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A Prototype Model of EU's 2007 Enlargement

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A Prototype Model of EU's 2007 Enlargement

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Abstract

EU's 2007 enlargement by Bulgaria and Romania is evaluated by applying a simple macro-economic integration model able to encompass as many of the theoretically predicted integration effects possible. The direct integration effects of Bulgaria and Romania spill-over to EU15, including Austria and the 10 new member states of the 2004 EU enlargement. The pattern of the integration effects is qualitatively similar to those of EU's 2004 enlargement by 10 new member states. Bulgaria and Romania gain much more from EU accession than the incumbents in the proportion of 20:1. In the medium-run up to 2020, Bulgaria and Romania can expect a sizable overall integration gain, amounting to additional ½ percentage point real GDP growth per annum. Within the incumbent EU member states Austria will gain somewhat more (+0.05%) than the average of EU15 (+0.02%) and the 10 new EU member states (+0.01%), which joined the EU in 2004.

JEL classification: F14; F15; F21; F23; F47
Keywords: Economic Integration, EU enlargement; Regionalism; Model simulations

Contents

1. Introduction[1]

EU enlargement is progressing. With the entry of Bulgaria and Romania in 2007 the EU has completed its fifth enlargement which started in 2004 with the accession of ten new members. The EU will enlarge further by absorbing the countries of the Western Balkan and may be also by Turkey. EU27 with 492 million inhabitants is the largest regional economic integration area, forming a specific kind of a regional integration agreement (RIA) with maximal economic and institutional integration, ranging from a customs union to the single market and is extending step by step towards an economic and monetary union (EMU) with a single currency – the Euro. RIAs which are also called regional trade agreements (RTAs) or free trade areas (FTAs) are preferential agreements and in principle inconsistent with the GATT's most favored nations (MFN) principle. However, GATT Article XXIV specifically allows RIAs unless they violate certain conditions. Free trade areas (FTAs) – like the EFTA or NAFTA – or customs unions (CUs) – like the EU - are allowed under the GATT unless they fail to eliminate barriers on "substantially all the trade" among members and, additionally, that external tariffs "shall not on the whole be higher or more restrictive" than prior to the formation of the FTA. Sluggish or no progress in the Doha Development Round has accelerated further the rush to forge RTAs. The total number of (at the WTO) notified preferential agreements in force is currently 170, while a further considerable number is under negotiations/proposal stage (see Crawford and Fiorentino, 2005, p. 1). Pascal Lamy[2], Director-General of the WTO forecasted recently that by 2010 around 400 of such agreements could be active, increasing the complicated web of incoherent rules, coined by Professor Bhagwati a "spaghetti bowl" of twisted rules of origin.

Whereas the trade purists condemn bilateral "spaghetti bowls" as second or third best welfare solutions to liberalizing world trade, Baldwin (2006B) takes them as political facts and as "building blocs on the path to global free trade". Accordingly, moving to global free trade requires the political will of WTO member states to multilateralisation of regionalism. By 2010, Baldwin sees the world as three more or less perfectly formed trade blocs – one in Europe, one in North America and one in East Asia. However, the blocs might be fuzzy since the proliferation

[1] I want to thank Harald Badinger, Gerhard Fink and Stefan Griller for helpful comments on an earlier draft.
[2] See: http://www.wto.org/english/news_e/sppl_e/sppl53_e.htm)

of FTAs makes it impossible to draw sharp lines around the big-3 trade blocks, and leaky since some FTAs create free trade "canals" linking the big 3 blocs.

The EU can be taken as a good example how to tame the "spaghetti bowl syndrome". Firstly, by its continuing enlargements from originally six to 27 members it integrated most of the EFTA countries. Secondly, by pushing through the Pan-European Cumulation System (PECS) in 1997 (on the basis of the European Economic Area – EEA – agreement of 1994) it simplified the spaghetti muddle in Europe. With this the EU15, the EFTA4 (Iceland, Liechtenstein, Norway and Switzerland), and ten of the then applicant nations in Central Europe decided to amend their various FTAs by substituting a common set of rules of origin for those they originally contained. Value could thus be cumulated between different European countries without prejudicing the duty-free status of end products. PECS was extended to Turkey (with which the EU forms a CU since 1996) in 1999. In 2005 the system has been enlarged to the Faroe Islands and the Mediterranean countries, and hence is commonly referred to as the Pan-Euro-Mediterranean cumulation system (PEMCS)[3]. The PEMCS comprises 42 countries and is applicable between the EC and Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Syria, Tunisia, West Bank and Gaza Strip, the EEA/EFTA countries (Iceland, Norway and Switzerland, including Liechtenstein), the Faroe Islands and Turkey. PEMCS members account for about 40% of world trade.

Contrary to this optimistic view of the enlarged EU on the way to remain an active player in further multilateral negotiations under WTO one could also get another impression. The growing economic power of the EU might dampen its ambitions to participate in further WTO world trade liberalization initiatives, may be those within the suspended Doha Round or in any other future round. Whereas EU15's intra-trade accounted for around 60% of its total trade, this share increased to 2/3 with the recent enlargements. Including the free trade with EFTA and Turkey the enlarged EU's intra-trade share amounts to about 70% of total trade. This is far more than NAFTA's intra-trade share (56%). An integrated EU, doing business with itself amounting to around ¾ has no longer the need for big liberalization steps with third countries. The only distinct interest lies in the access to cheap raw materials from developing countries. But also in this case the ACP (Cotonou) agreement is sufficient for the EU. After the Uruguay Round, industrial MFN

[3] For more details (general overview, legal framework, specific provisions) on the Pan-Euro-Mediterranean cumulation system, refer to the homepage of the European Commission: http://ec.europa.eu/taxation_customs/customs/customs_duties/rules_origin/preferential/article_783_en.htm

tariffs have come down to below 3% - in some sectors there is free trade anyway. Hence, trade relations with the major industrial countries of North America (NAFTA) and East Asia (Japan) or with the newly industrializing countries (China and India) are already at a near-free trade level. Further involvement in multilateral trade talks might be seen by the EU only as a kind of development policy. From a political point of view one could ask whether the progressing enlargement of the EU, constituting already the largest Customs Union (CU) in the world still satisfies the conditions of GATT Article XXIV. If this is not the case, this would also not be consistent with the theoretical predictions of the Kemp-Wan theorem (see Kemp and Wan, 1976). The latter implies that any group of countries can form a CU that is Pareto-improving for the world, so long as nondistorting lump-sum transfers within the union are possible. This is accomplished by setting the vector of common external tariffs (CET) so as to leave world prices unchanged. The larger EU's CU becomes the more likely it is that the last condition is violated in reality.

The theory of regional economic integration has to deal with geographically discriminatory trade policy issues and is regulated in different types of RIAs, ranging from FTAs to CUs and in the case of the EU it is a Single Market (SM) and partly also an Economic and Monetary Unions (EMU). Starting with the seminal work on CUs by Viner (1950) the theory of RIAs evolved along the lines of the new trade theory and was sometimes ahead of the political reality of RIAs, sometimes behind them. In the meantime the economic (and institutional) integration of the EU has come to its maximum possible level of an EMU with a single currency. Whereas most of the world-wide existing RTAs can be analyzed with Viner's theory of CUs or maybe with the theoretical extensions and generalizations of his followers (e.g. Cordon, 1972; Lloyd, 1982; Kennan and Riezman, 1990) the evaluation of EU's economic integration effects requires much more ingredients of modern trade theory. This is even more the case if one wants to analyze EU's enlargement which – as a special case – is the integration of two kinds of economies, a bloc with rich countries (the old EU15) with a bloc of poor (mostly transitional) economies like the 10 new member states which acceded the EU in 2004 and Bulgaria and Romania who became EU members in 2007. In this case of integration of unevenly high developed countries factors movements might dominate the trade effects.

Due to the complexity of EU's integration (enlargement in particular) one dreams of finding a "Grand Unified Theory" (GUT) like in theoretical physics. Theoretical physicists are searching for a unified theory that unifies three "fundamental" gauge symmetries: hypercharge, the weak force, and quantum chromo dynamics. So far, physicists have been able to merge electromagnetism and the weak nuclear force into the electroweak force, and work is being done to merge electroweak and quantum chromo dynamics into a QCD-electroweak interaction. Beyond grand unification, there is also speculation that it may be possible to merge gravity with the other three gauge symmetries into a "Theory of Everything" (THE)[4]. In the case of regional economic integration, Baldwin and Venables (1995) recommended such a GUT for the case of a (fictitious) country entering a RIA and by Kohler (2004) for the case of an incumbent country (Germany) if the EU is enlarging. In chapter 2 we present a stylized GUT of EU's enlargement. Based on this insights we build a simple model of EU's 2007 enlargement encompassing as many of the integration effects predicted by the GUT as possible (chapter 3). This prototype model could also be applied for further EU enlargement cases such as the countries of the Western Balkan (e.g. Croatia) and by Turkey. The simulation results with the enlargement model are presented in chapter 4. Conclusions are drawn in chapter 5.

2. A stylized GUT of EU's enlargement

In the following we study the welfare change in an open economy – in our case for a small country – joining the EU.

