Global Value Chain Participation and Current Account Imbalances*

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Abstract

This paper draws a causal link between increased levels of global value chain participation (GVCP) and increases in a country's current account. We document empirically that stronger GVCP is associated with larger current account balances. According to our estimates, cross-country differences in GVCP reduce the hitherto unexplained part of current account imbalances substantially for some countries. For example, for the United States and Japan the unexplained part of the current account falls by 75% and 50% over the sample period when controlling for their GVCP relative to the rest of the world; for Germany, the unexplained part of the current account deficit falls by an average of 10%.

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1 Introduction

One salient feature of the global economy during the last decades has been the existence of large and persistent external imbalances. For example, the years prior to the global financial crisis were marked by some emerging market economies — in particular China — running large current account surpluses, matched by deficits in some advanced economies — in particular the US. Several papers have shown that a large part of these global imbalances can be rationalised by the lack of financial market development in emerging market surplus economies (see Mendoza et al., 2007; Caballero et al., 2008). At the same time, the debate about the driving forces underlying large current account imbalances in several advanced economies — such as Germany — is still ongoing. Understanding the determinants of external imbalances is important, because they play a critical role in the transmission of shocks in an ever more integrated world. Also, persistent imbalances may nurture demands for protectionist policies, which are likely to be deleterious to global growth.

Another salient feature of the global economy has been the rise of global value chains. Spurred by the decline in transportation costs, the adoption of trade-liberalising policies as well as advances in information and communication technologies, firms increasingly disperse stages of production across countries (see, for example, Elms and Low, 2013; Baldwin, 2013; UNCTAD, 2013). By fragmenting production chains internationally, the share of intermediate goods in total trade has risen continuously relative to that of final goods (Antras, 2005). Specifically, data suggest that trade in intermediate goods and services account for as much as 56% and 73% of overall trade flows in goods and services (Miroudot et al., 2009). A widely discussed example is the off-shoring of low-skilled labor tasks from the US to emerging market economies. The regional dispersion of the research and development underlying the iPod, the manufacturing of its components,

their assembly as well as its sale and distribution in local markets is a famous example for the fragmentation of global value chains across borders in this respect (Dedrick et al., 2010); another is the role of Germany as the regional hub in "Factory Europe" (Baldwin, 2013).

It is no wonder, thus, that global value chains have attracted considerable interest. Specifically, several papers have improved our understanding of global value chains by documenting the increasing fragmentation of production across borders. Drawing on newly developed input-output tables, these papers have developed frameworks to measure trade in value added and an economy's integration in global value chains (see, for example, Hummels et al., 2001; Trefler and Zhu, 2010; Johnson and Noguera, 2012; Koopman et al., 2014). Building on these frameworks, other papers have been concerned with the economic implications of global value chains. For example, participation in global value chains appears to boost growth (IMF, 2013c), to amplify cross-country macroeconomic spillovers (Georgiadis, 2016), to render an economy's income distribution more uneven (Timmer et al., 2013), and it has improved our understanding of competitiveness (CompNet Task Force, 2014).

In this paper, we bring together these two strands of the literature by studying the role of global value chain participation (GVCP) for current account imbalances. In particular, we explore the relationship between GVCP and current account imbalances empirically. Rather than putting forth yet another empirical model for the current account, we adopt the IMF's current framework for the assessment of external imbalances: the External Balance Assessment model (EBA; see IMF, 2012, 2013b). After replicating the IMF baseline EBA results, we augment the set of explanatory variables by measures of economies' GVCP. Specifically, we measure overall GVCP by constructing an index corresponding to countries' backward and forward participation, i.e. the extent to which they participate in global value chains by using imported intermediates in the

production of exports and the extent to which exports are accounted for by intermediate goods. To construct these measures at the country level, we use data from the World Input-Output Database (WIOD; see Timmer et al., 2015).

Our panel regression results suggest that GVCP has a statistically significant effect on the current account. Economies with greater GVCP exhibit larger current account surpluses (or lower current account deficits). This empirical pattern holds independently of whether we measure GVCP through simple imports and exports of intermediate inputs or by more sophisticated measures such as the VAX ratio (Johnson and Noguera, 2014). Testing the robustness of this result to sample selection biases, we confirm that the positive effect of GVCP on the current account holds in surplus and deficit countries alike, for countries of different size and for different sample periods. Moreover, we further document that the effect of GVCP we estimate is not driven by EU membership, country size, trade openness or a country's domestic manufacturing intensity. In light of these robustness checks we conclude that GVCP has a positive and statistically significant effect on a countrys current account that is distinct from the effects of a large number of standard fundamental determinants of external imbalances.

We also find that GVCP is economically relevant for some major current account surplus economies (Germany and Japan) and deficit economies (the US). For example, GVCP helps to explain part of the rise in Germany's current account since the early 2000s. The part of Germany's overall current account surplus that cannot be explained by the fundamentals included in the IMFs original EBA model is reduced by around 10% over the sample period when its GVCP is controlled for. For Japan and the US, the unexplained part of the current account balance is even reduced by around 50% and 75% over the entire sample period. Our estimates thus imply that high levels of German GVCP at least partially explain large current account

balances. Similarly, for Japan and the US initially low levels of participation and the subsequent increase in Japanese and further decrease in US participation seem to improve the model's ability to explain the behavior of current account imbalances. Although accounting for GVCP reduces the unexplained part of the current account in the IMF's original EBA model for some important countries, it has to be noted that the unexplained part remains considerable for many countries.

The remainder of the paper is organised as follows. Section 2 presents the empirical framework we consider to explore the relationship between GVCP and current account imbalances and Section 3 presents our results. Section 4 concludes and discusses a possible mechanism which could explain the documented empirical pattern.

2 Empirical framework

2.1 The IMF EBA model

We consider the IMF's EBA model as it is a well-established empirical framework for the analysis of current account imbalances. Since its introduction in 2012, the EBA model has become the main reference for the assessment of current account imbalances in the IMF's Article IV and External Sector Reports. The IMF's EBA model has also been adopted by various policy institutions such as the European Commission, the ECB and several other national central banks. Hence, the IMF's EBA model has become an important frame of reference in discussions about global imbalances among policymakers in international fora, for example in the G20 or at the IMF Annual Meetings.[1] Using the IMF's EBA model also has the advantage that it

[1]See for example the recent paper by Joy et al. (2018), which aims to underpin the claim by the Bank of England the asymmetric trade liberalisation — i.e. the liberalisation of goods but not services trade — is one of the main culprits of persistent current account deficits in many economies specialising in services.

minimises the likelihood that the empirical findings we obtain in this paper concerning the impact of GVCP on the current account are specific to our own particular modelling choices.[2]

Inspired by a large literature that studies the drivers of the current account from an empirical perspective (Calderon et al., 2002; Chinn and Prasad, 2003; Gruber and Kamin, 2005; Ca'Zorzi et al., 2012), the backbone of EBA consists of the estimation of a reduced-form model for countries' current account balances given by

$$ca_{it} = \alpha + \boldsymbol{x}'_{it} \cdot \boldsymbol{\beta} + u_{it}, \tag{2.1}$$

where ca_{it} denotes the current account balance relative to GDP for country i in period t, and $\boldsymbol{x}_{it}$ is a $k \times 1$ vector that includes a set of fundamental determinants of the current account. Importantly, most of the explanatory variables are measured relative to rest-of-the-world averages; this is done because a change in, for example, the fiscal balance in country i can affect its current account balance only to the extent that other countries' fiscal balances do not change commensurately.[3] For the sake of brevity, in the remainder of the paper we refer to these relative variables simply as, for example, "the fiscal balance" without making explicit that they are measured relative to the rest of the world. The fundamentals included in the IMF's EBA model *inter alia* include the net foreign asset position, the oil balance, output per worker, demographics, capital account openness, expected output growth, the terms of trade, the output gap and the fiscal balance; for a detailed discussion of the choice of fundamentals included in the EBA model we refer the reader to IMF (2013a) and Phillips et al. (2013). In order to test whether GVCP impacts the current account, we add to the fundamentals in the IMF's EBA

[2] See Phillips et al. (2013) for a discussion of the EBA model.

[3] All "relative" measures, including the measures of backward and forward participation we use below, are constructed as the difference from the rest-of-the-world average, i.e. $x_{it} - x_{RoW_i,t}$. Some variables are already measured "relative" to the rest of the world by their nature, such as the net foreign asset position.

model relative backward and forward GVCP, which we define in more detail below.

The publicly available original IMF EBA dataset covers the time period from 1986 to 2010 for 49 economies. Unfortunately, it is not possible to simply expand the IMF dataset in its time and country dimension for various reasons. First, for some variables the IMF only provides the data as they enter the EBA regression; and as described above, most variables enter as difference relative to the rest of the world. Second, some variables are instrumented and enter as fitted values from a first-stage instrumental variables regression. For this reason, we rebuild from scratch the entire EBA dataset to determine the rest-of-the-world averages as well as the instruments that result from a broader country sample and from an update to include 2011 data.

2.2 The World Input-Output Database

Over the past years several institutions have assembled synthetic global input-output tables that describe the flow of intermediate and final goods across sectors and economies.[4] We follow Timmer et al. (2013), Baldwin and Lopez-Gonzalez (2013) and Costinot and Rodríguez-Clare (2014) and use the World Input-Output Database (WIOD).[5] The 2013 edition of the WIOD provides global input-output tables at annual frequency for 40 countries and 35 sectors for the time period from 1995 to 2011.[6] The broad cross-sectional coverage allows us to trace bilateral flows of intermediate inputs between countries at a fairly detailed level. Furthermore, the WIOD also provides information on both foreign and domestic final demand for each country's output.

