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Technical Paper

A model-based analysis of the German current account surplus

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Non-technical summary

An article in a recent Monthly Report (Bundesbank, 2020a) presented the findings of a model-based investigation into the key drivers of the current account surplus in Germany over the last two decades and discussed how various policy measures and changes to the external environment may help reduce the current account surplus. This paper documents the underlying simulations in more detail. To this end, we apply a wide range of macroeconomic policy models regularly used by staff at the Bundesbank when producing policy simulations and projections. Thus, the analysis also incorporates a methodological dimension, illustrating the relative strengths and weaknesses of the applied modelling frameworks.

As regards the historical current account developments, the modelling results suggest that the observed surplus can be attributed to several factors. In this regard, the rise in the rate of savings in Germany is one of the factors that have contributed to the persistent rise in the surplus. This finding is consistent with the increase in economy-wide savings, which is largely attributable to non-financial corporations. Although weak domestic investment and low government spending also tended to increase the surplus, their quantitative effects were found to be smaller. Moreover, according to the analysis, a considerable portion of the dynamics of German net exports is attributable to external factors, such as higher foreign demand and a weaker euro exchange rate.

Looking forward, several events would need to happen to bring the German current account back to equilibrium from its current level. Only some contribution could be expected from changes which are under the direct control of the German authorities, such as, for example, the widely debated idea of domestic fiscal expansion or a liberalisation of the service sector in Germany. As for the external factors, we find that an appreciation of the euro exchange rate and a possible economic slowdown in China could also make a sizeable contribution to producing a lower current account surplus in Germany.

To get an idea of the extent of model uncertainty, several common scenarios considered in the forward-looking part of this paper are simulated using a set of models featuring diverse modelling frameworks. To this end, seven macroeconomic models have been used: four standard structural (DSGE) models, one overlapping generations (OLG) model and two traditional macro-econometric models. We find that, in the case of demand-side shocks (e.g. fiscal expenditures), the semi-structural models tend to generate larger and more persistent reductions in the current account as compared to the standard structural models. The latter models display a comparable or even stronger current account impact in the case of supply-side shocks (e.g. changes to tax rates or firms' market power), which have more direct effects on the relative prices. Thanks to its explicit modelling of the precautionary savings motive, the OLG model helps to establish a link between the level of government debt and the net foreign

assets position of the countries and, thus, allows debt-financed fiscal expansions to exert sizeable effects on the current account.

Looking beyond the scope of the current investigation, future work on current account adjustment in Germany could benefit from further exploration of alternative modelling frameworks facilitating an in-depth analysis of fundamental, longer-term changes to the savings-investment balance. In this regard, we also provide illustrative simulations showing that, in a structural model with an endogenous long-term determination of the net foreign asset position – as opposed to an exogenous one as employed in most standard DSGE models – labour market liberalisation may have played a more prominent role in driving the current account surplus in Germany as compared to the related estimates found in the standard DSGE models. In addition, we demonstrate in an overlapping generation model that Germany's ageing society could be contributing sizeably to the observed persistent increase in the current account surplus.

Nichttechnische Zusammenfassung

Ein kürzlich veröffentlichter Monatsberichtsaufsatz (Bundesbank, 2020a) hat die Ergebnisse einer modellbasierten Untersuchung der treibenden Faktoren des deutschen Leistungsbilanzüberschusses in den letzten zwei Jahrzehnten vorgestellt und erörtert, wie verschiedene Politikmaßnahmen und Veränderungen im internationalen Umfeld dazu beitragen können, den Leistungsbilanzüberschuss zu reduzieren. Dieser technische Bericht dokumentiert die zugrundeliegenden Simulationen ausführlicher. Zu diesem Zweck wenden wir eine breite Palette von makroökonomischen Modellen an, die die Experten der Bundesbank im Rahmen von Politiksimulationen und Prognosen regelmäßig einsetzen. Die Analyse umfasst auch einen methodischen Aspekt, indem sie die relativen Stärken und Schwächen der angewandten Modellrahmen darstellt.

In Bezug auf die historischen Leistungsbilanzentwicklungen deuten die Modellergebnisse darauf hin, dass der beobachtete Überschuss auf mehrere Faktoren zurückzuführen ist. Dabei ist der Anstieg der Sparquote in Deutschland einer der Faktoren, die zum anhaltenden Anstieg des Überschusses beigetragen haben. Diese Feststellung steht im Einklang mit dem Anstieg der gesamtwirtschaftlichen Ersparnisse, der größtenteils auf nichtfinanzielle Kapitalgesellschaften zurückzuführen ist. Obwohl schwache Inlandsinvestitionen und niedrige Staatsausgaben ebenfalls den Überschuss tendenziell erhöhten, werden ihre Beiträge geringer eingeschätzt. Darüber hinaus ist laut Analyse ein erheblicher Teil der Dynamik der deutschen Nettoexporte auf äußere Faktoren wie eine höhere Auslandsnachfrage und einen schwächeren Euro-Wechselkurs zurückzuführen.

Mit Blick nach vorn müssten mehrere Ereignisse eintreten, um die deutsche Leistungsbilanz vom derzeitigen Stand aus wieder ins Gleichgewicht zu bringen. Von staatlichen Maßnahmen in Deutschland, wie z. B. die viel diskutierte Ausweitung der Staatsausgaben oder die Liberalisierung des Dienstleistungssektors, ist nur ein begrenzter Beitrag zu erwarten. Was die externen Faktoren betrifft, so stellen wir fest, dass eine Aufwertung des Euro-Wechselkurses und eine mögliche wirtschaftliche Abkühlung in China auch erheblich zu einem geringeren Leistungsbilanzüberschuss Deutschlands beitragen könnten.

Um eine Vorstellung vom Ausmaß der Modellunsicherheit zu erhalten, werden im zukunftsgerichteten Teil dieses Papiers mehrere gängige Szenarien mithilfe einer Reihe unterschiedlicher Modelle simuliert. Zu diesem Zweck wurden sieben makroökonomische Modelle verwendet: vier Standard-DSGE-Modelle (dynamische stochastische allgemeine Gleichgewichtsmodelle), ein OLG-Modell (Modell überlappender Generationen) und zwei traditionelle (halbstrukturelle) makroökonometrische Modelle. Wir stellen fest, dass im Falle von Schocks auf der Nachfrageseite (z. B. Staatsausgaben) die halbstrukturellen Modelle im Vergleich zu den Standard-DSGE-Modellen tendenziell zu größeren und anhaltenderen Reduzierungen des Leistungsbilanzsaldos führen. Die Standard-DSGE-Modelle weisen

vergleichbare oder sogar stärkere Leistungsbilanzeffekte bei angebotsseitigen Schocks aus (z. B. Änderungen der Steuersätze oder der Marktmacht der Unternehmen), die unmittelbare Auswirkungen auf die relativen Preise haben. Das OLG-Modell trägt dank der expliziten Modellierung des Vorsichtssparens dazu bei, einen Zusammenhang zwischen der Höhe der Staatsverschuldung und der Nettoauslandsvermögensposition der Länder herzustellen, und ermöglicht somit beträchtliche Auswirkungen schuldenfinanzierter Steigerungen der Staatsausgaben auf die Leistungsbilanz.

Über den Rahmen der aktuellen Untersuchung hinaus könnten künftige Studien zur Leistungsbilanzanpassung in Deutschland von der weiteren Erforschung alternativer Modellrahmen profitieren, die eine eingehende Analyse grundlegender, längerfristiger Änderungen des Gleichgewichts von Ersparnis und Investitionen ermöglichen. In diesem Zusammenhang veranschaulichen unsere Simulationen, dass die Arbeitsmarktliberalisierung in einem strukturellen Modell mit einer endogenen langfristigen Bestimmung der Nettoauslandsvermögensposition möglicherweise eine wichtigere Rolle bei der Steigerung des Leistungsbilanzüberschusses in Deutschland gespielt hat als in Standard-DSGE-Modellen, in denen die Nettoauslandsposition meist exogene bestimmt wird. Darüber hinaus zeigen wir in einem Modell überlappender Generationen, dass die alternde Gesellschaft in Deutschland erheblich zum beobachteten anhaltenden Anstieg des Leistungsbilanzüberschusses beitragen könnte.

A model-based analysis of the German current account surplus*

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Abstract

Germany's current account balance has been persistently high for about two decades and has increasingly attracted criticism as well as prompted proposals for policy measures geared to reducing the surplus. Assessing such proposals properly requires an analysis based on structural models. As pointed out in a recent Bundesbank monthly report and shown in more detail in this paper, model-based estimates of possible current account adjustments in Germany are subject to a substantial structural uncertainty, as point estimates vary greatly across a variety of models, with regard to both the size and the sign of the impact on the current account. Simulation exercises illustrate the cross-model differences, which could be related to the underlying modelling assumptions of each model. Overall, while several scenarios reveal scope for a significant reduction in the German current account surplus in some of the models, more precise estimates would require designing scenarios which are better tailored to the specific policy proposals and the environment in which the policy would be implemented.

Keywords: current account adjustment, business cycle, aggregative models, quantitative policy modelling

JEL-Classification: F32, E32, E1, C54

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1 Introduction

Current account surpluses have been a feature of Germany's economy since the 1950s.[1] In the aftermath of German reunification, the German current account turned to a deficit and fluctuated around -2% of GDP throughout the 1990s. At the turn of the millennium, the German current account balance started rapidly improving, reaching a surplus of almost 7% of GDP by the time the global financial crisis erupted. After a brief pause, it went up further to around 8½% of GDP in 2015. Since then it has declined slightly to around 7¼% of GDP in 2019. The persistently elevated level of the German current account surplus has attracted attention from both researchers and policymakers. Leading international institutions, in particular the International Monetary Fund and the European Commission, have long been arguing that a large part of the current account surplus is higher than desirable[2] and have recommended implementing various domestic policy measures intended to contribute to external re-balancing in Germany.

One such suggestion would be to provide more fiscal stimulus, for instance by raising government investment or reducing corporate taxes (see, for example, Fratzscher et al. (2016)). This is believed to stimulate domestic demand and imply higher imports. Second, there is the proposal that Germany should do more to raise wages in excess of productivity in order to compensate for the past modest wage developments. It is argued that higher wages would boost disposable income and contribute to higher private consumption. Domestic investment may rise as well since, faced with higher labour costs, firms would find it optimal to substitute labour with capital in production. In the course of the European (sovereign) debt crisis, it was also argued that higher wages would help other countries to regain price competitiveness, reducing Germany's trade surplus. Third, structural reforms are suggested, in particular, liberalisation of the services sector. As a result, the service sector would grow in size and attract more resources competing with the export-oriented sectors. Such reform should be supportive of domestic demand while at the same time reduce Germany's reliance on exports.

Several objections have been raised in response to these kinds of proposals (German Ministry of Finance, 2017). First, it is argued that there are no obvious policy failures or frictions which could be blamed for the observed rise in the surplus. Rather the latter is an outcome of an objective, market economy-based adjustment to developments which are beyond the

[1] See, for example, Deutsche Bundesbank (2013a).
[2] See, for example, data and estimates of the IMF External Balance Assessment (EBA): https://www.imf.org/external/np/res/eba/data.htm

government's control.[3] Second, critics point out that existing studies[4] have yet to provide convincing evidence as to whether the prescribed policies would be effective in external re-balancing and not counter-productive when it comes to internal macroeconomic stability in Germany. In support of the apparent hesitance to take more forceful action, it should be noted that, from a policy control perspective, a current account balance is a highly complex target reflecting effects of many developments stretched over time as well as across economic sectors and countries. In particular, the latter point implies that Germany's current account surplus also reflects external economic developments and policy decisions in other countries, e.g. an expansionary fiscal policy abroad. Understanding these limits is important in designing appropriate policy responses and setting realistic targets.

Bundesbank (2020a) contributed to the debate by, first, presenting estimates of the key contributors to the current account surplus in Germany over the last two decades and, second, assessing the quantitative implications of a number of the proposed measures to reduce the surplus. The retrospective analysis of the current account developments was largely carried out using a newly estimated multi-country dynamic general equilibrium (DSGE) model. The investigation of a possible adjustment in the surplus was conducted in seven macroeconomic models of the German economy, which were used to simulate three sets of hypothetical scenarios: fiscal policy, structural reforms and external shocks. While the first two scenarios deal with domestic policy measures, the last set of simulations gauges potential implications of possible external developments, which are exogenous from the national authorities' perspective. This paper documents the underlying calculations in more detail.

The simulation exercises based on various models highlight the sensitivity of the model-based estimates of the current account balance effects with respect to policy design and model choice. We find that, in the case of demand-side shocks (e.g. fiscal expenditures), the semi-structural models tend to produce larger and more persistent reductions in the current account as compared to the structural models. The latter, however, can produce a comparable or even stronger current account impact in the case of supply-side shocks (e.g. tax rate or mark-up), which have more direct effects on the relative prices. Overall, consistently with the literature, it is apparent that several considered scenarios would have to come true to bring the German current account considerably closer to a balanced state from its current level, while some

[3] For example, the persistence of the current account surplus in Germany could be related to an ageing domestic population and the implied need to save for retirement (Busl et al., 2012).

[4] Several studies provide quantitative assessments of various corrective measures which have been floated. Overall, realistically calibrated measures do not seem to be capable of bringing the current account surplus down to any significant degree. For example, Boysen-Hogrefe et al. (2017) find that liberalisation of the foreign trade in services and a fiscal stimulus of 1% of GDP (a combination of a debt-financed increase of public investment and a reduction of the corporate tax rate) would reduce the surplus-to-GDP ratio by roughly 1 percentage point over a medium term. In fact, some of the proposed measures may have ambiguous effects on the current account while at the same time inflicting sizeable damage on the domestic output. For instance, the NiGEM-based simulations show that an exogenous increase in wages would not only weaken output but also – due to a fall in employment – may lead to a lower aggregate demand, eventually causing lower demand for imports and a further improvement in the current account (Deutsche Bundesbank, 2013b).

contribution could be expected from changes which are under the direct control of the German authorities.

In line with the business cycle focus of the applied modelling frameworks, the conducted simulations mostly concern medium-term adjustments in the current account balance. An analysis of permanent shifts in the current account requires simulations of fundamental changes to the savings-investment balance, hence, calls for alternative modelling frameworks. In this regard, thanks to its explicit modelling of the precautionary savings motive, the OLG model helps to establish a link between the level of government debt and the net foreign assets position of the countries and, thus, allows for sizeable effects of debt-financed fiscal expansions on the current account. In addition, we provide illustrative simulations showing that, in a structural model with an endogenous long-term determination of the net foreign asset position – as opposed to an exogenous one of the kind employed in most standard DSGE models – labour market liberalisation may have played a more prominent role in driving the current account surplus in Germany as compared to the related estimates found in the standard DSGE models. In addition, we use an overlapping generation model to demonstrate that Germany's ageing society could be contributing sizeably to the observed persistent increase in the current account surplus.

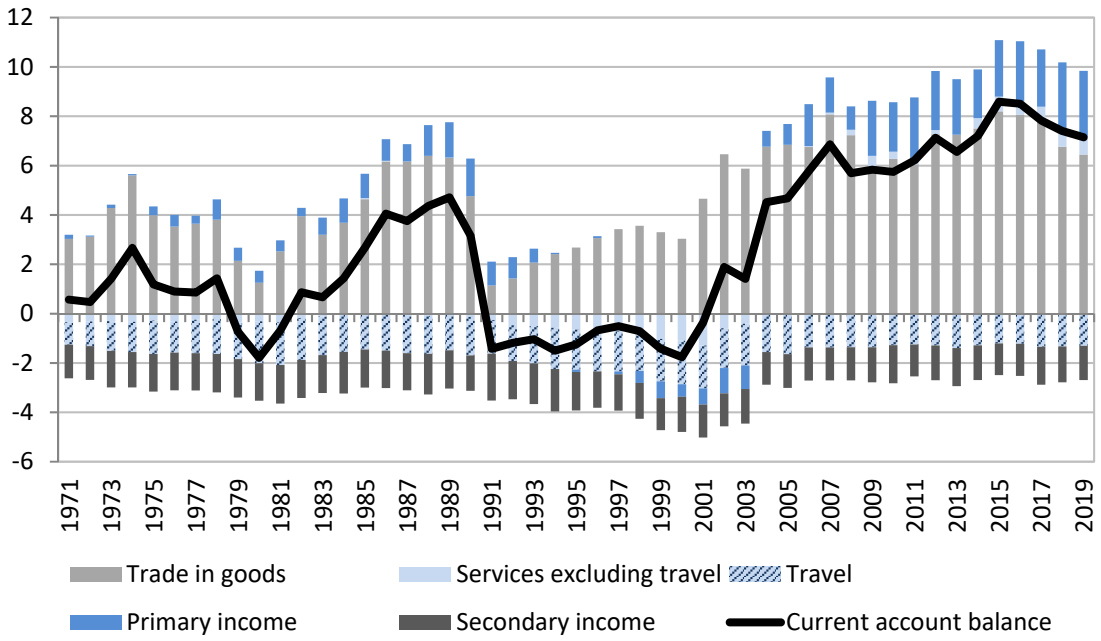
The rest of the paper is structured as follows. To provide the appropriate background for the following simulations and put them into perspective, Section 2 presents stylised facts about the evolution of Germany's current account balance and net foreign asset position. Section 3 undertakes a model-based evaluation of the key historical drivers of the current account surplus in Germany. As a first step, results of a historical shock decomposition using the Bundesbank's newly estimated multi-country DSGE model are presented. Next, we use a model with an alternative long-term determination of the net foreign asset position to gauge the sensitivity of the results, specifically regarding the role of labour market liberalisation and precautionary savings in driving the current account surplus in Germany. Lastly, we use an overlapping generation model to study the effects of an ageing society on the current account, in particular its contribution to the observed persistent increase in the surplus. Section 4 introduces the seven models used in the common scenario analysis. Motivation and design of the scenarios are discussed in Section 5. Section 6 overviews the key model-based simulation results. The concluding section summarises the main findings and discusses policy implications of the analysis. Additional statistical information, including detailed simulation results, is shown in the appendices.

2 Stylised facts

2.1 The German current account balance

The German current account surplus stood at 7¼% of GDP in 2019 and has exceeded the 6% threshold set by the European Commission in the macroeconomic imbalances procedure since 2011.[5] It reached its peak of 8½% of GDP in 2015 and has noticeably declined since then. Due to the coronavirus pandemic, the surplus is expected to decline sharply in 2020, mainly driven by trade balance adjustments.

Figure 2.1: Germany's current account
(as a percentage of GDP)



While the German current account has tended to be in surplus since the 1950s,[6] its current level is unprecedented from a historical perspective. The recent increase of the current account balance was concentrated on the years from 2000 to 2007 and from 2010 to 2015. The abrupt increase in the German current account balance around the year 2000 was preceded by a decade of current account deficits in the 1990s following Germany's reunification. These deficits were primarily driven by the strong net imports of the new federal states during the adjustment phase. Analyses based on data for the German federal states support the view

[5] For a general background on the macroeconomic imbalance procedure, see European Commission (2016).
[6] Notable exceptions were the energy crisis in 1979 and the years following German reunification.

that, without the reunification-related adjustment effects, Germany's net exports would have remained consistently positive, slightly above the level observed since the 1980s.[7]

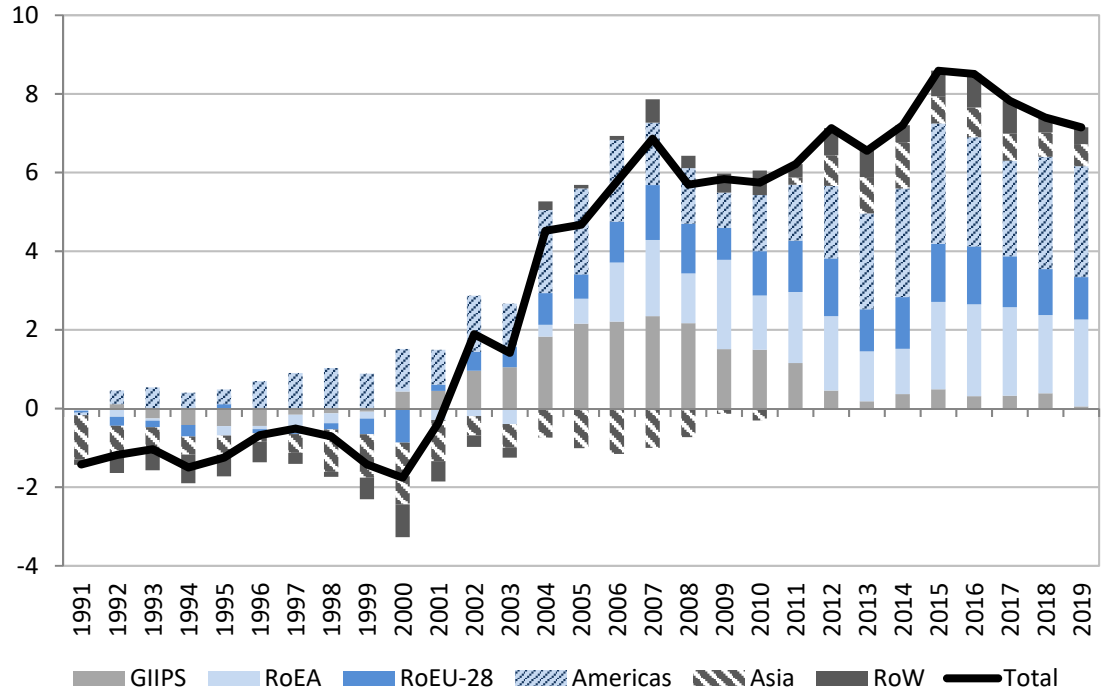
Regarding individual sub-accounts, the trade balance was the most important factor behind the current account surplus (Figure 2.1). In particular, the increase in the current account balance in both sub-periods (2000 to 2007 and 2010 to 2015) was primarily driven by hikes in the trade surplus. In the pre-financial crisis period, these hikes were a product of volume effects; between 2012 and 2016 they were due not least to favourable terms-of-trade developments (see also Deutsche Bundesbank (2018a)). Second in importance was the reversal in the primary income account – foremost the investment income balance – from a small deficit to a durable surplus since the mid-2000s. The resulting sustained current account surplus allowed for the re-accumulation of net foreign assets (see Section 2.2 for more details), which had been run down to about zero in the years after German reunification.[8] In addition, the services trade balance (excluding travel) also turned from a small deficit to a slight surplus due to a variety of sub-items. In contrast, the deficits in the travel balance and the secondary income account were comparatively stable over time.

At the current juncture, the surplus with non-euro area countries is the main contributor to the aggregate surplus (Figure 2.2). The current account with countries heavily affected by the euro area sovereign debt crisis (GIIPS countries: Greece, Ireland, Italy, Portugal and Spain) is almost balanced, while it had contributed sizeably to the increase of the German current account surplus until the sovereign debt crisis. Since then, the deficit with Asia has turned positive, and the surplus with the Americas (and to some extent with the rest of the world) has widened appreciably. Vis-à-vis individual countries, the surpluses with the United States (€70.3 billion), France (€53.6 billion) and the United Kingdom (€40.9 billion) were by far the largest in 2019 (Table A.1).

[7] See Deutsche Bundesbank (2020b).

[8] The global decline in interest rates in the aftermath of the global financial crisis, however, led to an appreciable dent in net investment income receipts (see Knetsch and Nagengast (2017, 2016), Deutsche Bundesbank (2015)).

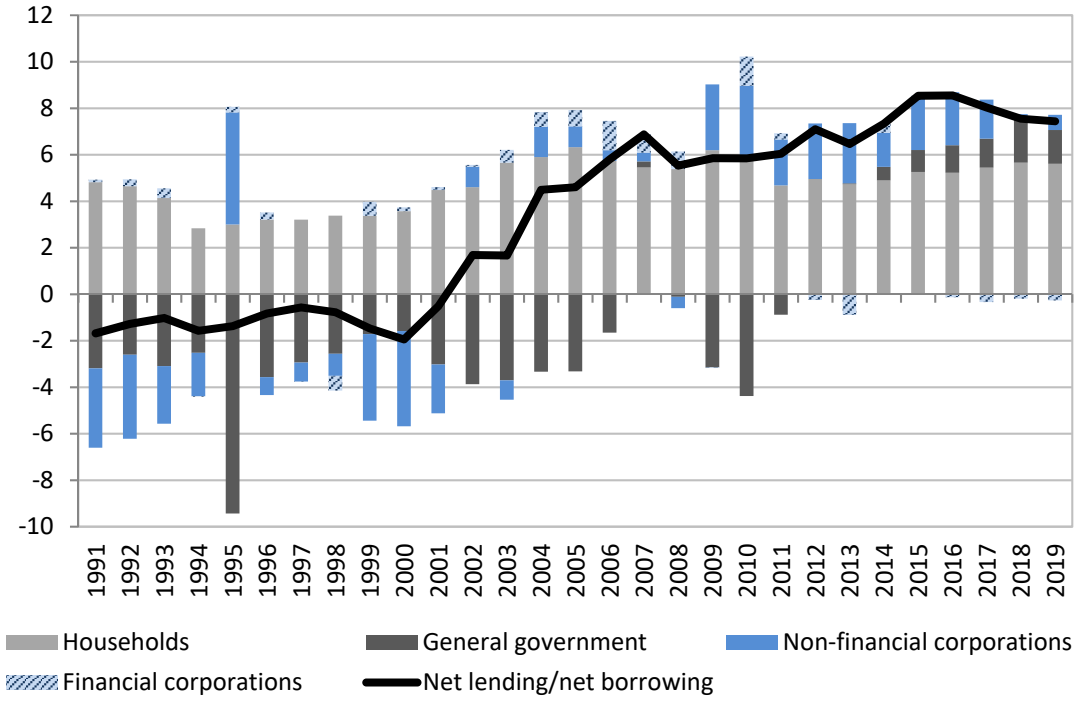
Figure 2.2: Germany's current account balance by region (as a percentage of GDP)



The German current account surplus can also be seen as the outcome of the investment and savings decisions made by the general government, households, and (financial and non-financial) corporations (Figure 2.3).[9] While the largest contribution to aggregate net lending in the past two decades has been made by households, their net lending has remained virtually unchanged since the start of the millennium. By contrast, the bulk of the increase in aggregate net lending until 2015 can be attributed to net lending by non-financial corporations (NFCs), but this has subsided somewhat since then. The sharp reduction in net borrowing by the general government, which turned into net lending in 2014, also contributed to the very high level of aggregate net lending in the later part of the sample. From an international perspective (all values for 2017), the German levels of net lending by households (Figure A.1; DE: 5.4% of GDP, EA: 1.8%, EU: 0.8%) and general government (Figure A.2; DE: 1.2% of GDP, EA: -0.9%, EU: -1.0%) are the most striking, while the net lending position of the corporate sector is less conspicuous (Figure A.3; DE: 1.3% of GDP, EA: 2.2%, EU: 1.1%).

