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Abstract

Many studies with different methods (CGE models, DSGE models, structural gravity equations) have recently evaluated EU's Single Market. The problem with all these studies is that they use complex models with data sets which are not replicable. The aim of this paper is to develop a simple EU model which uses readily accessible data, and which is replicable in EViews. First the 10 equations macro model is used to evaluate Austria's EU membership since 1995. Then the same prototype model is applied to make a comparison of the integration effects of a selected number of EU Member States. Our simple EU model covers the essential economic effects of EU integration of EU's Single Market, the introduction of the Euro, and the following EU enlargements: increase in intra-EU trade, price reduction because of more competition, the impact of the net budget position vis à vis the EU budget, and lastly that on growth.

Keywords: European Integration; Model simulations; country studies
JEL Classification: F15; C51; O52.

Contents

1. Introduction

In the context of the discussion about Brexit and the 25th anniversary of the creation of the EU' Single Market (SM), many studies were carried out to underline the importance of the SM for trade, growth and welfare of the EU Member States (MS). Except for one study (Andersen et al. (2019)) all concluded that EU's SM increased trade, welfare, and growth. They us the most advanced and complex methods, either in the form of CGE models, DSGE models or through the application of structured gravitational equations. As valuable as these studies are, they are not very transparent and replicable.

The purpose of this paper is to develop a simple EU model which uses easily available data, and which is replicable in EViews. Firstly, we give a short literature overview of the most recent attempts to evaluate EU's SM. Then a simple 10 equations EU model is developed, covering the most essential EU integration effects: (a) trade effects, resulting from participating in EU's SM, the introduction of the Euro and the grand EU enlargement, (b), the competition effects, (c) the impact of the net budget position vis à vis the EU budget, and lastly (d) the resulting growth effect of European integration. The study concludes with the application of this prototype EU model for Austrian EU to a selected number of EU MS: founding members and new MS which joined the EU later and which are Euro or non-Euro countries.

2. Literature overview

A whole bunch of studies evaluated ex ante the deepening steps of European integration: the start with EU's Single Market in 1993, the creation of the Economic and Monetary Union (EMU) in 1999 with the introduction of the euro in 2002, and the possible effects of the grand enlargement of the EU, starting in 2004.

Less studies cared about the outcome of these fundamental integration steps. We review briefly only the most important recent studies which primarily deal with the impact of EU's Single Market[1]. Similarly, to the ex-ante studies also those done ex post apply a variety of methods: model-based studies and econometric analyses. Whereas most of the model-based ex post evaluations of EU's Single Market find positive growth effects for trade and GDP, econometric studies like those of Andersen et al. (2019) find no significant effect of European integration on economic growth.

[1] Badinger and Breuss (2011) give an overview of the literature on studies which quantify the effects of Post-War economic integration.

London Economics (2017) uses an econometric model to measure the impact of EU's Single Market. It provides an estimate by relating five variables of interest to a number of other economic variables, including the summary indicator of Single Market integration[2]. The five variables of interest are: (i) GDP (measured by GDP per capita), (ii) household consumption (measured by household consumption per capita), (iii) employment (measured by employment rate), (iv) productivity (measured by growth of total factor productivity), and (v) investment (measured by gross fixed capital formation). The model results were estimated across all Member States for the period 1995 to 2015 (except for Croatia, Malta, and Luxembourg). Overall, the results suggest that Single Market integration since the completion of the Single Market Plan (SMP) has had a direct, positive and statistically significant impact on the growth of per capita GDP, per capita consumption and employment, and total factor productivity. Whilst no direct impact was found in the case of investment, the growth of Single Market integration still had an indirect effect: the increase of GDP, in turn stimulates investment. The resulting estimates show that EU GDP per capita is 1.0% higher than it would have been without an increase in integration since 1995. Moreover, there are almost 1.9 million additional jobs. If the level of Single Market integration since 1990 is used as the reference point (i.e. pre-SMP), then the impact of the Single Market is even greater. GDP per capita would have been 1.7% higher.

The longer a country is a member of EU's Single Market, the higher are the growth effects. As a result (London Economics, 2017, p. 35 and 37) the impact of Single Market integration on GDP per capita in 2015 since the completion of the SMP (1993) or since the accession of new Member States (MS) was highest in Austria (+1,7%) and lowest in Greece (-0,3%). The incumbent Germany increased its level of GDP per capita by 1,6%. The best performance of the new MS after the grand EU enlargement in 2004 was the Czech Republic (+0,8%). The countries which only entered the EU in 2007, like Bulgaria (+0.02%) and Romania (+0.1%) could not yet profit from EU accession.

Felbermayr et al. (2018) carry out simulation experiments that shed light on the economic benefits arising from various steps of European integration. Hence, they simulate the economic consequences of "undoing Europe". For this purpose, they use the ifo trade model, a computable general equilibrium (CGE) model, termed in the literature as "New Quantitative Trade Model" (NQTM). The model features 43 countries and 50 goods and services sectors with data from the World Input-Output Database (WIOD) over the period

[2] 17 different indicators are included in the summary indicator of Single Market integration (see London Economics (2017), p. 26).

2000-2014. “Undoing Europe” is simulated by looking at seven different counterfactual scenarios: (1) collapse of the European Customs Union (tariff-free trade replaced by MFN tariffs), (2) dismantling the European Single Market, (3) dissolution of the Eurozone, (4) breakup of the Schengen Agreement, (5) undoing all RTAs with third countries, (6) complete collapse of all European integration steps, (7) complete EU collapse including the termination of fiscal transfers.

Overall, the largest losses of income per capita in the base year 2014 would result from the dissolution of the Single Market which is at the heart of EU integration (Felbermayr et al., 2018, p. 24). The complete collapse of all EU integration steps would have significant welfare losses, measured by income per capita for the EU28 on average as a whole (-10.2%), but heterogeneity would exist across countries. Luxembourg (-23.3%) would suffer the most, followed by Malta (-17.8%) and the new EU Member States, which acceded the EU in 2004 like Hungary (-14.2%) and the others in the range of around -11%. From the three EU newcomers in 1995, Austria (-6.2%) would suffer from the end of the EU more than Finland (-3.8%) and Sweden (-4.2%). Germany (-5.2% would lose less than the EU on average.

Mion and Ponattu (2019) apply a computable general equilibrium (CGE) trade model to study the economic benefits of the EU’s Single Market (SM) for countries and regions across Europe. The model captures the impact of the trade boosting effects of the SM on productivity, markups, product variety, welfare and the distribution of population across European countries and regions. The CGE model is characterized by costly trade, love of variety, heterogeneous firms, labour mobility as well as endogenous markups and productivity. The authors use data on trade in goods (services) coming from the COMTRADE (ITS) database provided by the United Nations (Eurostat) for the period 2010-2016. Simulations give results for countries and European regions (283 NUTS2 regions, and 14 other OECD and BRIC trading partners).