To track changes in GVCP, we provide a simple average statistic to reflect a country's backward

[4] Johnson (2014) provides a list of existing public data sets on global input-output tables.

[5] Stehrer et al. (2014) provide a detailed description of the contents and construction of the WIOD.

[6] The 2016 edition of the WIOD covers the time period from 2000 to 2014. However, the two editions of the WIOD are not fully consistent in terms of variable definitions and country coverage. We therefore focus on the edition that includes more information on the time period before the global financial crisis when global imbalances reached their peak and before the great slowdown in global trade.

and forward participation. Denote by a_{ij} gross output of country i used in production in country j and denote by x_i gross output of country i. We define backward participation as the ratio of gross imported intermediates to gross output, that is:

$$bw_i = \frac{\sum_{j \neq i} a_{ji}}{x_i}. \tag{2.2}$$

Analogously, we define country $i's$ forward participation as the ratio of its gross intermediate exports to gross output:

$$fw_i = \frac{\sum_{j \neq i} a_{ij}}{x_i}. \tag{2.3}$$

Gross intermediate exports/imports are given by the off-diagonal elements in the international input-output matrix in the WIOD. Gross output is given by the sum of domestic output that is used as intermediate input in the domestic economy as well as abroad and domestic output that is used for final consumption in the domestic economy and abroad.

Our key metric is then defined as an unweighted average of a country's backward and forward participation.

$$gvcp_i = \frac{bw_i + fw_i}{2}. \tag{2.4}$$

This measure aims to capture a country's overall degree of integration into global value chains through both backward and forward participation. In robustness checks we will document that considering each measure separately will not affect our conclusions.

Figure 1 shows the evolution of the cross-country average of our measures of backward (bw_i) and forward (fw_i) participation over the time period from 1995 to 2011 for our baseline sample

of 29 economies; notice that the data shown in Figure 1 are *not* relative to the rest of the world. The country sample of our baseline specification corresponds to the intersection between the IMF's EBA and the WIOD dataset. The chart confirms the widely-documented rise in GVCP over the past 16 years (see, for example, Daudin et al. (2011); Johnson and Noguera (2014)). Both backward and forward participation increased gradually between 1995 and 2007, declined sharply during the global financial crisis in 2008 and 2009, and recovered nearly to pre-crisis levels in 2010 and 2011. The notable co-movement between both measures suggests that they are indeed highly correlated and hence further justify the use of a common index.

Figures 2 and 3 show that high levels of participation are typically found for small economies, both in 1995 and 2011. This largely reflects a high degree of specialisation of small economies, which warrants a high ratio of imported inputs relative to gross exports. This specialization is also reflected in our forward participation measure. Naturally, these rankings reflect the larger reliance of small open economies on trade in general. As part of our robustness checks, we will thus check whether our GVCP measure is not merely a proxy for country size and/or trade openness.

The descriptive statistics shown in Table A.1 for 1995 to 2011 suggest that the rise in participation in global value chains is somewhat unevenly spread, as reflected in the rise of the standard deviation of all GVC measures. This pattern of divergence in backward participation is also illustrated in Figures 4 and 5 which depict changes in GVCP relative to the rest of world between 1995 and 2011. For some Eastern European economies, such as Hungary and the Czech Republic, the level of backward participation has increased over the time period from 1995 to 2011, despite already relatively high levels of backward participation in 1995.

3 Results

3.1 Baseline results

The first column in Table A.2 replicates the results of the IMF's original EBA regression using the data provided by the IMF on its website (see Table 10 in IMF, 2013b).[7] The second column in Table A.2 reports the results from the estimation of the EBA regression model based on the replicated dataset for the smaller sample of countries and time periods for which we have data on backward and forward participation from the WIOD. Importantly, we estimate this regression without measures of backward and forward participation in order to ensure that we can reproduce the baseline results from the IMF's original EBA also in the replicated dataset and in a sample which includes only a much smaller sample of countries. Most coefficient estimates from the regression using our baseline sample of 29 economies for the time period from 1995 to 2011 are very similar compared to those from the IMF's original EBA regression.

The third column reports the results from the regression in which we include our baseline (combined) measure of economies' global value chain participation (relative to the rest of the world). The relevant coefficient estimate is positive and highly statistically significant. To investigate the individual relevance of our measures, the fourth and fifth column confirm that both measures remain positive and highly statistically significant if included separately.

In order to provide more insights on the channels through which GVCP may impact the current account, we modify the regression specification by replacing the current account as the dependent

[7] As in IMF (2013b), we perform pooled generalised least squares (GLS) estimation with a panel-AR(1) correction. Also, as in the IMF's original EBA model, we do not include the lagged current account balance in the regression (see IMF, 2013b, pp. 9) "as in pooled data this would amount to adding a quasi-fixed effect to the estimates and open up a key interpretative issue related to having the current account in a given year being explained by the previous year's current account. With such a specification, the lagged current account balance might pick up the effects of sustained distortions that are otherwise not captured by the regression (in addition to serving its intended purpose of picking up dynamics and gradual adjustment). Therefore, we instead use pooled GLS with a panel-wide AR(1) correction to deal with autocorrelation."

variable by the trade balance. The results reported in the sixth column of Table A.2 suggest that global value chain participation improves the current account through a positive impact on the trade balance.

A general finding in the various attempts to explain actual current account configurations in reduced-form regression models has been the failure to explain large external imbalances. Figure 6 to Figure 8 plot the actual current account balances against the fitted values of the EBA model estimated in this paper — excluding and including the GVC measure — for surplus, deficit and broadly balanced economies, respectively. The figures provide a number of insights. First, consistent with the findings of other reduced-form regression models, the EBA model performs relatively poorly in explaining the current account of a number of countries, in particular economies with large imbalances. Second, the fit improves when GVCP measures are added to the standard current account determinants, even though not by too much. For instance, the results for Austria suggest that accounting for GVCP initially has little impact on the predicted current account. Over time however, as Austria's GVCP rises relative to the rest of the world, the fitted values of the current account based on the EBA regression that includes GVCP measures increase relative to those based on the EBA regression that excludes GVCP measures, now considerably narrowing the gap to the actual value in the data. Similarly, for the US, the fitted values based on the EBA regression that includes GVCP measures get closer to the actual current account over time, as compared to the fitted values based on the EBA regression that excludes GVCP measures. Overall, the inclusion of GVCP measures helps accounting for the U-shaped dynamics of the US current account during the 2000s. Finally, for a number of countries the inclusion of GVCP measures improves the fit of the IMF's EBA regression through what seem to be level shifts. For example, the fitted values of the current account based on the EBA regression that includes GVCP measures are closer to the actual values in the data throughout

the sample period for Japan. However, against the background of the strong persistence of the current account in the data this should not be interpreted as a steady-state effect, but rather as a persistent dynamic effect.

A different way to illustrate the improvement of the fit when measures of GVCP are included in EBA, is to quantify the change in the size of model implied residuals over the whole sample period. Figures 9 and 10, respectively, plot the percentage and level change in the unexplained current account balance after GVCP has been included in the model.[8] Taken together, these figures imply that accounting for GVCP improves the fit of the baseline model for Japan and the United States by 50 and 75 percent, which corresponds to an average reduction in the unexplained current account by around 1 percentage point respectively. For Germany, the inclusion of GVCP reduces the residual on average by 10 percent.

At the same time, Figures 9 and 10 also point to pronounced cross-country and time variation in the reduction of the unexplained part of the overall current account balances. This raises the question which groups of countries and/or which periods drive the overall improvement of the fit upon inclusion of the GVCP measures. Against this background, we split the sample into (i) surplus and deficit economies, (ii) small, medium and large countries, and (iii) crisis times as well as the pre- and post-global financial crisis period. The results are shown in Table A.3. The coefficient estimate for our measure of GVC participation is both positive and statistically significant for all sample splits, suggesting that countries with higher GVCP tend to have a larger current account balance, and that this result holds irrespective of the sign of the country's current account balance, the country's size, and the sample period. The improvement of fit is

[8] Defining residuals of country i in year t of the original EBA and the GVC augmented EBA model by $u_{i,t}$ and $u_{i,t}^{\text{GVC}}$ respectively, the relative improvement in country i is measured as: $100 * \frac{\sum_{t=1}^{T}|u_{i,t}|-\sum_{t=1}^{T}|u_{i,t}^{\text{GVC}}|}{\sum_{t=1}^{T}|u_{i,t}|}$. The absolute improvement is measured in percentage points and calculated as: $100 * \left(\frac{1}{T}\sum_{t=1}^{T}|u_{i,t}| - \frac{1}{T}\sum_{t=1}^{T}|u_{i,t}^{\text{GVC}}|\right)$.

most sizeable for surplus and small economies.

3.2 Robustness

In this section we examine the robustness of our results to using different measures of backward and forward participation, to considering a sample that extends the country coverage relative to the IMF's original EBA regression to include all countries covered in the WIOD, to the inclusion of country fixed effects, to an alternative specifications of relative GVCP measures, and to a number of additional controls.