[9] Conceptually, the aggregate net lending/net borrowing position in the national accounts equals the sum of the current account balance and the capital transfers balance. Small statistical discrepancies between the two concepts are due to the use of different data sources and methodological differences.

Figure 2.3: Net lending/net borrowing in Germany by sector (as a percentage of GDP)



From a savings and investment perspective, both an increase in savings (Figure 2.4) and a decrease in investment (Figure 2.5) contributed to the increase in aggregate net lending. Aggregate savings started to expand sharply after 2003, fluctuated strongly during the financial crisis, and showed another slight increase after 2013. In this regard, both the rise in corporate savings[10] until 2015 and the increase in government savings were the key drivers of the aggregate development, while household savings relative to GDP were broadly stable from the beginning of the 2000s.

[10] Higher savings by NFCs are potentially related to the strengthening of equity capital ratios (which were low from an international perspective at the end of the 1990s), tax factors (e.g. corporate tax reform 2000-01), and higher pension provisions as a consequence of the low interest rate environment. An arithmetic decomposition of the savings rate of non-financial corporations suggests that the increase in NFC's savings between 1999 and 2015 was primarily attributable to the declining contribution of employee compensation, lower interest costs, and the subdued distribution of corporate profits with contributions varying substantially between time periods before and after the 2007-08 financial crisis (see Deutsche Bundesbank (2019a, 2018b, 2018c, 2016)).

Figure 2.4: Savings in Germany by sector
(as a percentage of GDP)

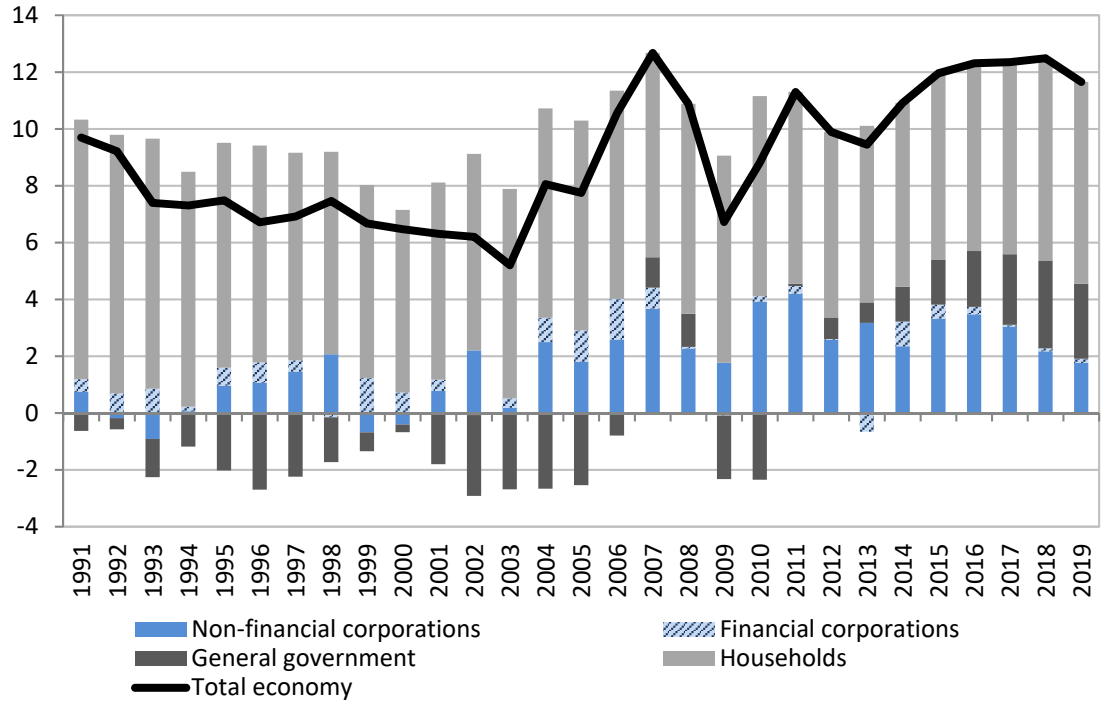
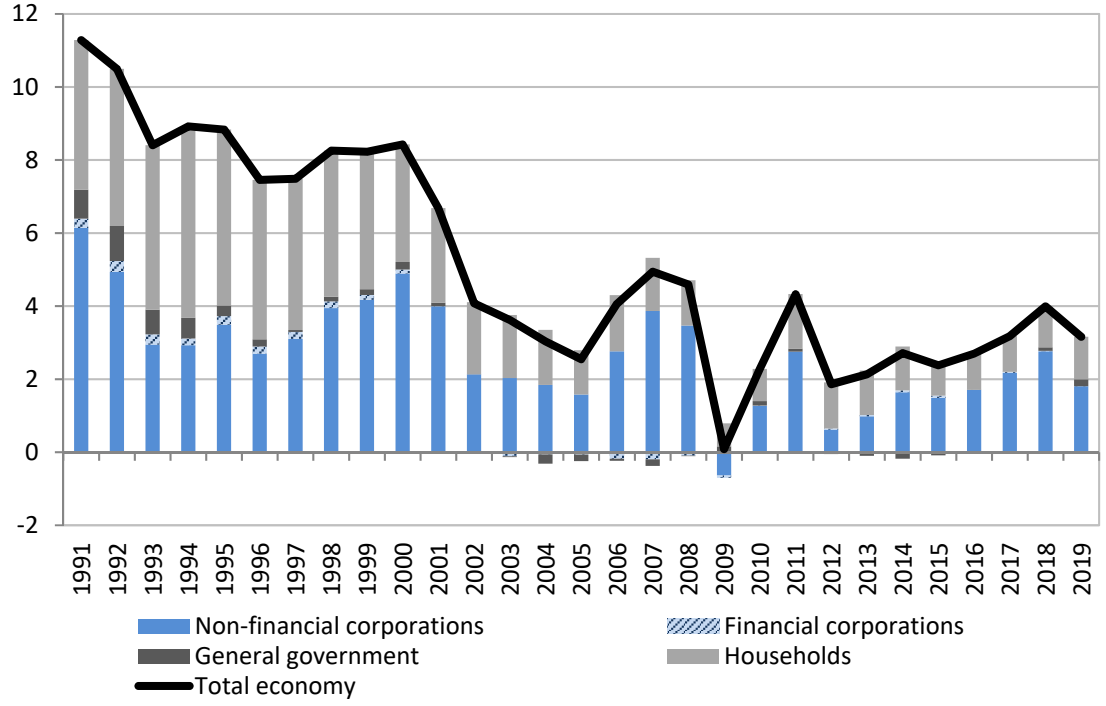


Figure 2.5: Net investment in Germany by sector
(as a percentage of GDP)



Aggregate net investment relative to GDP dropped around the beginning of the 2000s from the comparatively high level following German reunification, also showed pronounced fluctuations during the financial crisis, and has changed relatively little since then. The initial fall was driven, in part, by a decline in household investment after the building boom in the 1990s. In addition, the nominal business investment-to-output ratio has also decreased over time.[11] By contrast, by general government net investment relative to GDP has been close to zero since the beginning of the 2000s.

2.2 Germany's net financial assets position

Germany's net financial assets position has been subject to some significant changes during the past decades. In the 1980s it steadily increased, in line with permanent current account surpluses that occurred after two oil price shocks had been overcome. Then, in the aftermath of Germany's reunification, German net foreign assets (NFA) declined from 17% of GDP in 1991 to -4% in 1998 due to lower savings and substantial additional investment needs. During this period, the external position of Monetary Financial Institutions (MFIs) switched from a net surplus of €117 billion to net liabilities of €137 billion and public external debt increased from €99 billion in 1991 to €372 billion in 1998. This special effect came to an end around the turn of the millennium. Thereafter, the negative trend reversed and German NFA increased (remarkably since 2011), reflecting persistent current account surpluses. While Germany's international investment position was broadly balanced at the beginning of the new millennium, it stood at 71% of GDP at the end of 2019. The major share of this increase has occurred in the years since 2011 when the German current account balance – and hence external net savings – has consistently exceeded 6% of GDP and temporarily even surpassed 8 % of GDP.

The sectoral composition of Germany's NFA has undergone several changes since the reunification (see Figure 2.6). One of the most noticeable developments concerns the external position of MFIs. Until 2008 their net position correlated with total German NFA, reflecting their important role in cross-border payments and asset allocation. During the 1990s it switched from a surplus to a deficit before reversing after 2000. It reached an all-time high in 2008 (€627 billion). Afterwards it decoupled from total NFA of the economy and has been fluctuating around a level of about €370 billion. One likely reason for this volatile development since 2008 has been deleveraging associated with stricter regulatory requirements. As a consequence, many commercial banks reduced their external exposure, especially to the United States and United Kingdom – both home to important financial centres – and to the European periphery countries.

[11] In contrast, the price-adjusted business investment-to-output ratio shows no discernible trend and has largely fluctuated around a constant value since German reunification. This suggests that price trends for capital goods and gross value added differed during this period (see also Deutsche Bundesbank (2018d, 2017a)).

Figure 2.6a: Sectoral composition of Germany's NFA position, 1980 to 2019 (€ billion)

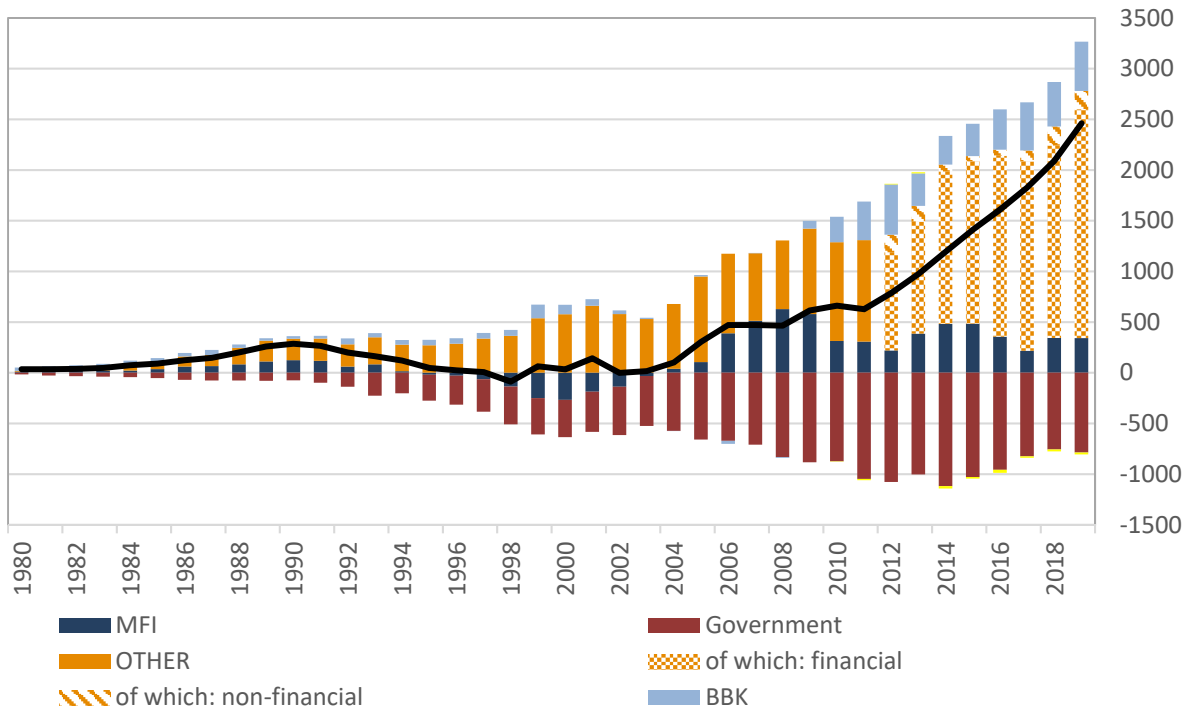
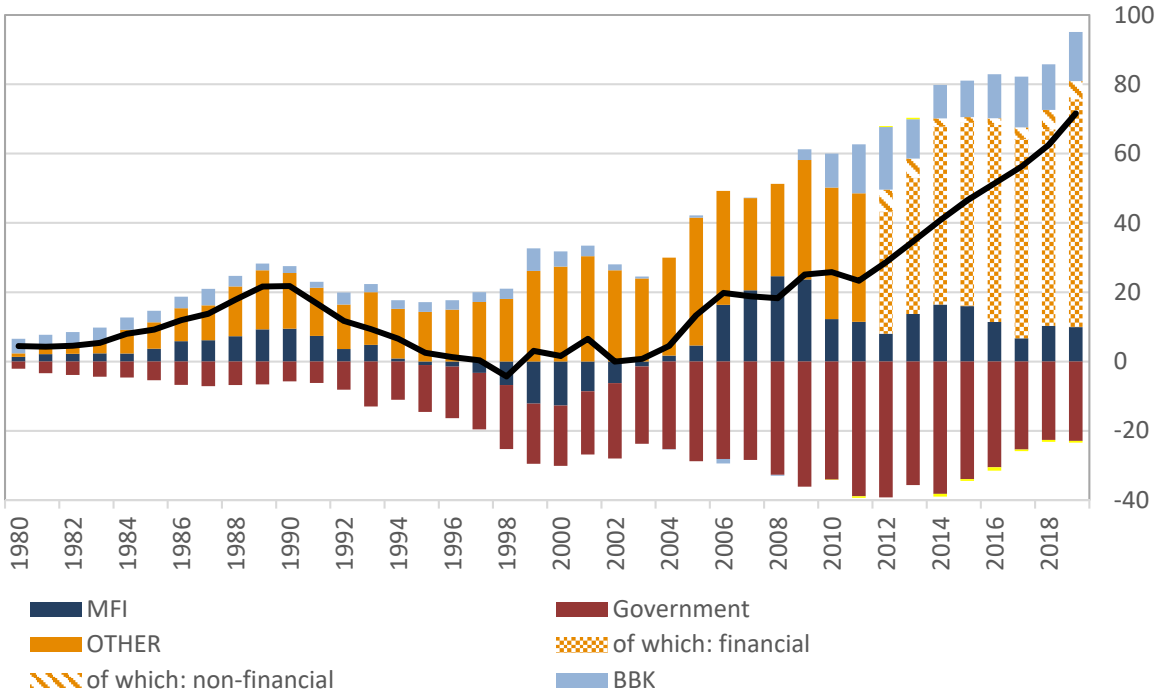


Figure 2.6b: Sectoral composition of Germany's NFA position, 1980 to 2019 (as a percentage of GDP)



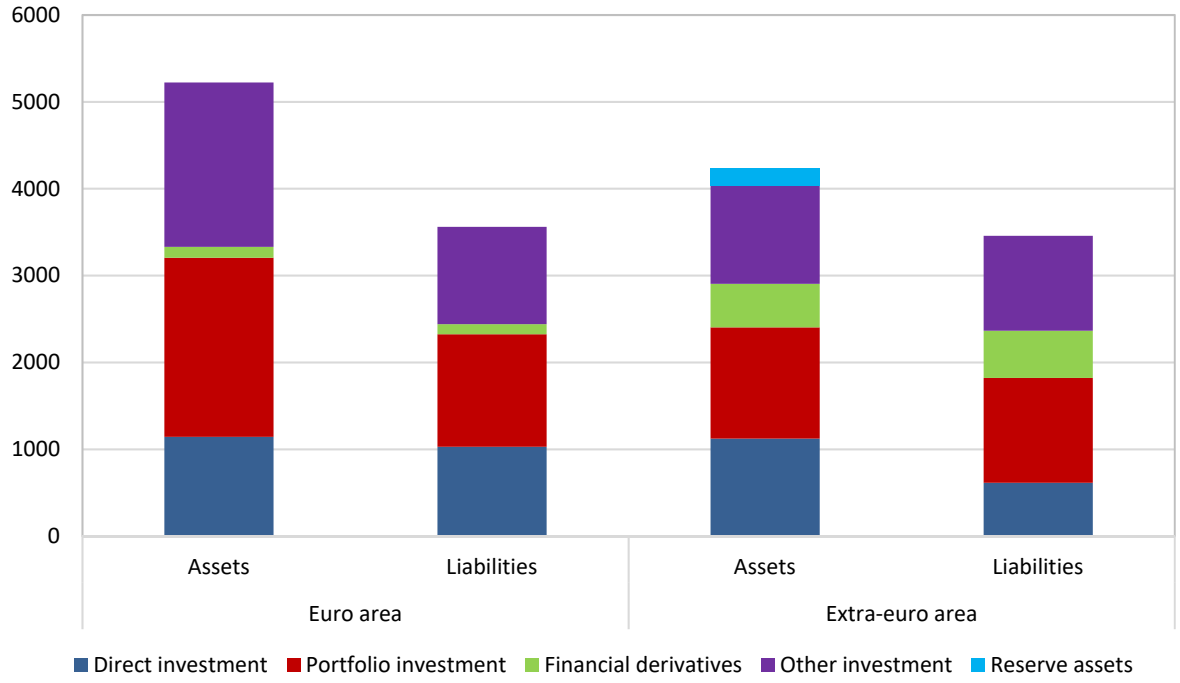
Another marked change relates to the net external position of the Bundesbank which, from 2009, has added significantly to positive overall NFA. After a temporary decrease in the years 2013 and 2014, the Bundesbank's net asset position has been growing to a level of €487 billion recorded at the end of 2019. This upward trend has mainly been driven by the Bundesbank's claims on the ECB within the Eurosystem's common payment system TARGET2.

Since 2012, the private non-bank sector has been disaggregated into a financial[12] and a non-financial sub-group. In general, this category ("other") has become more important since the disaggregation was introduced. The financial sub-category is clearly dominant with a positive net position of €2258 billion in 2019 against the non-financial sub-category's €179 billion. While net financial assets of non-financial firms have increased only slightly in recent years, the rise in net financial assets has been much stronger for financial firms, including investment funds and insurance companies. This development has been partly due to portfolio rebalancing as domestic ("institutional") investors - in a search for yield - have bought non-euro area securities on a large scale.

The NFA position of the German government has been continuously negative throughout the last two decades, reflecting substantial holdings of sovereign bonds by foreign investors, with a peak in absolute terms of €1,119 billion in 2014. Net foreign government assets have since been following a positive trend with a value of -€787 billion in 2019 not least on the back of purchases of German Federal bonds ("Bunds") by the Bundesbank from foreign holders under the Eurosystem's asset purchase programme (APP).

[12] E.g. insurance corporations, investment funds and pension funds.

Figure 2.7: Geographical composition of Germany´s NFA position: Euro area vs. extra-euro area, 2019



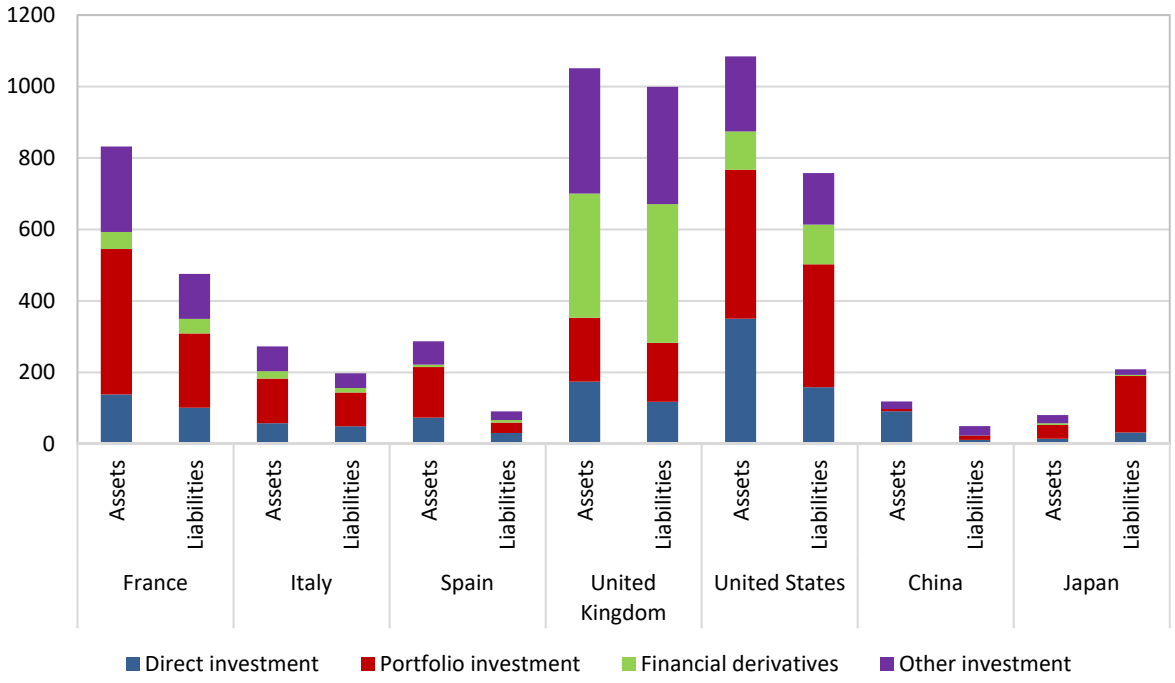
Germany's positive overall NFA position of €2,446 billion recorded in 2019 mainly arose within the euro area (+€1,663 billion) while the extra-euro area contribution was considerably smaller (+€783 billion).[13] With regard to euro area countries, Germany's direct investment position is almost balanced, reflecting the strong mutual integration of the European corporate sector, while assets from portfolio investment and from other investment significantly exceed respective liabilities. Within other investment, net assets of the Bundesbank (€+236 billion) play an important role.[14]

A different picture emerges when we consider the extra-euro area perspective. Here, the German net direct investment position is clearly positive, due to the international orientation of German firms. Portfolio investment and other investments are more balanced.

[13] One reason could be that Germany acts as a financial hub attracting funds from countries outside the euro area and channelling these funds to other member states.

[14] The decisive factor in this position is TARGET2 claims on the ECB that amounted to €895 billion at the end of 2019. Their marked increase since the end of 2014 has been mainly driven by the Eurosystem's asset purchase programme (Deutsche Bundesbank, 2017b).

Figure 2.8: Geographical composition of Germany's NFA position: selected countries, 2019



While the bilateral NFA positions with the three largest euro area economies are markedly positive (France +€356 billion, Italy +€75 billion, Spain +€196 billion), Germany also has a positive net investment position with the United Kingdom amounting to around €52 billion.[15] For the three euro area countries, net portfolio investment is the major category of the overall bilateral NFA position. Vis-à-vis the United Kingdom, the overall position is substantially influenced by net direct investment, even if gross positions of financial derivatives and other investment are much higher. Regarding the United States, Figure 2.8 displays a positive net position of around €326 billion at the end of 2019, with Germany engaging in direct investment worth approximately double its liability position. China has become more important in recent years: the NFA position now amounts to €69 billion, mainly due to heavy German direct investment in China. Finally, Japan is one of the few countries against which Germany has a negative NFA position (-€128 billion). The bilateral financial relations are characterised by large German liabilities in portfolio investments. This reflects the role of German government bonds as safe assets and their increased weight in official foreign reserve holdings in countries outside the euro area.

[15] In general, bilateral NFA positions should be interpreted with caution because the information on the actual holder of liabilities is imperfect.

3 The current account balance through the lens of structural models

3.1 Historical shock decomposition of German net exports

This section presents the results[16] of a structural shock decomposition of German net exports (including both goods and services trade) based on the Bundesbank's large-scale DSGE-model maintained by its Research Centre (FzBBKM).[17] In principal, the current account balance could also be extracted from the model as the change in the net foreign asset position. However, unlike the aggregate German net exports, the current account does not enter as an observable variable in the Bayesian estimation of the model parameters. Consequently, the model-implied current account does not necessarily coincide with the actual series from official statistics, which is why the shock decomposition was performed for net exports instead.[18]

As is common in DSGE models, which were primarily designed for the purpose of business cycle analysis (i.e. the analysis of cyclical fluctuations around some steady state), the German net exports were demeaned prior to the estimation, with the historical mean being 4½% of German GDP over the sample period Q2 1995 to Q4 2019.[19] Therefore, only variations of the German net exports around the historical mean can be explained by the shock decomposition.[20] Hence, a large part of the German net exports over the period under review remains unexplained in the FzBBKM (and similar DSGE models).

The model comprises a total of 22 structural economic shocks. In the interests of parsimonious exposition and achieving a more meaningful economic interpretation, the shocks were aggregated into nine groups: German technology (*Technology DE*), German aggregate savings (*Savings DE*), German aggregate investment (*Investment DE*), German government spending (G*overnment spending DE*), German wages (*Wages DE*), other domestic shocks including the share of tradable goods and the price-mark up (*Other DE*), euro area monetary policy shocks (*Euro area monetary policy*), rest of the euro area shocks (*Rest of euro area*), and rest of the world shocks (*Rest of world)*.[21]

[16] See also Deutsche Bundesbank (2019b).

[17] The model was estimated using Bayesian techniques using data from Q2 1995 to Q1 2017. A detailed description of the model can be found in Hoffmann et al. (2020). For related work that analyses the German current account balance using an estimated large-scale DSGE model see Kollmann et al. (2015).

[18] Even though the primary income balance gained in importance in the aggregate current account balance from around the year 2000 (Section 2.1), net exports were the main reason for the increase in the current account surplus in the time period under investigation.

[19] The historical mean over the period 1950 to 2019 is approximately 3% of GDP.

[20] While German net exports also exhibit an upward trend over the sample period, it was assumed for the purpose of the estimation (and thus also of the shock decomposition) that the net exports are stationary, i.e. they will return to the mean value in the long run.

[21] Details regarding the shock classifications can be found in the appendix (Table B.1).

Figure 3.1 shows the shock decomposition of the aggregate German net exports. The figure depicts the deviations of net exports as a fraction of GDP from the historical mean in percentage points (pp) and the contributions of each group of structural shocks (as well as the contributions stemming from the initial condition[22]). According to the model results, a considerable amount of the increase of the net exports until the beginning of the 2007-08 financial crisis was driven by increasingly positive contributions on the part of technology and savings as well as from government spending. Shocks in the rest of the euro area also contributed positively to the increase in the surplus. In this context, a decrease in savings and additional government spending were among the most important factors.