Following Baldwin and Venables (1995, p. 1691) suppose that the welfare of a representative consumer in the new EU member state at the time of acceding the EU can be represented by an indirect utility function $V(p+t,n,E)$, where p is the vector of border prices, t is a vector of trade costs including the tariff equivalent of import barriers (NTBs like border controls), n is a vector of the number of product varieties available in each industry, and the scalar E is total spending on consumption. Expenditure of a new EU member state is equal to the sum of factor income, profits, and rent from trade barriers that accrues to domestic agents (including the government), minus investment and income out of the EU budget under the title of structural funds transfers: $E = wL + rK + X\left[(p+t) - a(w,r,x)\right] + \alpha\, t\, m - I + SF$. Total factor income is $wL + rK$, where L and K are the country's supply of labour and capital and w and r are factor

[4] See: http://en.wikipedia.org/wiki/Grand_unification_theory)

prices. The third term on the right hand side is total profit. It is the inner product of the economy's production vector X and the gap between domestic prices and average costs, $a(w,r,x)$, where average cost in each sector depends on factor prices and production per firm in that sector, x. Domestically accruing trade rents amount to αtm, where m is the net import vector (positive elements indicate imports) and α is a diagonal matrix that measures the proportion of the wedge t that creates income for domestic agents; $\alpha = 1$ for a tariff or other barrier with domestically captured rent (DCR) and $\alpha = 0$ for a barrier where no trade rent is captured domestically (nonCDR). For example, t may represent real trade costs or a quota or voluntary export restraints (VER) under which foreigners capture the quota rents or in the case of integrating into the single market the trade costs of border control. Finally, I denotes investment and SF net income from structural funds transfers out of the EU budget.

By totally differentiating $V(p+t,n,E)$ and dividing through by the marginal utility of expenditure V_E Baldwin and Venables (1995, p. 1601 and Appendix A) derive an equation (here slightly extended) of welfare change which can be interpreted as a stylized GUT for a new EU member state in the process of EU enlargement[5]:

$$\begin{aligned} dV/V_E = {} & \alpha t\, dm - md[t-\alpha t] - m\, dp \\ & + [p+t-a]dX - xa_x\, dx + (V_n/V_E)dn \\ & + (\tilde{r}/\rho - 1)dI \\ & + dSF \end{aligned} \tag{1}$$

A GUT of enlargement should be able to explain at least three major effects of regional integration: *allocation of resources* (static "trade effects", "scale effects"), *accumulation or growth effects* and *location effects*[6] inclusive *factor movements*. Equation (1) involves the following integration effects:

i) "Trade effects": The first row includes static welfare effects of models with *perfect competition*. The first term is the "trade volume" effect. The trade volume changes subject to the wedge created by DCR trade barriers, αt. The second term is the "trade cost" effect, measuring the change in costs generated by changes in the nonDCR elements of trade barriers. The third is the "terms of trade" effect. The last effect occurs only if the acceding country is a large country

[5] Kohler (2004) derives a similar welfare equation for a single incumbent EU country, in particular for Germany.

[6] Location effects are discussed by Baldwin and Venables (1995, pp. 1616 ff.) in the context of the insights of models of "economic geography", pioneered by Krugman (1991). This model category also considers factor movements from one location to the other, from the "periphery" to the "centre" or vice versa.

having the possibility to influence world trade prices. In the case of EU's enlargement 2007 (as in those of 2004) only small countries joined the EU, which means that the third term is zero[7]. Prior to EU accession, candidate countries of the 2004 and 2007 enlargement already abolished tariffs in trade with the old EU member states in the context of the asymmetric liberalization process of the Europe Agreements (EAs). After EU accession the new member states entered the CU of the EU and now participate in EU's single market program. That meant, on the one hand, adjustments of the national external tariff to EU's CET and the abolishment of border controls. Hence, the remaining trade costs were eliminated. Interpreted with equation (1), in the pre-accession period (with $\alpha = 1$) the reduction of tariffs (t) contributed negatively to welfare (first term), whereas after accession (with $\alpha = 0$) the elimination of border controls and hence reduction of trade costs (t) contributed positively to welfare (second term).

Euro's pro-trade effect: The experience with the existing Euro area so far shows that the introduction of the Euro additionally reduces transaction costs and hence stimulates intra-euro-area trade in the range between 5% and 15% (with 9% the best estimate), depending on the method of gravity model estimates (for a critical survey, see Baldwin, 2006A). New research suggests, however, that reduced transaction costs were not primarily responsible for the pro-trade effect of the introduction of the Euro, arguing instead that it was caused by the export of new goods to Euro zone economies. The mechanism driving this is seen in a reduction in the fixed cost of introducing new goods into Euro zone markets (for such arguments, see Baldwin, 2006A, p. 87). One can expect that the same mechanism will play a role when the new member states of EU's 2004 and 2007 enlargement will join the Euro zone (first estimates forecast an increase of 5% intra-euro-area trade in the new EU member states; see Belke and Spies, 2007).

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[7] Baldwin and Venables (1995, pp 1604-1605) discuss in the context of an RIA with "large" countries the case of three countries, in which countries 1 and 2 form the RIA and country 3 remains outside. The members of the RIA can influence the terms of trade, and hence, the third term of equation (1) becomes relevant. The theoretical analysis of three-country problems (with three goods) becomes easily intractable or delivers ambiguous results (see Lloyd, 1982). The Kemp-Wan theorem (Kemp and Wan, 1976) gives a powerful and beautyful answer to the question what configuration of trade policy (towards non-members) would result in a necessarily welfare improving CU. Collect any subset of countries in a trading world. Hold their net trade vector with the rest of the world fixed (at the pre-CU level) and treat it as an endowment. Maintaining standard assumptions, direct application of the first welfare theorem suggests that the union's welfare is improved when all internal barriers to trade are eliminated. The difference between external prices and prices within the CU (common to all CU countries) determined the common external tariff of the CU. Each country within the union could be made better off than before using a suitable scheme of lump-sum redistributions while the rest of the world is left no worse off. The beauty of the Kemp-Wan solution lies in its ability to provide this ambiguous welfare result sidestepping the problem of second-best intrinsic to the analysis of PTAs. The Kemp-Wan theorem gained further attraction in alternative interpretations (see Richardson, 1995) and extensions of free trade areas (see Ohyama, 2004; Bond et al., 2004).

ii) "Scale effects": The three terms in the second row capture theoretical predictions of models with increasing returns to scale and *imperfect competition*. The first term is the "output" effect, arising if there is a change in output in industries where price differs from average cost. The second term is the "scale" effect, which gives the value of changes in average costs induced by changes in firm scale[8]. The third terms gives "variety" effects which may arise when the number of differentiated consumer products changes, like in trade models with Dixit-Stiglitz type utility functions and ingredients of the theory of monopolistic competition (see Grossman and Helpman, 1991).

iii) "Accumulation effects": The term in the third row captures what is also called the "growth" effect of regional integration. It implies that a change in investment is instantaneously costly, but it also augments the capital stock with a social rate of return $\tilde{r}$. Discounting this at a social discount rate ρ gives the present value $\tilde{r}/\rho$, and a change in investment has a first-order welfare effect if this ratio differs from one.

iv) "Net EU budget receiver effects": The term of the fourth row indicates the welfare improvement of being a net receivers vis à vis the EU budget. All countries of the fifth EU enlargement were poor countries and therefore eligible for high structural funds transfers out of the EU budget.

v) "Location or globalisation effects": A stylized GUT of a country joining the EU should also capture effects of "globalisation" or factor movements. Integration of rich and poor countries under the conditions of the rules of the single market (free movement of capital and labour, besides free movement of goods and services) induces huge factor flows: FDI from the old to the new EU member states because of expected higher rents in the "emerging markets" of Eastern Europe and labour from the new to the old member states because of the huge wage differential in the order of up to 1:10. Such factor movement and its welfare implications are only indirectly captured in equation (1). FDI inflows in the acceding country may renew the capital stock and hence increase investment (third row). Labour emigration leads to a welfare loss ("migration loss") in the sender country and to a welfare gain ("immigration surplus") in the recipient country (the old EU member states). In the context of equation (1) labour migration could be only

[8] A special case is the „Casella effect" implying that in case of trade bloc enlargement the gains from enlarging the bloc fall disproportionately on small countries, because – if economies of scale imply that firms located in large countries enjoy lower costs - the entrance of new members diminishes the importance of the domestic market and improves the small countries' relative competitiveness (see Casella, 1996).

interpreted if one assumes wage differentials in the expenditure equation E, which would induce migration. In the special case of EU enlargement it might well be that the effects of factor movements dominate the trade effects.

3. A simple model of EU's 2007 enlargement

With the completion of its fifth enlargement in 2007 the EU increased its number of members from 25 to 27. However, like in the preceding enlargement steps (1995 and 2004) only small countries entered the EU. In 2004 EU's population increased by 19%, in 2007 by only 6%, GDP (at PPS) increased by 9% and 2% respectively. Intra-EU trade increased by 11% and 1 1/2% respectively.

In the following we assume that the whole bunch of integration effects of the 2007 EU enlargement – i.e. the participation in the single market - is only occurring in the acceding countries Bulgaria (BG) and Romania (RO). The old EU (EU15), the bloc of new ember states of the 2004 EU enlargement (EU10N[9]) and Austria (AT) are affected only indirectly via spill-overs from BG and RO. Hence, we deal with prototype model approach for the case of 3 countries and two trade blocs. We model the integration effects explicitly for BG and RO, using a simple macro-model approach with no sectoral break-down like in CGE models. Most of the econometrically estimated equations are reduced form equations, capturing the essential linkages of integration channels (see Appendix B).

3.1 Implementing the integration effects

On the basis of the stylized GUT of equation (1) we explain the integration effects considered in our simple model and the channels of interactions. However, contrary to the theoretical ambitions laid down in equation (1) which explain changes in welfare due to regional integration for a new member of a RIA we aim at explaining the changes in real GDP as the final "welfare" measure due to the EU accession of BG and RO. Most of the integration effects modelled target directly the accumulation or growth effects of enlargement and do not consider static trade effects and its implications of trade creation and trade diversion.

[9] EU10N = Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia.

Ad i) "Trade effects": As we do not consider bilateral trade flows between BG, RO, AT, EU15 and EU10N we cannot analyze the welfare implications of enlarging the CU of the EU by BG and RO in our model context.