3.2.1 Alternative measures of GVC participation

Various concepts and metrics have been proposed to measure trade in value added and GVCP (see, for instance, Hummels et al. (2001); Johnson and Noguera (2012); Koopman et al. (2014); OECD (2015)). Our measures of backward and forward participation are not based on value added trade, and may hence be subject to double counting. A widely used measure of trade in value added is the VAX ratio proposed by Johnson and Noguera (2012), which is a generalisation of the 'VS measure' derived in Hummels et al. (2001). The VAX ratio can be interpreted as a metric of the domestic content of a country's gross exports, and should hence be inversely related to our measure of backward participation. Following Johnson and Noguera (2012), we calculate the VAX ratio as:

$$VAX_i = \frac{\sum_j va_{ij}}{\sum_j x_j}, \tag{3.1}$$

i.e. the ratio of value added produced in country i and absorbed abroad relative to gross exports

of country i. The time series correlation between the VAX ratio and our measure of backward participation (averaged over countries) is -0.93 in our baseline regression sample. In column (2) of Table A.4 we include the VAX ratio calculated based on Equation (3.1). The regression coefficient of the VAX ratio is negative and highly statistically significant.

Another framework for the measurement of trade in value added has been developed and established by the OECD (OECD, 2012, 2015). In this framework, the OECD has put forth definitions of backward and forward participation, labeled as 'foreign value added' (FVA) and 'indirect value added' (IVA). The indicators are based on the WTO-OECD TiVA Database on trade in value added. We follow this methodology to derive measures of foreign and indirect value added based on the WIOD database. Columns (3) and (4) of Table A.4 report the results when GVCP is measured according to the OECD indices. The OECD's backward participation measure remains positive and statistically significant, while the forward measure is statistically insignificant.

Overall, these results corroborate our finding that higher global value chain participation is associated with larger current account balances. Moreover, these results suggest our baseline findings are not specific to our simple measures of backward and forward participation, but that they also hold for more conventional and widely-used measures of GVCP, including the VAX ratio or the OECD's measures of foreign and indirect value added.

3.2.2 WIOD sample

The set of countries considered in our baseline specification is given by the intersection between the IMF's original EBA regression sample and the sample of countries covered by the WIOD dataset. In addition to the countries included in the IMF's original EBA regression, the WIOD

database includes some small European countries. In order to exploit these additional WIOD data, we extend the IMF's original EBA sample to cover 38 rather than only 29 of the countries covered in the WIOD. Column (5) in Table A.4 reports the results from our EBA regression for the sample of 38 countries. The coefficient estimate for GVCP is again positive and statistically significantly different from zero.

3.2.3 Inclusion of country fixed effects

The IMF's original EBA model does not control for country fixed effects. The IMF argues that fixed effects do not provide an economic explanation of observed current account balances (see IMF (2013a)). However, from an econometric point of view controlling for unobserved heterogeneity might be important to obtain consistent estimates of the coefficients of the explanatory variables, in particular if the latter are correlated with the unobserved country characteristics that affect the current account. Column (6) in Table A.4 reports the estimation results from our baseline model in Equation (2.1) when we include country fixed effects. The coefficient estimate of GVCP remains positive and statistically significantly different from zero.

3.2.4 Alternative specification of relative GVCP measures

As discussed in Section 2.1, all "relative" measures, including the measures of backward and forward participation, are constructed as the difference from the rest-of-the-world average: $x_{i,t} - x_{ROW_i,t}$. To ensure that our results are not driven by this specific definition of our relative GVCP measure, we calculate an alternative relative measure as a ratio with respect to the rest-of-the-world average: $\frac{x_{i,t}}{x_{ROW,t}}$. The last column in Table A.4 reports the results from this robustness check, which suggest that this alternative definition of our relative participation measure does

not affect our results.

3.2.5 Controlling for trade openness, country size, EU membership and manufacturing intensity

As illustrated in Figures 2 and 3 and discussed in Section 2.2, smaller economies tend to be more integrated in global value chains, in part reflecting the limited degree of diversification of production in small economies. Moreover, the majority of the smaller economies included in the WIOD database are members of the European Union. In order to ensure that our measures for GVCP are not merely proxies for trade openness, country size and/or EU membership, we enter the three variables as additional regressors. The results are reported in the first three columns of Table A.5. Again, the coefficient estimates for GVCP remain positive and statistically significant in all specifications.

Another possible concern is that our measure of GVCP may reflect a country's degree of manufacturing intensity, which tends to be correlated with the current account. The positive correlation between a country's GVCP and its manufacturing intensity may in part reflect that both measures are driven by the same underlying shock. Specifically, on the one hand, increased efficiency in the use of imported intermediates in domestic production, for instance due to a decline in transportation costs, results in a larger share of foreign value added in exports, i.e. in a rise of GVCP. On the other hand, the shock to the efficiency in the use of imported intermediates boosts competitiveness, thereby increasing foreign demand and domestic production. In order to filter out the common component in a country's GVCP and its manufacturing intensity, we run a simple regression of manufacturing intensity on GVC participation. Then, we add the residual from this regression as an additional control to our baseline regression specification. Results,

reported in column (4) of Table A.5 show that higher manufacturing intensity (stripped from the impact of GVCP) is indeed positively correlated with the current account. However, the coefficient estimate for GVCP also remains positive and statistically significant.

4 Conclusion

This paper examines the impact of economies' GVCP on their current account balances. Our empirical analysis suggests that GVCP raises economies' current account balances notably for some surplus and deficit economies. GVCP may give an economy a temporary competitive edge that results in a rise in its current account balance. Apart from fostering growth, magnifying cross-country spillovers and changing an economy's income distribution, GVCP may thus improve external positions.

A mechanism which could explain the empirical pattern we document is that strong GVCP may be reflective of an economy's temporary technological advantage that gives rise to an improvement in its competitiveness, resulting in a rise in its current account balance in order to smooth consumption over time. This could occur in a situation where a shock reduces the cost of imported intermediate goods from a subset of source countries. Such a shock could reflect the adoption of trade and capital-flow liberalising policies or advances in information and communication technologies, which have been identified in the literature as the driving forces behind the rise in GVCP. By substituting less expensive imported intermediate goods for those produced domestically, domestic firms increase their backward GVCP and achieve a gain in competitiveness relative to exporters in the rest of the world. At the same time, the increased domestic usage of foreign intermediates induces a positive demand shock for exports of intermediates in the source countries affected by the shock, which may increase their forward GVCP and real in-

come relative to other countries that are less integrated in global value chains. As it is expected that other source countries will — possibly with a delay — also adopt trade and capital-flow liberalising policies and exploit advances in information and communication technologies to increasingly fragment production across many source countries, both the gain in competitiveness for domestic exporters and the relative increase in demand for the source countries' intermediates is only temporary. As a consequence, in order to smooth consumption over time, part of the income gain in both the domestic and source economies will be saved, which improves the respective current account balances. A key element in this hypothesised mechanism is that increased GVCP reflects improvements in a country's competitiveness that are only temporary. If the competitive edge is permanent, or at least perceived to be so, the current account balance will actually deteriorate as consumption, and thus imports, rise commensurately with permanent income.

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A Tables

Table A.1 Descriptive statistics for GVC participation

	count	mean	sd	min	max
Backward participation	456	0.107	0.053	0.022	0.276
Backward partcipation in 1995	20	0.088	0.043	0.022	0.205
Backward partcipation in 2011	29	0.122	0.062	0.042	0.276
Forward participation	456	0.107	0.054	0.025	0.291
Forward partcipation in 1995	20	0.087	0.045	0.025	0.170
Forward partcipation in 2011	29	0.124	0.063	0.047	0.291
Overall GVCP	456	0.107	0.052	0.026	0.283
Overall GVCP in 1995	20	0.088	0.043	0.026	0.187
Overall GVCP in 2011	29	0.122	0.062	0.042	0.276

Table A.2 The impact of GVC participation on the current account — baseline regression results

	(1) IMF EBA	(2) GVC sample	(3) Baseline	(4) Backward	(5) Forward	(6) Trade Balance
Lagged Net Foreign Assets	0.02***	0.03***	0.03***	0.03***	0.03***	0.01
Lagged NFA*1(NFA<-0.6)	-0.02	-0.04***	-0.03**	-0.04***	-0.03**	-0.02
Financial Center	0.04***	0.04**	0.03**	0.04**	0.03*	0.00
Lagged Output/Worker rel. to Top-3 economies	0.02	0.04*	0.01	0.02	0.00	0.04**
Lagged Output/Worker*Capital Openess	0.04*	0.04**	0.06***	0.05***	0.06***	0.05**
Oil Balance*Ressource Temporariness Dummy	0.66***	1.34***	1.46***	1.57***	1.11***	2.15***
Old-Age Dependency Ratio	-0.03	0.04	0.04	0.04	0.05*	-0.00
Population Growth	-0.42	-0.30	0.11	-0.08	0.24	0.87***
Aging	0.16***	0.15***	0.18***	0.18***	0.18***	0.15***
Expected GDP Growth	-0.51***	-0.51***	-0.54***	-0.55***	-0.51***	-0.21
Lagged Public Health Spending to GDP	-0.67***	-0.66***	-0.64***	-0.65***	-0.64***	-0.24
Lagged VOX*Capital Openess	0.06***	-0.03	-0.02	-0.03	-0.02	0.00
Lagged VOX*Capital Openess*COFER share	-0.12*	0.12	0.11	0.11	0.11	0.05
Share of currency in world reserves	-0.01	-0.00	-0.00	-0.00	0.00	0.01
Output Gap	-0.41***	-0.26***	-0.25***	-0.26***	-0.23***	-0.27***
Commodity ToT*Trade Openess	0.23***	0.08***	0.08***	0.08***	0.08***	0.09***
Strength of Institutions	-0.11***	-0.05***	-0.06***	-0.05***	-0.06***	-0.08***
Demeaned Credit to GDP	-0.02**	-0.02**	-0.02***	-0.02***	-0.02***	-0.02***
Fiscal Balance (instr)	0.29***	0.44***	0.32**	0.38**	0.27*	0.20
Chg in FX reserves*Capital Openess(instr)	0.32*	0.39***	0.35***	0.37***	0.34***	0.26**
GVCP, rel. to RoW			0.22***			0.66***
Backward Participation				0.13***		
Forward Participation					0.30***	
Constant	-0.02***	0.03***	0.02***	0.03***	0.01*	0.04***
Observations	1080	456	456	456	456	456
R^2	0.43	0.49	0.56	0.53	0.58	0.58
Number of countries	49	29	29	29	29	29