The long-run country results (Mion and Ponattu, 2019, p. 12) show that the SM provides higher welfare, higher productivity and lower markups to all its members while at the same time countries outside the SM are actually (slightly) worse off because of the existence of the common market. The country results show a considerable heterogeneity. Overall, the long-run (in the period 2010-2016) welfare (income per capita) gains due to EU’s Single Market, are highest in Belgium (+4.4%) and Luxembourg (+4.3%), followed by the Czech Republic (+4.0%), Austria and Slovenia (each +3.9%). Finland (+2.5%) and Sweden (+2.8%) could profit less from EU accession. The large incumbent EU Member States, like

France (+3.1%), Italy (+2.8%) and Germany (+2.7%) rank in the middle of welfare benefits of the EU.

In't Veld (2019) evaluates the macro-economic benefits of EU's Single Market by applying the European Commission's QUEST DSGE model[3]. The model used in this simulation exercise is a multi-country version of the QUEST model. QUEST is a structural macroeconomic model, derived from micro-principals of dynamic intertemporal optimisation. It distinguishes between a tradable and non-tradable sector, both importing inter-mediate goods, and models bilateral trade flows in the traded good. Reported are only long run effects.

In't Veld (2019) simulates two counterfactual scenarios (capturing the non-SM effects):

1) *Effects of trade barriers:* in the SM simulation the author adds MFN tariffs and non-tariff barriers (NTB) although at the start of the SM the EU has already eliminated the MFN tariffs in intra-EU trade. The increase in trade costs of around 13% reduces intra-EU trade (intra-EU imports) by 20-30%, while total imports fall by about 20%. The fall in imports is larger than that in exports. The increase in trade costs not only affects trade flows but has a direct impact on domestic demand and hence on GDP (in the long run -6.6% for EU28). In the QUEST model, lower GDP is mostly a productivity effect, which is the result of lower investment.
2) *Effects of lower competition:* Greater trade openness of the SM has increased competition and lowered prices, and the re-establishment of trade barriers (scenario (i)) is likely to reduce competitive pressures. Assuming that the undoing of the SM would lead to an increase of mark-ups in manufacturing by 26% (no effect in the services sectors), real GDP would be lowered of 2.1% on average in EU28.

The simulated long run macroeconomic effects of counterfactual non-Single Market is the sum of the two simulated scenarios above (In't Veld, 2019, p. 814). In the long run, real GDP in EU28 would be lower by 8.7%. The effects differ from country to country. The biggest losses would occur in Luxembourg (-20.5%), followed by Slovakia (-19.3%), Czech Republic (-18.5%), Belgium (-18%) and Hungary (-16.5%). Austria (-11.8%) would suffer more than Finland and Sweden (both -7.7%). The large incumbent Member States France (-7.1%), Germany (-7.9%) and Italy (-6.8%) would lose less than the EU on average.

In't Veld's (2019) estimates can be directly compared to those of Mayer et al. (2019) and Felbermayr et al. (2018), who use gravity trade models to estimate the trade and welfare effects from European integration. Mayer et al. (2019) report large trade effects and welfare

[3] Breuss (2020A) made a comparable exercise with a two-country DSGE model (Austria and the Euro area). Accordingly, real GDP in Austria increased during 25 years of EU membership (1995-2020) cumulatively by 17.8% or by 0.7% per year.

losses for the EU of up to 5½%. Felbermayr et al. (2018) report income per capita effects for their Single Market disintegration scenario that are on average around 6.4% for the EU28 as a whole. While the country ranking in these two studies show strong similarities to those of In't Veld, their welfare or income per capita effects appear somewhat lower than In't Veld's GDP effects. Part of this difference can be attributed to the competition effects that are included in the results of In't Veld, but not in that of the two other studies.

Own simulations of the "Undoing the EU" scenario are comparable to those of In't Veld (2019). However, they are carried out with a Computable General Equilibrium (CGE) model, based on the Global Trade Analysis project (GTAP) database, version 10 (data of 2014)[4]. Our 20x20 model has 20 sectors and 20 countries. In contrast to In't Veld (2019) we simulate the "Undoing the EU" only with one scenario: we re-introduce non-tariff measures (NTMs) between the EU Member States which have been gradually (although) not completely eliminated since the inception of the Single Market in 1993. The problem with the implementation of NTMs is that they are only rough estimates. We apply the most recent estimated NTMs by Arriola et al. (2020). The re-introduction of NTMs – the elimination of which constituted the core of EU's Single Market – lead to a reduction in trade and economic growth. Intra-EU trade would shrink by 18% (Armington version) to 27% (Melitz version)[5]. This translates into a medium run reduction of real GDP in EU28 by 0.5% (Armington) to 2.8% (Melitz). Ireland would be the big loser: GDP loss of 1.2% to 8%. Austria would lose disproportionally (-0.8% to -4.9%); Finland (-0.6% to -3.3%) and Sweden (-0.7% to -3.4%). The GDP losses are lower in our simulations than those of In't Veld, mainly because we did not re-introduce MFN tariffs (as they were already eliminated in the intra-EU trade before the completion of EU's Single Market.

Andersen et al. (2019) evaluate the contribution of EU membership to economic growth. Asking the question whether it has been worthwhile to join the EU to trigger prosperity, they econometrically regress economic growth (annual growth rate of real GDP per capita) to a dummy variable for EU membership (taking the value of 1) with different data bases (OECD, Penn World Tables (PWT), World Development Indicators (WDI)) for periods since 1960 with and without the crises years (financial crisis 2009, Euro crisis 2010) and

[4] The simulations are executed with the CGEBox developed by Britz and Van der Mensbrugghe (2018). A full documentation of all equations for that open-source CGE modelling platform can be found in Britz (2019).

[5] The CGEBox allows to simulate the GTAP model in a Armington and in a Melitz version. The Armington model is based on the premise that each country produces a different good and consumers would like to consume at least some of each country's goods. The Melitz version considers firm heterogeneity, firm entry and exits in the industry as a whole and on specific trade linkages, and love-of-variety effects by different agents, resulting in monopolistic competition. For more details, see Breuss (2020D).

various econometric panel approaches (with and without considering convergences or catch-up effects). Lastly, the authors conclude that "this paper has been unable to reject the null hypothesis that 'EU membership has zero impact on economic growth'"[6].

In its own way the Anderson et al. study underlines the so-called "EU integration puzzle" formulated by Breuss (2014). It states that it is difficult to explain why the EU – despite a steady deepening of integration since World War II – could not achieve higher economic growth than the United States (see also, Breuss, 2017). This contradicts all predictions of the various integration theories and most ex-ante studies evaluating the growth-enhancing effect of EU integration, especially those of EU's Single Market.

