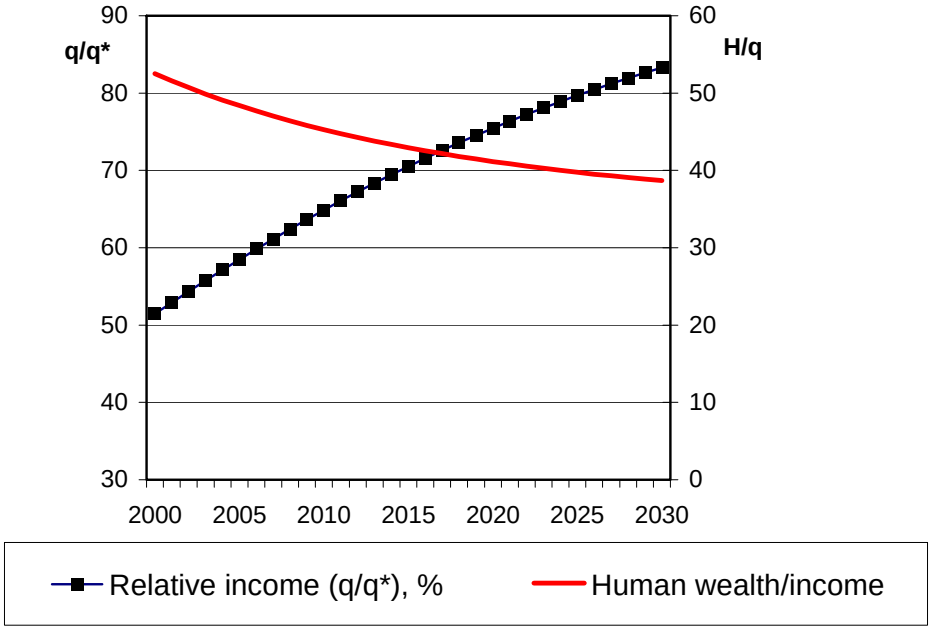
Expected human capital H per capita in relation to real income is equal to

$$\frac{H_t}{q_t} = \sum_{s=t}^{\infty} \left(1 + r^*\right)^{-(s-t)} \left[\frac{W_s/P_s}{q_t} \right], \tag{17}$$

where r^* is the constant real rate of interest determined exogenously in the world capital markets for both the EU-15 and the new member countries.

In Figure 5 we have depicted the expected human capital in relation to current income on the same basic convergence path, which was depicted already above in Figure 3. We see that the ratio H/q declines over the time span because as incomes gradually rise there is less to be expected in terms of future rises in real wages. There is thus an initial pressure in the NMCs towards borrowing by the forward-looking consumers to smoothen the consumption path and thereby run a deficit in the current account.

Figure 5 **Expected human wealth in NMCs in relation to the current income on a reference convergence path**



However, it would not be sensible to assume that all consumers can behave like this because the size of the current-account deficit would then initially become unsustainable. Consequently, we will assume that consumers in the new member countries are either forward looking or liquidity constrained. In the standard manner, consumption by the former group is based on expected human capital and current financial net wealth. Consequently, total real consumption C_1 by the forward-looking consumers is

$$C_{1t} = \theta\left(H_t L_t - B_{t-1}\right), \tag{18}$$

where θ is the rate at which wealth is consumed. We further fix this rate to be in the standard manner $\theta = r^* - g^* > 0$. Consequently, after convergence has been completed, in a steady state, consumption of human wealth and the rate at which it accumulates are the same, and (roughly) corresponds to the current situation in the EU-15. The equilibrium level of human capital H in relation to q after convergence is completed is equal to $\left(r^* - g^*\right)^{-1}$, because at equilibrium income levels in the NMCs and the EU-15 are identical.

Current aggregate real income is determined by

$$Y_t = Q_t - i^* B_{t-1} - \rho K_{fdi,t-1} + T_t, \tag{19}$$

where $Q_t = q_t L_t$ is the aggregate GDP, i^* is the nominal interest rate on foreign debt, $\rho = F_K$ is the rate of return on capital in the NMCs and therefore on FDI, and T is the budgetary transfer to the NMCs from the EU-15 through the EU budget. This will be specified in more detail in Section 5.1.