Robust standard errors.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A.3 The impact of GVC participation on the current account- – deficit vs. surplus economies; small vs. large economies; pre vs. post-crisis sample

	(1) Surplus	(2) Deficit	(3) Large	(4) Medium	(5) Small	(6) Pre-crisis	(7) Crisis	(8) Post-crisis
GVCP, rel. to RoW	0.14***	0.06**	0.30***	0.53***	0.37***	0.23***	0.30***	0.24***
Constant	-0.01	0.01**	0.01	0.00	0.03	0.02***	0.02	0.03
Observations	203	252	134	152	170	340	58	58
R^2	0.49	0.53	0.89	0.87	0.56	0.66	0.89	0.90
R-squared excl. GVC	0.43	0.49	0.89	0.83	0.45	0.59	0.85	0.87
Number of countries	20	24	9	9	11	29	29	29

Robust standard errors.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A.4 The impact of GVC participation on the current account — alternative GVCP measures, samples, and fixed effects

	(1) Baseline	(2) VAX	(3) FVA/IVA	(4) FVA/IVA	(5) WIOD sample	(6) Fixed Effects	(7) Relative shares
GVCP, rel. to RoW	0.22***				0.15***	0.41***	
VAX		-0.10***					
Foreign value added (OECD)			0.05**				
Indirect value added (OECD)				-0.05			
Eastern Europe					-0.06***		
GVCP, rel. to RoW (share)							0.01***
Constant	0.02***	0.02***	0.03***	0.03***	0.01	-0.07***	0.01
Observations	456	456	456	456	556	456	456
R^2	0.56	0.53	0.51	0.49	0.54	0.42	0.55
Number of countries	29	29	29	29	38	29	29

Robust standard errors.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A.5 The impact of GVC participation on the current account — population, EU membership, and manufacturing intensity

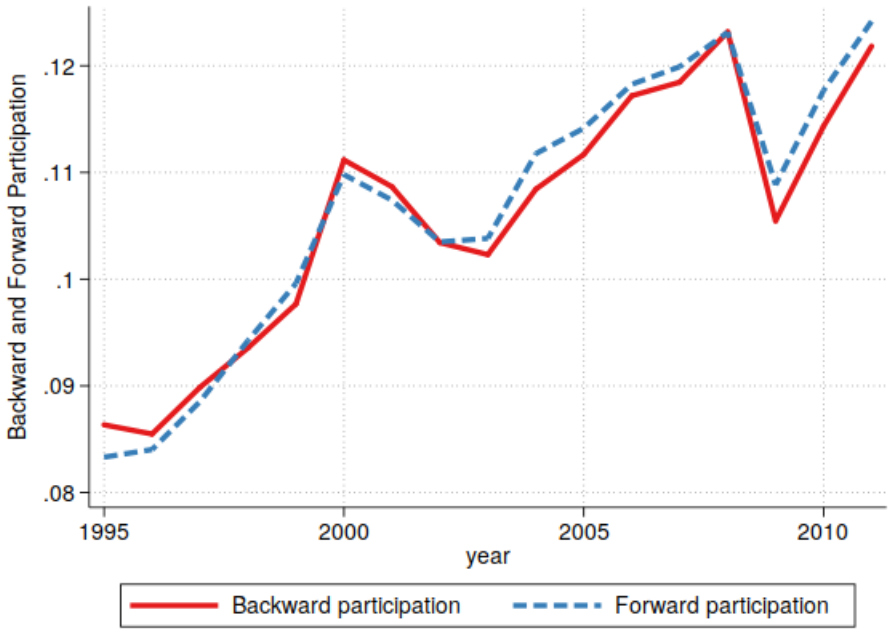
	(1) Trade openness	(2) Population	(3) EU	(4) Manuf intensity
GVCP, rel. to RoW	0.36**	0.26***	0.27***	0.18***
Trade Openess	-0.02			
Population		0.00***		
EU			-0.02***	
Manuf intensity (orthog comp)				0.00***
Constant	0.02***	0.02***	0.02***	0.01*
Observations	456	456	456	428
R^2	0.57	0.57	0.57	0.58
Number of countries	29	29	29	29

Robust standard errors.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

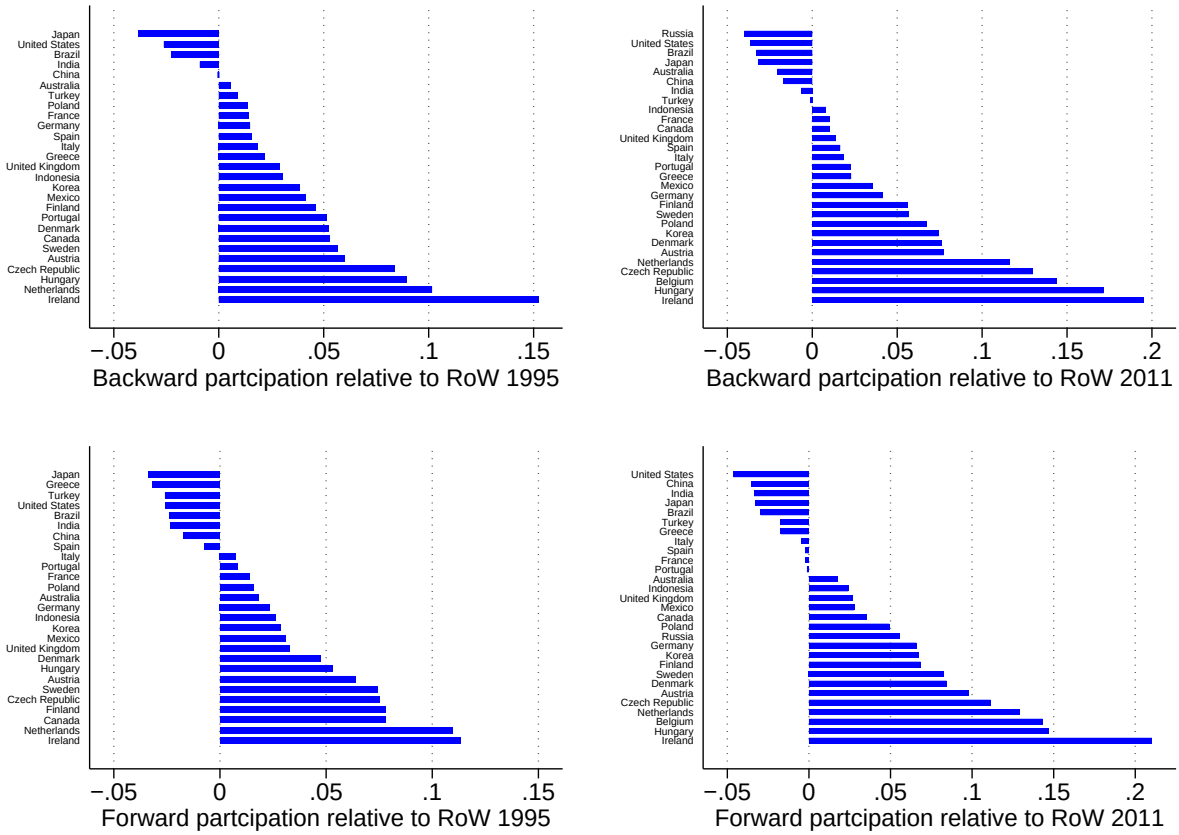
B Figures

Figure 1 Evolution of the cross-country average of backward and forward participation from 1995 to 2011