(1) Static welfare effects: A separate CGE analysis of the enlargement of EU's CU in 2004 from EU15 to EU25 is executed by applying the GTAP6 model with 11 countries/regions, 7 sectors and 5 factors of productions (see Appendix A). The EU25 CU was simulated by eliminating all remaining tariff barriers between the member states and considering the adjustment of national external tariffs to the CET of the EU. Prior to 2004 the EU15 CU already existed. Therefore only tariffs on trade between the countries of the EU10N on the one hand and those for trade between EU10N with EU15 on the other hand had to be eliminated; in addition EU's CET had to be adopted by the newcomers.

The main winners of the EU25 CU are the new 10 member states (EU10N) of the 2004 EU enlargement, based on a considerable trade creation between EU10N. This led to a welfare gain by 0.2% and an increase of real GDP by 0.3%. Austria also profited from additional trade creation and a slight welfare gain of 0.1% of GDP. The remaining member states of EU15 increased its trade with the group of EU10N by 5 ½%. However, welfare and GDP did not change. EU's 2004 enlargement led to a considerable trade diversion from the old EU member states to the new ones. Austria's trade with EU14 declined stronger than intra-EU14 trade. If one extends this exercise and considers the trade cost reduction by eliminating border controls (single market entry effect) – assuming bilateral reduction of trade costs equivalent to a 2.5 percent tariff reduction – augments the results of the CU exercise slightly, but does not change the qualitative results of changes in the pattern of regional trade flows.

Is then the progressing EU enlargement consistent with the Kemp-Wan theorem? This would imply that trade with non EU CU countries remained unchanged and would not hamper third country's welfare. Although our analysis is not directly suitable to evaluate the Kemp-Wan theorem, one conclusion can be drawn from the fifth EU enlargement: EU14's trade with the rest of the world (ROW) declined slightly whereas those of AT's and EU10N's trade with the ROW increased. As the decline of EU14's trade is nearly zero implying no welfare changes in ROW, but welfare increases in the enlarged EU's CU one could conclude that this approximately satisfies the Kemp-Wan propositions.

(2) Dynamic or growth effects of trade ("trade and productivity" links): In our simple enlargement model for BG and RO we consider the growth-enhancing effect of the opening up of both countries. The explicitly estimated equations can be found in Appendix B. In line with the insights of Frankel and Romer (1999) on the links between trade and productivity, surveyed by Lewer and Van den Berg (2003)[10] we model directly the link between the change of openness (measured by export (X) plus import (M) shares of GDP) and productivity growth in the productivity equation (PR). Via implementing PR as a proxy for total factor productivity in our GDP equation (Y) we are able to capture the trade effect on growth for BG and RO. The shares of exports are explained by the usual income (weighted GDP growth of the partner countries in EU15, AT and EU10N) and relative price (real exchange rate) effects plus an EU enlargement or scale effect in the export equation. The EU enlargement effect is captured by a dummy for the increasing size of the EU from 6 over 9 to 10, 15, 25 and 27 (ENLCTR). In this way we can also capture the opening-up of the EU in its trade with the CEECs via the Europe Agreements (EAs) since 2000, already prior to EU accession in 2007. The import share equation (M) explains imports with the usual income (instead of its own GDP growth, the export share variable X is used) and relative price (real exchange rate- REER) effects. Additionally, a dummy (INT) captures the effects of the opening-up of trade with the EU via the asymmetric trade liberalization of the EAs prior to EU accession in 2007.

Ad ii) "Scale and imperfect competition effects": As we deal only with a simple aggregate or macro model for BG and RO we capture only one effect of imperfect competition of the second row of equation (1). We model mark-up pricing in our price equation (P). We assume that after participating in EU's single market price competition increases and hence, reduces the market power of incumbent firms in BG and RO. This pricing behaviour can be detected empirically in the old EU member states after creating the single market in 1993 (see Badinger, 2007). This reduces the mark-up on unit labour costs and hence dampens inflation.

Ad iii and iv) "Accumulation effects": Only one accumulation or growth effect via the capital augmenting effect of real gross fixed investment is predicted theoretically in the third row of equation (1). However, the equation does not explain how investments are induced. In our investment equation (I) we explicitly try to explain changes in investment by FDI inflows (FDI)

[10] Lewer and Van den Berg (2003), surveying the literature on the growth effects of trade found an astonishing regularity: "Every 1 percentage point increase in the growth of trade (exports) leads to a 0.22 percentage point increase in economic growth".

and by transfers out of the EU budget (here we use only the structural funds transfers in percent of GDP – the variable COH) for improving the infrastructure. Via the GDP equation additional investments stimulates real GDP. With this modelling approach we combine the effects of the third and fourth row of equation (1). Besides the growth enhancing effect of trade opening (X+M) we also consider the positive link of changes of research and development for GDP growth. Hence, we consider the primary message of the new endogenous growth theory of trade (see e.g. Romer, 1990; Grossman and Helpman, 1991). Changes in the share of research and development in GDP (R&D) stimulate productivity and via the GDP equation also GDP growth.

From the hitherto existing practical experience with the single market program we know that newcomers in the single market experienced a striking productivity shock in the first adjustment phase. We implement such a transitional shock exogenously into our productivity equation (PR) by adjusting the residual accordingly (see Table 1).

Ad v) "Location or globalisation effects": Integration of unevenly developed economies induce stark factor movements which may dominate trade effects. In the case of EU enlargement one can speak of a "mini-globalisation" as a subset of the world-wide globalisation.

(1) "Migration effects": According to Borjas (1995) migration of labour may lead to an "immigration surplus" – i.e. a welfare gain - in the recipient country and – as a mirror image – one must conclude that it leads to a "migration loss" or welfare loss in the country from which labour emigrates. We model these effects in the equation for employment (E) and in those for the unemployment rate (U) in a reduced form. In both cases changes in the labour force via migration have a positive (negative) impact on the respective variables in the host (sender) countries of migrants. As in the case of EU's 2004 enlargement, transitional arrangements concerning the free movement of labour were negotiated in the accession treaties with BG and RO. We assume that only after 7 years, i.e. from 2014 onwards labour can freely migrate from BG and RO to EU15, EU10N and AT.

(2) "FDI flows": The opening-up of Eastern Europe created a new region of "emerging markets" nearby the western European countries. Statistical data by the Austrian National Bank (OeNB) show that the return on equity (RoE) of FDIs in Eastern Europe increased much faster and they are higher than those achieved in the old EU countries since 1989 (see Altzinger, 2006; Fuchs, 2006). FDI inflows in BG and RO help to improve investment (see our investment equation I)

and hence stimulate GDP growth. The FDI net outflows of the EU15 and that of AT are modelled explicitly as determined by the weighted GDP growth in the partner countries of the enlarged EU.

Ad vi) "Euro participation effects": The stylized GUT of enlargement is not able to capture the more complex effects involved if an EU member participates in the EMU. As we discussed earlier, however, we can – due to reduced transaction costs - expect similar pro-trade effects in the new EU member states when introducing the Euro. In order to take account of the possible macro-economic effects of the Euro zone participation we estimated a Taylor rule for BG and RO explaining the setting of the short-term interest rates (RS). In case of a future Euro zone participation - which requires to fulfilment of the Maastricht convergence criteria – one could substitute the national Taylor rule in BG and RO by the ECB's Taylor rule, which explains monetary policy for the Euro zone. The long-term interest rates, which are also a determinant of GDP growth, are linked to the change in the short-term interest rates. Euro area participation may also imply additional economic adjustment mechanism (a reduction of exchange rate uncertainty; more general efficiency and, hence an increase of total factor productivity (growth effects); but also fiscal restraints could dampen aggregate demand when the Stability and Growth Pact (SGP) rules have to be met). A first positive overall perspective is the outcome of macro-model simulations in the case of Slovenia's entry into the Euro zone on January 1, 2007 (see Neck and Weyerstrass, 2007).

Models for Bulgaria and Romania: In addition to the explicit implementation of all of the possible integration effects the macro models for BG and RO are closed by explaining GDP growth (Y) with the usual economic variables (productivity, investment, employment, unemployment) as well as the policy variables (fiscal and monetary policy stance). GDP growth then is linked with the unemployment rate (inverted Okun's law), the latter with wage bargaining (Phillips curve). The budget balance is also connected with the overall economic development and the latter determines the public debt dynamics. For BG and RO – two transition economies – we explicitly model the Balassa-Samuelson effect by explaining the real effective exchange rate (REER) by the gap of GDP per capita relative to EU15. A catching-up equation calculates the adjustment process in GDP per capita relative to those of EU15.

Models for EU15, EU10N and Austria: According to our philosophy we consider the integration effects in the old EU member states only as derived ones. The trade relations of EU15 with BG (0.2% of total exports) and RO (0.6%) and those of the EU10N (0.4% and 1.6% respectively) and even those of AT (0.5% and 1.5% respectively) are too small as one could expect a considerable direct integration impact in the old EU member states. Therefore we model only spill-overs from BG and RO to the old EU member states via GDP equations with weighted GDP growth's of BG and RO as explanatory variables.

As already mentioned, we also model net FDI outflows (FDINET) from the EU15 and from AT as determined by GDP growth in the partner countries, and hence also in BG and RO. In the case of *Austria* we also explain the declining wage share (functional income distribution – the variable LQ) by increased net FDI outflows (most of which are connected with the new opportunities in the new emerging markets of the new EU member states in Eastern Europe). This reduced form equation tries to capture in a nutshell the strong link between changes in product prices and that of factor prices predicted by the Stolper-Samuelson theorem in the case of trade liberalization. Accordingly, one can expect that after opening-up of the markets of Eastern Europe due to the trade liberalization with the EAs, the relative factor prices (rental price to wages) of the capital-abundant countries of the old EU15 (and hence also that of AT) increased (resulting in a decline in the wage share) whereas the relative factor prices of the labour-abundant countries in the new EU member states in Eastern Europe must have decreased. Hand in hand with the income distribution effect of trade liberalization, the accelerating net FDI outflows from AT into the new EU member states enforced the pressure on the wage shares. An auxiliary equation calculates Austria's income performance relative to that of EU15.