In contrast, the significant reduction in German net exports shortly after the occurrence of the financial crisis was mainly driven by technology shocks in Germany (i.e. the reversal from positive to substantially negative contributions).[23] Furthermore, a significant part of the reduction in the years 2008 and 2009 can be accounted for by shocks belonging to the *Rest of world* group.

The results suggest that – among domestic factors – positive shocks to technology and savings, as well as negative shocks to investment and, to a lesser extent, to government spending contributed to the further increase in the German net exports over the period 2011 to 2015.[24] With regard to investment, it cannot be ruled out that the positive contribution from low investment is partly due to the government sector since investment enters the estimation as aggregate gross fixed investment (also comprising government investment).

Shocks in the *Other DE* group also contributed to the most recent increase in German net exports. In this respect, a shock to the share of traded goods in consumption (i.e. the share of traded goods in German consumption declined) and price mark-up shocks in the tradable sector were the most important factors. In contrast, the effects from domestic wage developments as well as from monetary policy shocks in the euro area seem to be less important over this period.

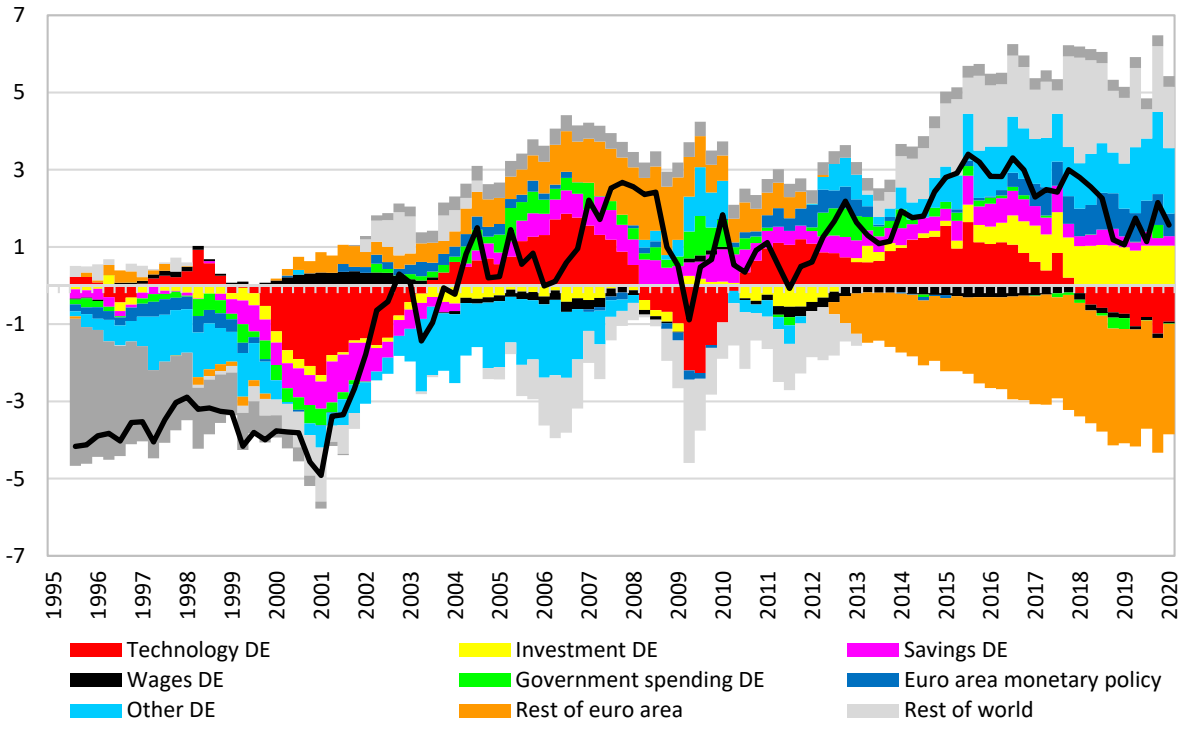
Shocks in the rest of the world also contributed positively over the 2011 to 2015 period, in particular due to a risk premium shock (i.e. the risk premium decreased in the rest of the world) and a shock to the share of traded goods in overall consumption (i.e. the share of traded goods

[22] The paths of the endogenous variables are affected by the distance from steady state at the first point in time. The decomposition takes into account the effect of the initial condition such that the contributions of structural shocks and the initial condition sum up to the endogenous variable net of its steady state. The contribution of the initial condition at the beginning of the sample period can be substantial (see Figures 3.1 and 3.2), but converges to zero over time.

[23] Note that the contribution of technology shocks in Germany appears to be pro-cyclical: positive in boom periods and negative in economic downturns. In general, the technology component in standard production functions reflects the part of economic activity that is not directly related to the main input factors capital and labour. Therefore, measured technology is typically constructed as a residual whose variations over time may, in principle, also reflect changes in other factors such as human capital or input factor utilisation (see, for instance, Imbs (1999)). In this respect, it also cannot be ruled out that the technology component in the model acts as a catch-up variable for factors that are not explicitly modelled (e.g. financial shocks).

in consumption increased in the rest of the world), while fiscal policy in the rest of the world has attenuated the increase since the financial crisis. Since the sovereign debt crisis, shocks in the rest of the euro area have increasingly dampened German net exports. Among the most important drivers in this regard were weak investment, higher savings, and lower government spending.

Figure 3.1: Shock decomposition of the aggregate German net exports (deviations from historical mean and shock contributions in pp)



Turning to more recent developments, the perceptible decline in German net exports starting around 2015-16 was mainly driven by technology shocks in Germany (i.e. the reversal from positive to negative contributions).

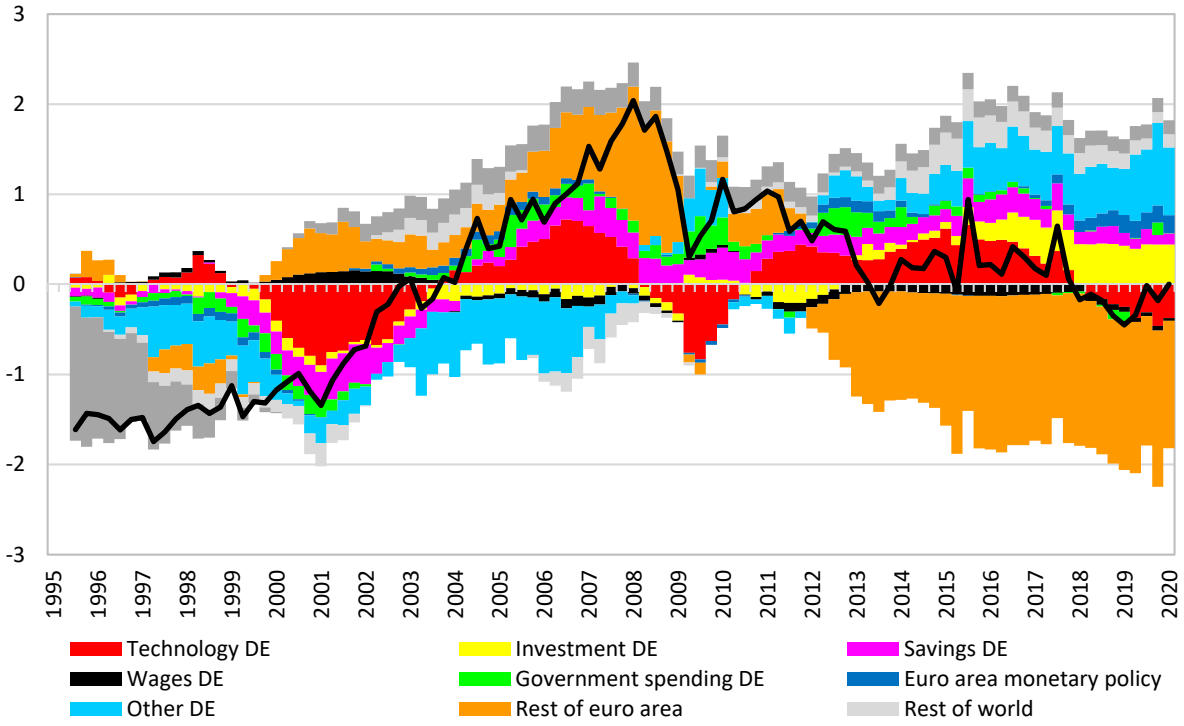
A similar shock decomposition can be performed for German net exports vis-à-vis the rest of the euro area only (Figure 3.2), which, in contrast to aggregate net exports, persistently declined after the financial crisis.[25] The results concerning the drivers of the increase in net exports vis-à-vis the rest of the euro area before the crisis are broadly in line with those described above. Analogously, while all other factors show qualitatively similar contributions

[25] As the corresponding time series was not used in the estimation of the model, the model-implied series deviates from the actual counterpart from official statistics. While, for instance, the net exports stood at the historical mean in 2013 according to the model results, the balance of payments statistics points towards net exports as a fraction of GDP which were around ¾ percentage points lower than the historical mean. The results from this decomposition should therefore be interpreted with caution.

to the aggregate net exports after the financial crisis, the rest of euro area group was the main driver of the decline after the year 2008.

When interpreting the results, it should be kept in mind that, first, the FzBBKM and similar DSGE models are designed for business cycle analysis and hence not able to account for permanent shifts in net exports (see above).[26] Second, the model assumes that net exports are stationary while trending data is used for the estimation of the model. Finally, other factors – which are not satisfactorily reflected in the FzBBKM – may have contributed to the evolution of net exports such as the tax reform in Germany in the 2000s and the launch of the euro.

Figure 3.2: Shock decomposition of German net exports vis-à-vis the rest of the euro area
(deviations from historical mean and shock contributions; in pp)



Overall, the results presented in this section tend to support the view that the large and persistent surplus of German net exports is due to a multitude of factors, none of which – taken in isolation – can account for the observed increase in the surplus. Furthermore, based on the historical shock decomposition, only part of the surplus can be attributed to domestic factors,

[26] It is also possible to assess how quickly net exports would converge back to the historical mean in the absence of new orthogonal shocks. The appendix (Figure B.1) contains an unconditional forecast of the aggregate German net exports in which the speed of convergence ultimately depends on the persistence of the (estimated) shock processes. From the viewpoint of the model, the first quarter to be projected corresponds to Q2 2017 (i.e. the first data point not used for the estimation of the model). The model predicts a reversal of net exports within around two years before slowly converge back to the historical mean. Given the relatively quick reversal of net exports, however, the forecast can only be regarded as an illustration of the model's propagation mechanism rather than being an economically meaningful forecast of German net exports.

let alone to those which can be directly influenced by policy. While, for instance, weak domestic investment and low government spending contributed to the German net exports, the quantitative effects, estimated over the historical sample, seem to be rather small. In contrast, a significant fraction of the increase was due to external factors. The impact of possible changes in both domestic policy and external factors on the current account adjustment going forward are analysed in greater detail in Sections 5 and 6.

3.2 Labour market liberalisation and precautionary savings in a model with an endogenous NFA position

As stressed in the introduction, the focus of the modelling framework applied in the previous subsection concerns medium-term developments in the current account balance. This is due to the underlying model setup. Given the commonly used infinitely-lived representative agent assumption, it has difficulties in identifying permanent changes to the savings-investment balance and, hence, the current account.[27] The reason is that such factors entail steady-state indeterminacy and non-stationary dynamics of NFA. To overcome this problem, modellers usually assume the existence of additional frictions in the international financial markets whenever holdings of NFA exceed some exogenously fixed reference level. That introduces a link between consumption and the NFA position to achieve stationarity. While this pins down the steady-state level of international financial assets uniquely, it does so independently of structural economic (policy) conditions.[28] Structural economic (policy) changes, however, may entail structural changes to the savings-investment balance. To display such effects, one therefore has to move away from the common representative agent assumption.

Against this background, we use a two-region real business cycle model with job search frictions and incomplete insurance that generates permanent savings and interest rate effects in response to permanent policy changes to quantify the contribution of far-reaching German labour market reforms in the early 2000s to its current account.[29] Compared to existing literature using a standard DSGE model to analyse this question (Gadatsch et al. (2016a), Busl and Seymen (2013), and Baas and Belke (2014)), we can establish a link between these reforms and the evolution of NFA, and our results suggest that the reforms may have contributed to the increase in the German current account surplus.

[27] Gadatsch et al. (2016a) show that, within a stereotype DSGE model, structural (fiscal) policy reforms in Germany during the 2000s had basically no impact on the German NFA position and its current account. Similar results are obtained by Busl and Seymen (2013) as well as Baas and Belke (2014). Not related to the specific German reform package, the general finding of no long-term current account effects of structural labour market policies is confirmed by, for example, Dao (2013) and Cacciatore et al. (2016). This stands in contrast to the (policy) argumentation discussed previously.

[28] Among others, Schmitt-Grohe and Uribe (2003) discuss the necessary modelling assumptions in more detail. Their usefulness in analysing the impact of structural economic changes on external balances is questioned by, for example, Lubik (2007), Di Giorgio and Nistico (2013) and others.

[29] See Hochmuth et al. (2019) for a formal model description. It is a modified extension of the one-country model introduced by Challe and Ragot (2016).

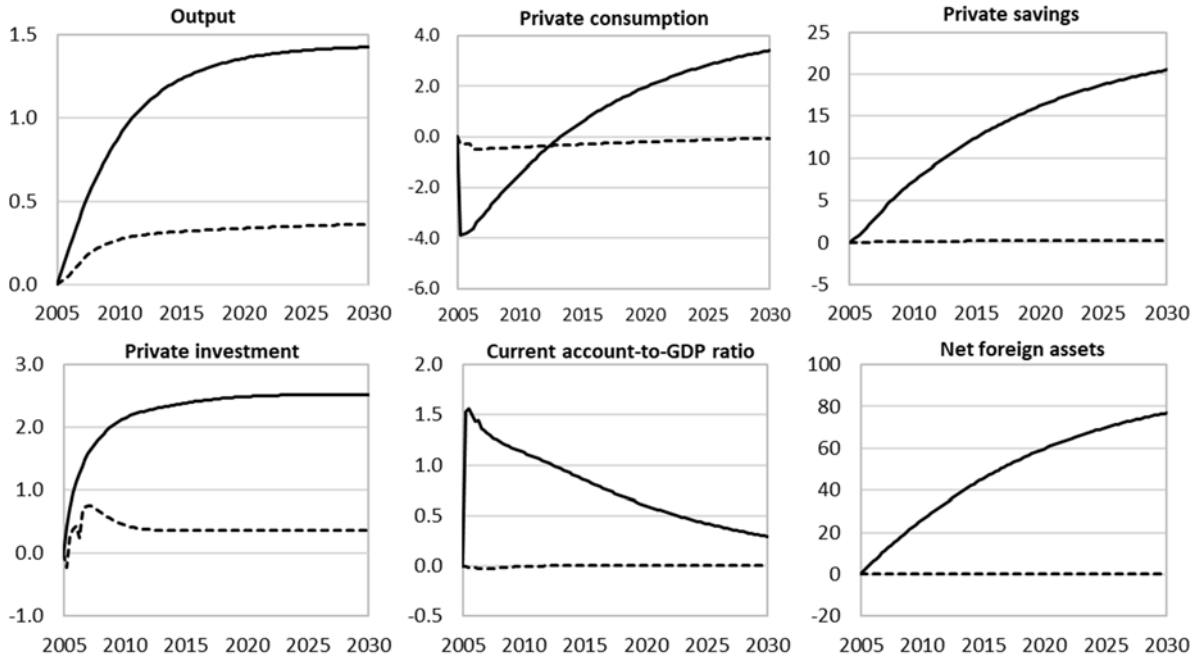
In the model, it is assumed that workers live in a large family while employed, and all family members make the same consumption/savings decisions. Once a worker becomes unemployed, he has to leave the family and must subsequently live on his own. He is allowed to take a share of the family assets with him and receives unemployment benefits. When finding a job again, the (formerly) unemployed worker re-enters the family and brings back the assets not used up during his unemployment spell. He is not allowed to borrow. Idiosyncratic unemployment shocks yield an endogenous distribution of workers that can be aggregated at each point in time, thus generating limited cross-sectional heterogeneity.

The incomplete consumption insurance gives rise to a first-order precautionary savings motive. Family members want to insure against income and consumption losses in case of unemployment. The amount of savings is derived endogenously and also depends on the unemployment risk. Households can save in physical capital and government bonds domestically. If domestic savings exceed the domestic asset demand, they also invest in international assets. The endogenous world interest rate guarantees that aggregate world asset demand equals supply. Therefore, the NFA position between the two regions is determined endogenously in our model, including in the steady state.

A reduction in the generosity of the unemployment insurance system in Germany yields the expected labour market effects. Because the fall-back utility of workers declines, they accept lower wages. This fosters job creation, employment and production. International competitiveness eventually increases because of lower unit labour costs. For savings, there are two opposing effects. On the one hand, higher job creation reduces the risk of a long unemployment spell. This reduces the need for precautionary saving. On the other hand, when becoming unemployed, the income loss increases. This augments the need for precautionary saving. Which of the two effects dominates is not clear from an ex ante perspective. However, when simulating the German labour market reforms, it is clearly the latter. In order to build up the desired level of savings, aggregate consumption in Germany falls for some time before rising again once asset holdings have increased sufficiently.

The increase in savings in Germany is not fully absorbed domestically. Hence, Germans transfer savings to the foreign region and the NFA position rises. This increases the German current account. As global saving increases, the world interest rate starts falling. These results are summarised in Figure 3.3. Compared to a simulation in which an analogous standard DSGE model with perfect insurance markets is used, the model suggests quantitatively important and permanent effects on the German NFA position and global imbalances.

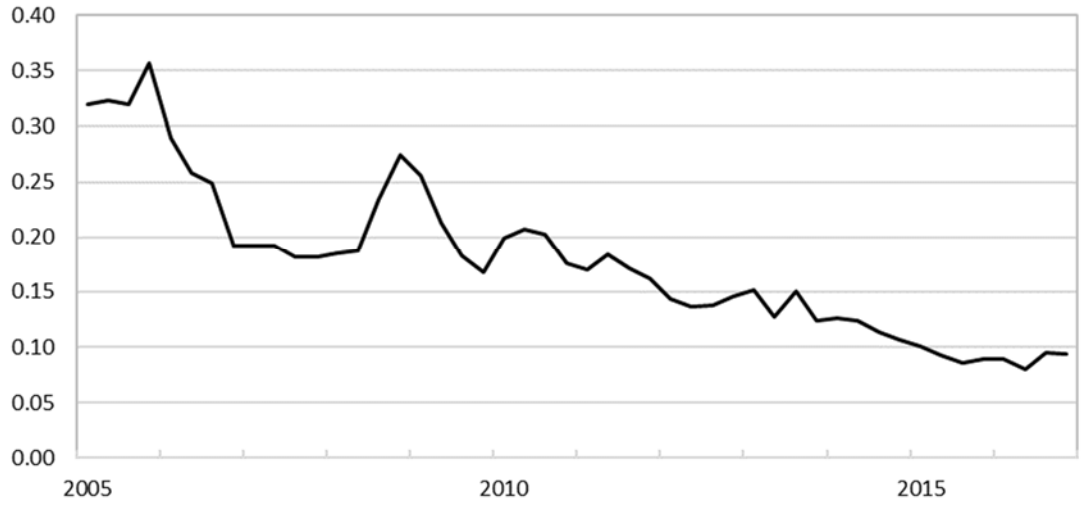
Figure 3.3: Macroeconomic effects of the German labour market reforms in the early 2000s



Note: This figure depicts the model-based responses of selected macroeconomic variables to the German labour market reforms in the early 2000s. Solid lines report the results in the incomplete insurance model described in this chapter. Dotted lines are those of the corresponding complete insurance model for comparative purposes. All responses are reported as percentage deviations from the baseline, except for the responses of the current account balance ratio which is reported as percentage-point deviation.

Figure 3.4 depicts the share of Germany's current account relative to GDP that can be explained by the labour market reforms. More precisely, it shows the quarterly current account effects generated by the model simulations as a share of the actual quarterly current account developments in the data for the years 2005 to 2016. Over the entire time span, according to this model, the labour market reforms have contributed by around 10 to 35% of the current account developments. As discussed above, the German current account relative to GDP was 4.8% in the first quarter of 2005 and climbed to around 8% by the end of 2016. On average, 0.58 percentage point (or roughly 18%) of this 3.2 percentage point-increase could be attributed to the labour market reforms according to the model simulations.

Figure 3.4: Share of Germany's current account ratio explained by labour market reforms in the early 2000s



Note: This figure depicts the share of the model-based increase in Germany's current account surplus after simulating the labour market reforms of the early 2000s relative to the increase observed in the data. The data is retrieved from Eurostat and seasonally adjusted on a quarterly basis using X12-Arima given that the model is calibrated at quarterly frequencies.

3.3 Effects of an ageing society on the current account in an OLG model

An alternative way to overcome the problem of indeterminate NFA, as discussed in the previous subsection, is to consider finite life time horizon. In overlapping generations (OLG) models, individuals want to insure against longevity and, therefore, have an endogenous savings motive. Furthermore, it is often argued that ageing societies – a term which certainly reflects the situation in Germany – tend to build up NFA and, thus, generate a higher current account balance. In order to assess how much ageing may have contributed to the German current account surplus, we simulate the German demographic situation in a multi-region life-cycle model.[30]

To analyse the impact of ageing on the current account, we apply a two-region real economy model that places particular emphasis on the demographic structure. This is done by including a life-cycle pattern on the household side, assuming that each region is inhabited by 80 cohorts at each point in time. An individual becomes economically active at the age of 20 and dies for sure at 100. In between, the individual may die with a certain probability each period. Life is split between a working phase and a retirement phase. Even though there is a public pension scheme, savings are also built to smooth consumption during the retirement period. Individuals

[30] A more detailed description of the applied model as well as the simulation can be found in the internal Bundesbank note by Matthias Schön, Auswirkungen der Alterung auf die Leistungsbilanz im Bundesbank-OLG-Modell "DEmOLG", 3 January 2019. Results qualitatively analogous to those shown here can also be obtained in an OLG model with a somewhat simpler life-cycle structure than the one applied in "DEmOLG"; see Schön and Stähler (2020).

can save in physical capital. The two regions reflect Germany and the rest of the European Union (the latter as an aggregate). Each region produces a homogenous good, and capital can move freely between the two regions.

Generally, the accumulation of foreign assets in the model reflects the difference between the domestic supply for capital and its domestic demand. Demographic changes, such as population ageing or an increase in life expectancy, can have an impact on demand for and supply of capital.

Specifically, demographic changes may affect the domestic supply of capital via their impact on the population's total savings in two ways. First, they alter the savings behaviour of individual households. Given a longer life expectancy (and an unchanged retirement age), the period over which a household draws the comparatively low income from a pension is extended. Moreover, in light of lower birth rates, households are anticipating that an ever smaller number of young people will have to fund the pensions of an ever greater number of retirees. The pressure on the pension system arising from this could, depending on the characteristics of the pension insurance scheme, lead to falling pensions (and/or rising contribution rates). The income gap in old age would become wider, and the optimal amount of assets required to smooth consumption would be higher. In order to smooth the consumption level in old age, the household must accumulate more wealth up until it enters retirement. This way higher individual savings raises the total assets of the economy. Second, ageing also changes the compositional structure of the population. The bulk of the population shifts from asset-poor young households towards asset-rich old households. Aggregated across all households, this raises the economy's total assets. The implied compositional effect is not dependent on the changed savings behaviour described above.

Turning to the demand side, demand for capital in an ageing society tends to fall. Due to the declining working-age population, the number of people in employment goes down. If this number decreases due to demographic trends, the demand for capital also falls. As a result, a greater supply of capital and lower demand for capital domestically lead to capital exports, growing NFA and a positive current account balance.

The Eurostat demographic projections[31] anticipate a continuous increase in life expectancy and ageing of population in Germany and the rest of the EU. In a quantitative exercise using an OLG model below we assess the implications of the anticipated demographic changes for the German current account surplus adjustment going forward.

As regards the projected demographic trends, panel (a) of Figure 3.5 depicts the expected growth rate of the population younger than 65 in Germany (black lines) and the EU (blue line) over 2020 to 2080. For most of the period considered, the growth rate in Germany is expected

[31] Eurostat (EUROPOP2015) https://ec.europa.eu/eurostat/en/data/database

to be negative. The largest a decline (-1.2 %) in 2029 can be chiefly attributed to the baby boomer generation reaching its retirement age. Falling numbers of births and lower immigration play only a subordinate role. As for the rest of the EU figures, a significant decline in the population of under 65s is also expected, though primarily in the first half of the sample.

Panel (b) shows the expected growth rate of the population older than 65. In Germany, until 2040 it is significantly positive, with the largest growth rate expected in 2028. The growth rate of the EU population older than 65 is positive until 2048.

The implied old-age dependency ratio[32] in Germany will increase from just under 35% (in 2016) to 62% (in 2070) (see panel (c)). The ratio sees significant fluctuations over time caused by disproportionately large generational cohorts, such as the baby boomers. In the EU, the old-age dependency ratio rises from 27% in 2016 to 56% in 2080. This means that the EU old-age dependency ratio remains below that of Germany over the long term, but exhibits similar growth between 2016 and 2080.

Panel (d) depicts the relationship between old-age dependency ratios in Germany and abroad (rest of the EU). Over time, the level fluctuates significantly. However, no persistent deviation from the mean is anticipated. The main reason for the fluctuations is that the baby boomer generation in the rest of the EU is significantly smaller than in Germany.