Consumption expenditure C_2 by the liquidity-constrained consumers is simply given by

$$C_{2t} = cY_t, \tag{20}$$

where c is the constant propensity to consume current income. Now let h denote the fixed share of forward-looking consumers in total population and $(1-h)$ the share of liquidity-constrained consumers. This means that aggregate consumption C is given by[5]

$$C_t = h\theta(H_t L_t - B_{t-1}) + (1-h)cY_t . \tag{21}$$

Net foreign debt of the NMCs accumulates through the current-account deficit, which is by definition equal to the excess of domestic expenditure over domestic income, less that part of it which is financed by FDI inflows. In real terms, foreign debt accumulates as follows:

$$B_t = (1-p_t)B_{t-1} + C_t + I_t - Y_t - (Kfdi_t - Kfdi_{t-1}) , \tag{22}$$

where $I = K_t - (1-d)K_{t-1}$ is the real investment flow.

As a final item in the model for the NMCs, consider the link between them and the inflows of FDI aside from the role of the latter in financing the current-account deficit, and consider the impact of FDI on the productivity of domestic firms through spillovers. This has been under intensive research recently, see e.g. Javorcik (2004) and Barr et al. (2004). There is also a technical argument related to the spillover. As supported by anecdotal evidence, foreign firms are assumed to produce in the NMCs with technology that is almost as advanced and with productivity that is almost as high as in the EU-15 countries, but with lower costs. This will necessarily lead to a rise in productivity in the NMCs. Consequently, we can modify equation (8) in the following way:

$$A_{Tt} = A_{T,t-1}\left[1 + g^* - \beta_1 \log\left(q_{t-1}/q^*_{t-1}\right) + \left(a_{T0} - g_0\right)\right]\left[1 + \left(\frac{Kfdi}{K}\right)_{t-1} \varphi \frac{Kfdi - Kfdi_{t-1}}{Kfdi_{t-1}}\right], \tag{23}$$

where $\varphi > 0$ and the impact of the rise in the FDI stock depends on the absolute size of the stock in relation to the total capital stock in the NMCs. Specification (23) also includes an element of endogenous growth, as TFP growth also depends on FDI inflows.

4 THE IMPACT OF CONVERGENCE ON THE EU-15

We finally want to incorporate the EU-15 countries into the analysis as an endogenous block and see how the convergence process may affect them. Presently, this is a heated policy debate as the fear of a relocation of firms from the EU-15 to the new member countries is a concern and measures, both at the firm level and by policy makers, to adjust to this pressure are under way to attract firms to stay in the EU-15. Therefore we have to describe the basic elements in the model, through which convergence affects the EU-15 countries and which have so far been considered as exogenous.

There are three basic factors of interaction in this respect. First, there is the outflow of FDI into the new member countries (and elsewhere), which causes a relocation of production from EU-15 so that their capital accumulation, and thereby production, will slow down. Secondly, as a result of FDI there is more production in the form of subcontracting in the new member coun-

5 We have incorporated the forward-looking consumption function into the numerical simulations by using the outcome for H/q^* over the baseline convergence path in Figure 3 of q/q^*, calculated over the time span 2000-2080. This has given us the terminal condition for the relative human capital variable used in the simulations.

tries, and as the cost and price levels are lower there than at home, firms gain in competitiveness when they produce abroad. The EU-15 firms can use this advantage in their increased supply to the world markets. This should compensate at least partly for the initial loss in employment in the EU-15 countries once the relocation of production to the new member countries is realised. And third, national income in the EU-15 countries will rise, in contrast to a potential loss in GDP, through a higher yield on capital investment in the new member countries than at home. Next we will enlarge our model to take into account these elements.

We now construct a model for the two areas that are also open to the rest of the world. Both areas can export to the world markets the remainder of their production not consumed at home. We assume that this price level is independent of the convergence process. The nominal interest rate i^* is also set in the world capital markets for both regions.

The EU-15 economy is considered to be a single entity without separating the two domestic sectors as was done above for the NMCs. Gross (total) output Q^* is produced by combining value added Y^* with intermediate goods input M^*, which is in a fixed input-output ratio to the value added. Consequently,

$$Q^* = F\left(Y\left(K^* - K_{fdi}, L^*\right), M^*\right) = \frac{1}{1-\xi} Y^*, \tag{24}$$

where $M^* = \xi Q^*$ and ξ is the share of imported inputs in total production, $0 < \xi < 1$. Value added in the EU-15 countries is produced using Cobb-Douglas technology with capital $K^* - K_{fdi}$, labour L^*. Assume that all intermediate goods are produced in the new member countries at the local price level P and total factor productivity which is the same as that in the EU-15. On the basis of (24) we further have that

$$P_Y^* = P_T \frac{1 - \xi \frac{P}{P_T}}{1-\xi}, \tag{25}$$

where P_T is the given price on tradables Q*. We see from this expression that a rise in ξ, ceteris paribus, leads to a rise in the value-added price of EU-15 production and thereby to a rise in profitability as P, the price level in the NMCs, is lower than that in the EU-15. On the other hand, the rise in P towards P_T during the convergence process leads to a reduction in P_Y^*.