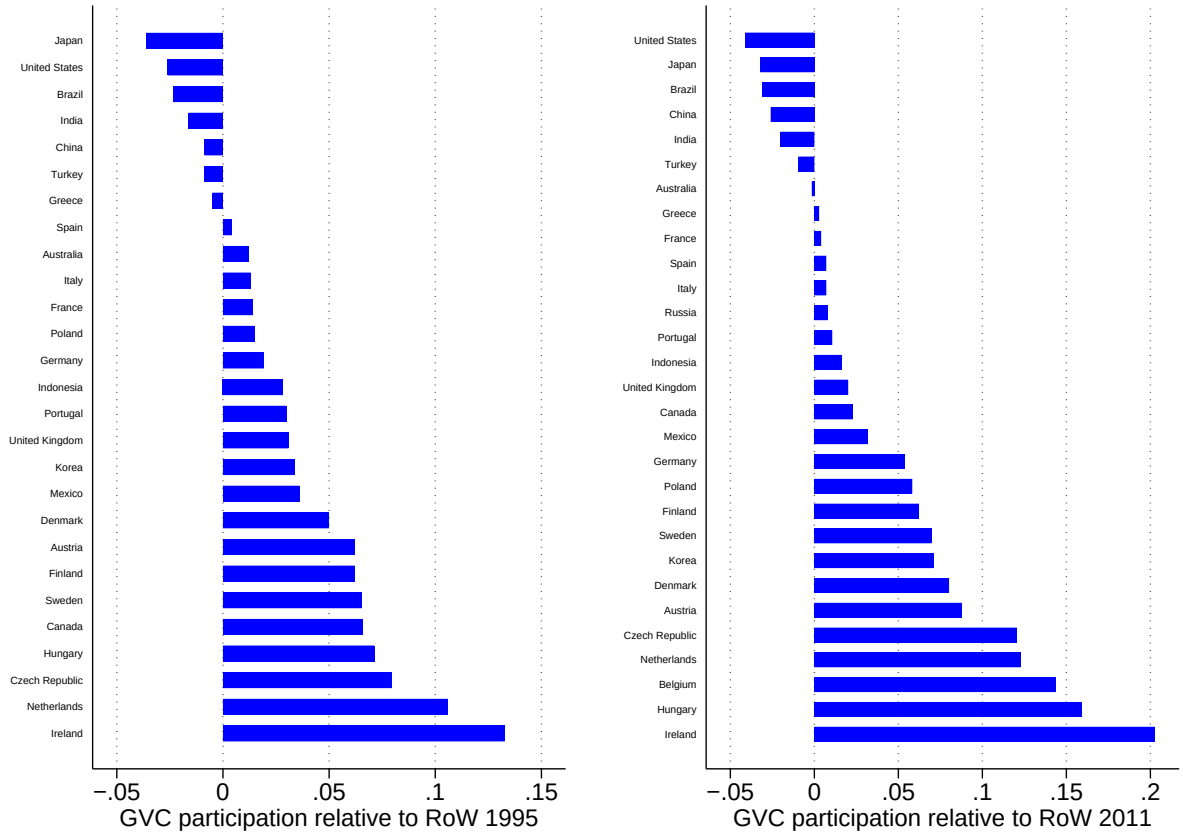
Note: The figure presents the evolution of the cross-country average of the measure of backward and forward participation as defined in Equations (2.2) and (2.3) for all countries that enter our regression analysis.

Figure 2 Rankings of backward and forward participation in 1995 and 2011



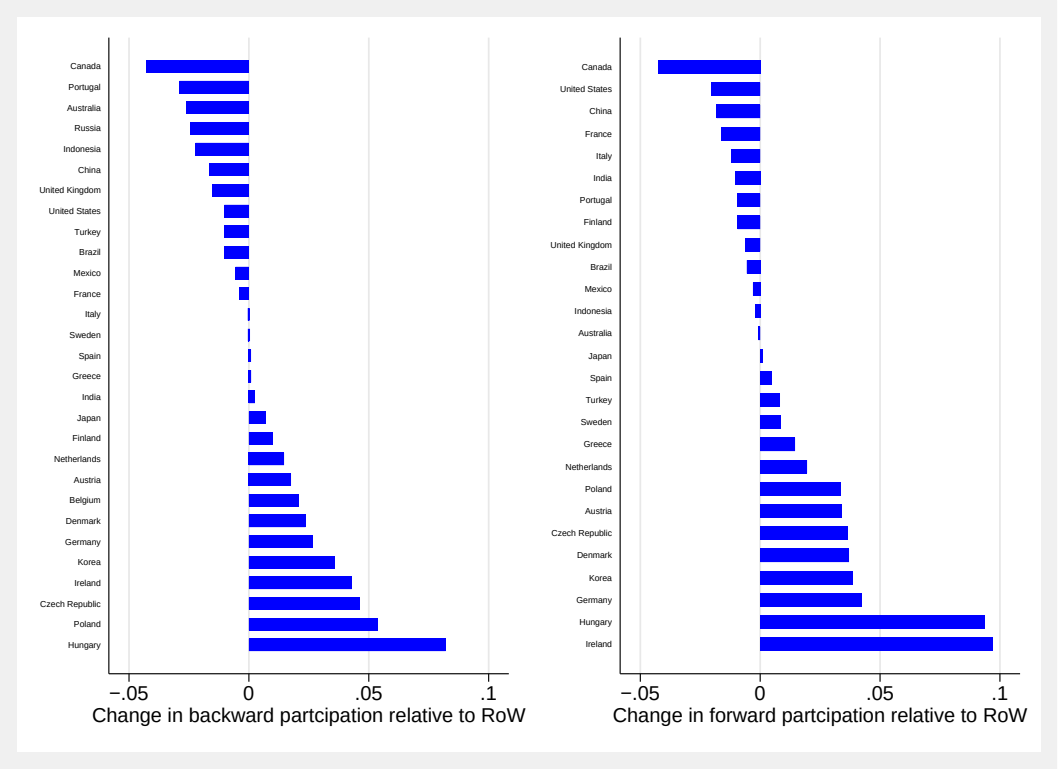
Note: The panels display the rankings of GVCP calculated based on Equations (2.2) and (2.3) and using the WIOD for the years 1995 and 2011. The rankings are shown for all countries which enter our regressions at least in one year during 1995 to 2011. The measure of GVCP is calculated as difference to the rest of the world.

Figure 3 Rankings of GVC participation (combined measure) in 1995 and 2011



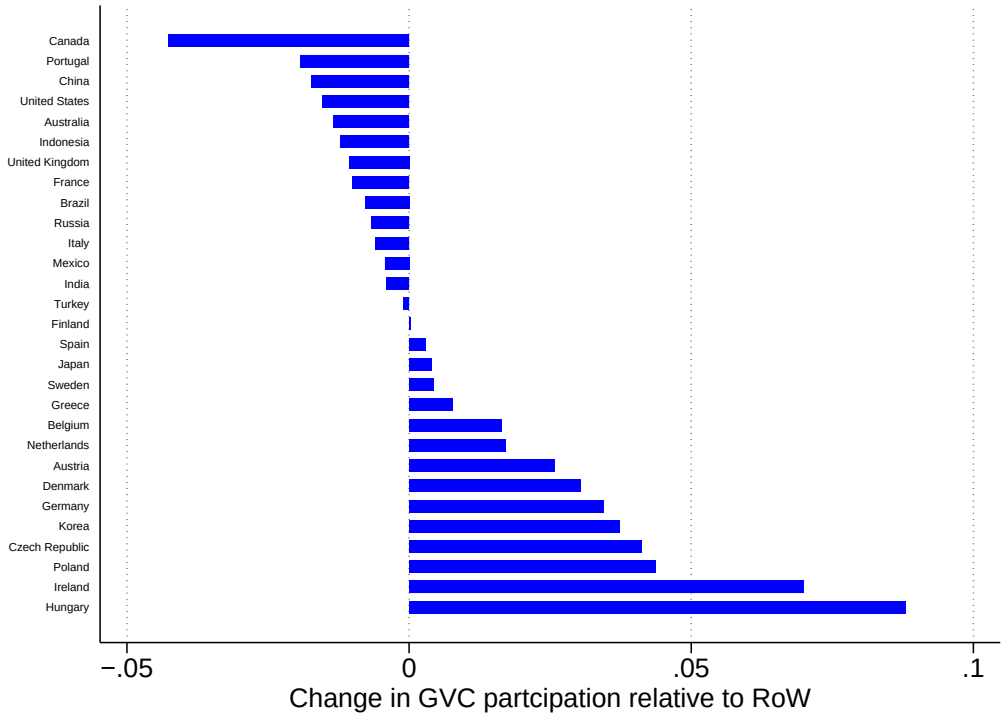
Note: The panels display the rankings of GVCP calculated based on Equation (2.4) and using the WIOD for the years 1995 and 2011. The rankings are shown for all countries which enter our regressions at least in one year during 1995 to 2011. The measure of GVCP is calculated as difference to the rest of the world.