Turning to the model simulations, we consider two scenarios. In the first one (scenario 1) the demographic change only occurs in Germany (grey dashed lines) and, in the second one (scenario 2), the demographic changes in both Germany and the rest of the EU are considered (blue and black solid lines).[33]

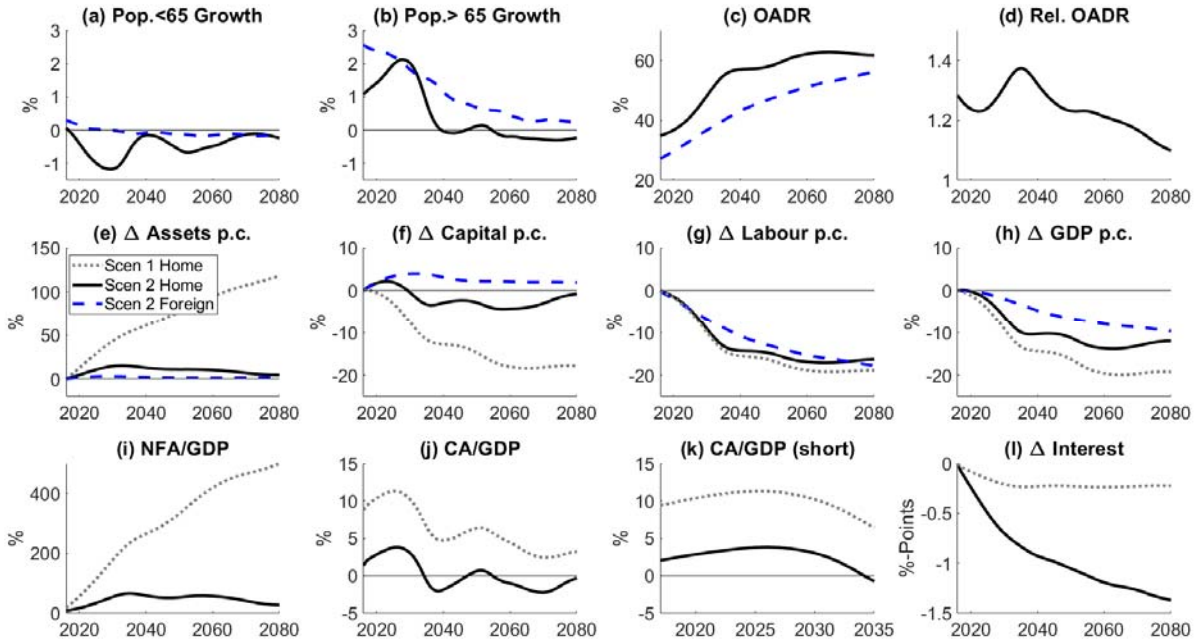
In scenario 1, assets of domestic households rise sharply. As a result, the current account balance improves by 5-10% of GDP over the first decade of the simulation period. The current account (CA) balance reaches its peak by around 2025 (see panel (k)) and remains positive thereafter, as the domestic population would continue to age. On the demand side, however, the declining number of employed persons in Germany leads to a reduced demand for capital. The implied lower capital stock and lower number of employed persons result in a reduction of aggregate GDP (and GDP per capita). At the same time, given that, according to our calibration, Germany constitutes approximately one-fourth of the “global” economy (i.e. the EU), an increase in the German savings rate would reduce return on assets globally (panel (l) in Figure 3.5). The latter has a dampening effect on the current account balance.[34]

[32] The old-age dependency ratio is defined as the ratio between the population aged over 65 and the population aged under 65. A rising old-age dependency ratio indicates an ageing society.

[33] All variables of the model are detrended and in real terms. Given the model does not account for a positive productivity growth rate, a positive inflation rate and a positive NFA position, the resulting current account in the model actually underestimates the current account balance which is needed to reach the desired foreign asset position (by probably 1% of GDP).

[34] If it was assumed that "foreign" refers not only to the rest of the EU but to the rest of the world, then Germany would be a small, open economy and its savings would have no impact on the global return on assets. In comparison with the described scenario,

Figure 3.5: Macroeconomic effects of the demographic change in Germany and the European Union



Note: Grey dashed lines show simulation results for Germany in scenario 1. Black lines show simulation results for Germany in scenario 2. Blue lines show demographics for the EU. Panel (d) shows the ratio between Germany and EU OADR. Panels (e)-(h) & (l) show deviations relative to the 2015 level.

In scenario 2, the effects on domestic macroeconomic variables (black solid line) are considerably less pronounced as compared with scenario 1. In the second scenario, households' savings behaviour and the demographic structures in other countries are changing as well. Population ageing abroad leads to a lower number of employed persons and a lower output in other countries. A stronger rise in savings globally implies a more pronounced fall in the return on assets. Hence, the accumulation of foreign assets by Germany follows a more moderate path, and the domestic capital stock actually increases in the first half of the sample. The number of employed persons as well as output in Germany is higher than in scenario 1. The smaller build-up of wealth and the less pronounced drop in the number of employed persons in Germany lead, on average, to a lower current account surplus which is, however, still sizeable (see panel (j)).

interest rates would not fall and households would increase their saving as a result. The additional wealth would largely flow abroad, driving the current account surplus up further.

4 Models

In the previous section, we identified potential contributors to the rise of the current account surplus in Germany since 2000s. We now turn to a common modelling exercise with a view to evaluating a range of possible adjustments in the current account associated with various domestic policy measures and possible external developments. To this end, we apply macroeconomic models which are regularly used at the Bundesbank in the context of policy analysis.

Specifically, the quantitative assessment of alternative current account re-balancing scenarios is carried out using the following models:

- EAGLE: **E**uro **A**rea and **GL**obal **E**conomy model
- FzBBKM: **F**orschungs**z**entrum's **B**undes**B**an**K** multi-country **M**odel
- FiMod: **Fi**scal policy **Mod**el
- FiModOLG: **Fi**scal Policy **Mod**el with an **O**ver**L**apping **G**eneration structure
- GEAR: **GE**rmany in the **E**uro **AR**ea model
- NiGEM: **N**ational **i**nstitute **G**lobal **E**conometric **M**odel
- MEM: **M**acro-**E**conometric **M**odel of the Bundesbank

These models feature rather diverse modelling frameworks, partly reflecting the different purposes for which these models were originally designed and have been used at the Bundesbank. Specifically, the EAGLE model (Gomes et al., 2012) is a calibrated global general equilibrium model which was developed by the Eurosystem's experts to study the international transmission of shocks with the main focus on the extra area and intra area adjustments. The recently estimated FzBBKM (Hoffmann at al., 2020) was primarily designed with structural analysis of the German business cycle in mind. FiMoD (Stähler and Thomas, 2012) and GEAR (Gadatsch et al., 2016b) have been predominantly employed as policy simulation tools to study the effects of domestic fiscal policy and labour market reforms. FiModOLG (Ruppert and Stähler, 2020) is a three-country version of the original FiMod model extended by a Blanchard/Yaari life-cycle structure (following Gertler (1999), Carvalho et al. (2016) and Schön and Stähler (2020)). NiGEM[35] is mostly used for quantitative analysis of international and

[35] For details on the model, please visit https://nimodel.niesr.ac.uk/

country-specific policy issues. Lastly, the MEM[36] is the central tool used in the macroeconomic projections[37] at the Bundesbank.

Admittedly, the model heterogeneity complicates the implementation of a common scenario as well as presentation and discussion of the simulation results. It nevertheless helps to give an idea of the extent of model uncertainty[38] and raises awareness of the relative strengths and weaknesses of various models used by Bundesbank staff. Some of the important modelling differences between the applied models are summarised in Table 4.1 below.

Table 4.1: Some key characteristics of the Bundesbank macroeconomic models

Features	EAGLE	FzBBKM	FiMod	FiModOLG	GEAR	NiGEM	MEM
Type	DSGE	DSGE	DSGE	Life-cycle DSGE	DSGE	Semi-structural	Semi-structural
Expectations	Forward-looking	Forward-looking	Forward-looking	Forward-looking	Forward-looking	Forward-looking (partly)	Backward-looking
Frequency	Quarterly	Quarterly	Quarterly	Annual	Quarterly	Quarterly	Quarterly
Parametrisation	Calibrated	Estimated	Calibrated	Calibrated	Estimated	Estimated	Estimated
Regions	4	3	2	3	3(2+VAR)	over 49	1
Tradable/Non-tradable	Yes	Yes	No	No	No	No	No
Banking sector	No	No	No	No	No	No	No
Financial accelerator	No	No	No	No	No	No	No
Unemployment	No	No	Yes	Yes	Yes	Yes	Yes
Fiscal policy	Fiscal rule	Bal. budget	Fiscal rule	Fiscal rule	Fiscal rule	Fiscal rule	Fiscal rule
Monetary policy	Endogen.	Endogen.	Endogen.	Endogen.	Endogen.	Endogen.	Exogen.
Exchange rate	UIP	UIP	UIP	UIP	UIP	UIP	Exogen.
Exports pricing	LCP	PCP	PCP	PCP	PCP	LCP	PCP, PTM
Imports pricing	LCP	PCP	PCP	PCP	PCP	PCP	PCP, PTM
Import content of exports	Yes	No	No	No	No	Yes	Yes
Import content of priv. expenditures	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Import content of pub. expenditures	No	Yes	No	No	No	Yes	Yes

Note: UIP stands for uncovered interest parity, LCP and PCP stand, respectively, for local and producer currency pricing, PTM stands for pricing to market.

The four DSGE models (EAGLE, FzBBKM, FiMoD and GEAR) form a group of closely related modelling frameworks, which, thanks to a general equilibrium setting, optimisation-based short- and long-term behaviour and forward-looking expectations, allow for sizeable supply-side effects and relatively quick adjustments to shocks. In addition to this, the life-cycle DSGE

[36] For information on the model and examples of its application, see also Deutsche Bundesbank (2019c, 2019d).

[37] The projections are part of the broad macroeconomic projection exercises of the Eurosystem (with a maximum horizon of four years). The model provides detailed information about the projected paths of the various national account aggregates. In the projection exercises, simulations are undertaken, for instance, to assess the macroeconomic impact of a change in the set of external assumptions (i.e. foreign demand), technical assumptions (e.g. interest and exchange rates) or of fiscal policy measures.

[38] Each model is a necessary simplification of the reality, which can be implemented in a variety of ways. The implied heterogeneity of model structures leads to different predictions by different models of otherwise the same policy action. In this regard, policy prescriptions based on application of just one specific model may be severely misguided.

model (FiModOLG) contains endogenous steady-state levels of household savings as an additional state variable, which, as discussed in Sections 3.2 and 3.3, overcomes the problem of indeterminate net foreign asset positions. This changes the international transmission of shocks and generates endogenous movements in steady-state net foreign assets after structural changes (see Ghironi (2008), Di Giorgio and Nistico (2013) and Oxborrow and Turnowski (2017) for an in-depth discussion). The other two models (NiGEM and MEM) comprise a semi-structural modelling framework, which is largely based on the neoclassical-Keynesian theoretical synthesis. In this class of models, the demand-driven changes tend to be dominating factors behind macroeconomic fluctuations in the short and medium run. In addition, forward-looking expectations play either a limited role (NiGEM) or no role at all (MEM). As a result, these models feature a more gradual adjustment to shocks.

Even within closely related models structural and parametrisation differences exist which could be decisive in driving heterogeneous responses to otherwise the same shock. Detailed comparison in this regard goes beyond the scope of this paper. Still, some structural differences of the applied models are worth mentioning.

- First, as regards the geographical representation, aside from the MEM, which models of the German economy only, all other models are multi-country models where cross-border spill-over effects are endogenously determined.[39]

- Second, in terms of sectoral structures, EAGLE and FzBBKM distinguish between tradable and non-tradable goods, whereas other models consider domestic production consisting of a single sector. The financial sector is rather rudimentary in all the considered models. Involuntary unemployment is modelled in five out of seven models, while the most elaborate labour market modelling can be found in FiMod and FiModOLG (search and matching frictions).

- Third, the public sector is relatively well represented in all the models, except for the FzBBKM, which relies on a more simplified[40] representation. In EAGLE, FiMod, FiModOLG, GEAR and NiGEM public infrastructure is an important input in domestic production and, hence, changes to government investment have both demand-side and supply-side direct effects. In most models, monetary policy is modelled via a Taylor-rule-style rule, whereas the exchange rate is determined by an uncovered interest rate parity condition. In MEM, monetary policy and the exchange rate are treated exogenously as these are given by the common assumptions in the projection process.

[39] Since FiMod and GEAR are essentially models of the euro area, the mutual cross-border effects are limited to spill-overs between Germany and the rest of euro area.
[40] Specifically, there is no public debt since a balanced government budget at each quarter is ensured by adjusting lump-sum taxes.

- Fourth, given the focus of the analysis, it is worth noting that private domestic expenditures feature import content in all the models. In FzBBKM and semi-structural models, there is also a non-zero import content in public expenditures. Import content of exports is explicitly modelled only in EAGLE, NiGEM and MEM. In these models, shocks to exports would therefore imply a greater co-movement of exports and imports as compared to other models. As regards the exchange rate pass-through, in most models, producer currency pricing is assumed for both German exports and imports. This assumption implies that, on impact, a change to the exchange rate will be fully passed to German import prices and have limited impact on German export prices (expressed in euro).

- Last, except for the EAGLE, FiMoD and FiModOLG, the remaining models are largely estimated. When bringing the models to data, different approaches are used as regards treatment of long-term trends in the data. While semi-structural models allow for a multiplicity of (possibly co-integrated) trends, structural models typically impose common real and nominal trends. Though the latter approach may affect interpretation of the estimated shocks and their contributions over a specific historical sample, it does not diminish the usefulness of the structural models in the scenario analysis of permanent changes, i.e. those affecting the models' steady state.

5 Simulation scenarios

The domestic policy scenarios considered in the analysis are largely based on the IMF and the European Commission policy recommendations. The latter primarily concern calls to increase domestic public spending and to liberalise the service sector. In addition, we investigate the sensitivity of the German current account balance to changes in the external environment. In this regard, the scenarios are motivated by the ongoing debates about the fiscal consolidation required in the United States, possible imposition of US import tariffs in the light of foreign trade disputes, the possibility of a "hard landing" in China, and the nominal appreciation of the euro associated with a monetary policy normalisation in the euro area. Moreover, it is worth recalling that a set of scenarios considered in the common simulation exercises below are also closely related to the key factors contributing to the historical rise of the German current account surplus as discussed in Section 3, specifically, domestic fiscal policy, producers' market power, external risk premium and foreign demand shocks.

5.1 Impact of debt-financed domestic fiscal measures

A fiscal stimulus in Germany is implemented using alternative policy instruments:

- An increase in public consumption
- An increase in public investment
- A reduction in the capital income tax
- A reduction in the labour income tax
- A reduction in the VAT

In the above-mentioned scenarios we consider an ex ante reduction in the public budget balance by 1% of GDP over a five-year horizon, thereafter the fiscal measure-to-GDP ratio returns to the baseline with a quarterly decay factor of 0.9. The fiscal policy rule is inactive for the first ten years. Monetary policy is kept endogenous throughout the simulation period. The scenarios are simulated under the assumption of perfect foresight.

5.2 Impact of domestic structural reforms

Only two models (EAGLE and FzBBKM) out of seven distinguish between tradable and non-tradable sectors. Service sector liberalisation in these models is approximated by a reduction in the price mark-up in the non-tradable sector. In addition, an economy-wide product-market liberalisation is simulated to compare implications of structural reforms with other structural models in which no such sectoral division is built in.[41]

[41] Admittedly, the proposed scenarios capture structural reforms in a highly stylised manner and mainly concern market competition enhancing measures, for example liberalisation of competition laws. These scenarios are predominantly used for illustrative purposes. For a more elaborate calibration of structural reforms, see for example Pierluigi and Vetlov (2018).

- Service sector liberalisation: a permanent 10 percentage-point reduction of the price mark-up in the non-tradable sector.
- Economy-wide product market liberalisation: a permanent 10 percentage-point reduction of the price mark-up.

In both scenarios, the reforms are simulated under the assumption of perfect foresight. The price mark-ups are reduced instantaneously to the new lower level, and their new path is fully anticipated by the economic agents.

5.3 Impact of external factors

The external environment scenarios comprise the following specific cases:

- A nominal appreciation of the euro
- Fiscal consolidation in the US
- An increase in tariffs on the US imports
- A hard landing of the Chinese economy

The nominal euro appreciation scenario implies a 10% nominal appreciation of the euro exchange rate against all currencies for five years.[42] In models with an endogenous exchange rate determination, the scenario is implemented via an external risk premium shock, i.e. an exogenous reduction in the return on foreign assets.

In the case of the fiscal consolidation in the United States, we consider a fully anticipated transitory improvement in the US public budget balance using either a reduction in government consumption or a VAT increase. The fiscal consolidation is equivalent to 1% of the initial GDP (ex ante) over five years, thereafter the fiscal measure-to-GDP ratio returns to the baseline with a quarterly decay factor of 0.9. The fiscal policy rule is inactive for the first ten years while monetary policy is endogenously determined in line with the model policy rule.

The increase in tariffs on the US imports envisages a rise of a tax rate applied to US imports from all countries by 20 percentage points over five years, thereafter the tax rate returns to the baseline level with a quarterly decay factor of 0.9. The scenario is also simulated under the assumption of perfect foresight.

Lastly, concerning China, a transitory but sharp slowdown of investment and consumption growth in China is simulated using the NiGEM. Specifically, shocks to Chinese investment and

[42] In NiGEM a 10% nominal appreciation of the effective exchange rate was approximated by an appropriately scaled shock to the euro exchange rate vis-à-vis the US dollar.

consumption growth were calibrated to cause a 3 percentage-point reduction in consumption growth and a 12 percentage-point reduction in investment growth.[43]

[43] The shocks are assumed to last in full for two years. Thereafter, Chinese consumption and investment demand returns to baseline levels with a quarterly decay factor of 0.9.

6 Simulation results

This section discusses the model-based simulation results[44] with the focus on the current account balance adjustment in Germany. Detailed charts illustrating reactions of the main macroeconomic variables can be found in Appendix C.

6.1 Higher government consumption in Germany

The basic transmission mechanism of the policy shock embodied in the applied models can be described as follows. An increase in the government consumption directly boosts domestic aggregate demand and exerts upward pressure on domestic prices. To clear the product market, output increases, contributing to a higher demand for factors of production and a higher return on labour and capital. As a result, utilisation of both employment and capital in the economy expands. At the same time, the elevated domestic production costs erode international price competitiveness of goods produced in Germany, which implies a lower demand for German exports and a higher demand for imported goods. The rise in imports is expected to be substantial in the event that government consumption features large import content and there is a large share of households whose consumption is sensitive to variation in the contemporaneous income (non-Ricardian households). The overall impact on the current account balance, which is measured in nominal terms, however, depends not only on the deterioration of the real net export position but also on the relative changes of export and import prices, i.e. changes in the terms of trade. Additional, though in most models quantitatively less significant, effects may stem from variation in cross-border flows of income payments due to, for example, changes to the relative return on a country's foreign assets and liabilities.

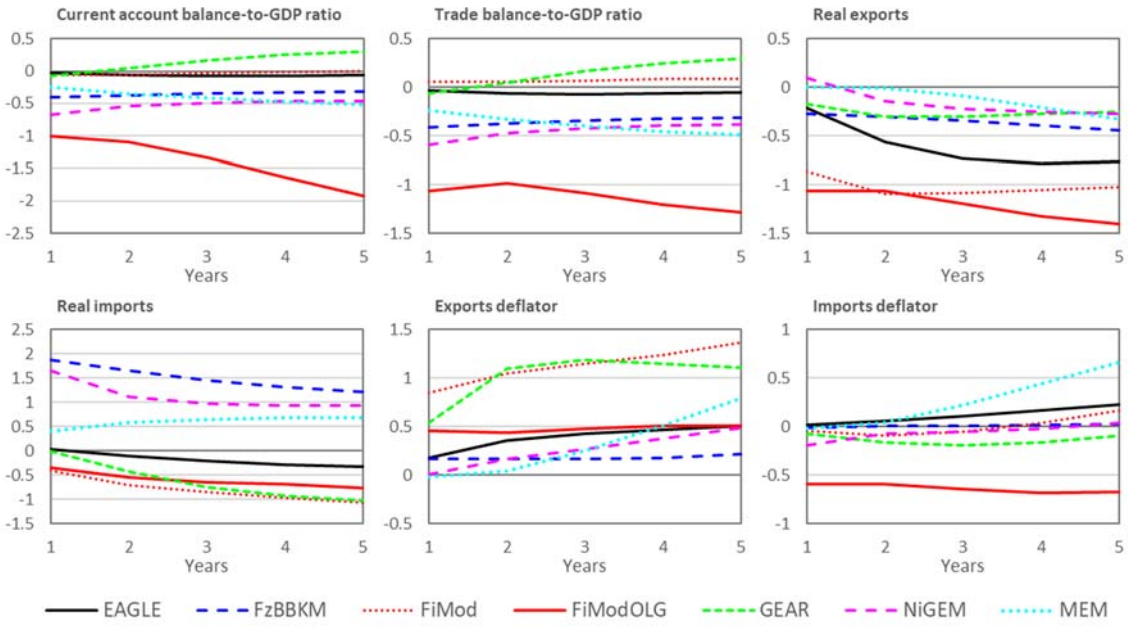
The model-based estimates of the German current account balance response to a higher level of government consumption are summarised in Figure 6.1. In all the models considered, the current account balance deteriorates on impact, though the degree of the deterioration varies greatly across the models. The two semi-structural models, as well as the FzBBKM and the FiModOLG models, show the largest decline in the current account balance. In the FzBBKM, the current account deteriorates by around 0.4-0.6% of GDP, which can be mainly attributed to a significant rise in real imports.[45] In the FiModOLG model, the current account deteriorates by 1.0 to almost 2.0% of GDP, mainly due to a strong real appreciation on impact and a gradual diminishing of the net income balance. The latter reflects the implied persistent reduction in the NFA position of the Germany economy as households across the globe increase investment in German government debt and reduce holdings of non-German assets. The MEM

[44] The model simulations were performed by Markus Jorra, Thomas Härtel, Britta Hamburg, Mathias Hoffmann, Oke Röhe, Kilian Ruppert, Nikolai Stähler, Uliana Sulakshina, and Igor Vetlov.

[45] It is worth remembering that the FzBBKM is the only structural model that features a non-zero import content of public expenditures.

simulations feature a particularly strong crowding-in effect on private consumption and investment. This reflects high sensitivity of private sector expenditures to the contemporaneous income as well as exogenous nominal exchange rate and interest rate setting in this model. The observed strong import reaction on impact in the NiGEM and FzBBKM partly reflects low adjustment costs for imports as well as a relatively large share of imports in the government consumption basket. In contrast, in the other DSGE models, the current account balance is barely affected or even increases (GEAR) and imports are lower, in line with a relatively strong decline in private consumption and investment (substantial crowding-out effects on the forward-looking private sector). Deterioration of external price competitiveness leads to a fall in exports in all the models, with the largest decline reported in FiMod and FiModOLG. The FiMod shows the strongest increase in domestic inflation and appreciation of the real exchange rate. The substantial price competitiveness losses reported in the FiMod largely reflect the rise of the labour adjustments costs in line with the explicitly modelled labour market frictions. In the FiModOLG, the euro appreciation also reflects the shift in the demand for German assets. In FiMod, FiModOLG and GEAR, thanks to a large decline in import prices (mostly due to initial nominal exchange rate appreciation combined with the producer currency pricing assumption adopted), the terms-of-trade increase contributes to an improvement of the foreign trade balance.

Figure 6.1: Current account balance response to a government consumption shock

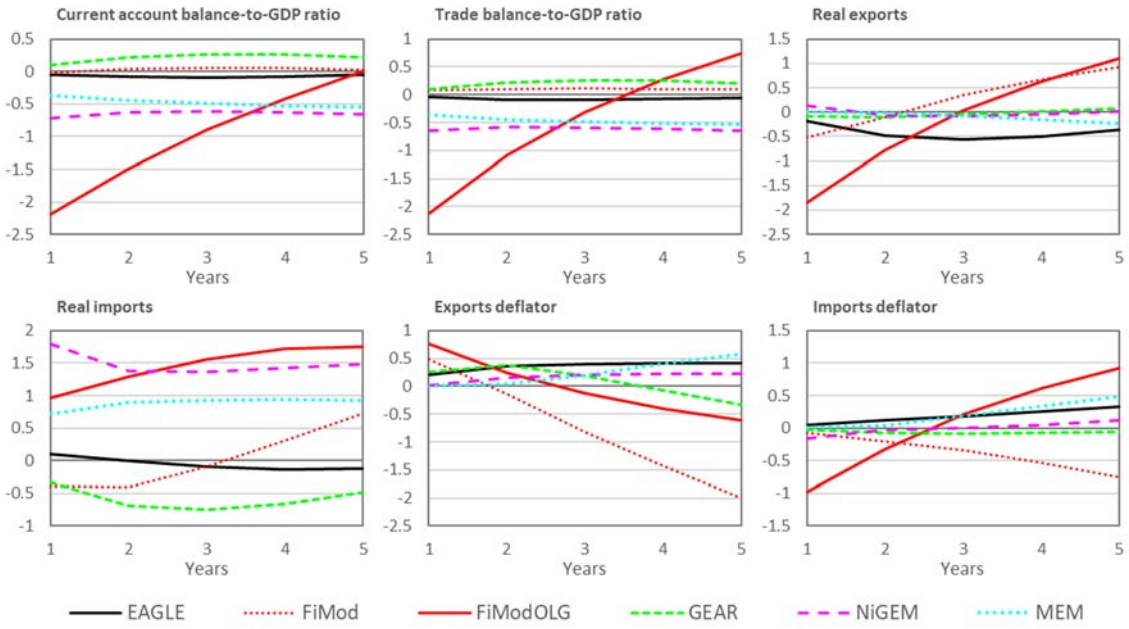


Note: This figure depicts the responses of selected current account balance variables to an ex ante increase in the government consumption by 1% of GDP over a five-year period. Thereafter, the shock returns to the baseline assuming an autoregressive parameter of 0.9 (on a quarterly basis). Fiscal rules are exogenous in the first ten years. All responses are reported as percentage deviations from the baseline, except for the responses of the current account and the trade balance ratios, which are reported as percentage-point deviations.

6.2 Higher government investment in Germany

In this case, the transmission mechanism may differ from that of the government consumption to the extent that a change to the government investment has direct supply-side effects and the import content of both variables differs. By expanding the public infrastructure (which is assumed to enhance productivity), an increase in public investment implies a more persistent positive impact on output. In addition, it also helps to contain inflationary pressures, associated with a higher aggregate demand, by reducing the marginal production costs, i.e. essentially acting as a productivity-enhancing shock. Thus, the crowding-out effects on private consumption and the decline in exports associated with international price competitiveness losses should be more limited as compared to a government consumption-based fiscal expansion. The overall reaction of private investment will depend on whether public and private capital stocks are substitutes or complementarities in production. Since most of the considered models use a Cobb-Douglas production function, the implied substitution effects will tend to dampen the private investment demand.

Figure 6.2: Current account balance response to a government investment shock



Note: This figure depicts the responses of selected current account balance variables to an ex ante increase in the government investment by 1% of GDP over a five-year period. Thereafter, the shock returns to the baseline assuming an autoregressive parameter of 0.9 (on a quarterly basis). Fiscal rules are exogenous in the first ten years. All responses are reported as percentage deviations from the baseline, except for the responses of the current account and the trade balance ratios, which are reported as percentage-point deviations.