3. The model

One of the major features of the above-mentioned integration studies is that they need either very complex and often large trade or DSGE models or highly sophisticated econometric techniques. Furthermore, they use different kinds of data bases, not always available for all researchers. And the most significant caveat of these studies is that they are not replicable.

The following simple 10-equation EU integration model aims at filling the gap of these caveats[7]:

1) It features the major impact factors of EU integration on trade and GDP growth:
   (i) trade effects of EU's Single Market; EMU/Euro, and EU enlargement since 2004.
   (ii) Net position vis à vis the EU budget (neglected by all previous studies).
   (iii) More competition in EU's SM.
   (iv) growth effects on GDP via increase in TFP
2) It encompasses these integration effects in a simple macroeconomic model in EViews with 10 equations.
3) Only two easily accessible data bases are used (AMECO database of the European Commission and the budget data of the European Commission).
4) This simple prototype model of EU integration is exemplified for Austria[8]. The EViews program and the data set is available from the author. This prototype model is, however, easily reproducible and applicable to other EU Member States, be they incumbents like

[6] Breuss (2020C, p. 329) in evaluating 25 years of EU's Single Market comes to a contrary conclusion. Using smart EU indicators and regressing these to real GDP per capita results in a significant impact of EU integration on EU's economic growth. Accordingly, EU28 could increase real GDP per capita since 1993 by 0.5% per year, in the whole period of European integration (1958-2019) only by 0.3% per year.

[7] The following simple EU model is a more compact version of the macroeconomic model to evaluate the economic impact of 25 years of Austria's EU membership developed by Breuss (2020B). The latter, however, is more elaborated but is also estimated in EViews.

[8] The EViews program and the data set for Austria is available from the author on request.

Germany or newcomers in the 1995 enlargement (Austria, Finland and Sweden) and those during the last grand EU enlargement in 2004 (like Hungary), and for EU MS with and without the Euro.

3.1 Methodology

In the spirit of Niklas Luhman (1997) we try to reduce the complexity of the European integration process. European integration is a multidimensional and multidisciplinary project. It has political, legal and economic dimensions. When we try to evaluate the economic effects of European integration, we simply hide the other dimensions. But also the economic dimension is complex enough. Therefore, we isolate the major features of possible economic impacts of being a member of the EU. Four effects are essential to evaluate the impact of EU integration.

One of the major features are the trade effects of the Single Market. The latter should also have contributed to more competition. Because the EU is composed very heterogeneously, EU Member States are either net recipients (if it is a poor country) or net payers to the EU budget (if it is a rich country). Finally, the EU – at least according to integration theory – should also lead to prosperity, measured by the growth of GDP or GDP per capita.

3.1.1 Trade effects

The first and essential impact of European economic integration, starting with the EC Customs Union in 1968 by the elimination of bilateral tariffs between EU Member States and reinforced by the creation of EU's Single Market (SM) with the elimination of non-tariff measures (NTM) in intra-EU trade are trade creation effects. All previously reviewed studies which evaluated the economic impact of EU's SM concluded that intra-EU trade has increased. However, they did this exercise by applying a big variety of methods. Either they re-introduce MFN tariffs and NTMs in their models (Felbermayr et al. 2018; Minon and Ponattu, 2019; In't Veld, 2020; and in our own CGE simulations) or EU membership is captured in a dummy variable in structural gravity trade models (Oberhofer, 2019).

In the following, we deal with the impact of EU's SM. Therefore, tariffs do not play a role, because they were eliminated already before 1993. To catch the possible trade effects the major factor of trade costs are NTMs. Ideally, one would like to know the exact size of the NTMs which have been eliminated – not all at once – but gradually, starting with the inception of the SM. Unfortunately, however, the NTMs are very heterogenous between EU

Member States and differ from sector to sector. Exact figures are therefore not available. There is a lot of effort to estimate NTMs. However, they vary from study to study. Also, the authors reviewed above used different sources of estimations of NTMs. A comparison is therefore not possible.

To get around these problems, let the data speak for itself. We therefore use dummy variables to capture the trade costs which are eliminated by the participation in EU's Single Market. Furthermore, we measure the impact of SM participation on intra-EU trade. The data for intra-EU trade (export and imports of an EU MS going to or coming from the EU) are available from the AMECO database of the European Commission[9].

Intra-EU exports of goods (FOB; billion EUR in current prices) of EU Member State (*i*), in time *(t)*, X_{EUit}

$$X_{EUit} = e^{\alpha SMit+\beta €it+\gamma ELit} \qquad \alpha,\beta,\gamma > 0 \qquad (1)$$

depend (positively) on the EU dummies. The three dummies (*SM, €, EL*) reflect the three fundamental regime changes of the EU since the early nineties. SM stands for the creation of EU's Single Market in 1993. For EU Member States (MS) which joined the EU later the SM dummy starts in the year of EU accession. For incumbent MS like Germany the SM dummy takes the value of 1 from 1993 to 2022. *€* is the dummy for the creation of EMU in 1999 and the introduction of the Euro in 2002. The *€* dummy takes the value of 1 from 1999 to 2022. The last big regime change and at the same time the extension of EU's SM was the grand EU enlargement, starting in 2004. The *EL* dummy gets the value of 1 from 2004 to 2022.

Intra-EU imports of goods (FOB; billion EUR in current prices) of EU Member State (*i*), in time (t), M_{EUi} is modeled similarly to the Intra-EU exports equation:

$$M_{EUit} = e^{\alpha SMit+\beta €it+\gamma ELit} \qquad \alpha,\beta,\gamma > 0 \qquad (2)$$

The Intra-EU trade equations (1) and (2) are estimated in Logarithms. All other equations are also estimated in Logarithms with one lagged endogenous variable to catch all other factors than EU integration. An essential point in capture the EU effect via the EU dummy is the timing. We assume that the integration process of the completion of the Single Market, the creation of the EMU with the introduction of the Euro and the enlargement of EU's SM by the grand enlargement of the EU from 15 to 28 MS does take time. Therefore, we do not only use a dummy variable with the value of 1 in the year of the start of the three

[9] AMECO database: https://ec.europa.eu/info/business-economy-euro/indicators-statistics/economic-databases/macro-economic-database-ameco/ameco-database_en

regime changes of the EU but, as mentioned earlier the three dummies get ones over the whole period.

From the estimated intra-EU trade equations, we derive total trade. Total exports of EU Member State (*i*), in time (t), X_{totit}

$$X_{totit} = f(X^{+}_{EUit}) \tag{3}$$

depend on the estimated intra-EU exports.