Figure 4 Change in backward and forward participation (year of first observation to 2011)



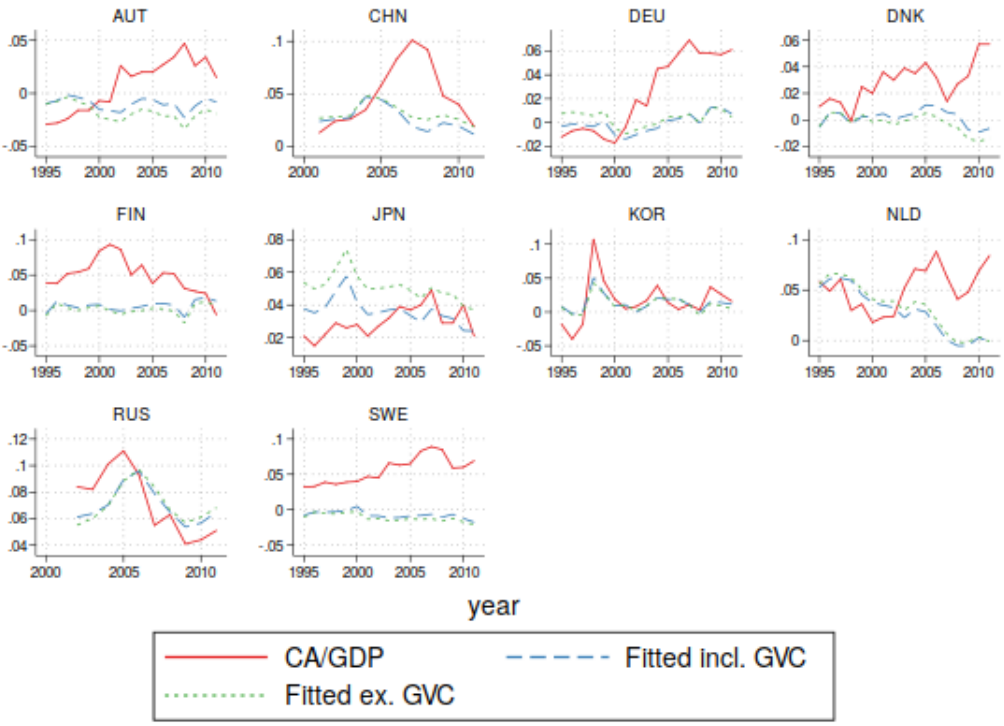
Note: Percentage change of backward and forward participation (measured relative to the rest of the world) from year of first observation to 2011.

Figure 5 Change in GVC participation (combined measure) (year of first observation to 2011)



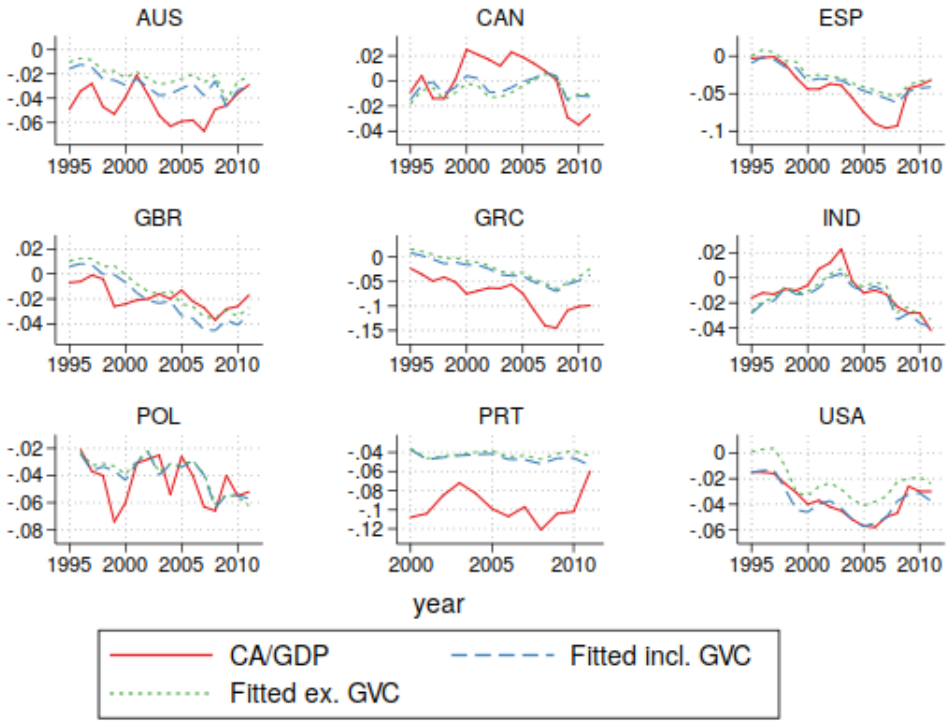
Note: Percentage change of GVC participation (measured relative to the rest of the world) from year of first observation to 2011.

Figure 6 Surplus countries: Current account balance and fitted values from baseline regression including and excluding GVCP measures



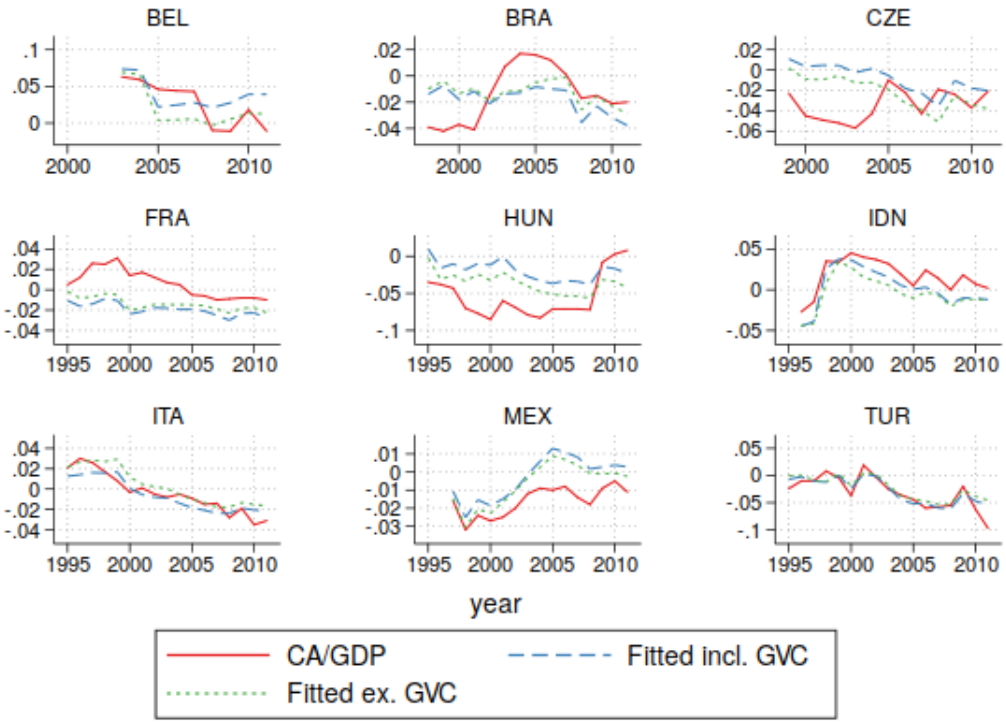
Note: The figure displays for all countries of the baseline sample with a current account surplus exceeding 2.5% of GDP in 2009 the current account balance and the fitted values from the baseline regression including and excluding the GVC measures.

Figure 7 Deficit countries: Current account balance and fitted values from baseline regression including and excluding GVCP measures



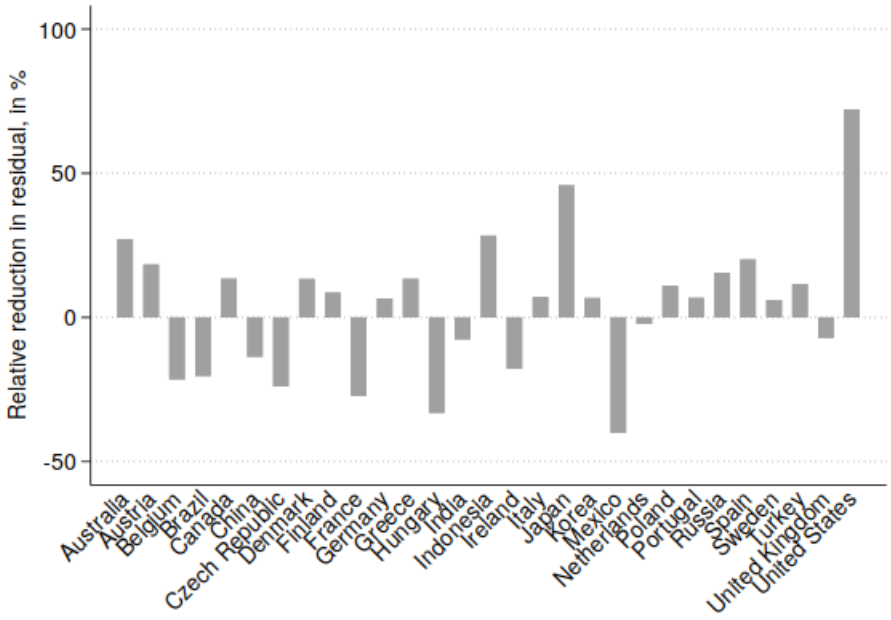
Note: The figure displays for all countries of the baseline sample with a current account deficit exceeding 2.5% of GDP in 2009 the current account balance and the fitted values from the baseline regression including and excluding the GVC measures.