If the demand for EU-15 goods Q^* remains unchanged, there will be a reduction in EU-15 production if there is a relocation of domestic production to the NMCs, which means that ξ in equation (24) rises. But this is not the final outcome as the rate of return on capital in the EU-15 rises as P_Y^* rises, which will lead to a rise in capital accumulation and production. This gain in competitiveness will be utilised in production for world markets and it neutralises some of the initial loss caused by relocation, see Section 5.2. below for an empirical evaluation of these diverse impacts.

Our final specification concerns the determination of FDI flows and the ratio ξ. We take this to be endogenous so that technology depends on the share of the aggregate capital stock that has been outsourced to the new member countries:

$$\xi = \frac{K_{fdi}}{K*}. \tag{26}$$

The amount of outward foreign direct investment by the EU-15 firms is determined in a portfolio balance type of allocation of the capital stock so that,

$$\frac{K_{fdi}^{opt}}{K^*} = s_0 + \eta\left[\rho_{FDI} - \left(i^* + d - p_T\right)\right], \tag{27}$$

where s_0 is the initial budget share of capital being allocated to the NMCs, and ρ_{FDI} is the rate of return on the FDI stock in the NMCs. This is compared to the (fixed) cost of capital in the EU-15. The parameter $\eta > 0$ depends on the attitude towards risk felt by firms. There is then a partial adjustment of the actual FDI stock K_{fdi} as a reaction to the lagged and the optimal stock (similarly as in (13) above).

The final element concerns the labour migration between the two areas. Labour which migrates from the NMCs comes to the EU-15 so that

$$L_t^* = L_0^* - \left(L_t - L_0\right). \tag{28}$$

5 SIMULATIONS OF CONVERGENCE

5.1 Calibration of the Model

In the calibration of the model we will take the year 2000 as the starting year so that the solution of the production optimum is identical with the situation prevailing then. In EU-15 the capital stock is at the desired level given the labour force and the exogenous cost of capital (0.08 per cent per annum) so that there is an instantaneous adjustment of the actual capital stock in the EU-15 to its optimal level.

The elasticity of capital in production α is assumed to be 0.4. The calibration of the initial capital stock in the NMCs presumes an initial rate of return to capital of 17 per cent, which is clearly higher than in the EU-15. Parameter ζ is fixed quite low to reflect a realistic adjustment and sensitivity of investment behaviour with respect to the rate of return. It is fixed at 0.05. This corresponds to what Alho (2004) found for Finnish manufacturing sectors. This parameter is quite essential for the outcome of the simulations. The speed corresponding to FDI flows is set higher at 0.25.

In the NMCs, the initial relative income level is 46 per cent, price level 47 per cent, and wage level 23 per cent of those in the EU-15. Initially the open sector has 30 per cent of total employment. The substitution parameter σ in (14) is quite crucial in many ways as it determines the internal resource allocation in the NMCs. It is fixed here to unity. Parameter φ in (23) is set at 0.05, similarly as in Haskel (2002).

Calibration of parameter h takes place so that initially the current-account deficit corresponds to the average in the NMCs in 2000. If h is high, the current-account deficit is very big to start with, but the debt ratio will then stabilise. The calibration gives an estimate of h = 0.05 only. The human capital variable in (17) is discounted by using a fixed real rate of interest of 5% p.a.

The rise in total factor productivity is fixed at 1.4 per cent per annum in the EU-15. Together with the endogenous rise in the capital stock this would lead to a GDP growth rate of 2 per cent. The annual rise in the international price level is fixed at 2 per cent. In the NMCs, the initial rise in TFP in the open sector is fixed at 6 per cent and in the closed sector at 4.5 per cent. The parameter β_1 is calibrated, as above, to be 0.043.

The nominal interest rate in the NMCs is lowered in 2003 from 8 per cent to 5 per cent, which is the level globally and in the EU-15. It will stay at this level throughout reflecting the developments which have taken place in Estonia. Parameter η in the portfolio balance equation (25) is fixed at 0.2,

which will raise the FDI stock eight fold during the time span considered. This elasticity in broad terms corresponds to what can be inferred from the typical reaction of FDI to a change in corporate taxes according to de Mooij and Everdeen (2003), and from that by Barrell and Pain (1997) concerning the reaction of FDI to the labour cost. The elasticity υ in the labour migration in equation (16) is fixed at 0.01, which will lead to a reduction of by almost 10 per cent in the NMC labour force over 30 years, i.e. to a less than 2% increase in EU-15 labour force.