Similarly, we derive the total imports of EU Member State (*i*), in time *(t)*, M_{totit}

$$M_{totit} = f(M^{+}_{EUit}) \tag{4}$$

depending on the estimated intra-EU imports. Of course, in both equations the intra-EU trade has a positive impact on total trade.

From total trade one can calculate the trade balance, $TB_{it} = X_{totit} - M_{totit}$.

3.1.2 Competition effects

The creation of EU's Single Market should have had an impact on competition. Greater trade openness (increased intra-EU trade) has increased competition and lowered prices. Firms lost market power to raise mark-ups of their prices over their marginal costs, which has a positive impact on output. According to the study by Badinger (2007)[10] mark-ups went up in most service industries of EU's SM since the early 1990s, confirming the weak state of the Single Market for services and provoked an additional liberalization program of services in the EU[11]. In the manufacturing sectors, however, mark-ups were reduced on average my 26%. In't Veld (2019, p. 812) uses this figure in his counterfactual simulations of the impact of non-SM.[12]

With a political economy model of market regulation Gutiérrez and Philippon (2018) show that countries in a Single Market like those of the EU willingly promote a supranational regulator that enforces free markets beyond the preferences of any individual country. European institutions (the European Commission) are more independent and enforce competition more strongly than any individual country ever did. Countries with ex-ante weaker institutions benefit more from the delegation of competition policy to the EU level.

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[10] A methodological similar study was carried out previously for Austria (Badinger and Breuss, 2005).

[11] After a long discussion, the EU concluded The Services Directive (2006/123/EC). The SD directive was adopted in 2006 and implemented by all EU countries in 2009. The European Commission is now working with EU countries to further improve the single market for services (see: https://ec.europa.eu/growth/single-market/services/services-directive_en). About the possible economic impact of the SD, see: Breuss et al. (2008).

[12] There are recent studies by the European Commission (Cai et al., 2020, p. 12), demonstrating that EU's strict competition policy had a considerable impact on GDP. The macroeconomic impact of competition policy enforcement under the baseline scenario are done with the QUEST III model. Accordingly, prices (GDP deflator) decreased by 0.2 ppts after 5 years and real GDP increased by 0.3 ppts. See also an overview over similar studies by Ilzkovitz and Dierx (2021).

Over the last two decades, U.S. markets have gradually become less competitive. Today, European markets are more competitive than those in the United States which invented modern antitrust in the late nineteenth and early twentieth century. By 1950 it was clear to most observers that American markets were more competitive that European ones. The creation of EU's Single Market with its strong competition policy[13] brought the turning point.

In our simple integration model, we catch the competition or mark-up effect only with the EU dummy for being a member of EU's SM. Accordingly, consumer prices are influenced by a negative impact at entering the SM. The two other integration steps (Euro or enlargement) are not considered. Harmonized Consumer prices of EU Member State (*i*), in time *(t)*, P_{HICPit}

$$P_{HICPit} = e^{\alpha SMit} \qquad \alpha < 0 \tag{5}$$

depend (negatively) only on the EU dummy representing EU's Single Market. In the simulations they get the annex "MUP" for mark-up.

The GDP deflator, P_{GDPit} depends on consumer prices

$$P_{GDPit} = f(MP^{+}_{HICPit}). \tag{6}$$

3.1.3 Net budget position

The European Union is a solidarity community. The Treaty of the European Union (TEU) states in Article 3 that "It shall promote economic, social and territorial cohesion, and solidarity among Member States.". To fulfil this objective a redistribution mechanism has been established in the Treaty on the Functioning of the European Union (TFEU) under Title XVII: Economic, Social and Territorial Cohesion. Via several financial instruments the rich EU Member States finance the poor MS.

Practically, all in the literature review mentioned studies neglect the budgetary aspect of EU integration. In fact, the impact of the net position of the EU MS have a considerable dimension – negatively in the incumbent rich countries and positively in the new Member States in Eastern Europe.

Data by the European Commission on the net position of its Member States (operating budgetary balances) [14] show, that e.g., Germany is the largest net payer into the EU budget (14.3 bn EUR in 2019); over the period 1992-2018 Germany's net contributed to the EU budget amounted to 0.4% of its Gross Net Income (GNI). On the other side, Poland was the biggest net receiver from the EU budget (12.0 bn EUR in 2019), followed by Hungary (5.1 bn

[13] For more information, see: https://ec.europa.eu/competition-policy/index_en
[14] The data are available at: https://ec.europa.eu/info/publications/operating-budgetary-balance-gni_en

EUR). In the period 2004-2018, Hungary received regional transfer income out of the EU budget amounting to 3% of its GNI (Poland 2% of GNI).

To evaluate the effect of the net budgetary position vis à vis the EU budget on real GDP we use the following definition (identity):

$$GDP_{neteuit} = GDP_{it} + \frac{NETEU_{it}}{P_{GDPit}}. \quad (7)$$

Real GDP (GDP_{it}) is corrected by the real net position vis à vis the EU budget ($NETEU_{it}/P_{GDPit}$) and results in a net budget position adjusted real GDP ($GDP_{neteuit}$).

3.1.4 Growth effects

Finally, the trade effects are translated into growth effects. Nearly all theories on economic integration[15] postulate a growth effect of integration – primarily via more investment, stimulating productivity (see In't Veld, 2019, p. 811).

In our reduced form model, we assume that more openness (the increase of exports plus imports) stimulates productivity. The latter is the major driver for GDP growth.

Total factor productivity (TFP_{it}) of EU MS (*i*) in time *(t)* increases when the trade volume (trade openness) increases. The latter is a consequence of deeper integration into EU's Single Market:

$$TFP_{it} = f([X_{totit} + M_{totit}]^{+}). \quad (8)$$

Real GDP (GDP_{it}) of EU MS (*i*) in time *(t)* is positively stimulated by TFP and negatively influenced by the competition effect, measured by the GDP deflator:

$$GDP_{it} = f(TFP_{it}^{+}, P_{GDPit}^{-}). \quad (9)$$

Finally, as a welfare measure, we estimate GDP per capita (GDP_{pcit}), nominal in 1000 PPS as a function of real GDP:

$$GDP_{pcit} = f(GDP_{it}^{+}). \quad (10)$$

This 10-equation model captures to major ingredients of European integration. The growth or GDP effects are caused endogenously by the trade and competition effects. The influence of the net position vis à vis the EU budget on real GDP is added exogenously which gives the overall impact of European integration on GDP. The estimated model can be found in the Appendix.

[15] See, e.g., Baldwin and Venables (1995) but also Kohler (2004).

3.2 Integration scenarios

As mentioned earlier, this prototype model can now be used for simulations of the impact of the participation in EU's Single Market (inclusive its enlargement) and of EMU/Euro.