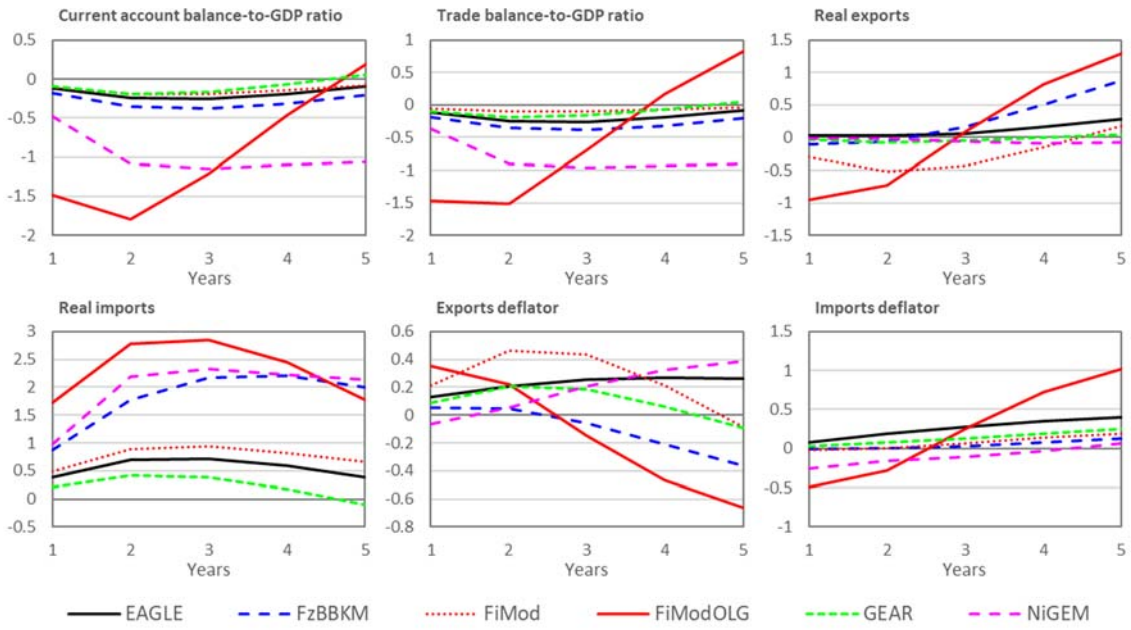
As regards the available model-specific estimates of the German current account balance effects, the government investment-driven fiscal expansion delivers a somewhat stronger deterioration in the current account balance in EAGLE and MEM. In the case of MEM, this is related to government investment having higher import content than government consumption. In the case of FiMod and GEAR, the current account improves. The latter could be largely

attributed to sizeable cost-cutting effects of the shock on the enhanced competitiveness of German exports, i.e. these models implicitly assume a high impact of the public investment projects on aggregate productivity. In contrast, net trade deteriorates significantly in the FiModOLG, reflecting a rise in private investment-driven domestic imports.

6.3 Lower capital income tax in Germany

A reduction in the capital income tax stimulates investment by raising the return on capital. The higher demand for investment goods increases domestic production and boosts foreign borrowing. The implied rise in imports results in a deterioration of the current account balance.

Figure 6.3: Current account balance response to a capital income tax shock



Note: This figure depicts the responses of selected current account balance variables to an ex ante reduction in the capital income tax rate by 1% of GDP over a five-year period. Thereafter, the shock returns to the baseline assuming an autoregressive parameter of 0.9 (on a quarterly basis). Fiscal rules are exogenous in the first ten years. All responses are reported as percentage deviations from the baseline, except for the responses of the current account and the trade balance ratios, which are reported as percentage-point deviations.

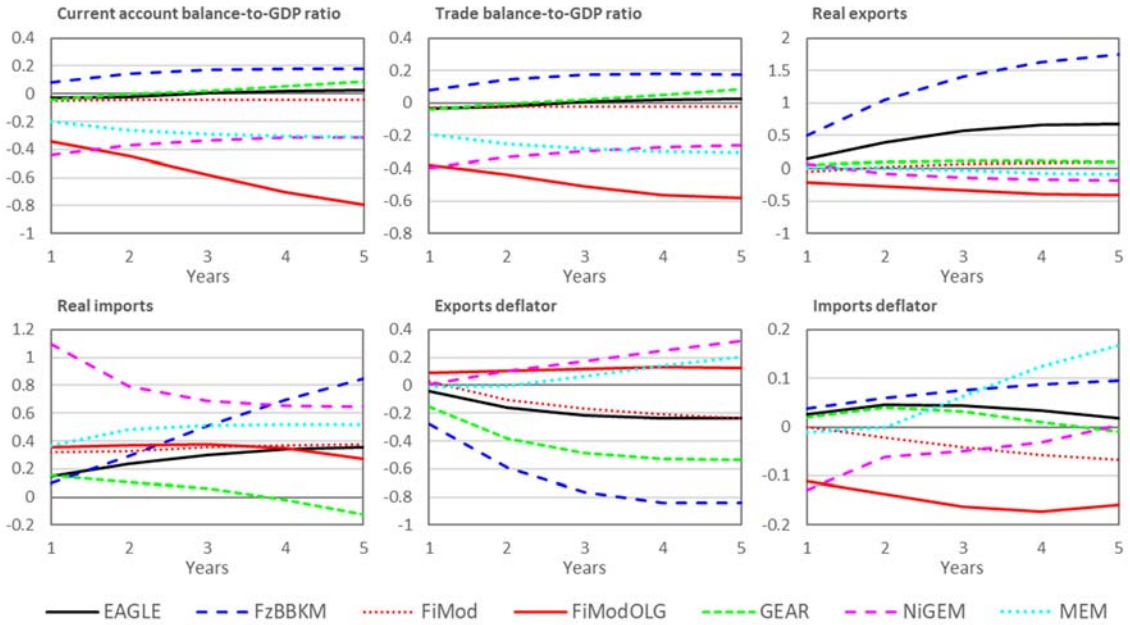
In comparison to the expenditure-based fiscal expansion scenarios described above, a reduction in the capital income tax results in a larger deterioration of the current account balance (see Figure 6.3), though in the standard DSGE models the impact is once again considerably lower as compared to the NiGEM: 0.3-0.4% against 1.2% of GDP, respectively. In the NiGEM, besides a large rise in investment, the higher imports are also supported by a relatively strong increase in private consumption. In the DSGE models, private consumption tends to slightly decline temporarily due to the need to finance the expansion in investment. In addition, lower labour income following the reallocation of production from labour to capital leads to lower consumption by non-Ricardian households. The OLG model yet again demonstrates a more sizeable though only transitory deterioration of the current account

balance. As regards the trade balance, real exports are modestly affected in all the models with the exception of a transitory decline observed in the FiMod and FiModOLG in line with a strong appreciation in the real exchange rate.

6.4 Lower labour income tax in Germany

In response to a higher after-tax labour income[46], two opposite effects on the current account balance can be distinguished. First, in line with the implied higher disposable income, households would raise consumption, thus contributing to higher domestic inflation and imports. Second, households may also extend labour supply (more relevant for optimisation-based modelling frameworks). In the latter case, the equilibrium wage falls and employment increases as firms substitute capital for labour in production. The implied lower production costs exert downward pressure on domestic inflation. Besides raising contemporaneous income, the tax reduction thus also boosts potential output and enhances the international price competitiveness of German exports. As a result, in the group of DSGE models, aside from domestic demand, exports are also expected to increase. The overall impact on the current account, however, depends on the relative strength of income and international competitiveness channels.

Figure 6.4: Current account balance response to a labour income tax shock



Note: This figure depicts the responses of selected current account balance variables to an ex ante reduction in the labour income tax rate by 1% of GDP over a five-year period. Thereafter, the shock returns to the baseline assuming an autoregressive parameter of 0.9 (on a quarterly basis). Fiscal rules are exogenous in the first ten years. All responses are reported as percentage deviations from the baseline, except for the responses of the current account and the trade balance ratios, which are reported as percentage-point deviations.

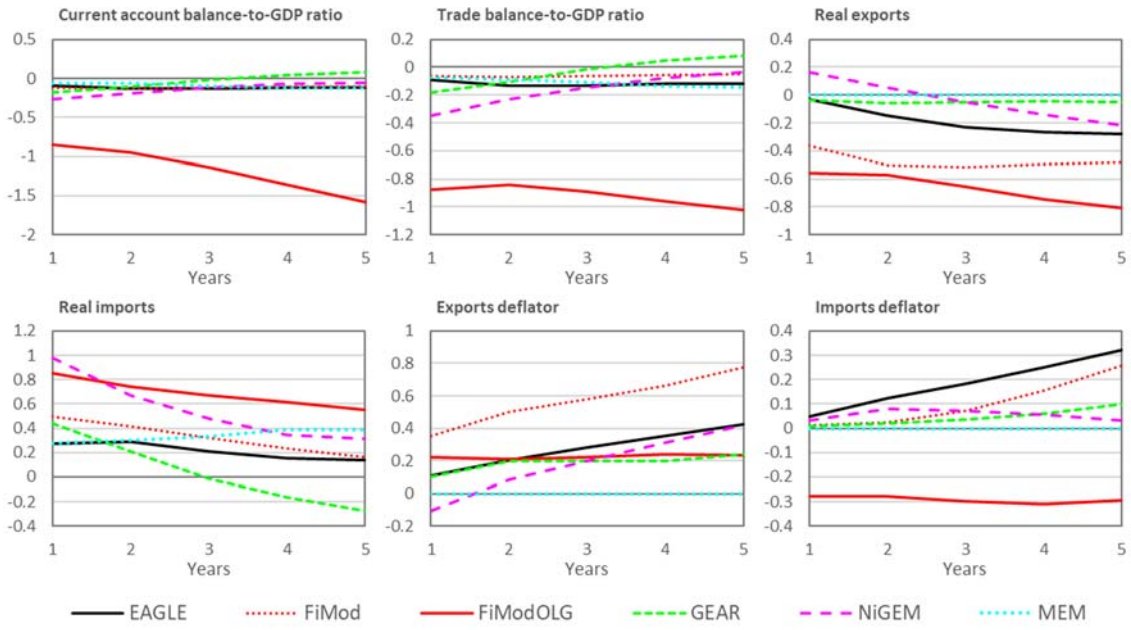
[46] A labour income (wage) tax paid by households.

The model-based simulations in the case of the standard DSGE models show that a reduction in labour income taxes implies a negligible to slightly positive impact on the current account, whereas in the case of semi-structural models the current account deteriorates sharply (around 0.4 percentage point of GDP). In the latter models, the rise in households' labour income has a rather strong positive impact on private consumption. As a result, both imports and domestic inflation rise. The implied real appreciation and lower exports in the semi-structural models contrast with the real depreciation and higher exports estimated in the standard DSGE models, especially in the FzBBKM and the EAGLE model, primarily reflecting the greater role played by the supply-side (cost-reduction) effects of the shock in this class of models. In contrast, the shift in demand for German assets in FiModOLG implies a significant appreciation of the euro and contributes to a decline in Germany's net exports.

6.5 Lower consumption tax (VAT) in Germany

A reduction in the consumption tax primarily boosts private consumption via a rise in the purchasing power of households. The higher domestic demand allows the producers to take advantage of the reduced tax distortion and raise the pre-tax (producer) prices. The latter compensates for the increase in the costs of production associated with a higher output, but at the same time leads to a deterioration in German exports due to international competitiveness losses. Imports are expected to increase in line with the higher domestic absorption and real appreciation.

Figure 6.5: Current account balance response to a consumption tax shock



Note: This figure depicts the responses of selected current account balance variables to an ex ante reduction in the consumption tax rate by 1% of GDP over a five-year period. Thereafter, the shock returns to the baseline assuming an autoregressive parameter of 0.9 (on a quarterly basis). Fiscal rules are exogenous in the first ten years. All responses are reported as percentage deviations from the baseline, except for the responses of the current account and the trade balance ratios, which are reported as percentage-point deviations.

Indeed, all the applied models show that a reduction of consumption taxes in Germany is estimated to worsen the current account balance, albeit moderately in most models, with the exception of the FiModOLG, where income balance deteriorates significantly. As regards the trade balance, real imports tend to increase and exports fall. However, the deterioration of net exports is largely matched by an improvement in the terms of trade. The NiGEM and FiModOLG exhibit the largest worsening of the trade balance in line with the strongest increase in consumption and imports.

It is noteworthy that in comparison to other tax-based measures, in most models, the lower consumption tax results in only a temporary boost to GDP as the implied skewness of the aggregate demand towards consumption goods implies a limited, in some cases negative, impact on private investment and, thus, the longer-term output.

6.6 Services sector liberalisation in Germany

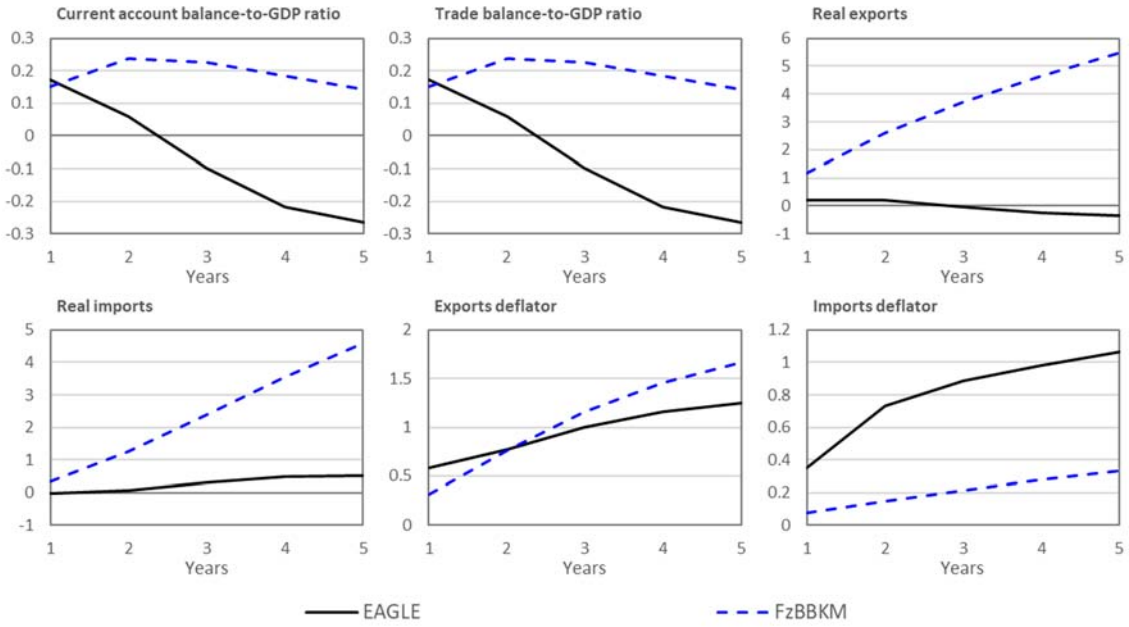
In this scenario, the market competition in the non-tradable sector permanently increases, which is modelled as a permanent drop in the sector-specific wedge between the final price and the marginal costs of production. At a lower price, higher demand for non-tradable goods will be satisfied by an expansion in the sector's output. The implied greater demand for the factors of production boosts demand for labour and capital by the non-tradable goods producers. To the extent that factors of production can move freely across the sectors, costs of production will increase across the economy, resulting in inflationary pressures and weaker output in other (non-reformed) sectors of the domestic economy.

Due to a permanently lower level of distortions in the economy, overall GDP is expected to be higher in the new equilibrium. In the transition phase, however, the output gains may take a while to materialise. The latter depends on the speed at which the reform is implemented as well as on the ability of monetary policy to accommodate the positive supply-side shock. Specifically, anticipation of a gradual fall in prices combined with a limited monetary policy accommodation will imply a persistently higher real interest rate, higher private savings and lower contemporaneous private consumption.

Turning to the available quantitative estimates, the FzBBKM and the EAGLE model-based simulations show that the increase in imports is a gradual process in line with a delayed rise in domestic absorption. Moreover, the euro depreciates on impact, reflecting the excess production in the (non-reformed) tradable sector. As a result, sizeable positive spill-over effects are estimated in the rest of the euro area countries. Hence, exports also increase in both models, though only temporarily in the EAGLE model. In the FzBBKM model the response of net exports remains positive in the medium run. In the EAGLE model, following a transitory surplus, the current account balance deteriorates by almost 0.3% of GDP. It is also remarkable

that despite rather similar GDP reactions in both models, foreign trade variables exhibit a considerably larger response in the FzBBKM as compared to the EAGLE model.[47]

Figure 6.6: Current account balance response to a service sector liberalisation



Note: This figure depicts the responses of selected current account balance variables to a permanent reduction of a price mark-up in the non-tradable sector by 10percentage points. All responses are reported as percentage deviations from the baseline, except for the responses of the current account and the trade balance ratios, which are reported as percentage-point deviations.

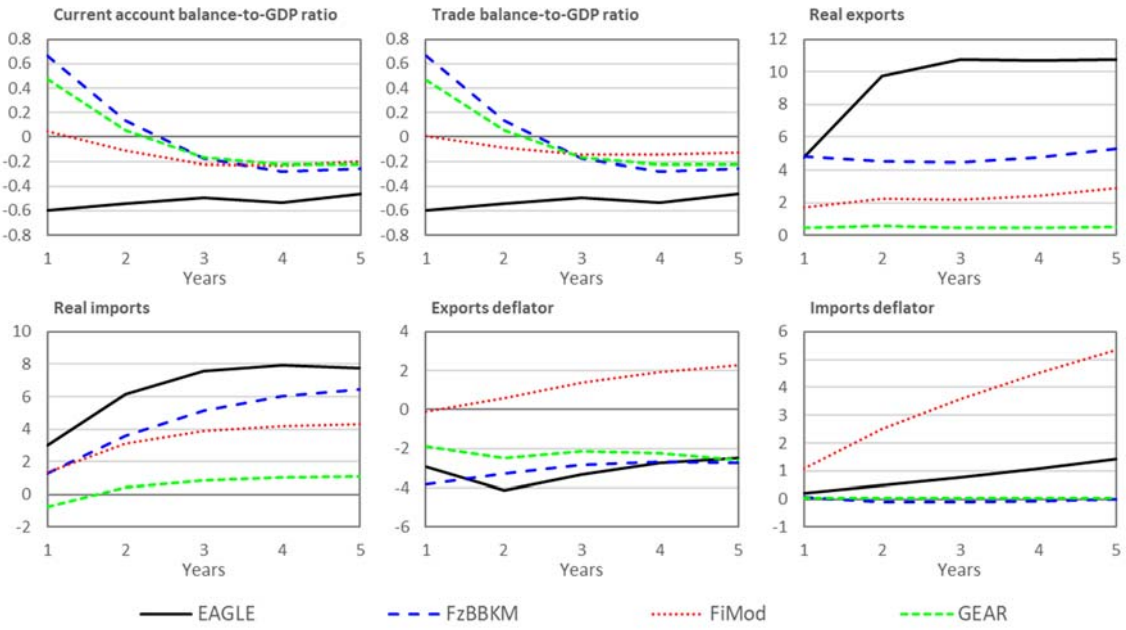
6.7 Economy-wide liberalisation in Germany

In comparison to the previous scenario, output price decline and output increase are now expected in both tradable and non-tradable sectors. This implies a greater rise in overall employment and investment and hence a larger boost to imports. In addition, a stronger and more persistent increase in exports is expected in line with the price competitiveness gains implied by the reform.

The largest current account deterioration is yielded by the EAGLE model: around 0.5% of GDP. In response to the shock, real net exports increase sizeably; however, this is over-compensated by a significant deterioration in the terms of trade. In other models, the current account balance improves in the short run due to a stronger increase in net exports on impact whereas imports rise only gradually. Over the medium run, a small current account deficit of 0.2% of GDP arises as well.

[47] The stronger increase of exports in the FzBBKM model seems to be partly attributable to the producer currency pricing assumption, which enables a stronger pass-through of the euro depreciation to the export prices expressed in foreign currency. In turn, real imports are supported by a gradual rise in private consumption. Unlike the EAGLE model, the FzBBKM features a very high risk aversion parameter which implies a stronger consumption smoothing behaviour – a feature clearly visible in other scenarios presented in this section too.

Figure 6.7: Current account balance response to an economy-wide product market liberalisation



Note: This figure depicts the responses of selected current account balance variables to a permanent reduction of an economy-wide price mark-up by 10percentage points. All responses are reported as percentage deviations from the baseline, except for the responses of the current account and the trade balance ratios, which are reported as percentage-point deviations.

6.8 Nominal appreciation of the euro

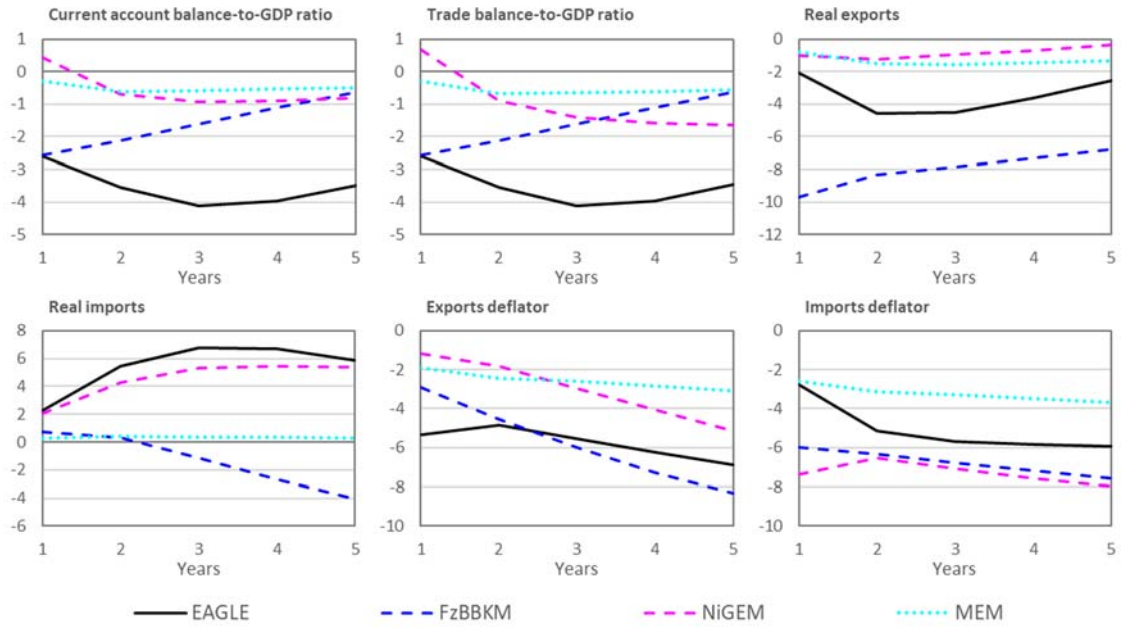
An appreciation of the euro worsens the competitiveness of German exports (as well as those of the rest of the euro area) and makes extra-euro area imports more attractive. As a result, the net exports are expected to worsen. The shock implications on the current account balance, especially in the short run, also depend on the speed of the appreciation pass-through to export and import prices. Here alternative modelling assumptions as regards the pricing decisions of the domestic and foreign firms trading internationally are a major factor.[48]

The largest deterioration of the current account balance is reported by the EAGLE model: around 4.0% of GDP. In other models the deficit varies from 0.5 to 1.0% of GDP. Due to the local currency pricing, exports prices, expressed in euro, react fastest and strongest in the EAGLE model whereas the imports deflator declines more gradually. The latter contrasts with the NiGEM simulations where, due to the producer currency pricing, imports prices, expressed in euro, on impact show the largest drop amongst all the considered models. Lastly, due to a

[48] It is worth noting that, while the models at hand assume simple invoicing rules, in practice the currency structure of invoicing may be far richer. For example, according to the German Federal Statistical Office, 57.6 % of German exports to non-EU countries in 2018 were invoiced in euro, 27.7 % in US dollars, and 14.7 % in other currencies. The corresponding shares for imports are 47.5 % (euro), 45.6 % (US dollars) and 6.9 % (other currencies).

frictionless modelling of real exports, the FzBBKM features a remarkably strong reduction in real exports, which largely explains a sizeable current account deficit in the short run.

Figure 6.8: Current account balance response to an appreciation of the euro



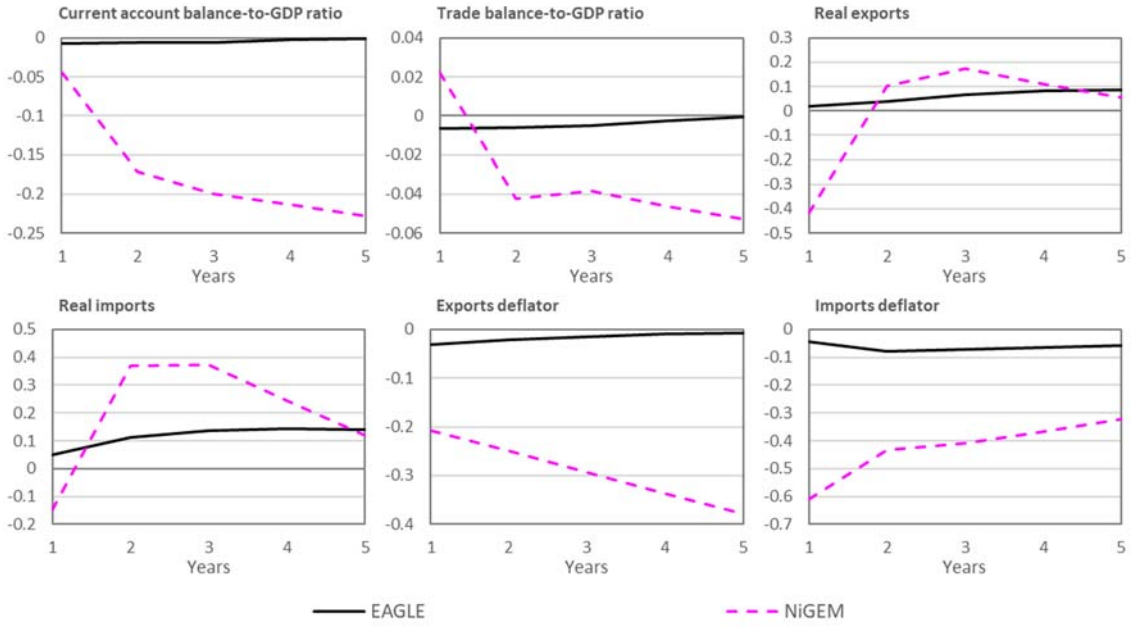
Note: This figure depicts the responses of selected current account balance variables to a nominal appreciation of the euro by 10% over a five-year period. All responses are reported as percentage deviations from the baseline, except for the responses of the current account and the trade balance ratios, which are reported as percentage-point deviations.