The transfer *T* to the NMCs via the EU budget is calibrated so that initially it is equal to 1.3 per cent of their GDP, and will then decline over time as convergence proceeds so that the elasticity of the transfer from the EU budget with respect to the income level is −0.025 as estimated by Kauppi and Widgrén (2004).[6] The transfer is financed by levying a tax on labour in the EU-15.

The interesting variables for the EU-15 are GDP, GNI (gross national income), and the income of the incumbent EU-15 population. GDP and GNI may diverge because of the gap in the rates of return on capital between the two regions, the burden of the foreign debt and through the EU budget. The income of the incumbent EU-15 population is important, as there will be migration from the NMCs to the EU-15, which can divert the total incomes and those of the incumbent EU-15 population from each other. In calculating this variable we assume that the immigrants from the NMCs only bring with them their labour input.

5.2 Simulations Results

We carry out two convergence simulations by varying the degree of relocation. In the *baseline scenario*, we retain the FDI stock of the EU-15 countries in the NMCs fixed in volume terms at the level it was in 2000 all through the simulation period 2001-2030. This is 0.5 per cent of the initial capital stock calibrated to be in the EU-15. In the *alternative scenario 1*, FDI is allowed to react according to the portfolio-balance equation (27). In effect, this means that the FDI stock will grow eight fold in comparison to the baseline scenario over time (average rate of growth of the FDI stock being 6.5% in real terms).

The GDP growth rate in the NMCs in the two scenarios is presented in Figure 6. In terms of growth, the larger inflow of FDI is better for the NMCs in the beginning, but the effect will vanish as the income level in the NMCs rises because the assumption of β convergence makes itself felt. The acceleration of the growth rate in the early years is also due to the fact that there is a reduction in the nominal interest rate following EU membership and, consequently, a vigorous investment period.

Real and nominal convergence with endogenous FDI (scenario 1), is presented in Fig. 7. Convergence is now more rapid than what was depicted above in Figure 3 and real and nominal convergence will be completed by 2030. The rise in real incomes and the inflationary process are quite rapid with the average rise in GDP equal now to 4.6 per cent, in wages 9.3 per cent and in the price level 4.5 per cent. This more rapid convergence than in Fig. 3 is essentially due to the fact that there is an extensive capital deepening in the open sector in the NMCs, which is then reflected in a rapid rise in the wage rate and an internal resource allocation so that the open sector booms in the NMCs. So, we can recognize in this model the Irish case by the end of the time span. The rate of return on capital rises in the early years, see Fig. 8, but will then gradually start to convergence to the level where it is in the EU-15 (which is 0.08 throughout).

The rate of return on FDI is based on that in the open sector in the NMCs, added by two factors mentioned above: the price level is P and total factor productivity is the same as that in the EU-15. The initial rate of return on FDI and domestic investment is calibrated to the

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[6] The impact of structural funds on income disparities have been analysed in Beugelsdijk and Eijffinger (2003). They find some evidence that the funds contribute to decrease in disparities. Baldrin and Canova (2003) argue, however, that structural funds are not able to affect long-run growth rates in NMCs.

same, but in the simulations after that the rate of return on FDI starts to decline. This implies that the rate of new FDI from the EU-15 to the NMCs will slow down over time.