3.2.1 Trade

The trade effects of the participation in EU's Single Market – in the case the EU accession in 1995 – is captured in the equations (1) and (2) with the three dummy variables: *SM* ("EU95" for EU accession in 1995), *€* ("EU99" for the participation in EMU/Euro in 1999) and *EL* ("EU04" for the grand EU enlargement, starting in 2004). As mentioned earlier the three EU dummy variables take a value of 1over the whole period of integration (1995 to 2022).

The counterfactual scenario assumes that the respective EU dummies get zeros. The trade integration effects are then calculated as the baseline (actual) development of intra-EU trade (competition, EU budget) compared with the counterfactual simulated trade development.

3.2.2 Competition

The competition effect of the participation in EU's Single Market is captured in the consumer price equation (5) with the *SM* dummy variable for EU's SM ("EU95MUP" for mark-up). The procedure for the respective counterfactual scenario is the same as those for the trade effects.

3.2.3 EU budget

The impact on real GDP of the net budget position vis a vis the EU budget is modelled in equation (7). $NETEU_{it}$ contains the actual net payments of Austria to the EU budget. In the counterfactual scenario we simply set this variable to zero.

3.2.3 Growth

Including the trade effects into the TFP equation (8) and the competition effects into the GDP equation (9) delivers the growth effects of EU integration. The growth effects of the net position vis a vis the EU budget is separately added to the total GDP effects. The growth effects of EU integration – trade (participation in EU's SM and in EMU/Euro), competition, and net budget effects – is then given by the comparison of the baseline scenario (actual development of real GDP) with the simulated counterfactual scenarios (if no EU accession would have taken place).

4. Results

4.1 Austria

4.1.1 Overall

In general, the results of our simple EU integration model are comparable but a little bit lower than those of previous estimates of the integration effects of Austria's EU membership. Nevertheless, our model is richer than most of the previously reviewed EU studies. Overall Austria's EU membership (simulated over the period 1995-2022) resulted in 0.47% additional annual growth of real GDP (see Table 1)[16]. The trade effects by the increase in intra-EU trade after entering EU's Single Market in 1995, by the participation in the EMU (in 1999) and the introduction of the Euro in 2002 and by the enlargement of EU's SM after the grand EU enlargement, starting in 2004 contributed the major part to the growth impulse to real GDP (see also Figure 1 in comparison with Figure 3). The nominal total Austrian exports increased between 1995 and 2022 by 166% (or by 6% per year). Total imports improved by 143% (or 5% per year; see Table 2).

The competition effect of participating in EU's SM did not add up much to the overall result (see Table 1). As a net payer into the EU budget, Austria's GDP has been reduced by the transfer system of the EU.

The greatest growth effect of joining EU's Single Market comes from the trade effects (+0.44%). Austria, however, profited as an EFTA and EEA member country already before the creation of the SM. The Free Trade Agreements between the EC and the EFTA in 1973 (which led to a free trade area for industrial goods in Europe since 1977) and the EEA membership in 1994 already led to a free trade area in Europe. The accession to the EU and the associated entry into the SM in 1995 did not immediately contribute much to the increase in intra-EU trade. The remaining NTMs were only gradually eliminated. Nevertheless, the model estimates a cumulative increase of intra-EU exports by 39% and of intra-EU imports of 31% which resulted in a positive trade balance effect because also the total exports and imports developed comparably (see Table 1). The trade effects of introducing the Euro and that of the grand EU enlargement in 2004 were even higher than joining the EU in 1995 (see Table 1). In sum of the three integration steps, total intra-EU exports increased by 144%, intra-EU imports by 118%, resulting in a cumulative improvement of the trade balance of 2.7% of GDP since 1995.

[16] More comprehensive evaluations of Austria's EU membership show higher real GDP effects. Oberhofer (2019) with a structural gravity model approach (plus an input-output model ADAGIO) find that 20 years EU membership (1995-2014) results in an annual real GDP growth of 0.7% and 40% more trade. Breuss (2020B) with a more extensive integration macro-model as the present one, finds that 25 years of Austria's EU membership resulted in additional real GDP growth of 0.8% per year.

Participation in EU's SM should has led to a pressure on monopoly power and increased competition. Our model simulations show that consumer prices have decreased by 1.2% per year since 1995. (see Table 1).

Table 1: Austria in the EU: 1995-2022 – Integration effects

	GDP, real			**Trade**			**Consumer prices**
	cumlative change in bn EUR	cumlative change in ppts	Average annual growth in %	Intra-EU exports cumul.	Intra-EU imports average change in ppts	Trade balance cumulative average % of GDP	average annual change in %
EU accession 1995	10.57	2.92	0.10	39.32	31.19	1.12	
EMU/Euro 1999	16.50	4.64	0.19	71.68	51.29	2.47	
EU enlargement 2004	16.93	4.76	0.25	63.33	63.72	-0.85	
Trade effects[*)]	44.00	12.32	0.44	143.74	118.40	2.66	
Competition 1995	4.89	1.33	0.05				-1.20
Net position EU budget	1.46	-0.39	-0.01				
Total EU effects	**47.43**	**13.26**	**0.47**				-1.20

[*)] EU accession + EMU/Euro + EU enlargement.
Source: Own simulations withe the integration model in the Appendix.

Figure 1: Trade effects of EU accession, EMU/Euro and EU enlargement
(Cumulative change of real GDP in percentage points)