3.2 Model inputs

The integration effects in BG and RO are simulated by considering 7 scenarios (see Table 1). We have to differentiate between a pre-accession phase and the EU membership phase proper. The integration process into the EU starts with a pre-accession phase in which the candidate countries are supported with several financial aids (ISPA, SAPARD etc.) out of the EU budget. Trade integration already takes place before becoming an EU member. Trade between the old EU and the CEECs was already liberalized via the EAs in an asymmetric manner. Tariffs on EU's

imports from BG and RO were abolished already in 1997, while the tariffs on imports from the EU in the latter countries were eliminated in 2002. Being an EU candidate country makes these economies attractive and secure for FDIs. With EU accession the new members are participating in the CU of the EU implying an adjustment of their national tariffs to EU's common external tariff (CET).

Table 1: Model inputs for simulating integration effects

Scenarios	**Integration effects**	**Pre-accession period 2000-2006**	**EU membership 2007-2020**
Inputs in the models for BG and RO			
1	Trade effects	*Exports (X):* since 2004 EU25 instead of EU15 *Imports (M):* since 2000 more openness due to EA liberalization (same inputs in BG and RO)	*Exports (X):* since 2007 EU27 instead of EU15 *Imports (M):* since 2007 additional openness due participation in EU's CU and single market in BG and RO
2	Investment effects of FDI	*FDI inflows:* since 2000 2% of GDP more in BG (+½% in RO)	*FDI inflows:* after 2007 petering out of this process
3	Investment effects of structural funds transfers	*COH transfers:* no input	*COH transfers:* since 2007 ½% of GDP more with declining tendency
4	Productivity stimulating R&D	*R&D:* no input	*R&D:* since 2007 0.1 % of GDP (BG) and 0.25% of GDP (RO) higher
5	Mark-up pricing	*MUP:* no input	*MUP:* since 2007 5% lower mark-ups with declining tendency in BG and RO
6	Exogenous productivity shock	*PR_A:* no input	*PR_A:* since 2007 to 2010 an increase in productivity by ½% in BG and 1% in RO with declining tendency
Inputs in the models for BG and RO and in AT, EU15 and EU10N			
7	Migration effects	*LS:* no input	*LS:* since 2014 1% of labour force migrates from BG (-36.000) and RO (-92.000) to AT (20%), to EU15 (70%) and to EU10N (10%)

Model inputs refer to an integration scenario in comparison with a baseline scenario without EU integration; for the detailed model inputs, see Appendix C.

Prior to EU accession the import tariffs in RO (19%) were higher than in BG (12%), whereas EU's CET was around 6%. Also the tariffs for agricultural products were much higher in both

countries than in the EU. Besides becoming a member of the CU of the EU the newcomers enter the single market what implies a productivity shock and more competition and, therefore, a dampening effect on prices. The new member states have better access to the research framework programs of the EU and – because they are poor countries – are eligible to receive structural funds transfers out of the EU budget.

The exact quantitative inputs used in the simulations of the 7 integration scenarios are collected in Appendix C. In some cases the inputs are the same in both countries, in others we differentiate between BG and RO. Ex ante, one never knows the intensity of the adjustments shocks (e.g. in labour productivity) and one can only speculate about the length or the timing of the shocks. In principle, the quantification of our inputs are calibrated according to past experiences with the enlargement of EU's single market.

4. Results

Ahead of EU's fifth enlargement in 2004 a vast variety of studies were undertaken with the whole range of models available – multi- and single countries CGE models or world and single countries macro models. The great attraction to carry out such studies was founded in the novelty of the problem. Past EU enlargements primarily dealt with the integration of industrial countries with comparable levels of development (also Greece, Portugal and Spain lagged somewhat behind the old EU member states). The eastern enlargement of the EU posed several challenges. The formerly communist and planned economies firstly had to qualify as an EU candidate country according to the Copenhagen criteria (the countries had to transform to democracies, market economies and they had to adjust their legal system to EU's acquis communautaire). Secondly, after the systemic transformation these countries had to catch-up to EU income levels and to reorient their trade relations from the former CMEA to the EU. The EU supported this process with the help of liberalizing trade relations with the CEECs in the EAs.

Most of the model simulation studies ahead of EU's 2004 enlargement resulted in an asymmetric but win-win outcome (for an overview of the results, see European Commission, 2006). On average, both the old EU15 member states and the newly acceding countries can expect positive welfare and GDP gains. However, the gains of the new member states will be much higher than those of the old EU15 on average, sometimes at the proportion of 10:1. Within the old EU15 member states those countries with more intensive trade relations already before accession (like

Austria and Germany) can also expect higher welfare gains than those countries at the periphery of the EU (like Portugal and Spain) which nearly do no trade with the CEECs. The latter even might lose in the enlargement game.

In the case of EU's 2007 enlargement by Bulgaria (BG) and Romania (RO) we can expect a similar pattern as in the 2004 enlargement. The newcomers will gain the most, Austria (AT) will profit more from spill-overs than EU15 and the 10 new EU member states, which joined the EU in 2004 (EU10N).

Bulgaria and Romania: For the new EU member states we fully modelled the expected integration effects of entering EU's single market. The macro-economic effects for some major variables are shown in Table 2. The *overall results* (all 7 scenarios combined) exhibit the following features:

Table 2: Direct Integration effects[1)] of EU's 2007 Enlargement in Bulgaria and Romania

Integration effects	**Scale**	**Pre-accession period 2000-2006**		**EU membership 2007-2020**	
		Bulgaria	**Romania**	**Bulgaria**	**Romania**
GDP, real	%	+0.3	+0.2	+0.6	+0.6
GDP, real	*C%*	*+1.8*	*+1.2*	*+9.2*	*+8.9*
GDP, real (incl. migration)	*%*	*+0.3*	*+0.2*	*+0.5*	*+0.6*
Investment quota (% GDP)	%	+1.5	+0.5	+0.7	+0.6
Labour productivity (PR)	%	+0.3	+0.2	+0.4	+0.5
Employment (E)	%	+0.0	+0.0	+0.3	+0.1
Wages, nominal (W)	%	+0.3	+0.1	+0.3	-0.2
Inflation rate (P)	%	+0.0	-0.0	-0.2	-0.6
Unit labour costs (ULC)	%	+0.1	-0.1	-0.2	-0.8
Unemployment rate (U)	%	-0.4	-0.0	-2.8	-0.4
Budget balance (% GDP)	%	+0.1	+0.0	+0.3	+0.1
Public debt (% GDP)	%	-0.1	-0.0	-0.2	+0.1
Interest rate, short-term	%	+0.1	+0.2	+0.2	+2.0
Interest rate, long-term	%	+0.0	+0.1	+0.0	+1.9
Export quota[2)] (% GDP)	%	+1.3	+1.5	+4.6	+3.5
Import quota[2)] (% GDP)	%	+3.2	+2.9	+12.9	+10.1
Real effective exchange rate	%	+0.1	+0.1	+0.4	+1.0
Wage share (LQ) (% GDP)	%	+0.0	+0.0	+0.6	+0.2
GDP p.c. relative to EU15	%	+0.2	+0.2	+3.3	+3.1

[1)] Without migration effects

% = annual average growth rate in % or average annual change in % of GDP; C% = cumulated deviations from the baseline in percentage points.

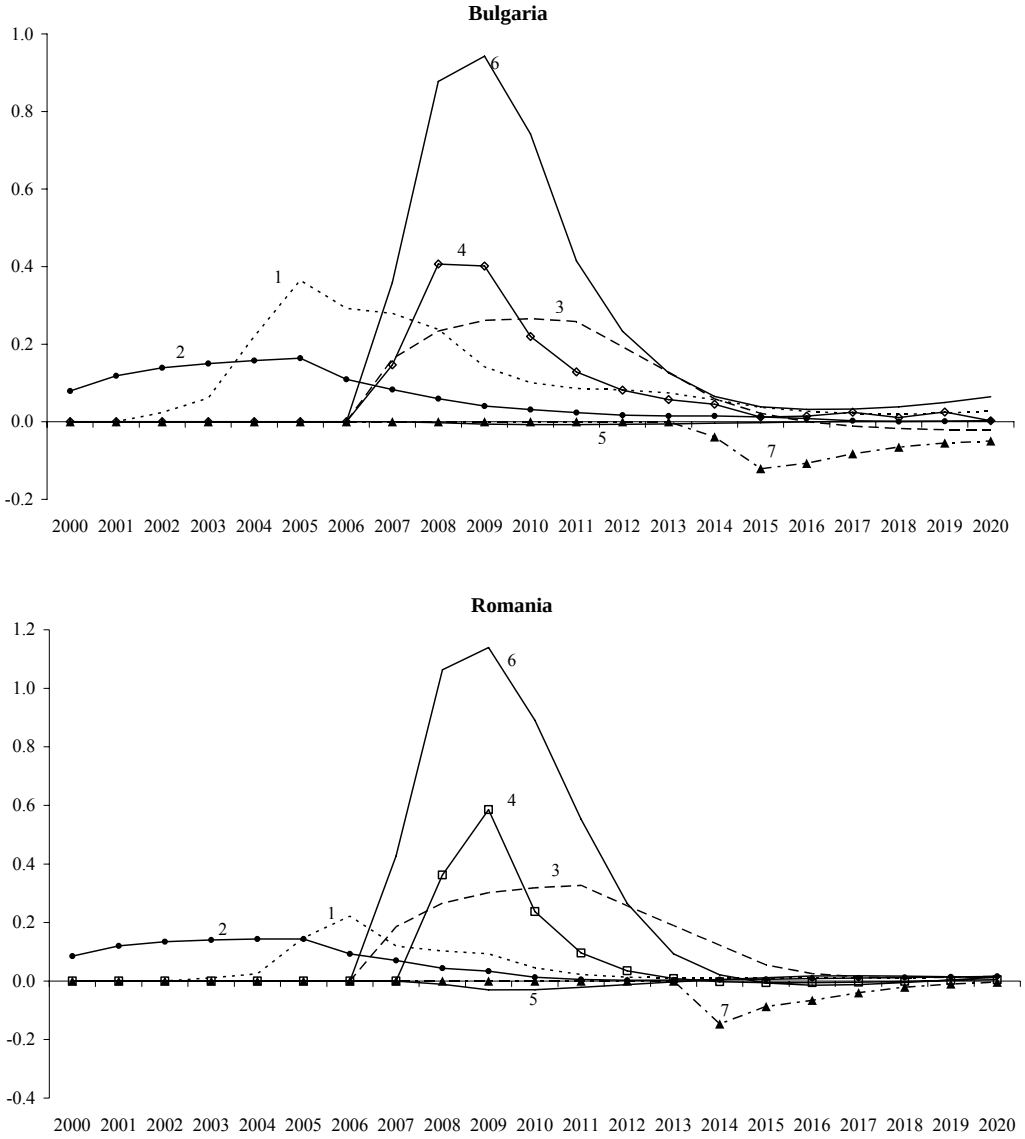
[2)] Export and import quota refer to total exports and imports of goods and services.