Figure 6. GDP growth rate (g) in the NMCs in the two scenarios

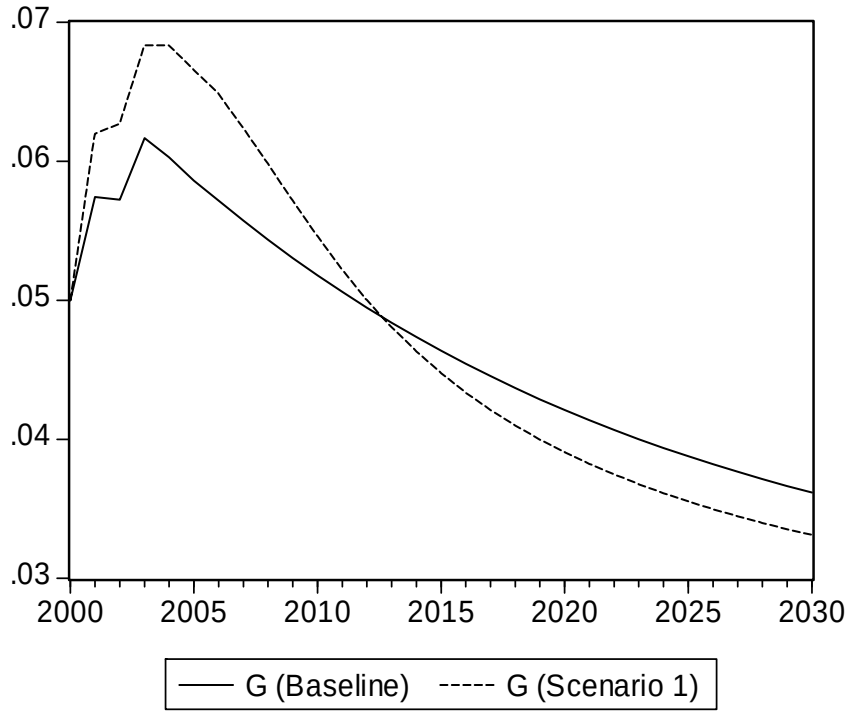


Figure 7 Real and nominal convergence in Scenario 1 (endogenous FDI), EU-15 = 1

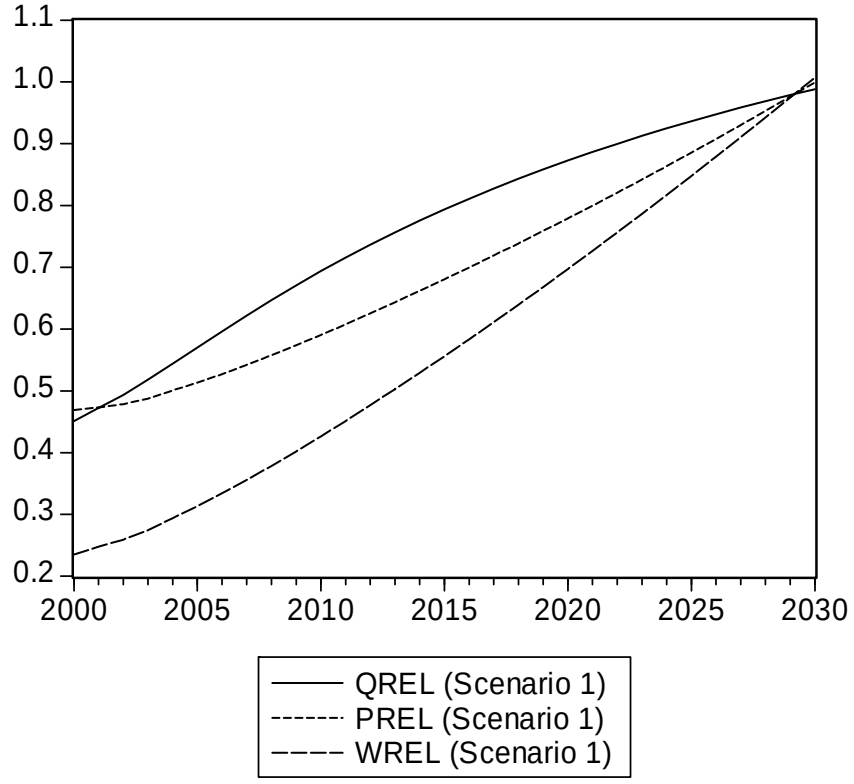


Figure 8. The rates of return (rho) on capital and FDI in the NMCs

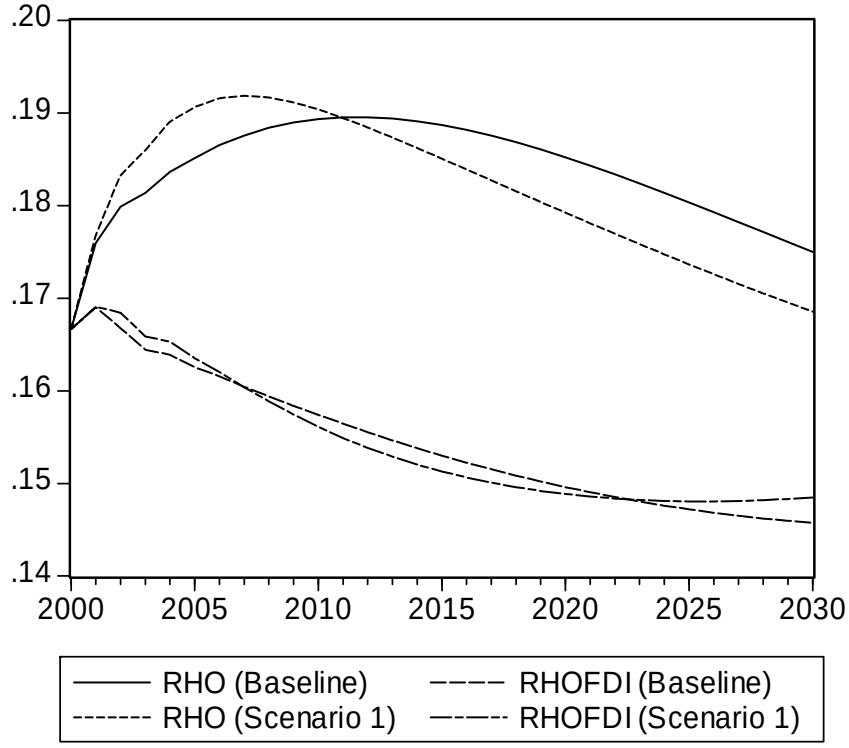