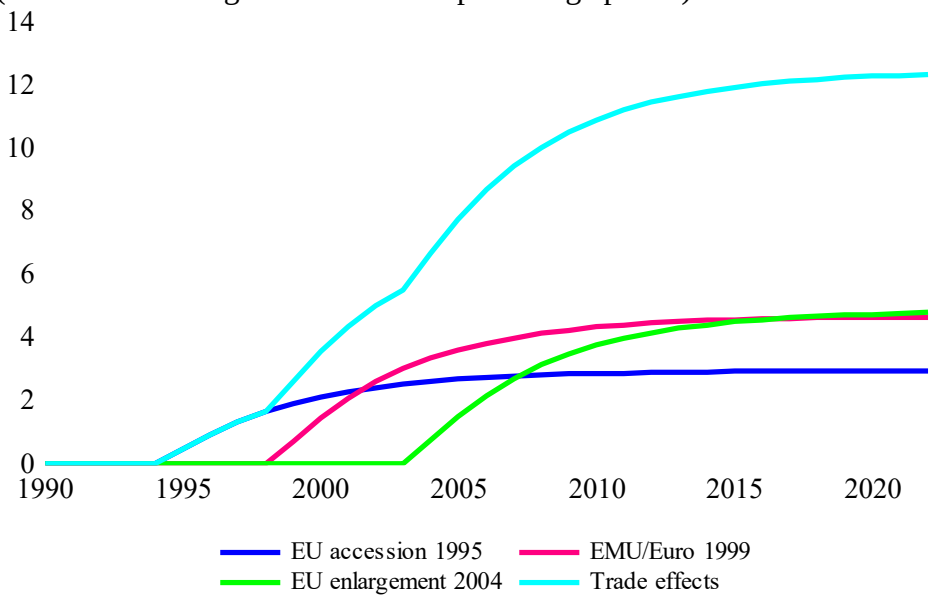
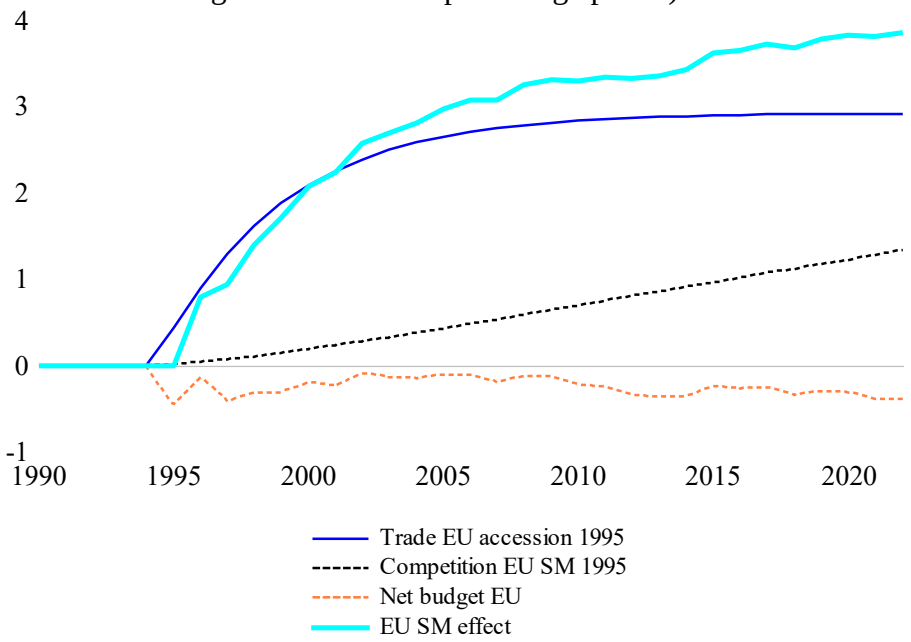


Figure 2 illustrates the isolated Single Market effects if one only considers Austria's EU accession in 1995. The pure trade effect on GDP is reduced by the net payment effect but enhanced by the competition effect.

Figure 2: Isolated EU Single Market effects of Austria's EU accession in 1995
(Cumulative change of real GDP in percentage points)



Austria's EU membership led to a cumulative increase of real GDP since 1995 by 47 bn EUR (or 2 bn per year) or over 13 percentage points (see Figure 3). Austria's welfare measured by GDP per capita (in PPS) improved by 5.100.

We deliberately kept the model slim. Nevertheless, it would be easy to add to the 10 equations in the simple EU model additional equations, e.g. those that represent the labour market. We did these by adding a simple equation for total employment (EE = f(GDP)) and for the unemployment rate (Ocun's law: ΔU = f(GDP%). As a result, Austria's EU membership since 1995 should have added 321.000 persons to total employment (or an annual increase of 0.26%). The unemployment rate should have been reduced cumulatively since 1995 by 0.1 ppts.

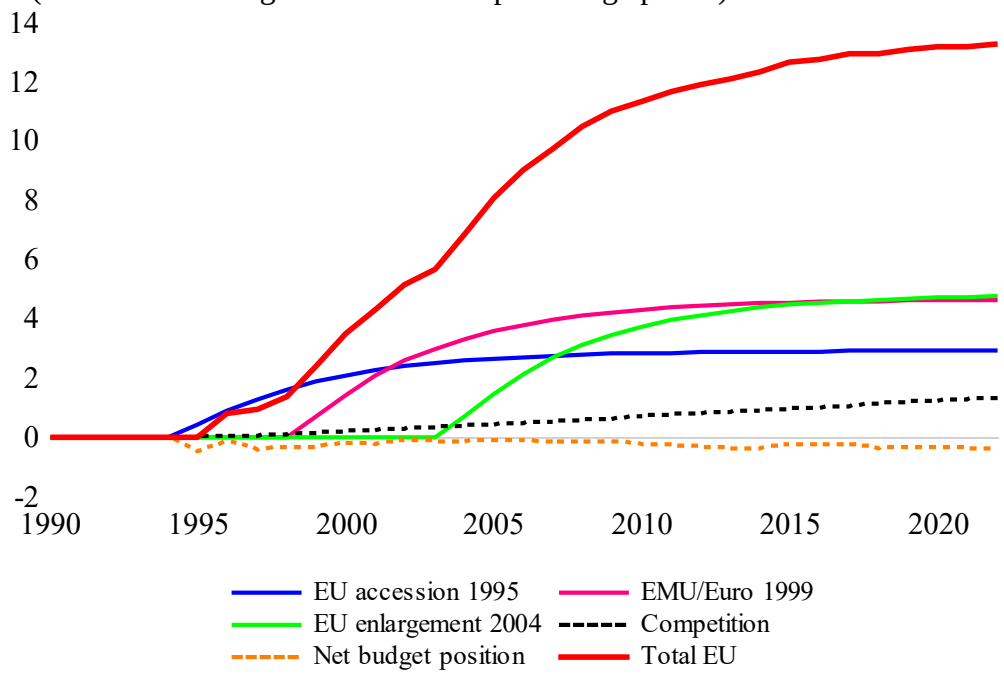
4.1.2 Level versus growth effect

The studies mentioned in the literature review above did not address the important question whether EU integration leads to a permanent growth (rate) effect as some of the representatives of the endogenous growth theory (e.g. Romer, 1990) postulate or whether it only leads to a level effect in GDP. Romer postulates that economies of scale lead to a permanent growth effect through integration. Accordingly, larger countries grow faster than smaller ones. Doubling the size of an economy (or doubling the size of the domestic market or those of EU's SM) would therefore double the stead-state growth rate of GDP. This approach has been sharply criticized by Jones (1995) and others. In the evaluation of 25 years EU SM

by estimating a growth equation, Breuss (2020C) rejected the idea of a permanent growth rate effect through EU integration.

Our simple EU model also delivers only GDP level effects and only short-term growth rate effects. The GDP level effects of the Austria's participation in all integrations steps since 1995 can be seen in Figure 3. After each integration step (EU accession in 1995, EMU participation in 1999 and EU enlargement in 2004) the used EU dummy variables lead to a jump in the levels of real GDP which then flatten out in the absence of further integration steps. Due to the specific specification of our EU dummies, the overall picture of the cumulative increase of real GDP resembles a logistic function.