Source: Own simulations with the integration models of Appendix B

1) Due to our input calibration the overall effects in both countries are quite similar.
2) The integration effects started already in the pre-accession period. Preparation for accession resulted already in a higher average annual growth of real GDP of 0.3% in BG and 0.2% in RO.
3) The integration effects start to accelerate with joining the EU in 2007. Calculated until 2020 we expect an average annual growth effect of real GDP of 0.6% in both countries. Real GDP will have accumulated from 2000 to 2020 by more than 9 percentage points in BG and by around 9 percentage points in RO.
4) Due to the need to adjust the efficiency of the economy to the challenge of the single market, labour productivity will increase by around ½ percentage point per year after 2007.
5) More competition in the single market leads to a deceleration of inflation – more in RO than in BG.
6) In accordance with the predictions of the Balassa-Samuelson hypothesis both countries will appreciate their currencies in real terms during the catching-up process.
7) The income gap vis à vis EU15 will be steadily closed – on average by around three percentage points per annum between 2007-2020.
8) Like in other less developed countries joining the EU (e.g. Greece, Portugal and Spain) we can expect that the current account balance will further deteriorate in BG and RO as the import quotas increase much faster than the export quotas. BG starts with a deficit in the current account of 14% of GDP in 2007, RO with one of 12% of GDP.
9) The policy variables – budget balance, debt to GDP ratio, as well as interest rates (with the exception of RO) – are not very much affected by joining the EU.
10) Due to higher GDP growth, the unemployment rate declines.

If one breaks down the overall GDP effects into the *7 integration scenarios* (Table 1 and Appendix C) one recognises the following features:
1) Contrary to the postulates of some of the literature of the endogenous growth theory (e.g. Romer, 1990; Rivera-Batiz and Romer, 1991) and in accordance with empirical results of the past EU integration experiences (see Badinger, 2005), the growth effects of integration are only short-lived. EU integration means a temporary shock to the level of GDP, which translates in a jump in GDP growth rates but does not lead to a permanent steady-state increase of growth. This pattern is replicated here in the case of BG and RO (see Figure 1).

Figure 1: Short-term growth impact effects of 2007 EU's enlargement in Bulgaria and Romania
Real GDP effects of 7 Scenarios
(Real GDP; annual percentage change)

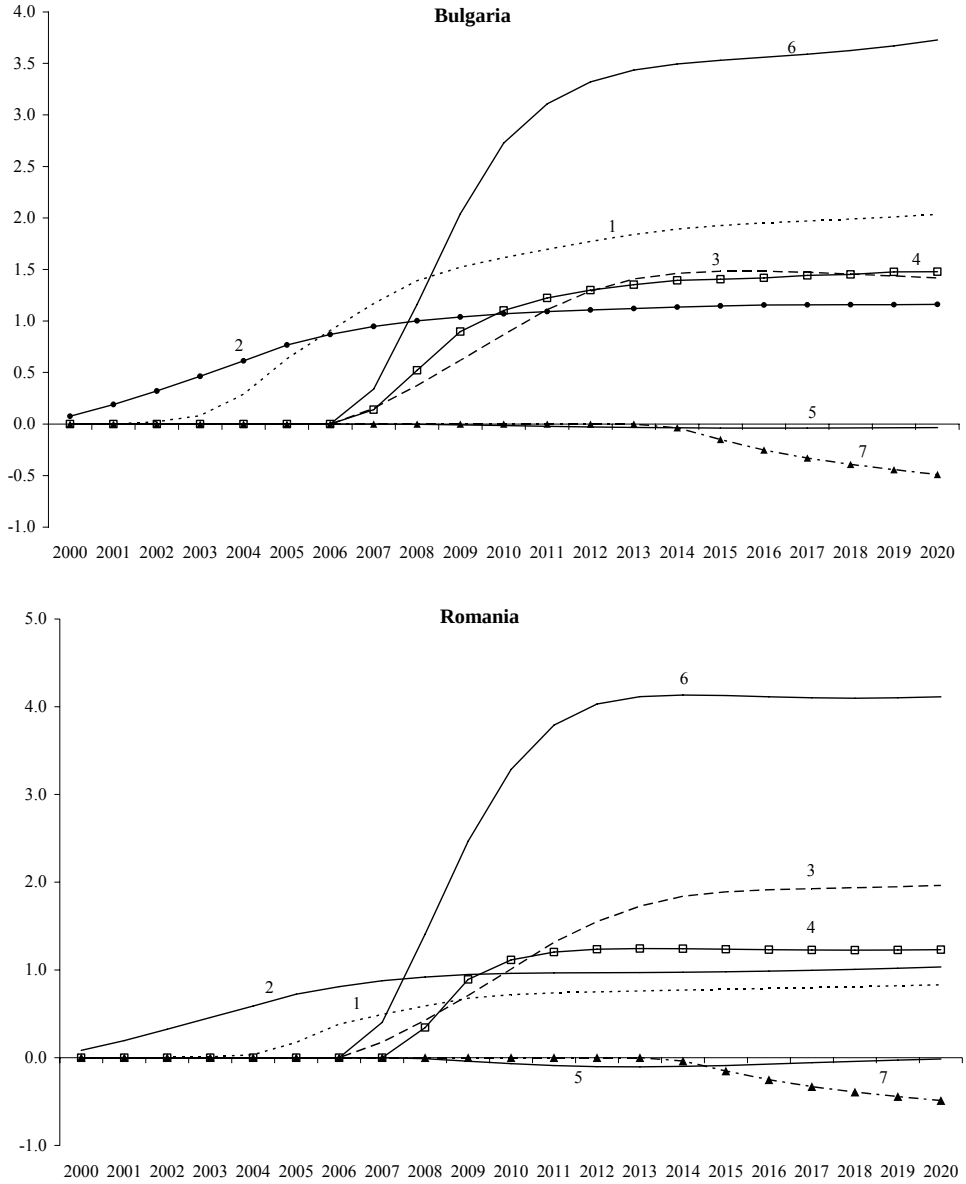


Scenarios: 1 = trade effects, 2 = investment effect of FDI, 3 = investment effect of structural funds, 4 = productivity effect of R&D, 5 = Mark-up pricing; 6 = exogenous productivity adjustment shock, 7 = migration effect.

2) The biggest isolated GDP growth shock stems from the exogenously implemented productivity shock (scenario 6). As we do not know ex ante how strong this shock might be and how long it will last, we calibrated it as such that it is somehow similar in both countries, with a slightly stronger impact in RO because the productivity performance was weaker than in BG ahead of EU accession. Anyway, we distributed the shock only over the period 2007 to 2010 and made sure

that it dies away later on. Of course, in the case of the PR shock one could also consider more or less impact on the economies. Here, we inputted only modest shocks.

Figure 2: Cumulative long-run effects of 2007 EU's enlargement in Bulgaria and Romania
Real GDP effects of 7 Scenarios
(Real GDP; cumulative deviations from baseline in %)



Scenarios: 1 = trade effects, 2 = investment effect of FDI, 3 = investment effect of structural funds, 4 = productivity effect of R&D, 5 = Mark-up pricing; 6 = exogenous productivity adjustment shock, 7 = migration effect.

3) The trade induced GDP growth effect (via more stimulated productivity growth) peters out relatively fast after EU accession.
4) The mark-up pricing behaviour has no impact on GDP.
5) Migration exerts – as expected – a negative effect on GDP ("migration loss"), starting with 2014 when the EU opens its labour markets completely. The simulation exercise of scenario 7 is only a tentative one, maybe considering a too strong migration effect when assuming that 1% of the labour force in both countries could emigrate in each year, starting in 2014.

Figure 2 shows the resulting long-run cumulative level effects of GDP for the 7 integration scenarios in both countries. Again, the assumed exogenous productivity effect is the strongest single integration effect.