6.9 Lower government consumption in the USA

An expenditure-based fiscal consolidation in the United States dampens economic activity in that country. In addition, as the US monetary authorities reduce interest rates in response, the US dollar depreciates in line with the UIP condition. As a result, demand for German exports falls. To the extent that lower import prices lead to downward inflationary pressures in the euro area, a softening of the euro area monetary policy is expected. The lower interest rate in the euro area boosts private consumption and investment, hence, imports demand in Germany.

The quantitative assessment of the expenditure-based fiscal consolidation in the United States is conducted using the NiGEM and the EAGLE models – the only two models which explicitly account for the US economy. According to the NiGEM, the US fiscal consolidation would have a sizeable impact on the German current account balance as well as the rest of the macroeconomic indicators. In contrast, in the EAGLE model the cross-border effects are rather negligible, although qualitatively the responses in the two models are similar.

Figure 6.9: Current account balance response to a government consumption shock in the United States

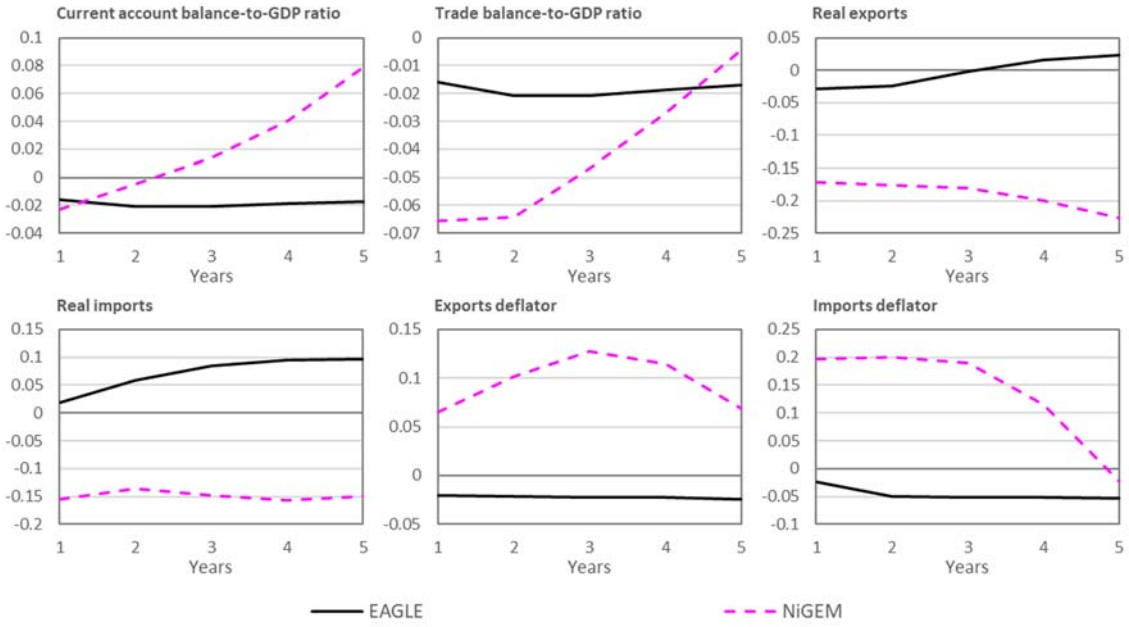


Note: This figure depicts the responses of selected current account balance variables to an ex ante reduction in US government consumption by 1% of GDP over a five-year period. Thereafter, the shock returns to the baseline assuming an autoregressive parameter of 0.9 (on a quarterly basis). Fiscal rules are exogenous in the first ten years. All responses are reported as percentage deviations from the baseline, except for the responses of the current account and the trade balance ratios, which are reported as percentage-point deviations.

6.10 Higher consumption tax in the USA

Similarly to the previous scenario, a fiscal consolidation in the US implemented via higher consumption taxes leads to deterioration in the German current account balance. In this case, however, both models reveal small shock effects since the tax-based consolidation has no direct demand implications in the United States (rather, implications via income). As a result, the implied inflation reaction and exchange rate movements are estimated to be more moderate. At the same time, the effects on the real variables are found to be more persistent.

Figure 6.10: Current account balance response to a consumption tax shock in the United States



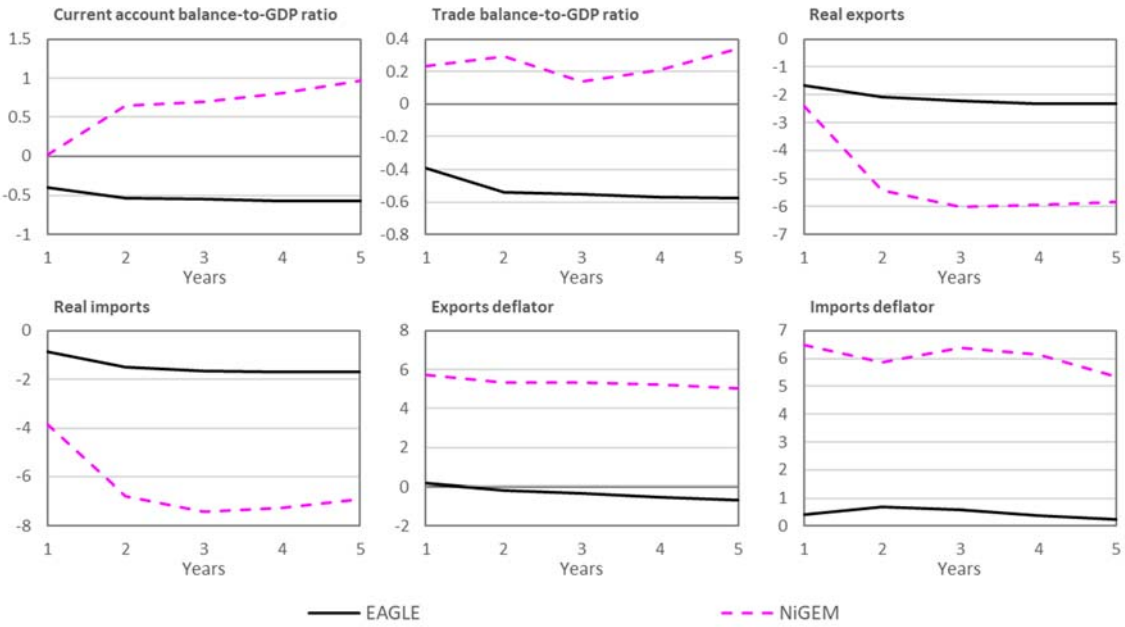
Note: This figure depicts the responses of selected current account balance variables to an ex ante increase in the consumption tax rate by 1% of GDP over a five-year period. Thereafter, the shock returns to the baseline assuming an autoregressive parameter of 0.9 (on a quarterly basis). Fiscal rules are exogenous in the first ten years. All responses are reported as percentage deviations from the baseline, except for the responses of the current account and the trade balance ratios, which are reported as percentage-point deviations.

6.11 Higher tariffs on US imports

Higher tariffs on US imports lead to a switch in US demand from imported goods towards domestically produced goods. The US inflation rate increases, and the US monetary authorities raise interest rates in response. As a consequence, the US dollar appreciates.

In the EAGLE model, the German current account balance worsens by over 0.5% of GDP. This is driven by a persistent decline in net exports as well as a deterioration of the terms-of-trade. In the NiGEM simulations, however, the current account tends to improve in response. The implied sizeable depreciation of the euro, in the event of a quick pass-through to domestic prices, leads to a strong surge in euro area inflation and, as a consequence, monetary policy tightening. Private demand falls, contributing to a widening of the output decline and a stronger (as compared to exports) reduction in imports. In the EAGLE model, due to a limited depreciation pass-through to domestic prices, the recessionary output effects prevail and the euro area authority reduces the interest rate. As a result, private demand and hence imports turn out to be relatively stronger than in the NiGEM.

Figure 6.11: Current account balance response to a higher US imports tariff rate



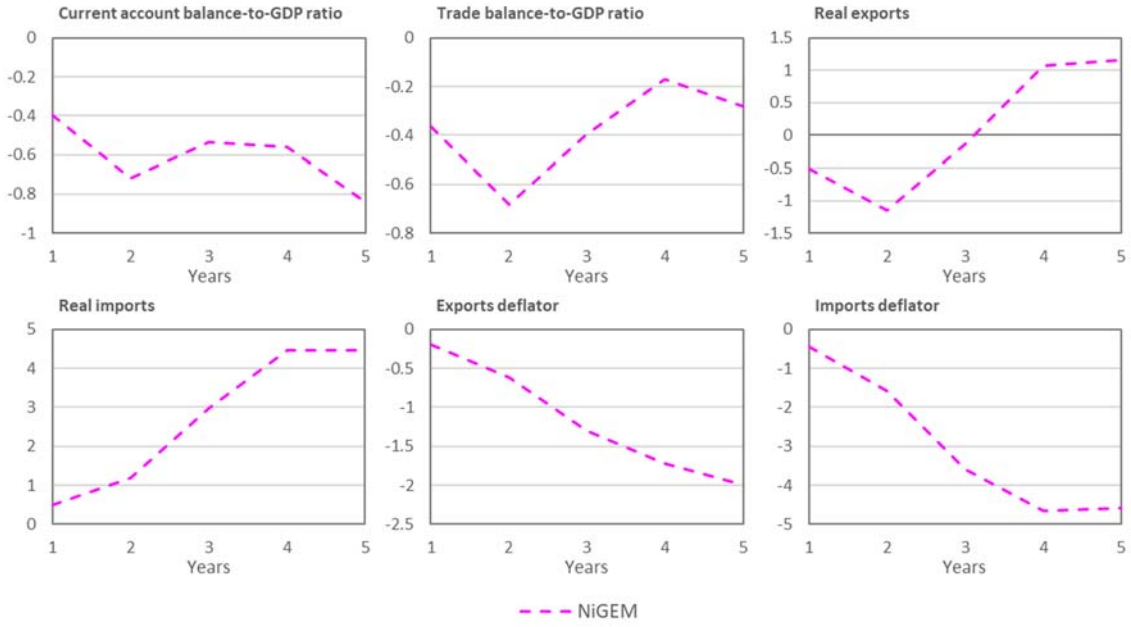
Note: This figure depicts the responses of selected current account balance variables to an increase in the US import tariff rate by 20 percentage points over a five-year period. Thereafter, the shock returns to the baseline assuming an autoregressive parameter of 0.9 (on a quarterly basis). All responses are reported as percentage deviations from the baseline, except for the responses of the current account and the trade balance ratios, which are reported as percentage-point deviations.

6.12 Sharp slowdown in China

A strong decline in domestic demand growth in China implies a deceleration of global demand. As a consequence, German exports are expected to fall, leading to worsening of the country's current account balance. Moreover, the implied downward trend in global inflation will also result in lower rate of inflation in the euro area due to lower import prices. In order to stabilise the inflation rate, the euro area monetary authorities will reduce the interest rate to stimulate domestic demand. The latter also boosts domestic imports, contributing to a further worsening of the current account balance.

The NiGEM-based simulation of the hypothetical slowdown in China shows that the shock will lead to a sizeable and persistent worsening of the German current account balance. In particular, the maximum decline of almost 1.4% of GDP is reached after six years. In the short run, the current account balance worsens mainly due to a reduction in exports and surging imports. Over the longer run, lower global interest rates also weigh on the current account position of Germany and other net creditor countries. The boost provided to domestic demand by monetary policy easing helps compensate for the fall in net exports and, as a consequence, output in Germany increases. Similar positive domestic demand reactions in other countries and declining slack in the Chinese economy partly explain the rebound in German exports over the second half of the simulation sample.

Figure 6.12: Current account balance response to a domestic demand slowdown in China



Note: This figure depicts the responses of selected current account balance variables to a slowdown of private consumption and investment growth in China over a two-year period by respectively 3 and 12 percentage points (in annual terms). All responses are reported as percentage deviations from the baseline, except for the responses of the current account and the trade balance ratios, which are reported as percentage-point deviations.

7 Conclusions

The model-based estimates of possible current account adjustments in Germany are subject to a high degree of structural uncertainty as point estimates vary greatly across the considered models, with regard to both the size and the sign of the impact on the current account. The simulation exercises illustrated the cross-model differences, which could be related to the underlying modelling assumptions of each model. Overall, while several scenarios reveal scope for a significant reduction in the current account surplus in some of the models, more precise estimates would require designing scenarios which are better tailored to the specific policy proposals and the environment in which the policy will be implemented – size, timing and coordination with other policies.

As regards fiscal scenarios, structural models, with the exception of the FiModOLG and FzBBKM, tend to produce rather negligible effects on the current account whereas the semi-structural models predict considerable deterioration, especially in the case of an expenditure-based fiscal expansion. As concerns an income-based fiscal expansion, both types of models show the strongest deterioration in the current account implied by a capital income tax reduction. In this regard, the FiModOLG reports by far the largest decline at about 2% of GDP.

The model-based simulations of a structural reform in Germany also point to a deterioration of the current account, though a transitory surplus, due to limited monetary loosening in the face of the induced deflationary pressures, cannot be ruled out. The simulations of competition-enhancing reforms result in a deterioration in the current account by at most 0.3-0.5% of GDP, depending on the sectoral scope of the reform. As concerns the empirical relevance of these findings, to gauge the potential impact of the structural reforms one needs to assess the distance between the current and desired level of market efficiency. For example, in the case of the liberalisation of the services sector in the EAGLE model, if the reforms aimed to bring the level of the price mark-up in Germany to the corresponding level in the United States, the implied deterioration in the German current account balance would be above 0.6% of GDP, as the initial inefficiency gap in the model is more than double the size of the shock considered in the simulations.

Large movements in the euro exchange rate are estimated to have sizeable effects on the German current account balance but may also have significant unfavourable implications for domestic output. Our estimates of a persistent 10% appreciation of the euro could reduce the current account balance in Germany by 0.5-4.0% of GDP. These findings need to be taken with caution since they are conditioned by the assumption that the underlying shock driving the euro's appreciation is a higher external risk premium paid on foreign assets holdings. Should the exchange rate movements be attributed to other shocks, the implications for the current account and output might differ from the ones presented in this paper. Hence, more sensitivity analysis addressing this issue may need to be undertaken in future.

The US fiscal policy simulations confirm the common finding in the literature that policy spill-over effects are small in the standard DSGE models: the implied rise in private sector savings largely neutralises the policy shock effects on foreign trade. The NiGEM, in contrast, predicts a sizeable (almost 0.3% of GDP) deterioration of the German current account balance in response to a 1% of GDP government expenditure-based fiscal consolidation in the United States.

The model-based simulations show that a hypothetical increase of import tariffs in the United States by 20 percentage points could exert ambiguous effects on the current account balance in Germany. The latter seems to depend on the scale of the US dollar's appreciation and the implied emergence of the imported inflationary pressures in the euro area. If the recessionary effects of lower foreign demand dominate the inflation response in the euro area, easing of euro area monetary policy would be supportive of German private demand, hence imports, and a sizeable deterioration of the current account balance, i.e. 0.5% of GDP, is to be expected. If, however, the weaker euro led to a higher inflation rate in the euro area, a tighter monetary policy would further bring domestic demand down. The implied reduction in imports may result in an overall improvement of the current account balance in Germany.

Lastly, even a transitory slowdown in China, as predicted by the NiGEM, could induce a sizeable, lasting reduction in the German current account surplus, by almost 0.9% of GDP. In this scenario, the external re-balancing could be achieved while maintaining buoyant aggregate demand developments in Germany in line with the euro area monetary policy easing and a lower relative price on imports.

Overall, consistently with the literature, it holds that several scenarios would have to come true for the German current account to return to equilibrium from its current level and only a limited contribution could be expected from changes that are under the direct control of the German authorities. It is also important to note that, given the business cycle focus of the applied modelling frameworks, the conducted simulations mostly concern the current account balance adjustment over a medium run. Analysis of permanent shifts in the current account requires simulations of fundamental changes to the savings-investment balance and hence calls for alternative modelling frameworks. Such in-depth analysis is beyond the scope of the current investigation and left for future work. However, as the illustrative simulations presented in this paper reveal, the OLG modelling approach can indeed constitute a promising avenue in this regard.

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Annex A

Table A.1: Germany's current account balance by country (in 2019; € billion)

	Country	CA balance
Bilateral current account surpluses	**United States**	70.3
	France	53.6
	United Kingdom	40.9
	Luxembourg	16.4
	China	14.6
	Austria	14.2
	Sweden	12.5
	Italy	11.3
	Switzerland	9.1
	Denmark	9.0
	Australia	8.9
	Canada	8.6
	Spain	7.1
	Saudi Arabia	5.9
	United Arab Emirates	5.4
	Brazil	5.1
	Mexico	4.6
	Poland	4.1
	Republic of Korea	3.9
	Hong Kong	3.5
Bilateral current account deficits	**Taiwan**	-2.6
	Belgium	-2.6
	Lybia	-2.8
	Cyprus	-3.2
	Hungary	-4.1
	Malaysia	-4.8
	Bangladesh	-4.9
	Vietnam	-6.6
	Slovakia	-6.6
	Ireland	-17.6

Figure A.1: Net lending/net borrowing of households (selected countries in 2017; as a percentage of GDP)

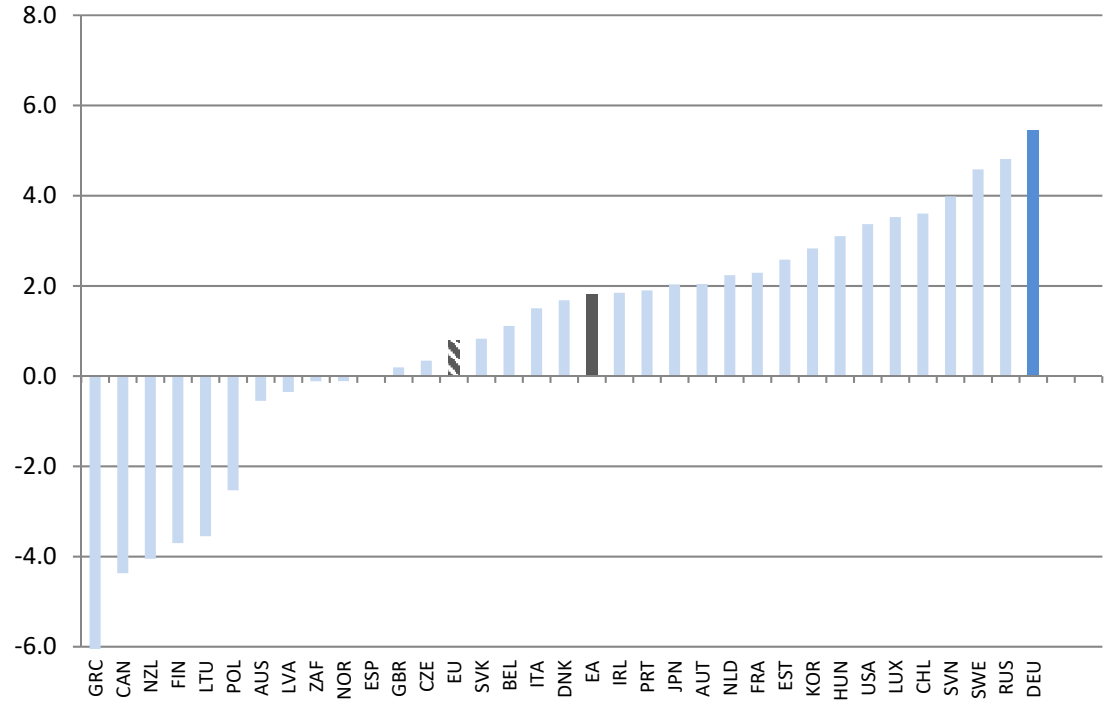


Figure A.2: Net lending/net borrowing of general government (selected countries in 2017; as a percentage of GDP)

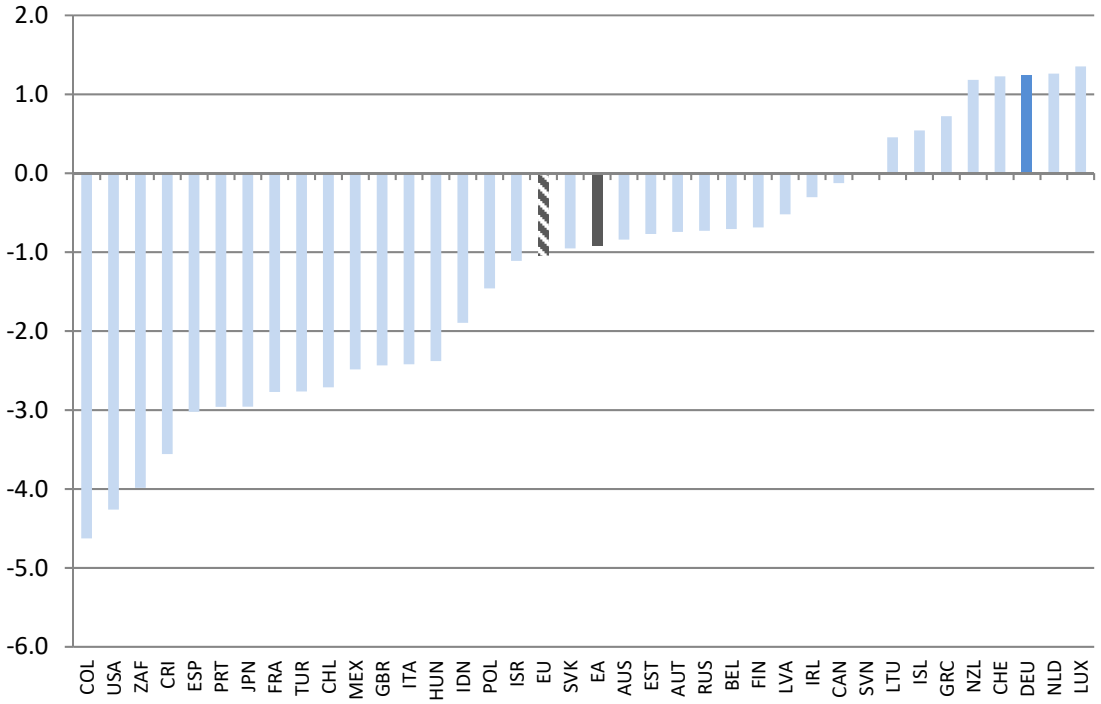
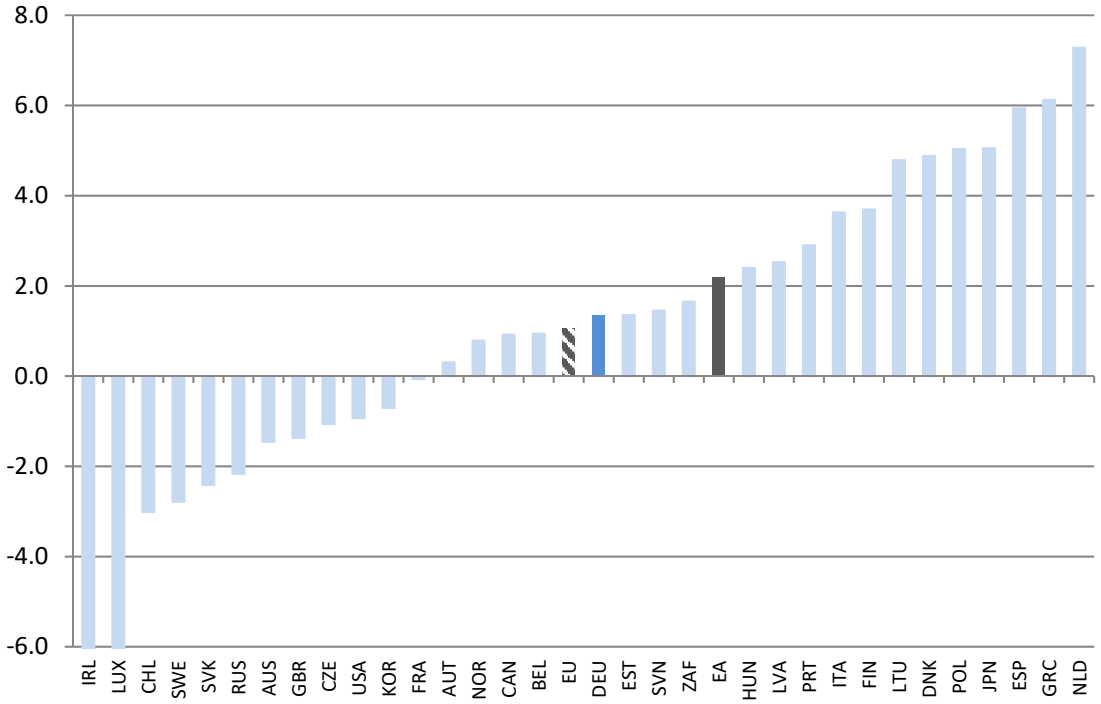


Figure A.3: Net lending/net borrowing of corporate sector (selected countries in 2017; as a percentage of GDP)



Annex B

Figure B.1: Unconditional forecast of aggregate German net exports (deviations from historical average; in pp)