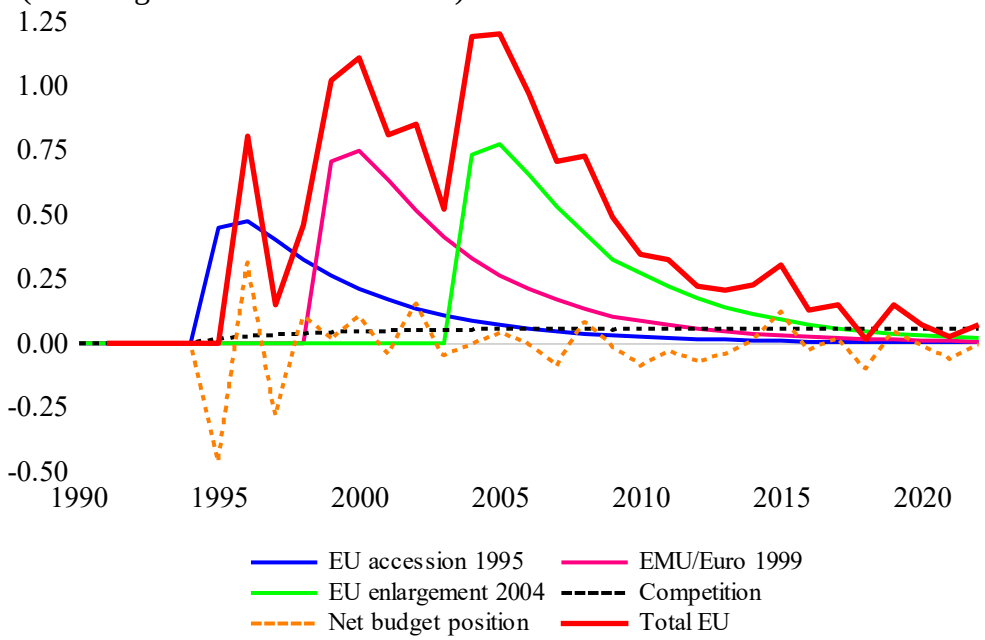
Figure 3: Austria in EU: 1995-2022 – Total integration effects
(Cumulative change of real GDP in percentage points)



The growth rate effects of EU integration in the case of Austria's EU integration is illustrated in Figure 4. Each of the three major new integration steps (EU accession, EMU/Euro, and EU enlargement) led to a temporary increase of the growth rate of real GDP. Also, the sum of the growth rate performance of all integration steps reflects this pattern. After the initial integration impact the growth rate declines until another integration impulse might arise.

Additionally, Figure 4 demonstrates, that reporting only the average GDP growth figures are misleading, because the growth rate effects are unevenly distributed over the entire period of the EU membership of an EU MS.

Figure 4: Austria in EU: 1995-2022 – Total integration effects
(Annual growth of real GDP in %)

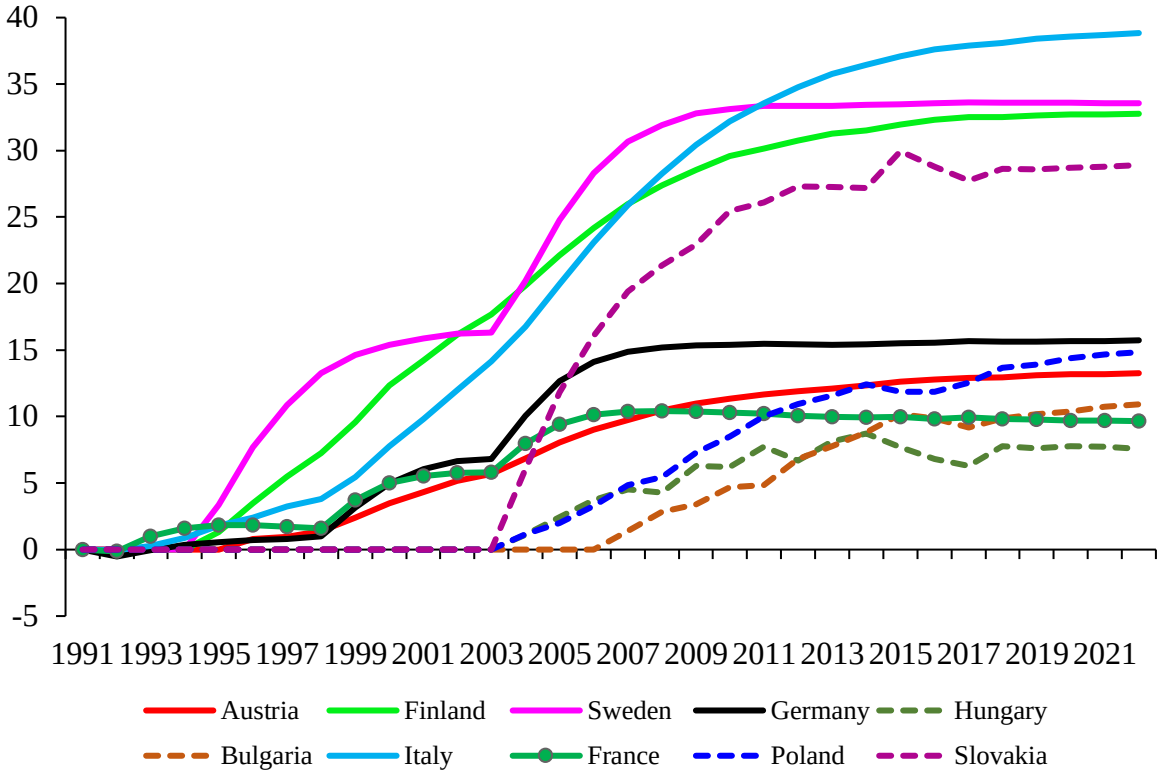


4.2 Selected EU MS

The simple 10 equations prototype EU integration model for Austria (see Appendix) is now applied to a selected number of EU MS with different history of EU membership. We evaluate three EU founding MS (France, Germany and Italy) with the Euro, three countries of the 1995 EU enlargement (Austria and Finland with the Euro and the non-Euro country Sweden), three countries of the 2004 enlargement (the non-Euro countries Hungary and Poland, and Slovakia with the Euro), and Bulgaria, joining the EU in 2007.