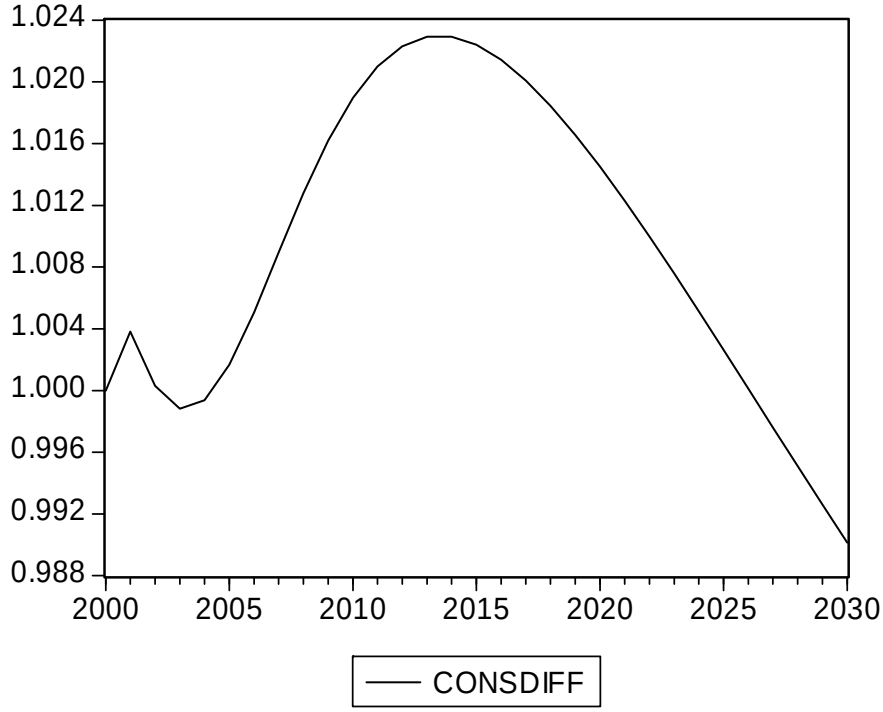


Figure 9. Level of consumption in the NMCs between the two scenarios (scenario 1 relative to baseline)

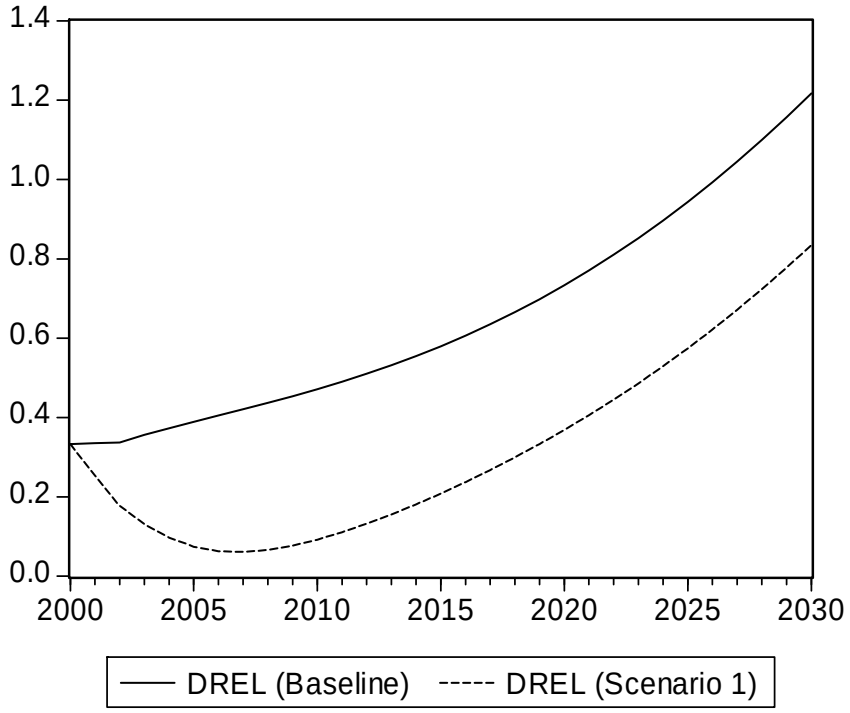


The higher inflow of FDI is also better in terms consumption level in the NMCs, as can be seen in Figure 9. The reason for the initial loss is that, as there will be less profits to paid