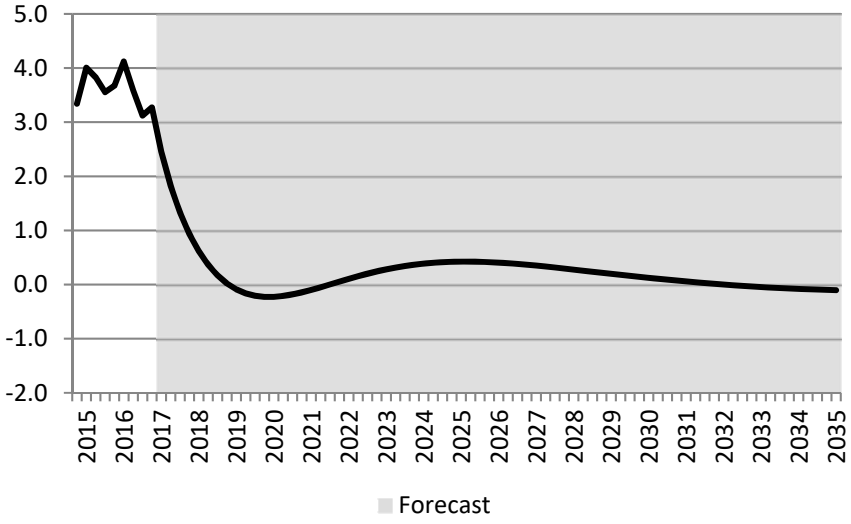
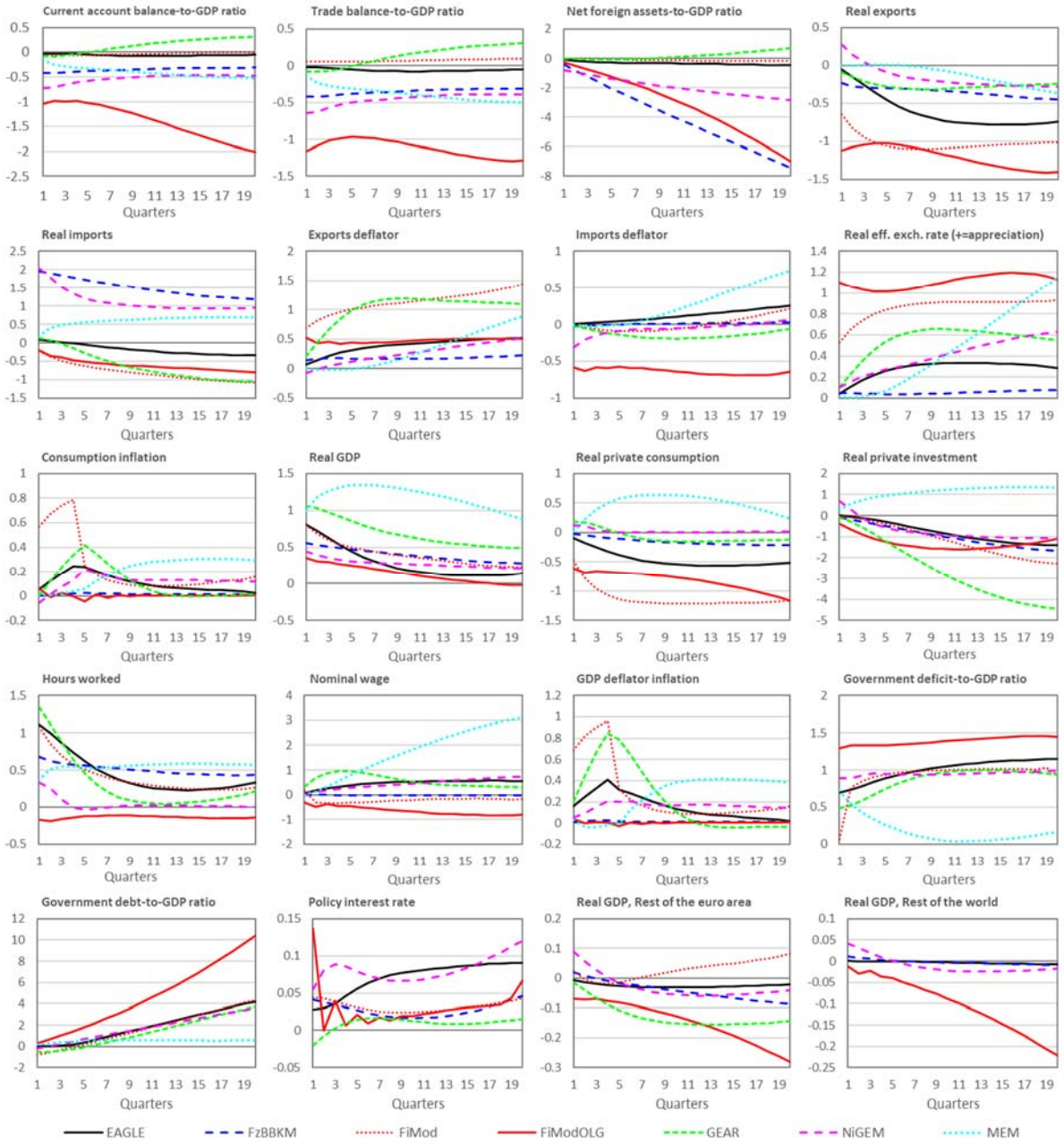


Table B.1: Classification of structural economic shocks

Group	Shock	Description	Group	Shock	Description
Savings DE	nuBet_a	Time preference shock	**Rest of euro area**	nuBet_b	Time preference shock
Investment DE	nuI_a	Investment shock	**Rest of euro area**	nuI_b	Investment shock
Wages DE	nuTau_W_a	Wage mark-up shock	**Rest of euro area**	nuG_b	Government spending shock
Government spending DE	nuG_a	Government spending shock	**Rest of euro area**	nuTau_V_N_b	Price mark-up shock in non-tradable sector
Technology DE	nuA_a	Technology shock	**Rest of euro area**	nuTau_V_T_b	Price mark-up shock in tradable sector
Other DE	nuTau_V_N_a	Price mark-up shock in non-tradable sector	**Rest of world**	nuA_c	Technology shock
Other DE	nuTau_V_T_a	Price mark-up shock in tradable sector	**Rest of world**	nuG_c	Government spending shock
Other DE	nu_G2_aa	Shock to share of traded goods in overall consumption	**Rest of world**	nuTau_V_c	Price mark-up shock in non-tradable sector
Euro area monetary policy	nuM_mu	Interest rate shock	**Rest of world**	nuM_c	Interest rate shock
Rest of euro area	nuA_b	Technology shock	**Rest of world**	nu_G2_ac	Shock to share of traded goods in overall consumption
Rest of euro area	nuTau_W_b	Wage mark-up shock	**Rest of world**	nuRP_ca	Risk premium shock

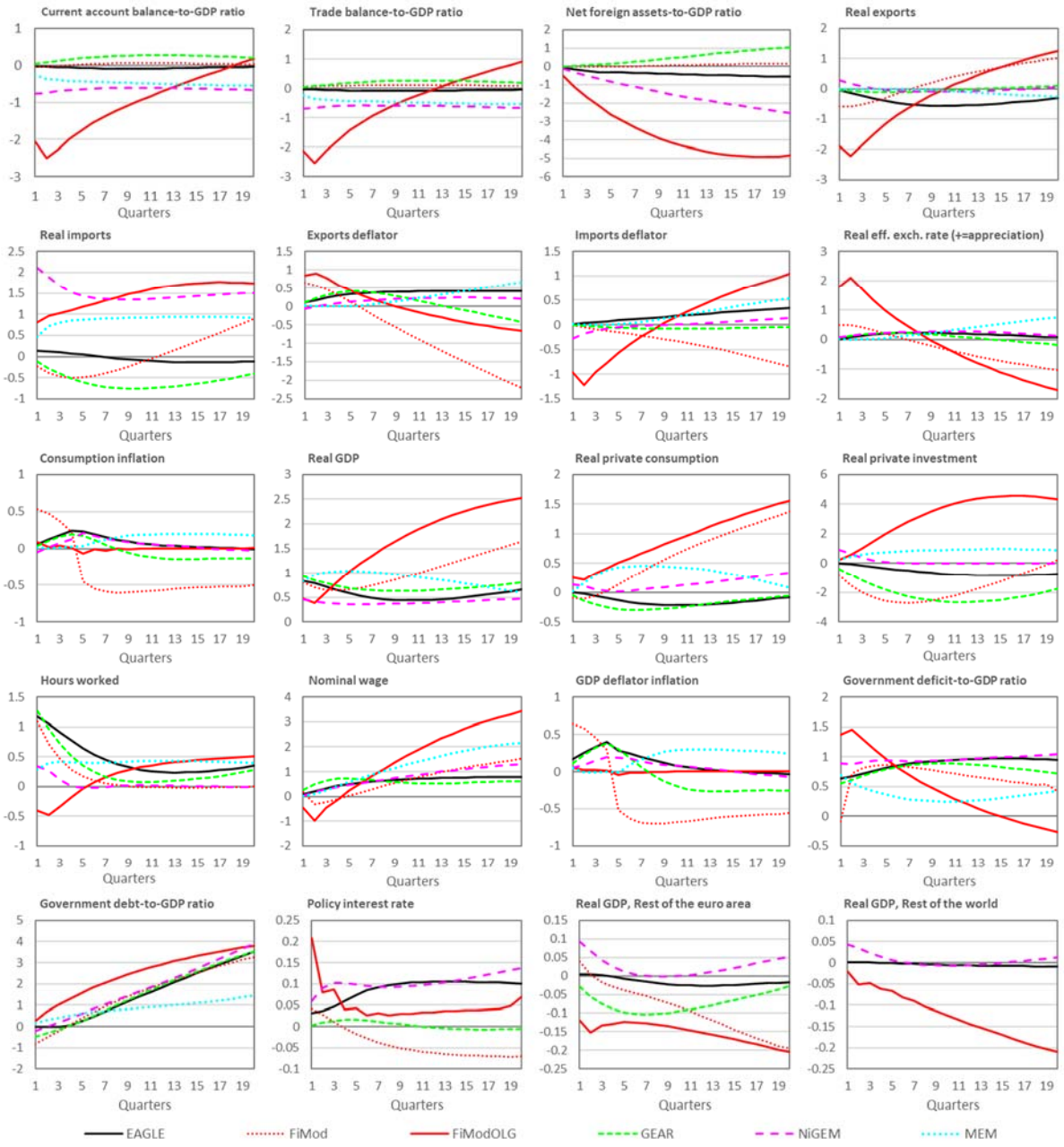
Annex C

Figure C.1: Macroeconomic response to a government consumption shock



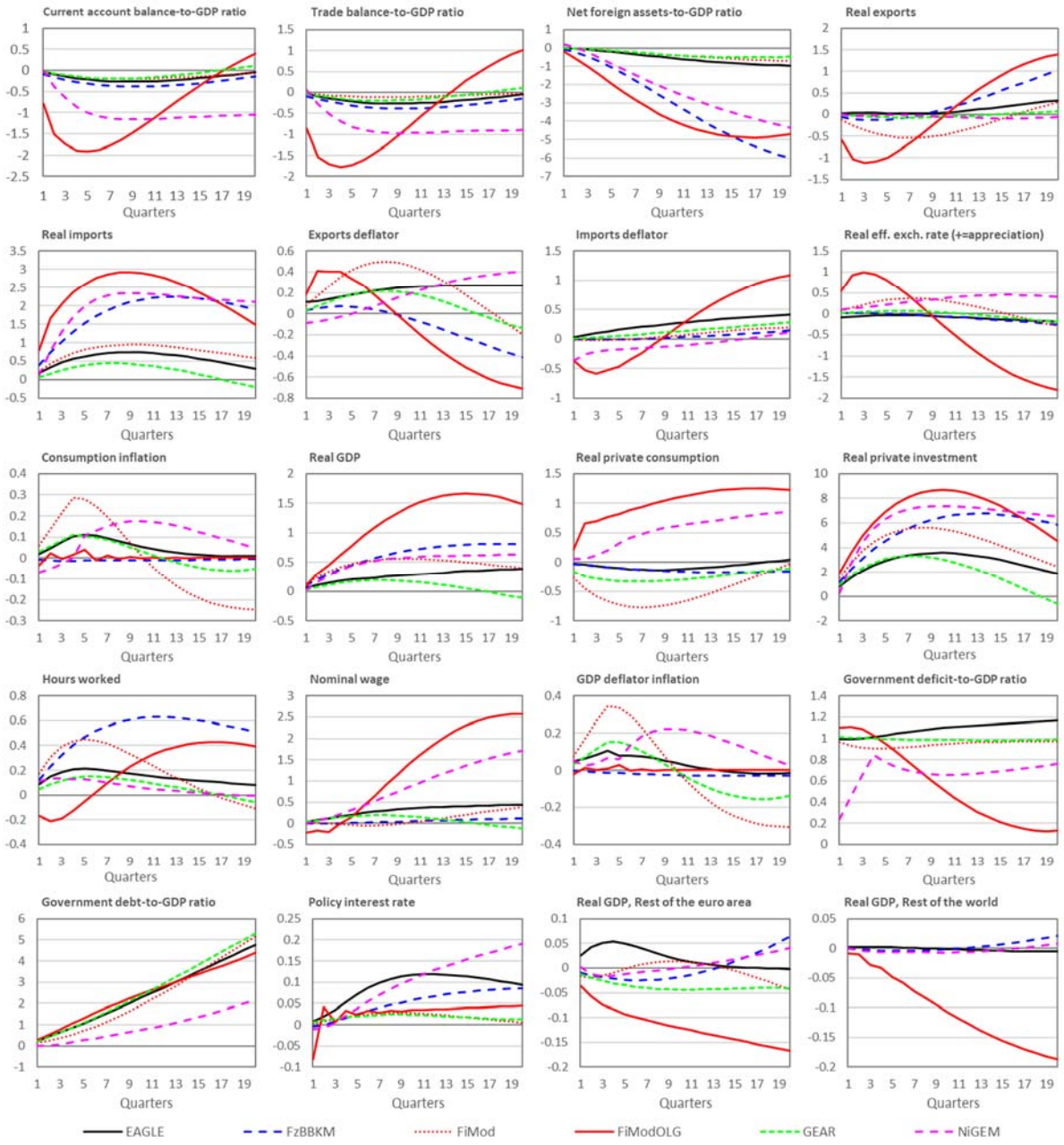
Note: This figure depicts the responses of selected variables to an ex ante increase in the government consumption by 1% of GDP over a five-year period. Thereafter, the shock returns to the baseline assuming an autoregressive parameter of 0.9 (on a quarterly basis). Fiscal rules are exogenous in the first ten years. All responses are reported as percentage deviations from the baseline, except for the responses of the inflation, interest rate, balance and stock ratios, which are reported as percentage-point deviations. In addition, inflation and interest rates are annualised.

Figure C.2: Macroeconomic response to a government investment shock



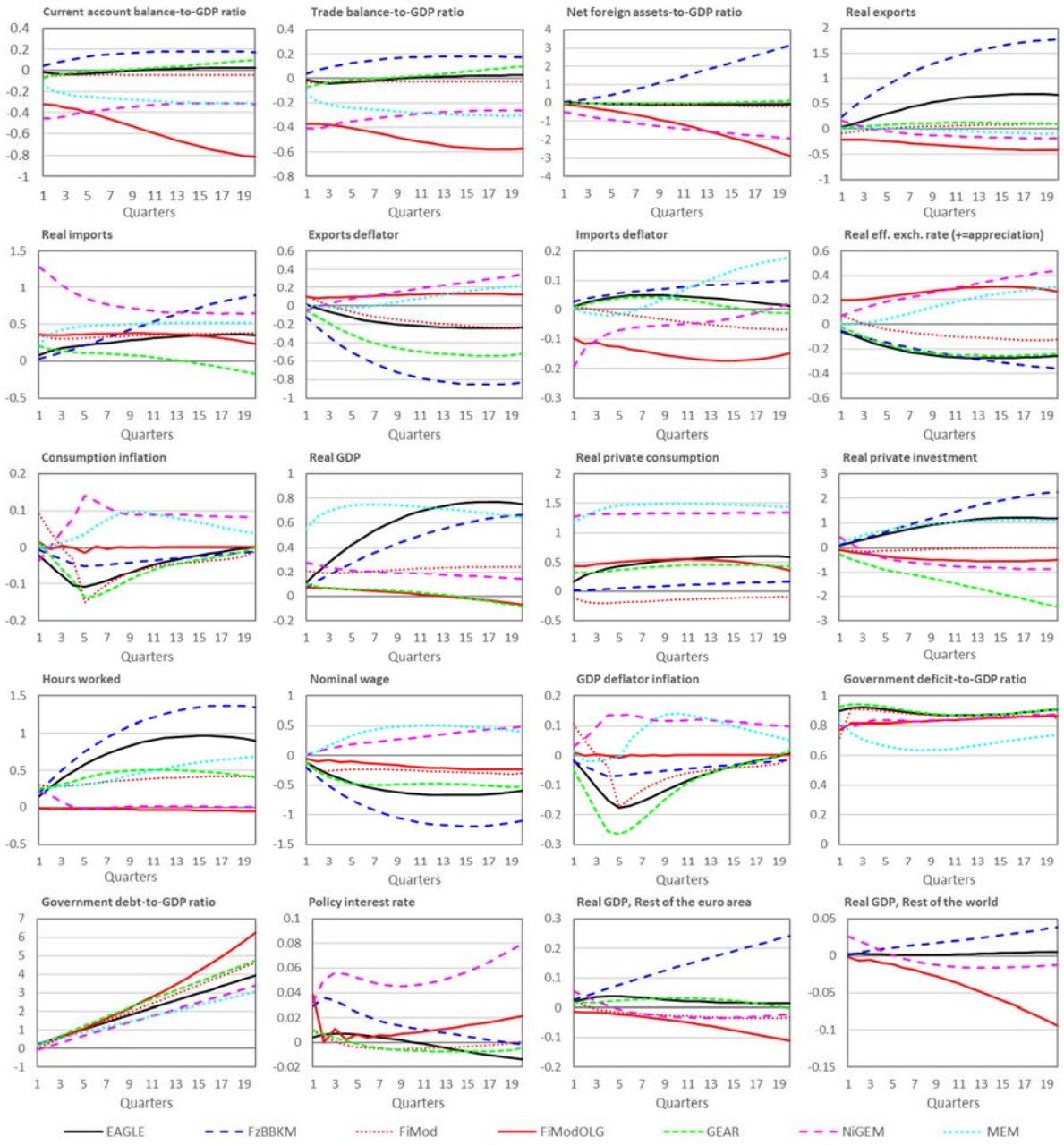
Note: This figure depicts the responses of selected variables to an ex ante increase in the government investment by 1% of GDP over a five-year period. Thereafter, the shock returns to the baseline assuming an autoregressive parameter of 0.9 (on a quarterly basis). Fiscal rules are exogenous in the first ten years. All responses are reported as percentage deviations from the baseline, except for the responses of the inflation, interest rate, balance and stock ratios, which are reported as percentage-point deviations. In addition, inflation and interest rates are annualised.

Figure C.3: Macroeconomic response to a capital income tax shock



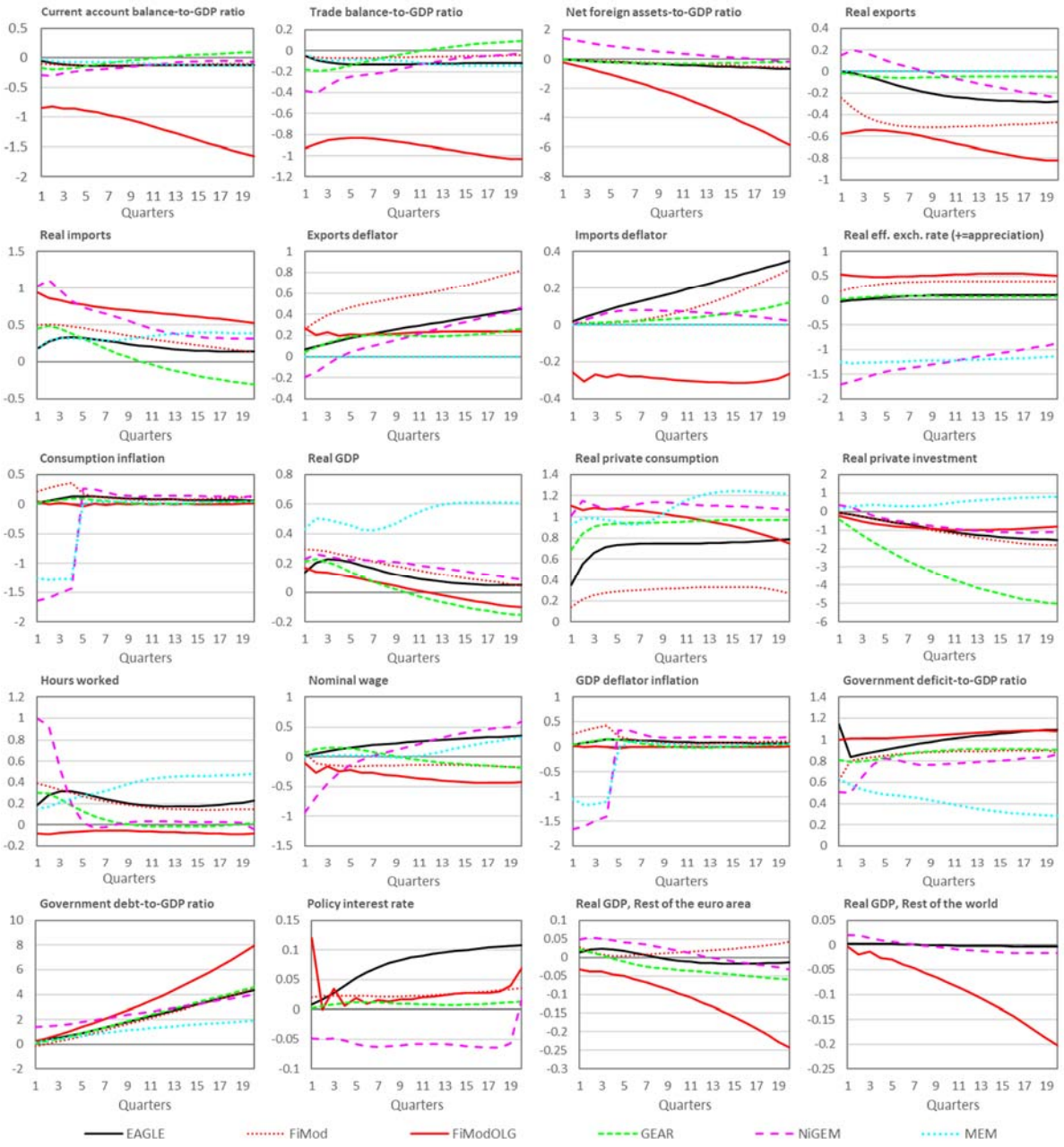
Note: This figure depicts the responses of selected variables to an ex ante reduction in the capital income tax rate by 1% of GDP over a five-year period. Thereafter, the shock returns to the baseline assuming an autoregressive parameter of 0.9 (on a quarterly basis). Fiscal rules are exogenous in the first ten years. All responses are reported as percentage deviations from the baseline, except for the responses of the inflation, interest rate, balance and stock ratios, which are reported as percentage-point deviations. In addition, inflation and interest rates are annualised.

Figure C.4: Macroeconomic response to a labour income tax shock



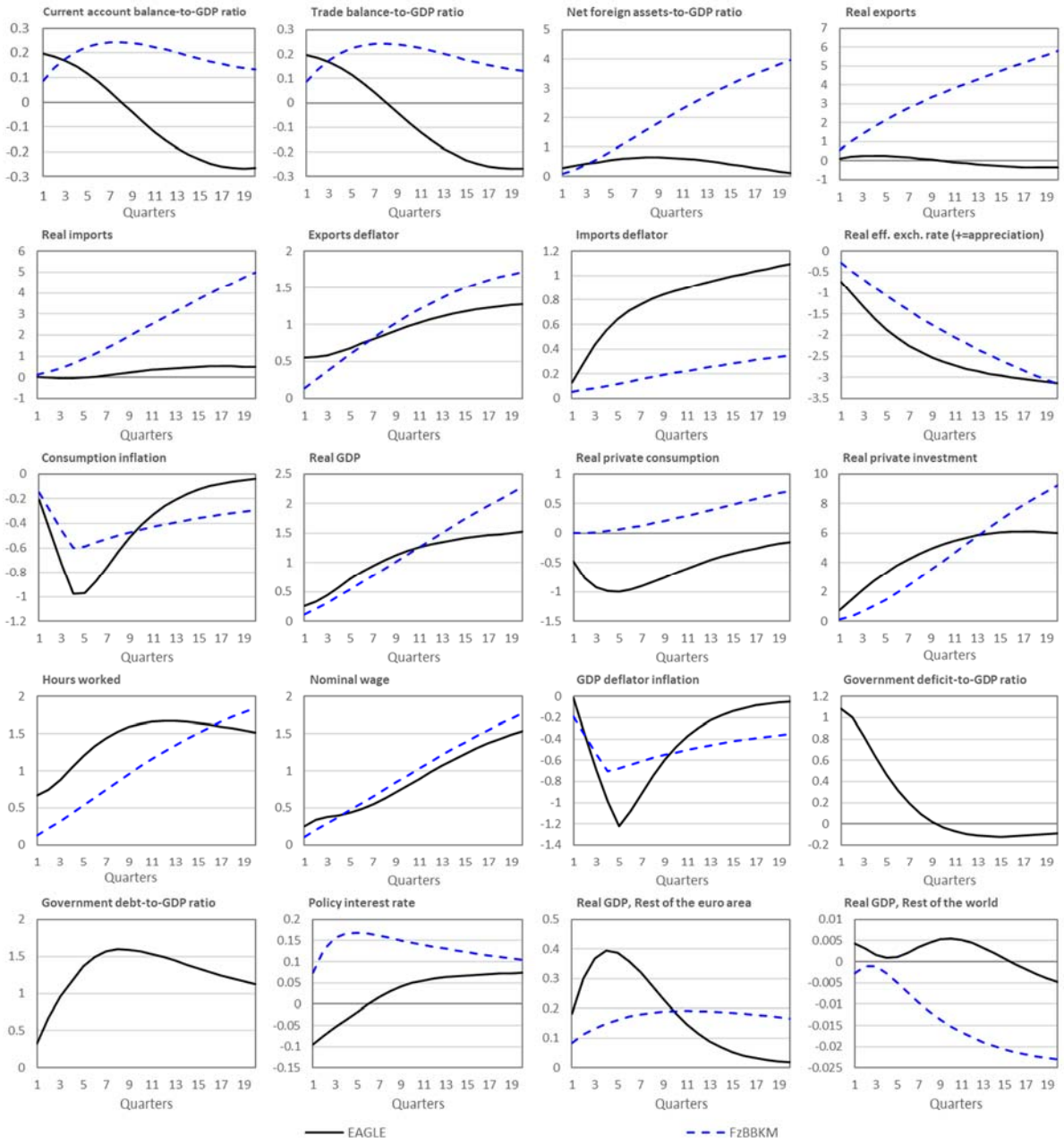
Note: This figure depicts the responses of selected variables to an ex ante reduction in the labour income tax rate by 1% of GDP over a five-year period. Thereafter, the shock returns to the baseline assuming an autoregressive parameter of 0.9 (on a quarterly basis). Fiscal rules are exogenous in the first ten years. All responses are reported as percentage deviations from the baseline, except for the responses of the inflation, interest rate, balance and stock ratios, which are reported as percentage-point deviations. In addition, inflation and interest rates are annualised.