The studies reviewed earlier are mostly static in so far as they do not differentiate between the timing of EU accession and some also ignore the fact that not all EU MS have introduced the Euro. Our simple EU model can differentiate in these respects between the EU MS. Figure 5 illustrates the timing of the selected EU MS concerning their EU membership. Whereas the three founding members France, Germany and Italy entered EU's Single Market right at the start in 1993, their cumulative GDP integration effects also began to materialize since that date. The next new EU MS, Austria, Finland, and Sweden joined the EU and hence the SM in 1995 and the integration effects began to take off. Accordingly, Finland and Sweden increased cumulatively their GDPs more than Austria. The new MS of the next EU enlargements in 2004 (Hungary, Poland, and Slovakia) and 2007 (Bulgaria) had therefore less time to profit of EU integration.

Figure 5: The timing of the integration effects of selected EU MS
(Cumulative change of real GDP in percentage points)



A comparison of the integration effects of selected EU MS therefore makes only sense if one measures the integration effects (GDP growth and trade) not only in cumulative form but as the percentage change per year as done in Table 2.

Table 2: Integration effects of selected EU Member States

	EU member since:	EMU/ Euro	**GDP, real** Cumulative change in ppts	change % per year	**Trade**[*)] Total exports change cum. in ppts	% per year	Total imports change cum. in ppts	% per year
France	1958	1999/2002	9.66	0.32	97.72	3.26	111.12	3.70
Germany	1958	1999/2002	15.73	0.52	143.22	4.77	122.96	4.10
Italy	1958	1999/2002	38.84	1.29	119.56	3.99	110.80	3.69
Austria	1995	1999/2002	13.26	0.47	166.29	5.94	143.07	5.11
Finland	1995	1999/2002	32.77	1.17	126.14	4.50	146.12	5.22
Sweden	1995	no	33.57	1.20	158.24	5.65	174.94	6.25
Bulgaria	2007	no	10.92	0.68	163.02	10.19	201.38	12.59
Hungary	2004	no	7.58	0.40	28.01	1.47	27.30	1.44
Poland	2004	no	14.84	0.78	39.23	2.06	32.75	1.72
Slovakia	2004	2009/2009	28.89	1.52	90.99	4.79	69.1	3.64

[*)] Trade in current Euro prices.
Source: Own simulations with the model approach of the EU model for Austria in the Appendix.

The simulations in Table 2 show that out of the three founding EU MS Italy (+1.3% more real GDP per year) profited more than the two other countries (France +0.3%, Germany

+0.5%). However, the trade effect of participation in EU's SM was greatest in Germany. Whereas the competition effect of the SM was positive in Germany and Italy, it was negative in France and dampened the overall growth effect.

In 1995 there was the last EU enlargement by rich countries: Austria, Finland and Sweden joined the EU. However, only the first two also introduced the Euro. Contrary to earlier studies (Oberhofer, 2019; Breuss 2020B) which showed higher GDP effects of the EU accession for Austria than for those of Finland and Sweden, this study delivers the highest growth effects in Finland and Sweden (each an increase of annual GDP growth of 1.2%). However, the trade effects are higher in Austria (see Table 2).

Of the new EU MS covered in this study, Slovakia appears to have performed best. This is also a consequence of the introduction of the Euro. As far as the intra-EU trade is concerned, Bulgaria could profit more than the other MS. The problem with our simple EU model is that it is less stable for countries that have recently joined the EU (like Bulgaria, Rumania, and Croatia) and which also did not yet introduce the Euro. The model then only works with the membership dummy and can only capture a short period of EU membership.

5. Conclusions

We have developed a simple EU integration model which captures the main features of economic EU integration (trade effects, competition effects and budgetary effects). Most comprehensive EU studies which use complex models with a variety of data bases are not replicable. In contrast, our model is developed in EViews, uses readily available and it can be replicated. We applied this simple EU model for Austria, receiving plausible results. Then this prototype model is also used to evaluate the EU integration of selected EU MS. It is flexible enough to deals with the complex EU history of the respective EU MS. Some founding MS, some countries which became EU members later with and without having the Euro.

Appendix: The Austrian EU integration model

A) Trade effects

(1) Intra-EU exports (goods) bn EUR (nominal)

LOG(AUT_XEU) = 3.128 + 0.3316 * EU95 + 0.5405 * EU99 + 0.4906 * EU04

(2) Intra-EU imports (goods) bn EUR (nominal)

LOG(AUT_MEU) = 3.4570 + 0.2715 * EU95 + 0.4140 * EU99 + 0.4930 * EU04

(3) Total exports (goods) bn EUR (nominal)

LOG(AUT_XTOT) = 0.4518 + 0.7958 * LOG(AUT_XEU) + 0.1736 * LOG(AUT_XTOT(-1))

(4) Total imports (goods) bn EUR (nominal)

LOG(AUT_MTOT) = 0.3015 + 0.8451 * LOG(AUT_MEU) + 0.1398 * LOG(AUT_MTOT(-1))

B) Competition effects

(5) Consumer prices (2015=100)

LOG(AUT_CPI) = 0.0466 - 0.0156 * EU95MUP + 0.9970 * LOG(AUT_CPI(-1))

(6) GDP deflator (2015=100)

LOG(AUT_GDPP) = 0.1819 + 0.1944 * LOG(AUT_CPI) + 0.7683 * LOG(AUT_GDPP(-1))

C) Net budget position

(7) Net contribution to EU budget: bn EUR

AUT_GDPNETEU = AUT_GDP + (AUT_EUNET / AUT_GDPP) * 100

D) Growth effects

(8) TFP: Index 2015=100

LOG(AUT_TFP) = 0.8432 + 0.0158 * LOG(AUT_XTOT + AUT_MTOT) + 0.7995 * LOG(AUT_TFP(-1)) - 0.0376 * D2009 - 0.0693 * D2020

(9) GDP real bn EUR (2015 prices)

LOG(AUT_GDP) = - 0.0465 + 1.1253 * LOG(AUT_TFP) + 0.1019 * LOG(AUT_GDP(-1)) - 0.0384 * LOG(AUT_GDPP) + 0.0116 * T

(10) Welfare - GDP per capita nominal 1000 PPS

LOG(AUT_GDPPC) = - 1.5988 + 0.6439 * LOG(AUT_GDP) + 0.3532 * LOG(AUT_GDPPC(-1)) + 0.0059 * T

Trade balance (goods) bn EUR (nominal)

AUT_TB = AUT_XTOT - AUT_MTOT

Estimation with EViews 12.0 for the period 1991-2022. Two data sources are used: a) for the macroeconomic data the AMECO database of the European Commission; b) for the budget data (operation budgetary balance) the European Commission. The EU dummy variables have the following input: EU95/EU95MUP =1 (in 1995-2022); EU99/EU99MUP = 1 (in 1999-2022); EU04/EU04MUP = 1 (in 2004-2022). T = time trend; D2009 and D2020 are dummy variables for the Great recession in 2009 and the Corona recession in 2020.

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