out of the NMC region to the EU-15, real disposable income is higher in the baseline scenario in the early years, but then, subsequently, the financing of the current account deficit by FDI inflows will give more room for consumption and disposable income, too. This will boost domestic consumption. In the long run, however, the inflow of further FDI will decline and the higher profits paid out of the NMC production will lead to a relative decline in the volume of consumption.

Sustainability is examined in Figure 10. The parameter h in equation (21) can have a major effect on the profile of foreign indebtedness. There may loom future problems in this respect, which are here basically due to the vigorous investment activity in the open sector. The labour force in the NMCs shrinks due to the migration by around 10 per cent, slightly less in scenario 1 where the rise in the real wages is faster.

Figure 10 The debt ratio (B/Q) with $h = 0.05$



In the EU-15 convergence of the NMCs and the consequent relocation of domestic manufacturing to the new member countries will lead to a loss in GDP, see Figure 11. At the same time, real wages will fall by roughly an equal amount. But to compensate for this, national income will expand by almost one per cent permanently, and this gain will only gradually decline as the rate of return will decline in the NMCs. Also the incomes of the incumbent EU-15 population will rise.

Total capital stock K^* in the EU-15 is higher in scenario 1 than in the baseline scenario because of the increase in competitiveness due to outsourcing, referred to above. This gap is at its highest 0.7 per cent. This gain will, however, erode over time as the cost level rises in the new member countries. But this gain will not fully neutralise the adverse effect of relocation of production. The fall in GDP in EU-15, see (24) above, can be decomposed as follows, see Fig. 12,

$$d\log Y^* = \alpha d\log K^* - \alpha d\left(\frac{K_{fdi}}{K^*}\right) + (1-\alpha)\, d\log L^* . \qquad (29)$$

Figure 11 **The impact of convergence on the EU-15 (scenario 1 in relation to the baseline, QEUdiff = GDP, QEUnatincdiff = national income, Weurdiff = wage rate, Yincumbdiff = income of the incumbent EU-15 population**