Austria, EU15 and EU10N: As mentioned with the presentation of the specific modelling in chapter 3, the old EU member states are affected by the accession of BG and RO only on a indirect way via trade spill-overs and factor movements (FDI outflows and labour immigration). The results, collected in Table 3, exhibit the following features:

Table 3: Indirect Integration effects[1)] of EU's 2007 Enlargement in Austria, EU15 and EU10N

Integration effects	**Scale**	**Pre-accession period 2000-2006**			**EU membership BG, RO 2007-2020**		
		Austria	**EU15**	**EU10N**	**Austria**	**EU15**	**EU10N**
GDP, real	%	+0.03	+0.00	+0.00	+0.03	+0.01	+0.01
GDP, real	*C%*	*+0.10*	+0.02	+0.01	+0.50	+0.18	+0.10
GDP, real (incl. migration)	*%*	*+0.03*	*+0.00*	*+0.00*	*+0.05*	*+0.02*	*+0.01*
Employment (E)	%	+0.00	+0.00	+0.00	+0.00	+0.01	+0.00
Uneymployment rate (U)	%	-0.01	+0.00	+0.00	-0.03	-0.09	-0.01
FDInet (% GDP)	%	+0.01	+0.00	-	+0.04	+0.01	-
Wage share (LQ)	%	-0.03	-	-	-0.10	-	-
GDP p.c. relative to EU15	%	+0.03	-	-	+0.33	-	-

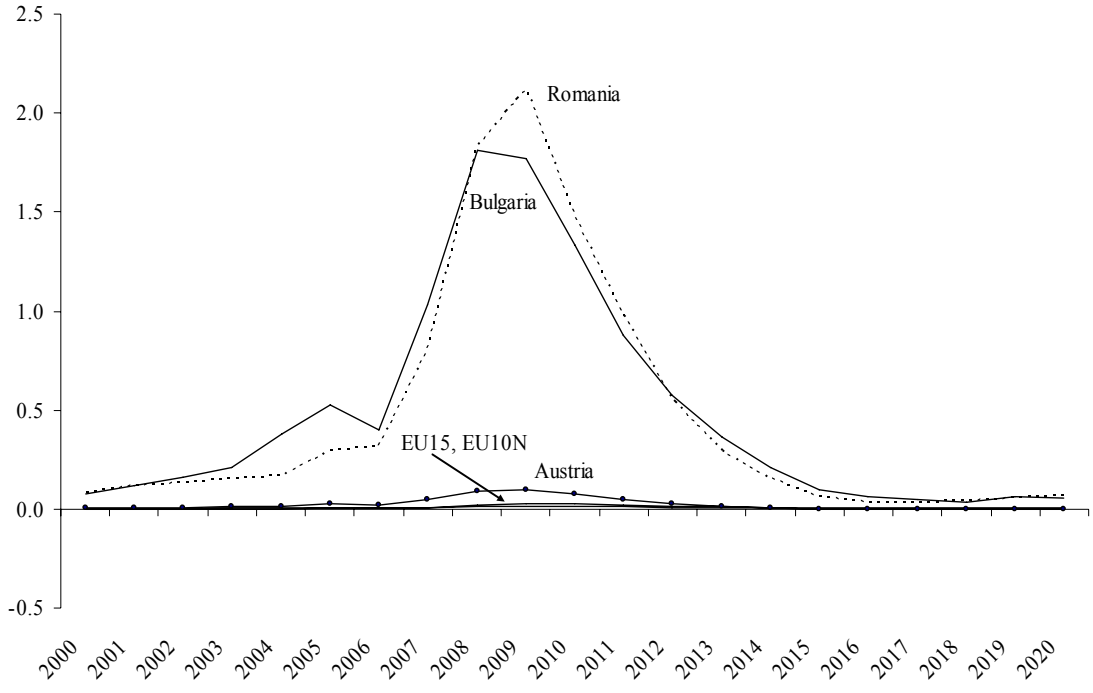
[1)] Without migration effects
% = annual average growth rate in % or average annual change in % of GDP; C% = cumulated deviations from the baseline in percentage points.
Source: Own simulations with the integration models of Appendix B

1) Austria, which on average trades more with BG and RO than the EU15 and EU10N can also expect somewhat higher GDP gains: 0.03% additional annual GDP growth in the period 2007-2020, compared to 0.01% in EU15 and EU10N, respectively.
2) Derived from the slightly positive GDP effects we also get the expected improvement in the labour market and more net FDI outflows.

3) The further process of EU's "mini-globalisation" by an ongoing enlargement towards ever poorer countries implies a further (slight) deterioration of Austria's income distribution, i.e. a shrinking wage share.

As already mentioned before, we cannot expect a permanent increase of steady-state GDP growth. Instead, we foresee a temporary jump in GDP growth rates in BG and RO and consequently also in a much alleviated manner in AT, EU15 and EU10N (see Figure 3).

Figure 3: Integration Effects of EU's 2007 Enlargement: BG, RO, AT, EU15 and EU10N (Real GDP; annual percentage change)



The long-run level effects of the cumulated real GDP are depicted in Figure 4. Calibrated as such that both countries, BG and RO can expect similar long-run GDP effects, we see BG slightly ahead in the cumulated GDP in 2020. Figure 4 nicely shows, that also EU's 2007 enlargement

may be a win-win situation. The gains in BG and RO are relative to, say Austria in the order of 20:1. In order to identify the mini-integration effects in AT, EU15 and EU10N we portray them in Figure 5.

Figure 4: Integration Effects of EU's 2007 Enlargement: BG, RO, AT, EU15 and EU10N (Real GDP; cumulative deviations from baseline in %)

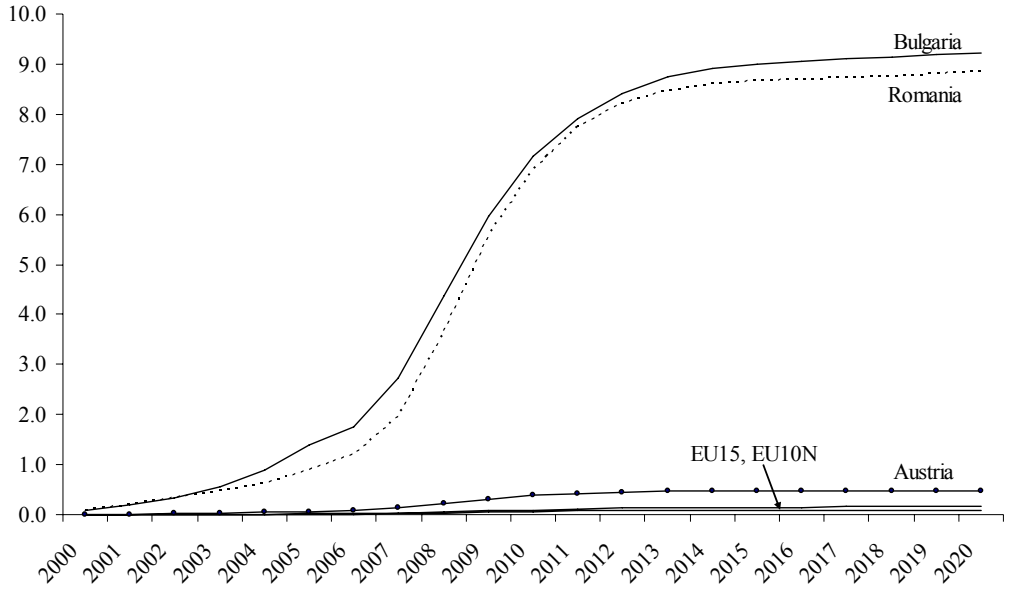
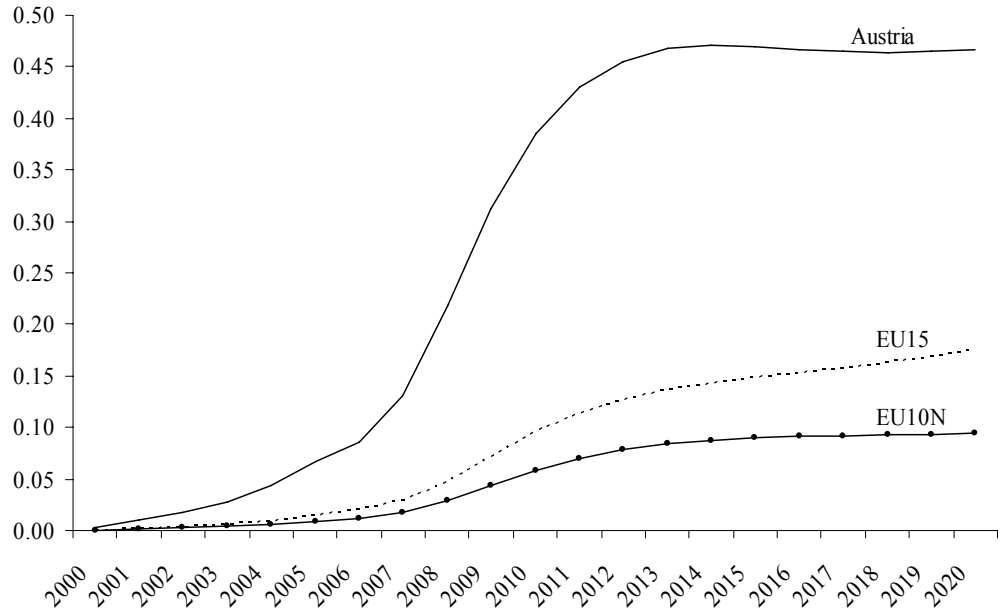
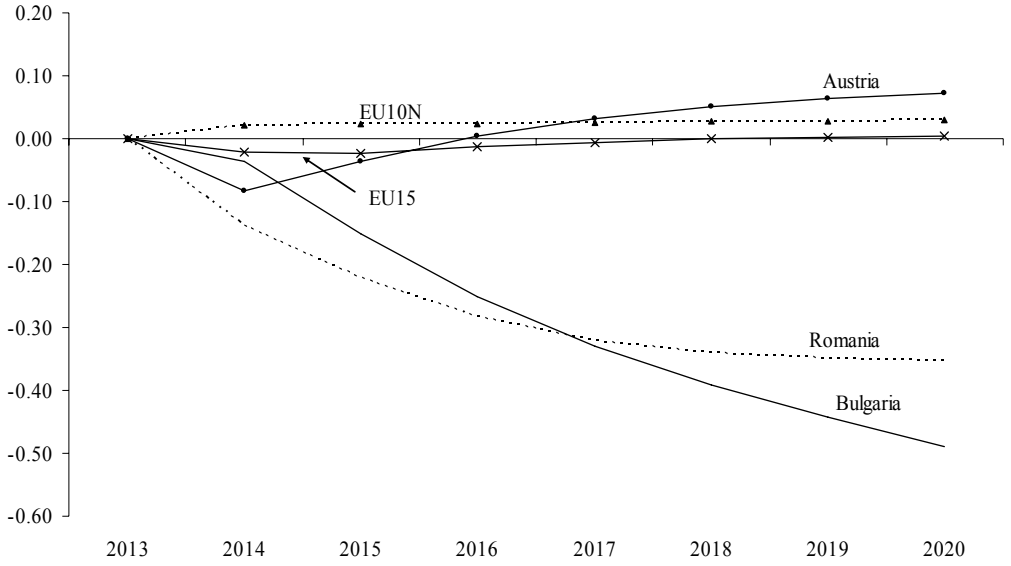