Figure C.5: Macroeconomic response to a consumption tax shock



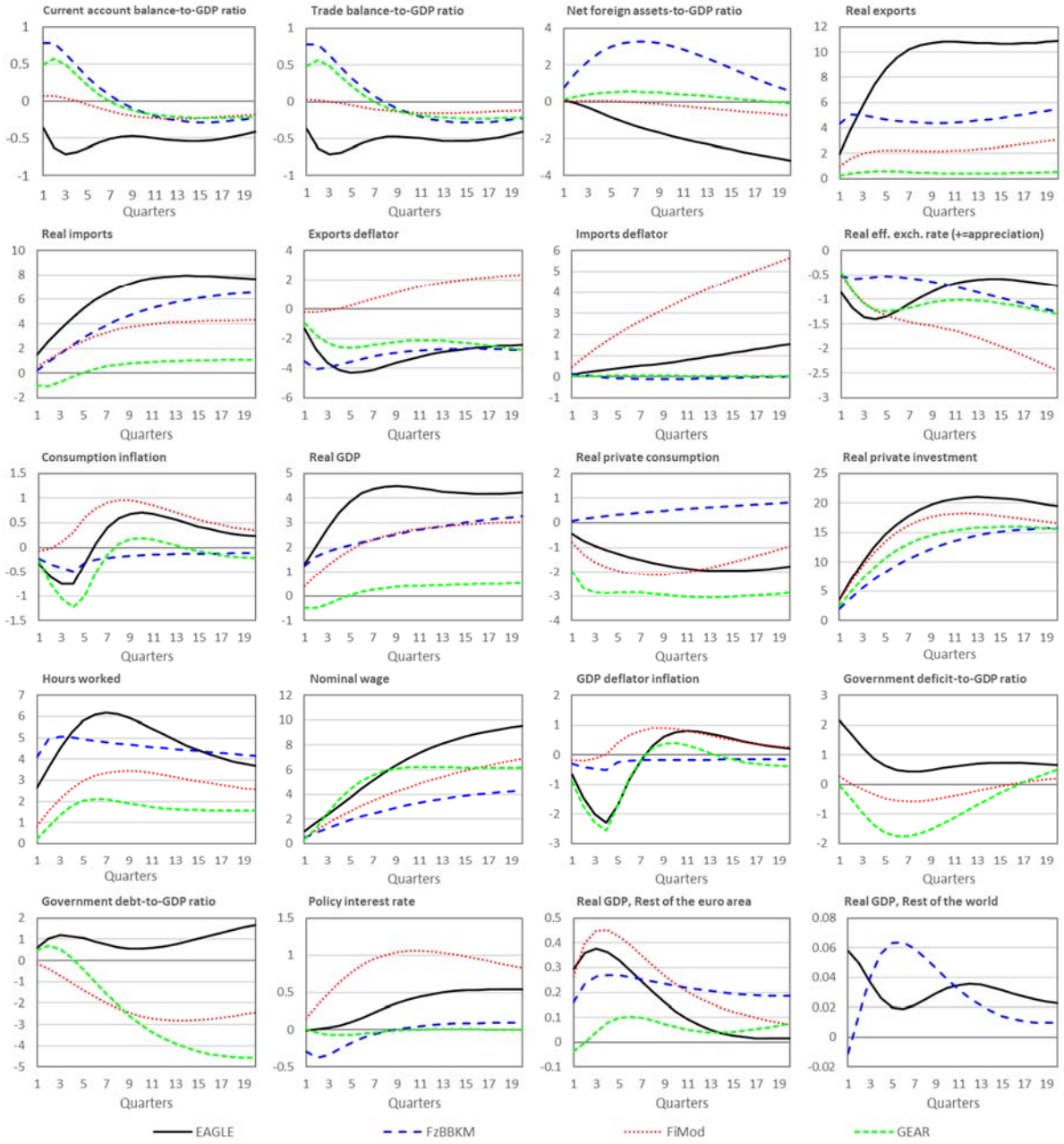
Note: This figure depicts the responses of selected variables to an ex ante reduction in the consumption tax rate by 1% of GDP over a five-year period. Thereafter, the shock returns to the baseline assuming an autoregressive parameter of 0.9 (on a quarterly basis). Fiscal rules are exogenous in the first ten years. All responses are reported as percentage deviations from the baseline, except for the responses of the inflation, interest rate, balance and stock ratios, which are reported as percentage-point deviations. In addition, inflation and interest rates are annualised. In NiGEM and MEM, the consumption and GDP deflators include value-added tax.

Figure C.6: Macroeconomic response to a service sector liberalisation



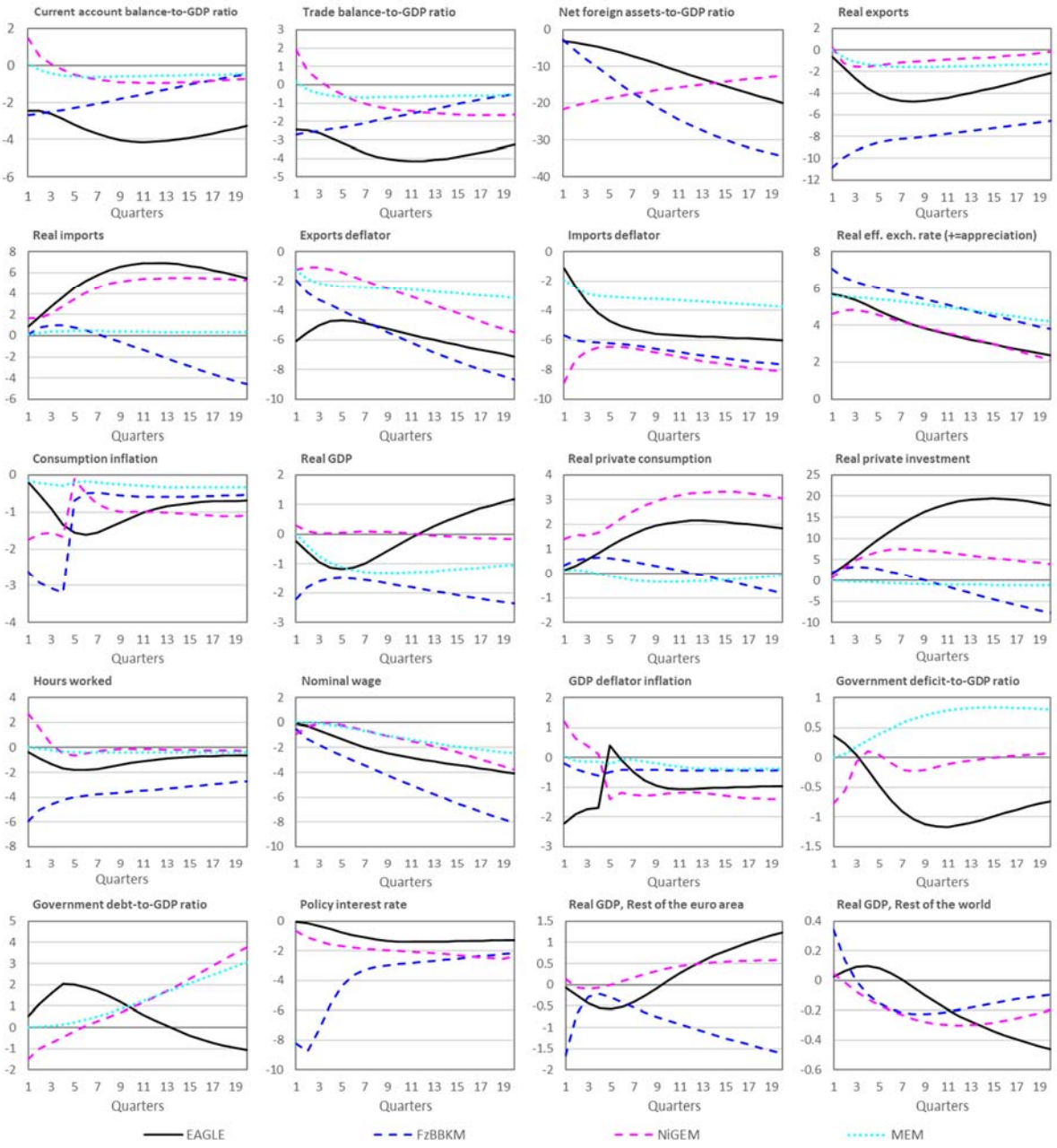
Note: This figure depicts the responses of selected variables to a permanent reduction of a price mark-up in the non-tradable sector by 10 percentage points. All responses are reported as percentage deviations from the baseline, except for the responses of the inflation, interest rate, balance and stock ratios, which are reported as percentage-point deviations. In addition, inflation and interest rates are annualised.

Figure C.7: Macroeconomic response to an economy-wide product market liberalisation



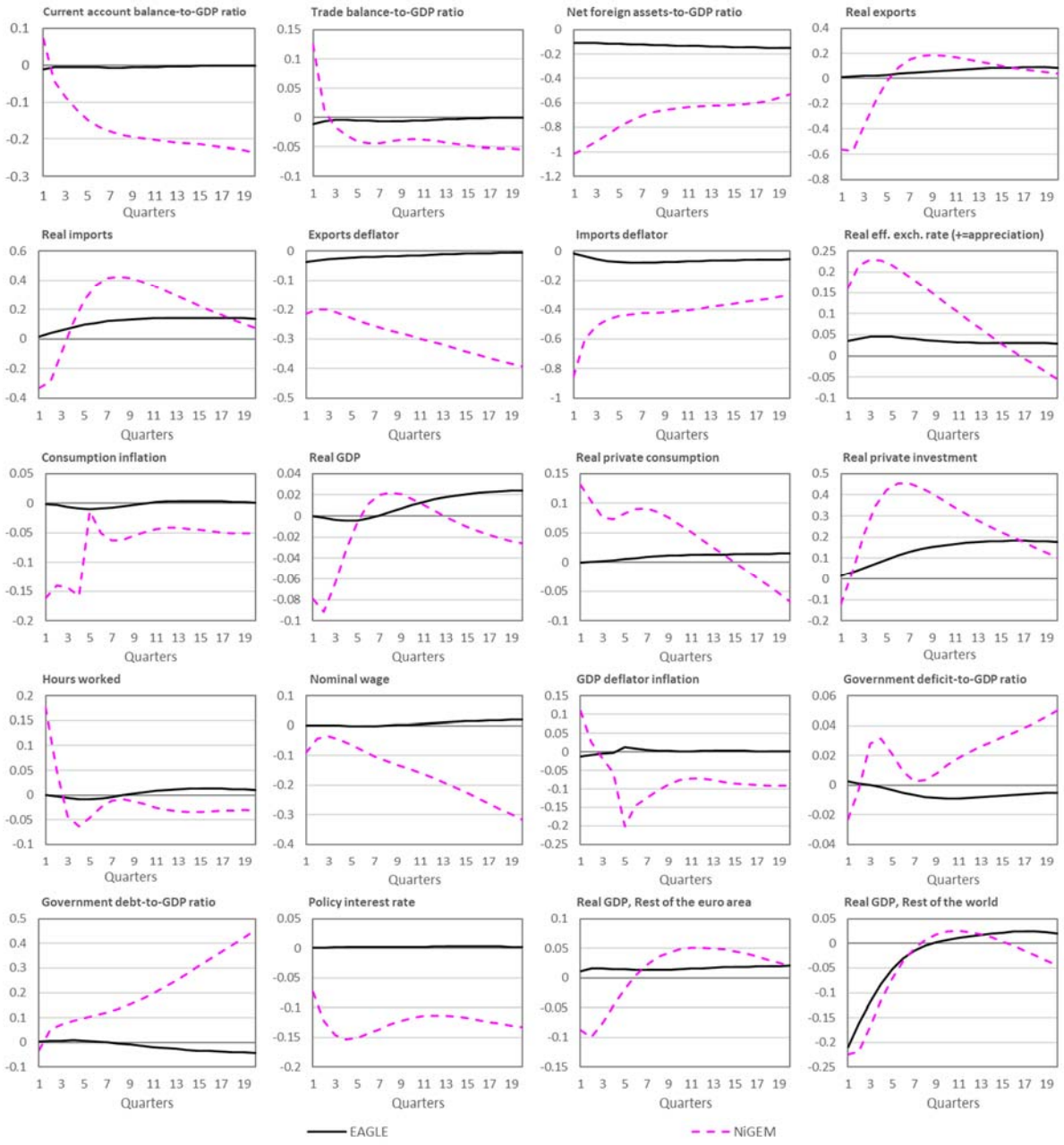
Note: This figure depicts the responses of selected variables to a permanent reduction of an economy-wide price mark up by 10 percentage points. All responses are reported as percentage deviations from the baseline, except for the responses of the inflation, interest rate, balance and stock ratios, which are reported as percentage-point deviations. In addition, inflation and interest rates are annualised.

Figure C.8: Macroeconomic response to an appreciation of the euro



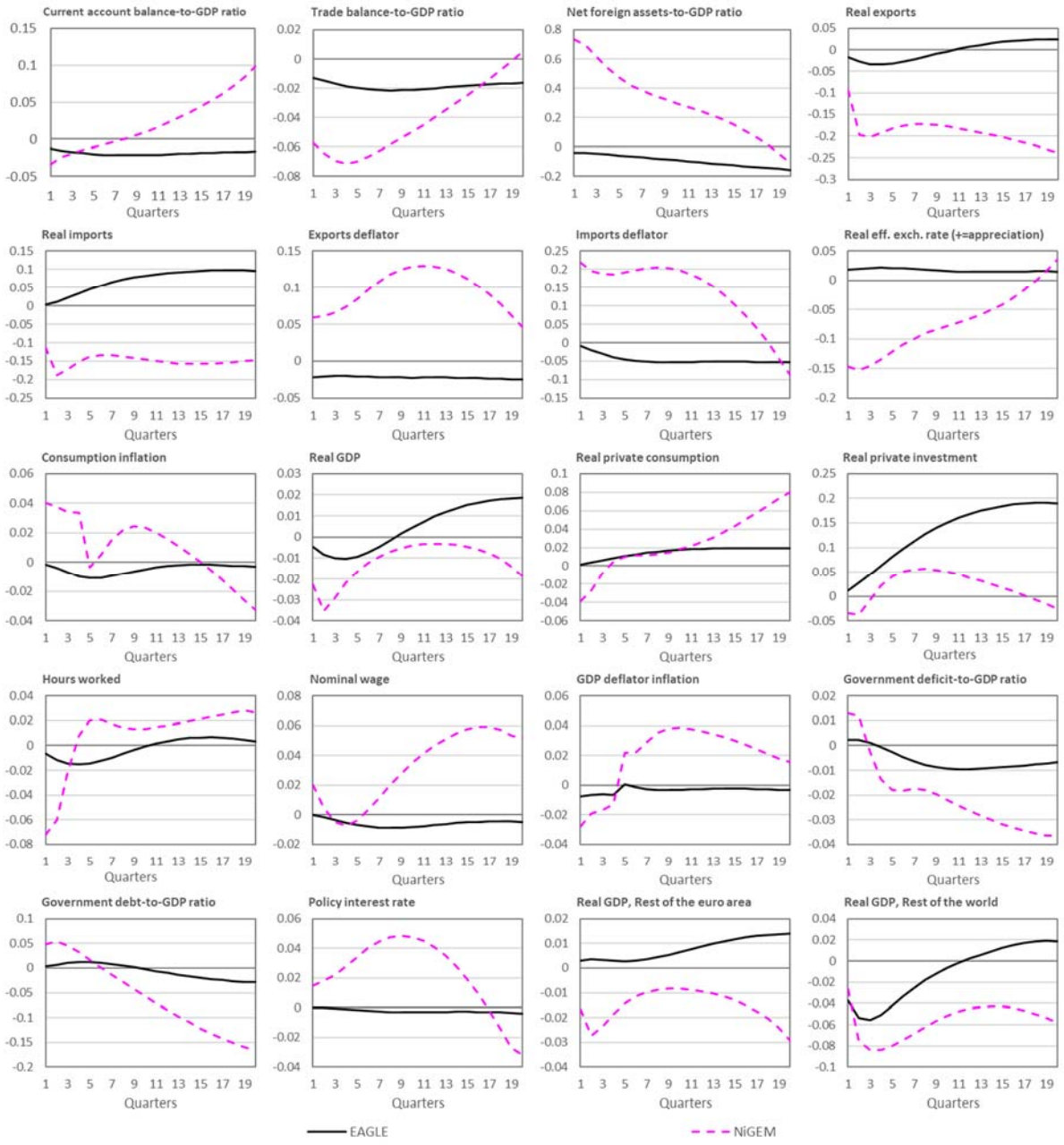
Note: This figure depicts the responses of selected variables to a nominal appreciation of the euro by 10% over a five-year period. All responses are reported as percentage deviations from the baseline, except for the responses of the inflation, interest rate, balance and stock ratios, which are reported as percentage-point deviations. In addition, inflation and interest rates are annualised.

Figure C.9: Macroeconomic response to a government consumption shock in the USA



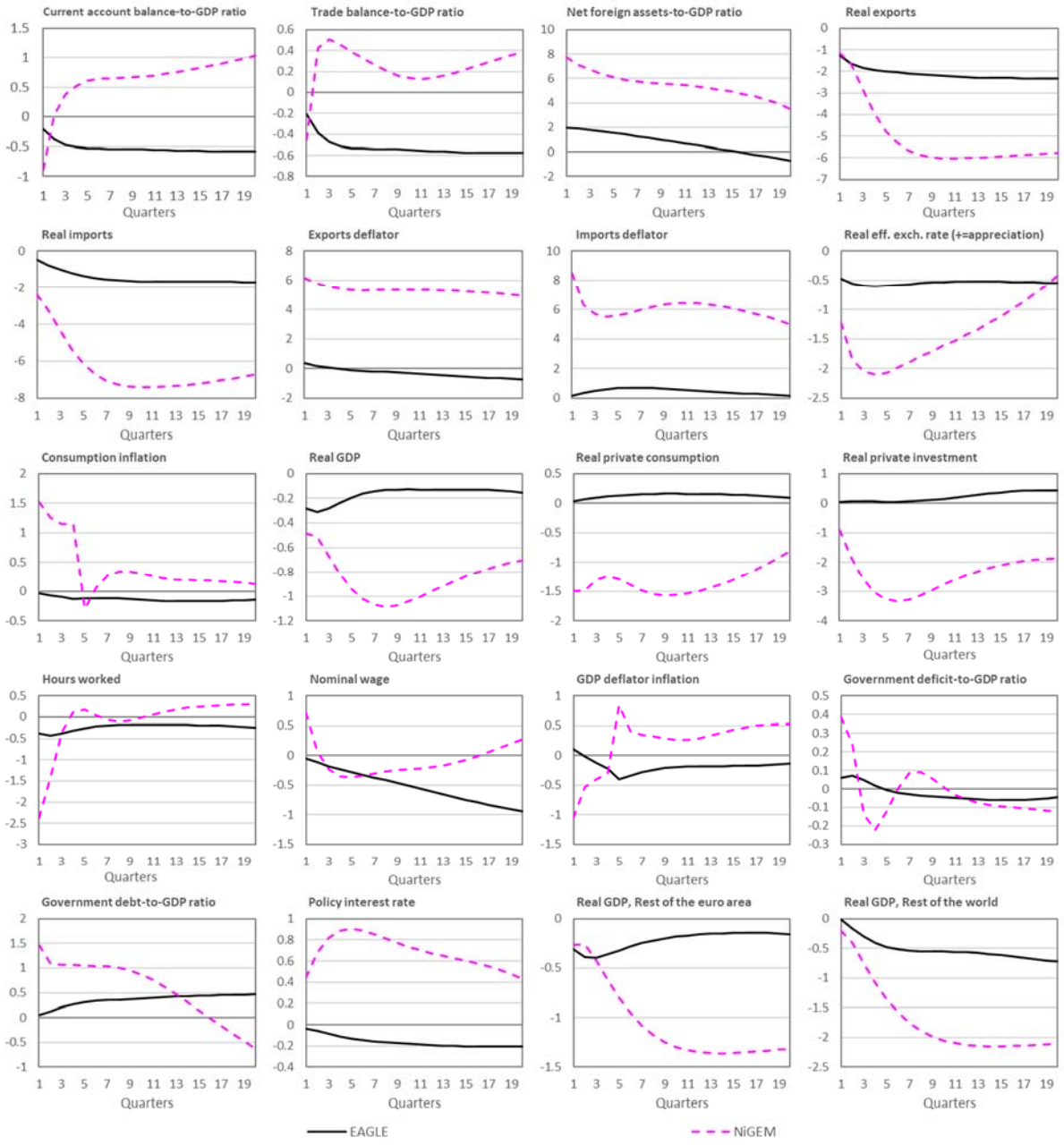
Note: This figure depicts the responses of selected variables to an ex ante reduction in the government consumption by 1% of GDP over a five-year period. Thereafter, the shock returns to the baseline assuming an autoregressive parameter of 0.9 (on a quarterly basis). Fiscal rules are exogenous in the first ten years. All responses are reported as percentage deviations from the baseline, except for the responses of the inflation, interest rate, balance and stock ratios, which are reported as percentage-point deviations. In addition, inflation and interest rates are annualised.

Figure C.10: Macroeconomic response to a consumption tax shock in the USA



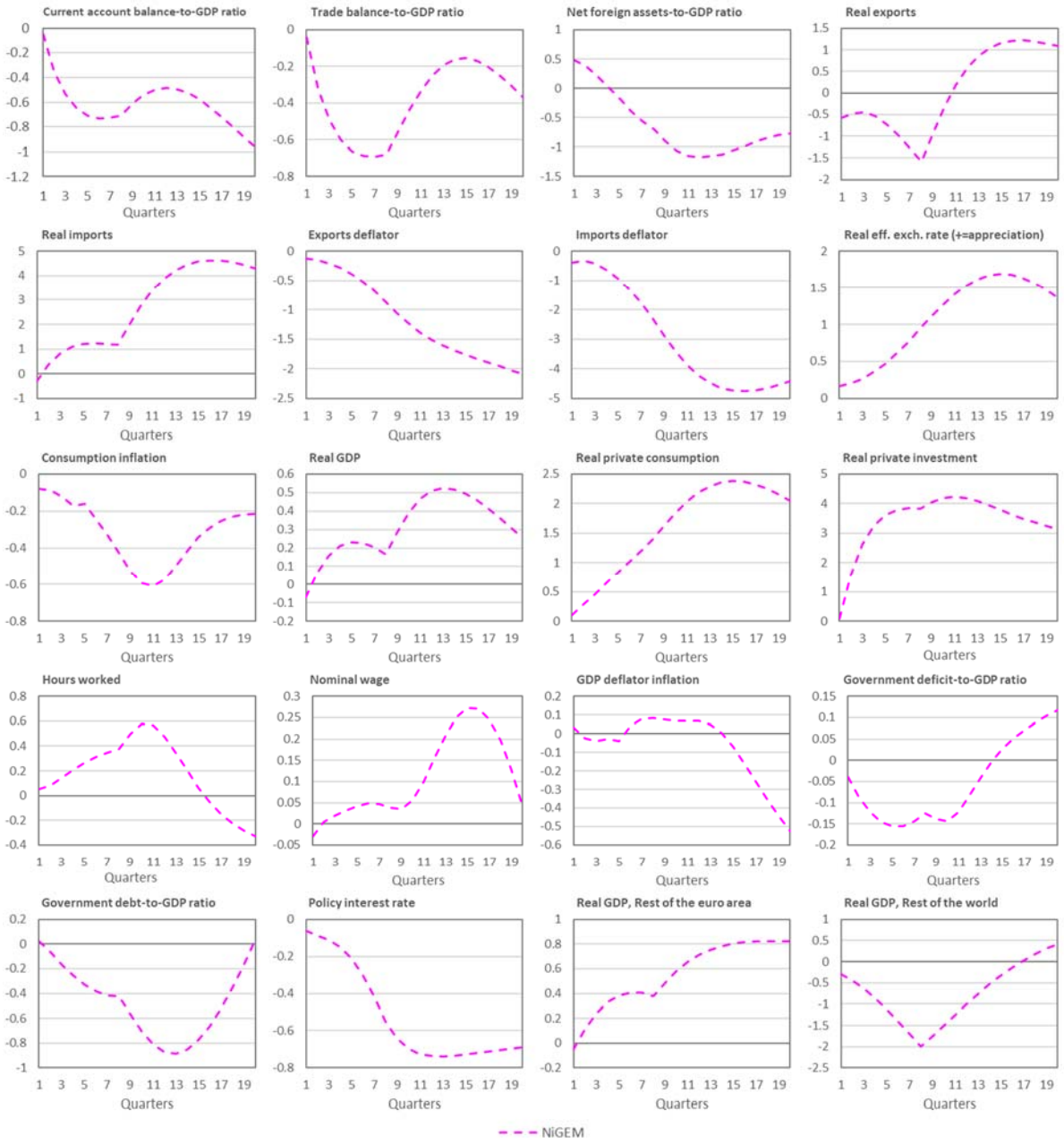
Note: This figure depicts the responses of selected variables to an ex ante increase in the consumption tax rate by 1%of GDP over a five-year period. Thereafter, the shock returns to the baseline assuming an autoregressive parameter of 0.9 (on a quarterly basis). Fiscal rules are exogenous in the first ten years. All responses are reported as percentage deviations from the baseline, except for the responses of the inflation, interest rate, balance and stock ratios, which are reported as percentage-point deviations. In addition, inflation and interest rates are annualised.

Figure C.11: Macroeconomic response to a higher US imports tariff rate



Note: This figure depicts the responses of selected variables to an increase in the US import tariff rate by 20 percentage points over a five-year period. Thereafter, the shock returns to the baseline assuming an autoregressive parameter of 0.9 (on a quarterly basis). Fiscal rules are exogenous in the first ten years. All responses are reported as percentage deviations from the baseline, except for the responses of the inflation, interest rate, balance and stock ratios, which are reported as percentage-point deviations. In addition, inflation and interest rates are annualised.

Figure C.12: Macroeconomic response to a domestic demand slowdown in China



Note: This figure depicts the responses of selected variables to a slowdown of private consumption and investment growth in China over a two-year period by respectively 3 and 12 percentage points (in annual terms). All responses are reported as percentage deviations from the baseline, except for the responses of the inflation, interest rate, balance and stock ratios, which are reported as percentage-point deviations. In addition, inflation and interest rates are annualised.