Figure 8 Broadly balanced countries: Current account balance and fitted values from baseline regression including and excluding GVCP measures



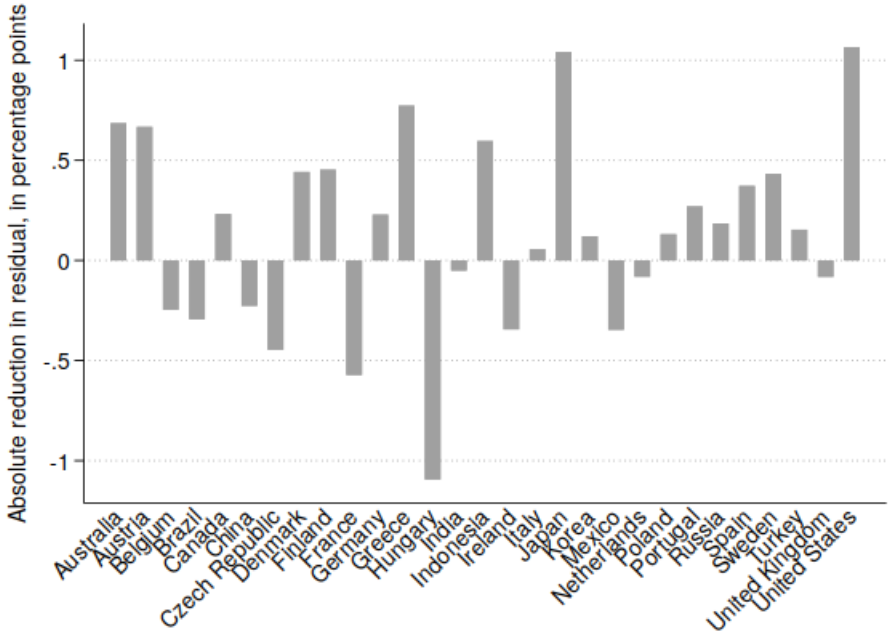
Note: The figure displays for all countries of the baseline sample with a current account surplus between -2.5% and 2.5% of GDP in 2009 the current account balance and the fitted values from the baseline regression including and excluding the GVC measures.

Figure 9 Percentage reduction of unexplained current account balances upon inclusion of GVC participation between 1995 and 2011



Note: The figure displays the percentage reduction of the time average of the absolute residuals from the IMF's EBA regressions that results from the inclusion of GVC participation in the EBA model. Denoting residuals of country i in year t of the original EBA and the GVC augmented EBA model by $u_{i,t}$ and $u_{i,t}^{\text{GVC}}$ respectively, this figure plots the following quantity for country i: $100 * \frac{\sum_{t=1}^{T}|u_{i,t}| - \sum_{t=1}^{T}|u_{i,t}^{\text{GVC}}|}{\sum_{t=1}^{T}|u_{i,t}|}$.

Figure 10 Absolute reduction of unexplained current account balances upon inclusion of GVC participation between 1995 and 2011

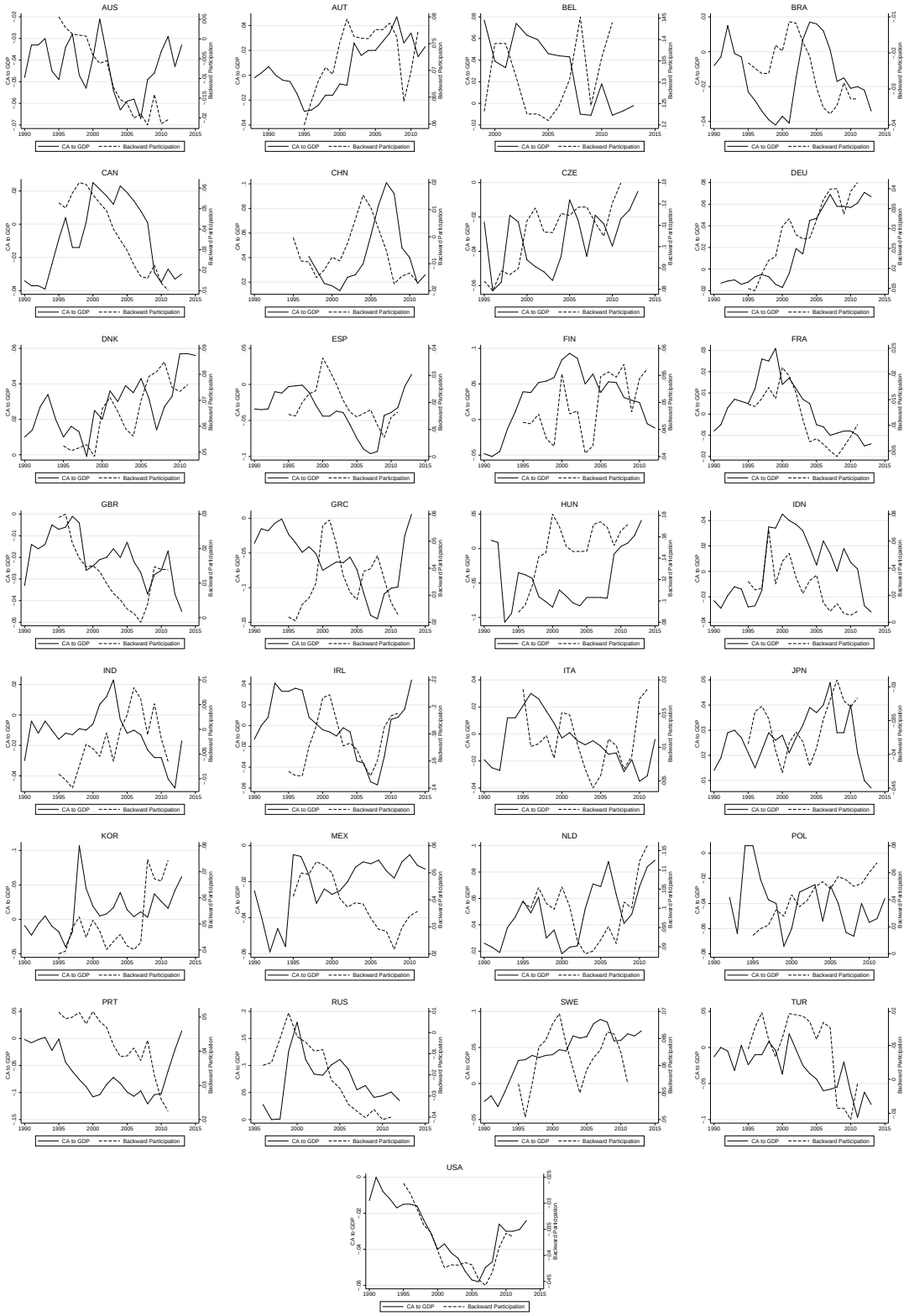


Note: The figure displays the percentage point reduction of the time average of the absolute residuals from the IMF's EBA regressions that results from the inclusion of GVC participation in the EBA model. Denoting residuals of country i in year t of the original EBA and the GVC augmented EBA model by $u_{i,t}$ and $u_{i,t}^{\text{GVC}}$ respectively, this figure plots the following quantity for country i: $100 * \left(\frac{1}{T} \sum_{t=1}^{T} |u_{i,t}| - \frac{1}{T} \sum_{t=1}^{T} \left| u_{i,t}^{\text{GVC}} \right| \right)$.

C Webappendix — Not for Publication

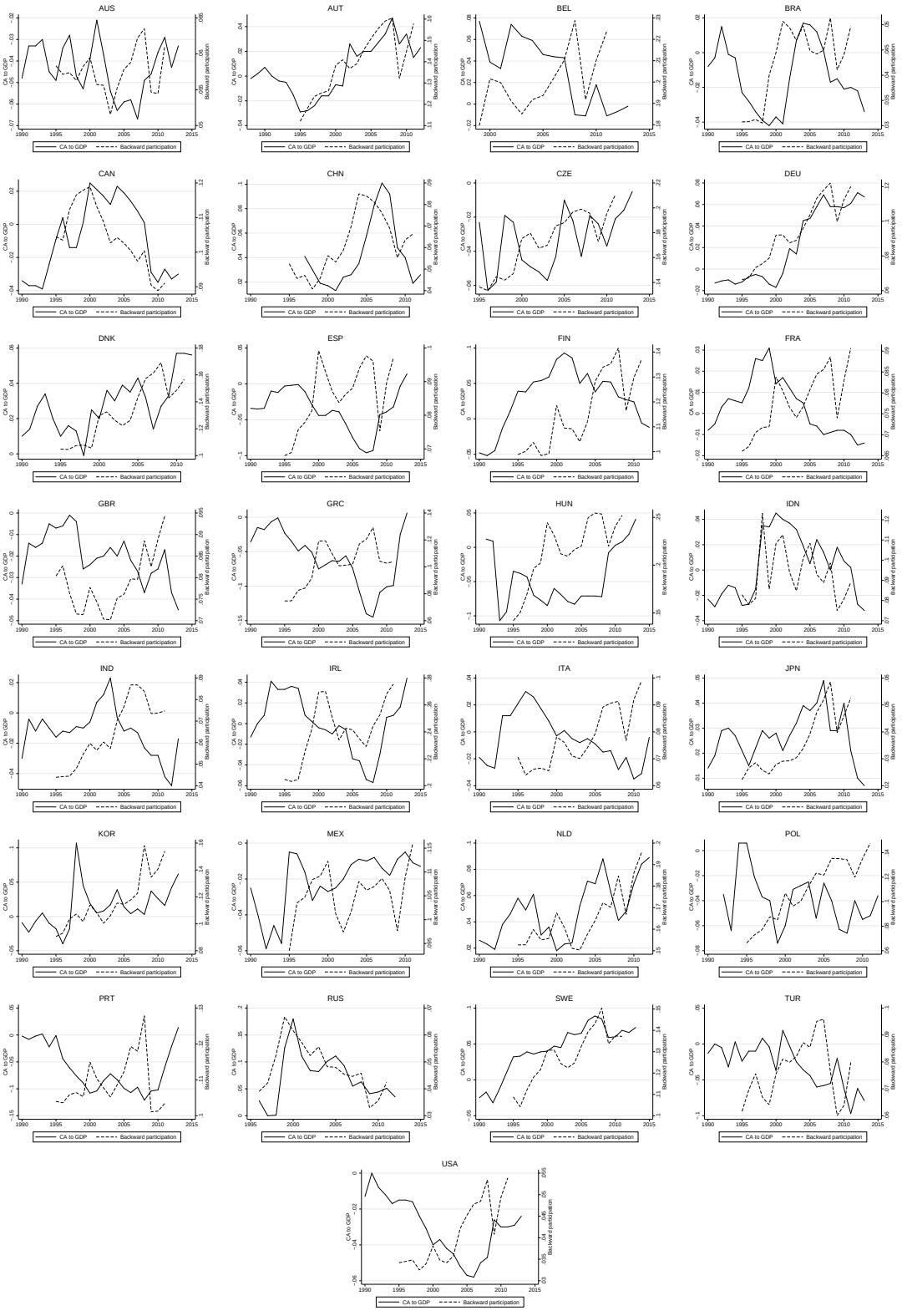
C.1 Figures

Figure 11 Current account balance and backward participation (relative to the rest of the world)