Figure 5: Integration Effects of EU's 2007 Enlargement: BG, RO, AT, EU15 and EU10N (Real GDP; cumulative deviations from baseline in %)



Finally, we show the results of the assumed *migration* in 2014 (scenario 7) in Figure 6. As expected, we replicate the "immigration surplus" in AT, EU15 and EU10N and the "migration loss" in BG and RO. Although, for only demonstrative purposes we assumed that starting in 2014 1% of the labour force of BG and RO will leave their countries and migrate to AT, EU15 or EU10N, the GDP effects are small: -0.07% real GDP p.a. in BG and -0.05% in RO; +0.03% in AT and practically zero in EU15 and EU10N.

Figure 6: Migration Effects of EU's 2007 Enlargement: BG, RO, AT, EU15 and EU10N (Real GDP; cumulative deviations from baseline in %)



Assumption: after the end of the seven year transitional arrangement concerning the free movement of labour, migration starts in 2014 amounting to 1% of labour force in BG and RO.

5. Conclusions

EU's 2007 enlargement by Bulgaria and Romania is evaluated by applying a simple macro-economic integration model which has two ambitions. On the one hand, it tries to encompass as many of the theoretically predicted integration effects possible, and on the other hand it should be easily tractable. In an explicit simulation exercise, with our prototype model for Bulgaria and Romania with spill-overs to the old EU member states we receive qualitatively similar results as those in the case of EU's 2004 enlargement by 10 new member states. Bulgaria and Romania

gain much more from EU accession than the incumbents by the proportion of 10:1. In the time up to 2020, Bulgaria and Romania can expect a considerable overall integration gain, amounting to additionally ½ percentage point more real GDP growth per annum. The incumbent EU member states will profit only slightly from this last step of EU enlargement. Due to more intensive trade relations, Austria will gain somewhat more (+0.05%) than the average of EU15 (+0.02%) and the 10 new EU member states (+0.01%) which joined the EU in 2004.

The prototype model presented and applied here for Bulgaria and Romania may in principle also be applicable in the case of further EU enlargements toward the countries of the Western Balkan (e.g. Croatia) and Turkey.

Appendix A: Enlargement of EU's Customs Union from EU15 to EU25 in 2004

	Austria	**EU14**	**EU10N**	**Current account**	**Welfare**	**GDP, real**
Trade with:	Bilateral trade, % changes			Change in % of GDP	in % of GDP	% change
Austria	-	-0.35	3.89	-0.05	0.09	0.06
EU14	-0.85	-0.19	1.42	0.01	0.00	0.00
EU10N	4.59	5.59	8.26	-0.89	0.20	0.31
Bulgaria	-6.31	-0.53	16.29	-0.03	0.04	0.01
Romania	-2.33	-1.34	24.36	-0.18	0.12	0.02
Croatia	-2.68	-1.37	21.15	-0.14	0.24	0.08
Turkey	-3.43	-0.81	26.90	-0.01	0.03	-0.01
EFTA	-0.08	-0.20	2.43	0.01	0.01	0.00
Rest of Europe	-0.56	-0.79	8.37	-0.05	0.06	0.02
NAFTA	1.72	-0.20	9.63	0.01	0.00	0.00
ROW	1.65	-0.33	17.01	0.01	0.00	0.00
World total	0.19	-0.03	5.64	0.00	0.00	-

EU10N = Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia; ROW = rest of the world.

Source: Own simulations with the GTAP6 model with 11 countries/regions, 7 sectors and 5 factors of production

Appendix B: Estimated Integration Model for Bulgaria and Romania with spill-overs to Austria, EU15 and EU10N

BULGARIA:

GDP growth %:
Y_BG% = 0.47 + 0.86*(PR_BG%+PR_BG%(-1))/2 + 0.03*I_BG + 0.46*E_BG% +
0.20*BD_BG - 0.11*BD_BG(-1) - 0.09*D(U_BG) - 0.15*(RL_BG(-1)-P_BG%(-1))

Investment in % of GDP
I_BG = 1.17 + 0.90*I_BG(-1) + 0.36*FDI_BG(-1) + 0.03*COH_BG_GD

Labour productivity growth %:
PR_BG% = 0.55 + 0.61*Y_BG% + 4.96*D(R&D_BG) + 0.05*D(X_BG+M_BG)

Total employment (in 1.000):
E_BG = 994.74 + 0.29*(LS_BG+MIGR_BG) + 29.53*Y_BG - 74.65*PR_BG + 0.31*E_BG(-1)

Wage bargaining – Phillips curve:
W_BG% = 0.72 - 0.40*D(U_BG) + 0.74*P_BG% + 1.07*PR_BG% + 0.04*W_BG%(-1))

Mark-up pricing:
P_BG = 0.50 + 0.47*MUP_BG*ULC_BG + 0.81*P_BG(-1)

Unemployment rate % (inverted Okun's law):
U_BG = 3.23 + 0.92*U_BG(-1) - 0.54*Y_BG% + 0.04*D(LS_BG+MIGR_BG)

Budget balance in % of GDP:
BD_BG = -0.90 + 0.27*Y_BG% + 0.35*BD_BG(-1)

Public debt dynamics:
DB_BG = - BD_DB + (RL_BG – P_BG% - Y_BG%)*DB_BG(-1) – DB_BG(-1)

Taylor rule for short-term interest rate %:
RS_BG = -3.13 + 0.33*(Y_BG%(-1))-3) + 0.001*(P_BG%-2) + 0.85*RS_EU15 + 0.61*RL_BG

Long-term interest rate %:
RL_BG = 2.31 + 0.08*RS_BG + 0.48*RL_BG(-1)

Export (of goods and services) share in % of GDP:
D(X_BG) = -6.03 + 5.76*(0.46*Y_EU15%+0.02*Y_AT%+0.05*Y_EU10N%+0.038*Y_RO%)
- 0.22*REER_BG% + 0.27*D(D_ENLCTR)

Import (of goods and services) share in % of GDP:
LOG(M_BG) = 0.14 + 0.04*INT_BG + 0.43*LOG(REER_BG) + 0.58*LOG(X_BG)

Balassa-Samuelson hypothesis:
LOG(REER_BG) = 0.42 + 0.13*LOG((YPC_BG/YPC_EU15)*100) + 0.81*LOG(REER_BG(-1))

GDP p.c. at 2000 PPS:
YPC_BG = YPC_BG(-1)*(1+Y_BG%)/100)

Catching-up of GDP p.c. to EU15 level:
YPC_BGEU15 = (YPC_BG / YPC_EU15) * 100

Unit labour costs:
ULC_BG = (W_BG / Y_BG) * 100

Income distribution (wage share in % of nominal GDP):
LQ_BG = (W_BG / YN_BG) * 100

GDP at current prices:
YN_BG = YN_BG(-1)*(1+(P_BG% + Y_BG%) / 100)

ROMANIA:

GDP growth %:
Y_RO% = -1.26 + 0.77*(PR_RO%+PR_RO%(-1))/2 + 0.12*I_RO + 0.29*E_RO% + 0.002*BD_RO + 0.20*BD_RO(-1) - 0.25*D(U_RO(-1)) - 0.79*(RL_RO(-1)-P_RO%(-1))

Investment in % of GDP
I_RO = 13.56 + 0.15*Y_RO% + 2.25*COH_RO_GDP + 1.05*FDI_RO

Labour productivity growth %:
PR_RO% = 1.01 + 0.61*Y_RO% + 3.43*D(R&D_RO(-1)) + 0.04*D(X_RO(-1)+M_RO(-1))

Total employment (in 1.000):
E_RO = 1794.74 + 0.34*(LS_RO+MIGR_RO) + 23.42*Y_RO - 178.61*PR_RO + 0.39*E_RO(-1)

Wage bargaining – Phillips curve:
W_RO% = 4.86 - 4.73*D(U_RO) + 0.81*P_RO% + 0.60*PR_RO%

Mark-up pricing:
P_RO = 3.94 + 0.24*MUP_RO*ULC_RO + 0.71*P_RO(-1)

Unemployment rate % (inverted Okun's law):
U_RO = 2.12 + 0.80*U_RO(-1) - 0.13*Y_RO% + 0.001*D(LS_RO+MIGR_RO)