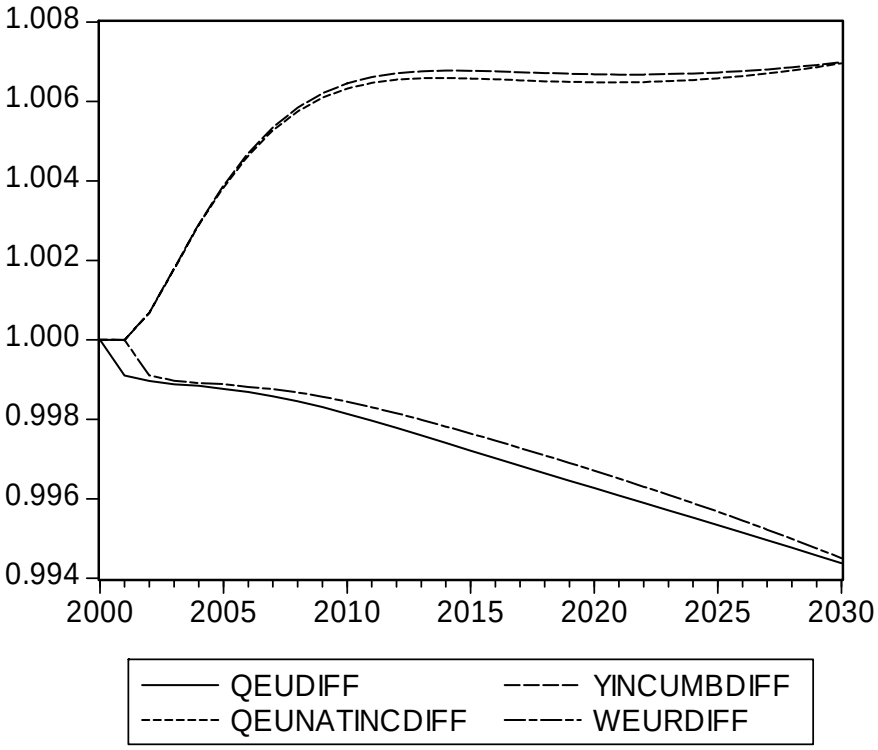
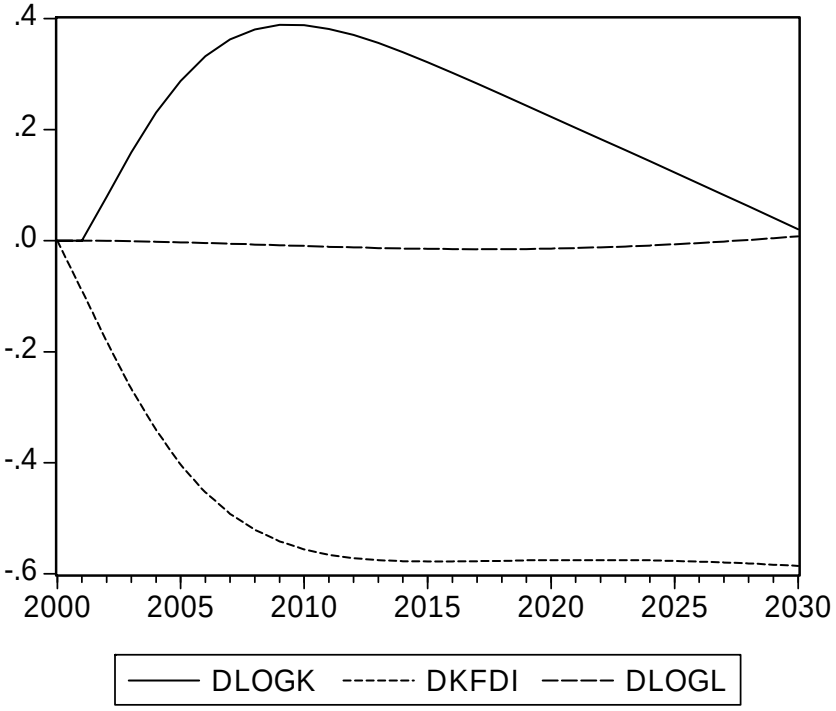


Figure 12 **Decomposition in eq. (29) of the difference in EU-15 GDP, percentage points**



We see that the competitiveness gain to the EU-15 GDP will peak in around 2010, and the relocation loss through outward FDI will also level off some time after that. The former gain is in no point of time, however, big enough to compensate for the latter loss. The nominal convergence of the NMCs towards the EU-15 will lead to the fact that the outsourcing gain will gradually vanish. Note that after the nominal convergence is completed, there is no point any further to relocate domestic production through outsourcing in the NMCs and the parameter ξ in (24) will be driven to zero. In our scenario 1 nominal convergence is almost completed till the end of the time span, so that the time then comes to make a shift in the location of production, which decision is not, however, analysed in the model here.

6 CONCLUSIONS

We have strived to shed new light on the speed of real and nominal convergence of the new EU member countries (NMCs) towards the average of the EU-15 countries. The analysis covers both convergence of real income and nominal convergence in terms of the price and wage levels. This comprehensive approach to the convergence process is vital for both country groups and therefore for the whole Union.

First, we constructed a two-sector model of production in the Balassa-Samuelson tradition, and enlarged it then with several ways to capture key issues of the convergence process. At the same time we also enlarged the model to cover two regions by endogenising FDI flows from the EU-15 to the NMCs and allowing for interaction between the regions through outsourcing of EU-15 production in the NMCs. Thereby we were able to address the current concern over relocation of production and jobs from the EU-15 countries to the new member countries.

Our general result on the speed of convergence of the NMCs showed that it crucially depends on the speed of capital accumulation there, but that, not surprisingly, there is sizeable uncertainty related to the speed of convergence. The EU-15 GDP will decline slightly due to outsourcing, and it is, on the other hand, partially compensated for by the consequent rise in profitability. But in contrast, the future gain in terms of national income and the incomes of the incumbent EU-15 population is quite unambiguous during the 30-year time period considered in the analysis, compared with a situation with no increase in FDI flows into the NMCs.

The model built here is, of course, quite a crude description of the economy. Although we enlarge the basic framework in several ways, the model has its shortcomings. For example, the public sector is very rudimentary and is considered only through the EU budget. All other forms of taxation have been discarded so that, in effect, tax competition is omitted. However, despite these deficiencies we believe that the above analysis sheds new light on the topical issue of convergence and its link to relocation of EU-15 production to the new member countries through FDI.

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