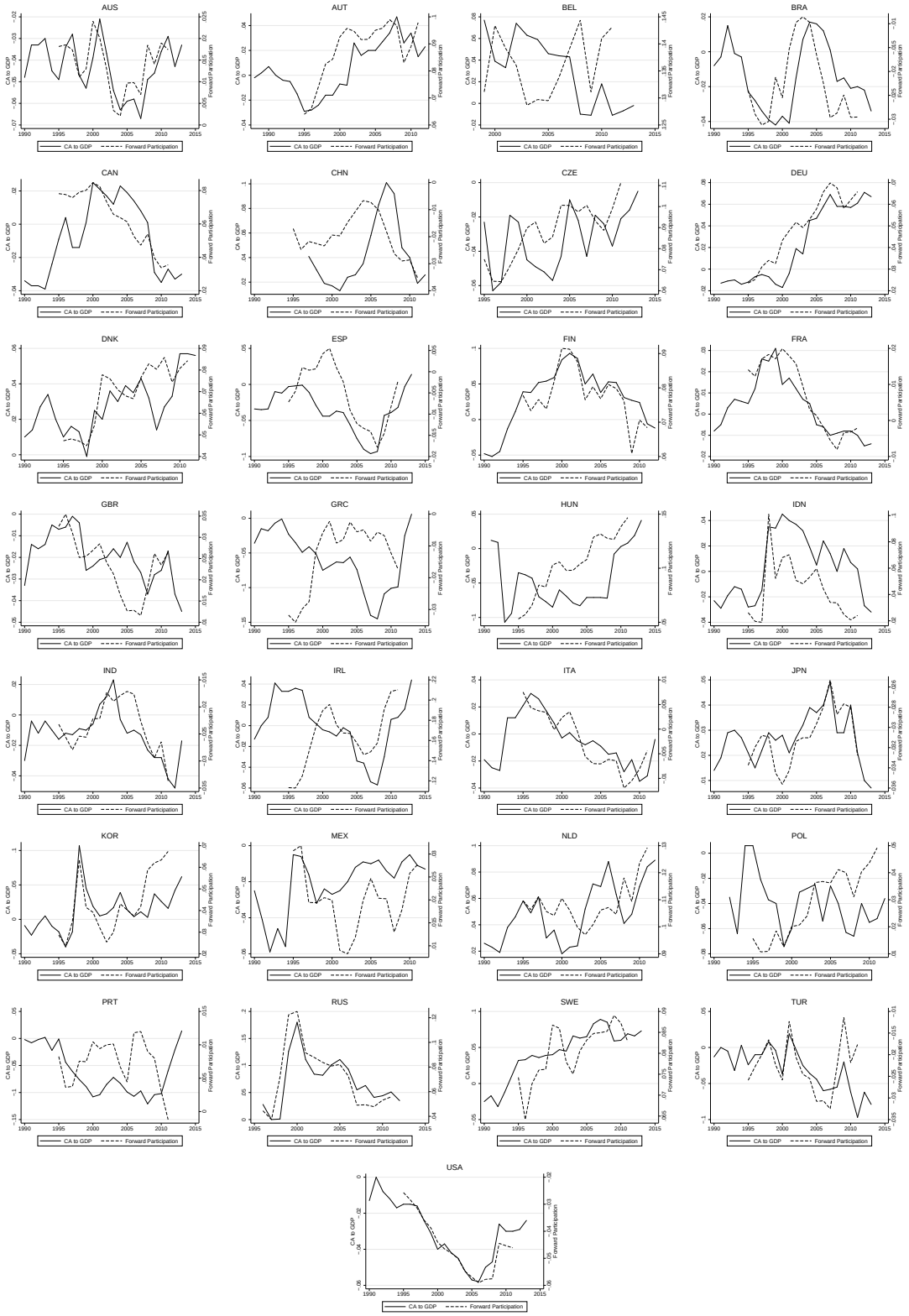
Note: The figure displays for each country of the baseline sample the current account balance and the backward participation relative to the rest of the world.

Figure 12 Current account balance and backward participation



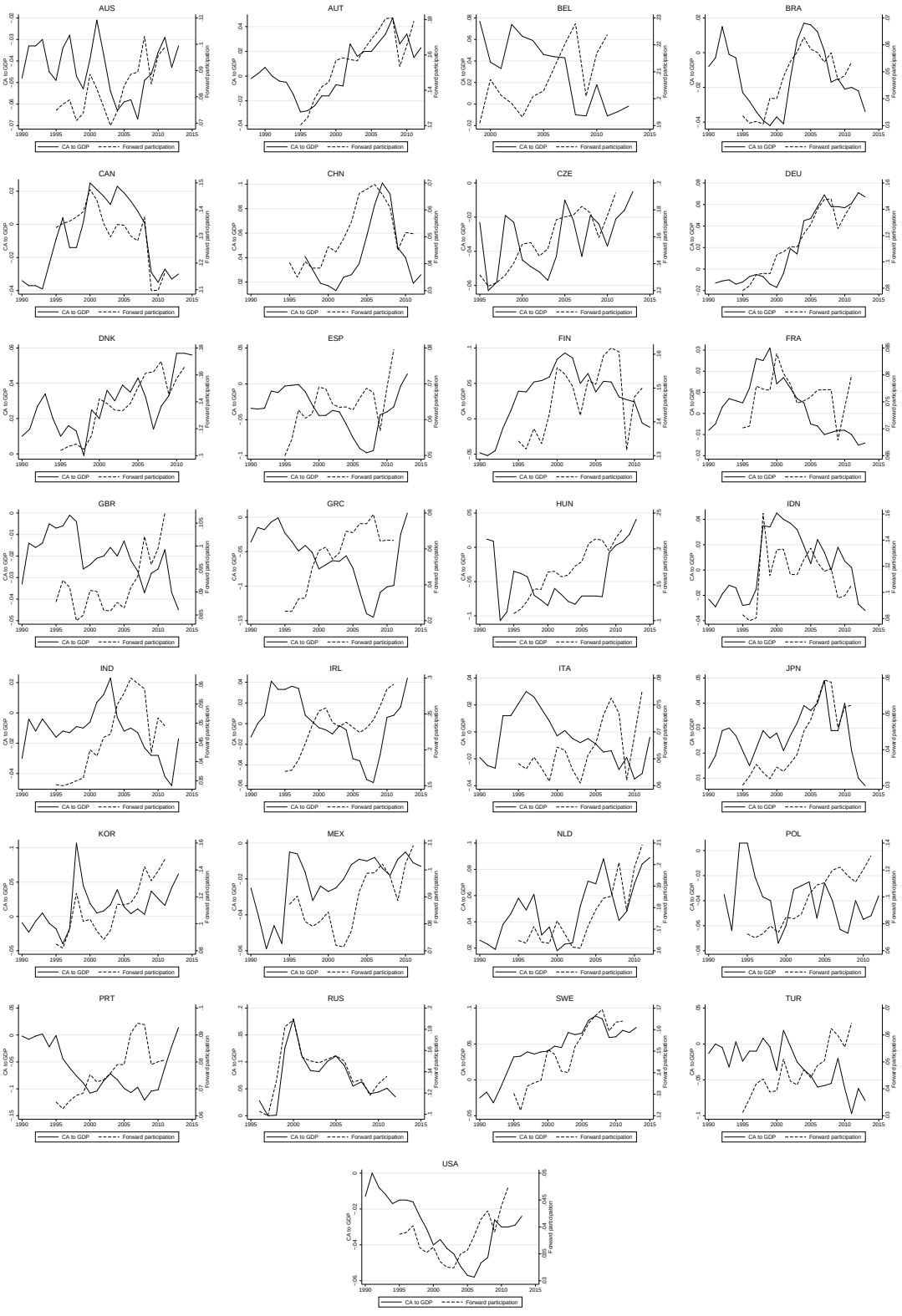
Note: The figure displays for each country of the baseline sample the current account balance and the backward participation.

Figure 13 Current account balance and forward participation (relative to the rest of the world)



Note: The figure displays for each country of the baseline sample the current account balance and the forward participation relative to the rest of the world.

Figure 14 Current account balance and forward participation



Note: The figure displays for each country of the baseline sample the current account balance and the forward participation.