Budget balance in % of GDP:
BD_RO = -1.86 + 0.08*Y_RO%

Public debt dynamics:
DB_RO = - BD_RO + (RL_RO - P_RO% - Y_RO%)*DB_RO(-1) - DB_RO(-1)

Taylor rule for short-term interest rate %:
RS_RO = -2.84 + 0.56*(Y_RO%(-1)-3) + 0.08*(P_RO%-2) + 0.57*RL_RO + 0.33*RS_RO(-1)

Long-term interest rate %:
RL_RO = 0.22 + 0.46*RS_RO + 0.53*RL_RO(-1)

Export (of goods and services) share in % of GDP:
D(X_RO) = -3.03 + 2.53*(0.6*Y_EU15%+0.03*Y_AT%+0.08*Y_EU10N%+0.027*Y_BG%) - 0.15*REER_RO% + 0.33*D(D_ENLCTR)

Import (of goods and services) share in % of GDP:
LOG(M_RO) = 0.61 + 0.04*INT_RO + 0.11*LOG(REER_RO) + 0.80*LOG(X_RO)

Balassa-Samuelson hypothesis:
LOG(REER_RO) = -0.35 + 0.25*LOG((YPC_RO/YPC_EU15)*100) + 0.89*LOG(REER_RO(-1))

GDP p.c. at 2000 PPS:
YPC_RO = YPC_RO(-1)*(1+Y_RO%)/100)

Catching-up of GDP p.c. to EU15 level:
YPC_ROEU15 = (YPC_RO / YPC_EU15) * 100

Unit labour costs:
ULC_RO = (W_RO / Y_RO) * 100

Income distribution (wage share in % of nominal GDP):
LQ_RO = (W_RO / YN_RO) * 100

GDP at current prices:
YN_RO = YN_RO(-1)*(1+(P_RO% + Y_RO%) / 100)

<u>AUSTRIA:</u>

GDP growth %:
Y_AT% = 0.79 + 0.52*(0.59*Y_EU15%+0.125*Y_EU10N%+0.05*Y_BG%+0.015*Y_RO%) + 0.25*E_AT% - 1.11*D(U_AT) + 0.12*Y_AT%(-1)

Total employment (in 1.000)
E_AT = 360.37 + 0.51*(LS_AT+MIGR_AT) + 0.38*E_AT(-1) + 0.08*Y_AT

Unemployment rate % (inverted Okun's law):
U_AT = 1.02 + 0.85*U_AT(-1) - 0.18*Y_AT% + 0.005*D(LS_AT+MIGR_AT)

FDI net outflow (in % of GDP)
FDINET_AT = -0.91 +
0.45*(0.59*Y_EU15%+0.125*Y_EU10N%+0.05*Y_BG%+0.015*Y_RO%) +
0.44*FDINET_AT(-1)

Income distribution (wage share in % of nominal GDP):
LQ_AT = 49.70 - 2.70*FDINET_AT

GDP p.c. at 2000 PPS:
YPC_AT = YPC_AT(-1)*(1+Y_AT%)/100)

Relationship of GDP p.c. to EU15 level:
YPC_ATEU15 = (YPC_AT / YPC_EU15) * 100

EU15:

GDP growth %:
Y_EU15% = 1.55 + 0.14*(Y_AT%+Y_AT%(-1))/2 + 0.47*E_EU15% - 0.63*D(U_EU15) -
0.05*Y_EU15%(-1))

Total employment (in 1.000)
E_EU15 = 39385.45 + 0.19*(LS_EU15+MIGR_EU15) + 0.31*E_EU15(-1) + 4.82*Y_EU15

Unemployment rate % (inverted Okun's law):
U_EU15 = 0.62 + 1.04*U_EU15(-1) - 0.55*Y_EU15% +
0.17*D(LS_EU15+MIGR_EU15)/1000

FDI net outflow (in % of GDP)
FDINET_EU15 = 0.07 +
0.27*(0.60*Y_EU15%+0.023*Y_AT%+0.053*Y_EU10N%+0.002*Y_BG%+0.006*Y_RO%) +
0.71*FDINET_EU15(-1)

GDP p.c. at 2000 PPS:
YPC_EU15 = YPC_EU15(-1)*(1+Y_EU15%)/100)

EU10N:

GDP growth %:
Y_EU10N% = 3.25 + 0.25*(0.55*Y_EU15%(-1)+0.04*Y_AT%+0.004*Y_BG%+0.016*Y_RO%) + 0.48*E_EU10N% - 0.43*D(U_EU10N(-2)) + 0.21*Y_EU10N%(-1)

Total employment (in 1.000)
E_EU10N = -13180.04 + 1.30*(LS_EU10N+MIGR_EU10N)

Unemployment rate % (inverted Okun's law):
U_EU10N = 1.47 + 0.89*U_EU10N(-1) - 0.14*Y_EU10N%(-1)) + 0.002*D(LS_EU10N(-1)+MIGR_EU10N(-1))/1000

GDP p.c. at 2000 PPS:
YPC_EU10N = YPC_EU10N(-1)*(1+Y_EU10N%)/100)

Catching-up of GDP p.c. to EU15 level:
YPC_EU10NEU15 = (YPC_EU10N / YPC_EU15) * 100

Legend of the labels:
Label_i = name of the variable for country *i*; *i* = BG, RO, AT, EU15 and EU10N.
Y = real GDP; PR = labour productivity; I = investment quota in % of GDP; E = total employment (in 1.000); BD = budget balance (in % of GDP); U = unemployment rate (in %); P = index of consumer prices; COH_GDP = structural funds transfers out of the EU budget (in % of GDP); FDI = FDI inflows (in % of GDP), R&D = expenditures on research and development (in % of GDP); LS = labour supply (in 1.000); MIGR = migrating labour (in 1.000); W = wages and salaries (at current prices); MUP = mark-up index; DB = gross public debt (in % of GDP); RL = nominal long-term interest rate (%); RS = nominal short-term interest rate (%); X = export quota (exports of goods and services in % of GDP); M = import quota (imports of goods and services in % of GDP); REER = real effective exchange rate (vis à vis EU15); YPC = GDP per capita at 2000 PPS; LQ = wage share (wages in % of nominal GDP); ULC = unit labour costs; YN = nominal GDP.

Parameter estimates for dummy variables are not reported. The model is estimated in EViews for the period 1992 to 2020. Data source: AMECO database of the European Commission with own forecasts up to 2020.

Appendix C: Quantitative model inputs of 7 scenarios in Bulgaria and Romania
(Additional effects compared to the baseline scenario without EU integration)

	Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5	Scenario 6		Scenario 7				
	ENLCTR	INT	FDI		COH		R&D		MUP	PR		MIGR				
	BG+RO	BG+RO	BG	RO	BG	RO	BG	RO	BG+RO	BG	RO	BG	RO	AT	EU15	EU10N
2000	0.00	0.00	2.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0
2001	0.00	0.00	2.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0
2002	0.00	0.39	2.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0
2003	0.00	0.69	2.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0
2004	10.00	1.19	2.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0
2005	10.00	1.69	2.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0
2006	10.00	2.19	0.50	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0
2007	12.00	2.69	0.50	0.20	0.50	0.50	0.05	0.25	-0.03	0.60	1.00	0	0	0	0	0
2008	12.00	2.69	0.20	0.10	0.45	0.50	0.10	0.25	-0.07	0.40	0.90	0	0	0	0	0
2009	12.00	2.69	0.00	0.10	0.40	0.50	0.10	0.25	-0.06	0.30	0.60	0	0	0	0	0
2010	12.00	2.69	0.00	0.00	0.35	0.50	0.10	0.25	-0.05	0.00	0.30	0	0	0	0	0
2011	12.00	2.69	-0.10	0.00	0.30	0.50	0.10	0.25	-0.04	-0.02	0.10	0	0	0	0	0
2012	12.00	2.69	-0.20	0.00	0.10	0.30	0.10	0.25	-0.03	-0.02	0.00	0	0	0	0	0
2013	12.00	2.69	-0.20	0.00	0.00	0.20	0.10	0.25	-0.02	-0.03	0.00	0	0	0	0	0
2014	12.00	2.60	-0.20	0.00	-0.10	0.10	0.10	0.25	-0.01	-0.03	0.00	-36	-92	25.6	89.6	12.8
2015	12.00	2.50	-0.30	0.00	-0.10	0.00	0.09	0.25	0.00	-0.03	0.00	-36	-92	25.6	89.6	12.8
2016	12.00	2.40	-0.40	0.00	-0.10	0.00	0.10	0.25	0.00	-0.02	0.00	-36	-92	25.6	89.6	12.8
2017	12.00	2.30	-0.50	0.00	-0.10	0.00	0.09	0.25	0.00	-0.02	0.00	-36	-92	25.6	89.6	12.8
2018	12.00	2.20	-0.50	0.00	-0.10	0.00	0.10	0.25	0.00	-0.03	0.00	-36	-92	25.6	89.6	12.8
2019	12.00	2.10	-0.50	0.00	-0.10	0.00	0.08	0.25	0.00	-0.03	0.00	-36	-92	25.6	89.6	12.8
2020	12.00	2.00	-0.50	0.00	-0.10	0.00	0.09	0.25	0.00	-0.02	0.00	-36	-92	25.6	89.6	12.8

Scenarios: 1 = trade effects (ENLCTR = additional number of EU member states in the process of enlargement from EU15 to EU25 and EU27; INT = dummy for opening-up of import barriers, 2 = investment effect of FDI (change in % of GDP), 3 = investment effect of structural funds (COH; change in % of GDP), 4 = productivity effect of R&D (change in % of GDP), 5 = Mark-up pricing (mark-up – MUP decreases; %-change); 6 = exogenous productivity adjustment shock (adjustment in the residuum of the PR equation), 7 = migration effect (MIGR – in 1.000 persons).

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