German current account effects

SUMMARY

We estimate a three-country model using 1995–2013 data for Germany, the Rest of the Euro Area (REA) and the Rest of the World (ROW) to analyse the determinants of Germany's current account (CA) surplus after the launch of the euro. Our results suggest that the German surplus reflects a succession of distinct shocks. Mono-causal explanations of the surplus are thus insufficient. The most important factors driving the German surplus were positive shocks to the German saving rate and to ROW demand for German exports, as well as German labour market reforms and other positive German aggregate supply shocks. The key shocks that drove the rise in the German CA tended to worsen the REA trade balance, but had a weak effect on REA real activity. Our analysis suggests these driving factors are likely to be slowly eroded, leading to a very gradual reduction of the German CA surplus. An expansion in German government consumption and investment would raise German GDP and reduce the CA surplus, but the effects on the surplus would be weak.

JEL codes: E3, E6, F3, F4, F6

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What drives the German current account? And how does it affect other EU Member States?

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1. INTRODUCTION

Germany experienced a spectacular current account reversal, after the launch of the euro (1999). In the 1990s, the German current account was in deficit, but close to balance – however, in the early 2000s, the current account shifted to steadily increasing surpluses, vis-à-vis both the rest of the Euro Area (REA) and the rest of the world (ROW).[1] During the financial crisis, German capital flows to the REA fell abruptly, but the overall German current account surplus bounced back rapidly and reached record levels–185 billion EUR in 2012, i.e. 7% of German GDP–due inter alia to a rise in the surplus vis-à-vis Asia. As a result, Germany has become one of the major surplus countries in the world.

These developments are currently at the heart of heated debates about the role of the German surplus and of intra-Euro Area external imbalances for the crisis and the slow recovery in Europe (see Lane (2012), Chen *et al*. (2012) and Hobza and Zeugner (2013) for discussions of intra-EA imbalances). In October 2013, the US Treasury sharply criticized Germany's external surplus: 'Germany's anaemic pace of domestic demand growth and dependence on exports have hampered rebalancing at a time when many other Euro Area countries have been under severe pressure to curb demand and compress imports in order to promote adjustment. The net result has been a deflationary bias for the Euro Area, as well as for the world economy' (US Treasury, 2013, p. 3). The Treasury argued that countries with large and persistent surpluses 'need to take action to boost domestic demand growth and shrink their surpluses' (p. 25). The German Government dismissed this criticism and argued 'The Trade surpluses reflect the strong competitiveness of the German economy and the international demand for quality products from Germany' (Wall Street Journal, 31 October 2013); the German current account surplus was 'no cause for concern, neither for Germany, nor for the Eurozone, or the global economy', and that 'On the contrary, the innovative German economy contributes significantly to global growth through exports and the import of components for finished products' (Financial Times, 31 October 2013).

The IMF has likewise repeatedly expressed concerns about the German external surplus, and argued that 'stronger and more balanced growth in Germany is critical to a lasting recovery in the Euro Area and global rebalancing' (IMF Executive Board, 6 August 2013a). In contrast to the US Treasury, the IMF's policy advice centres on structural reforms in the German economy, such as measures to increase the productivity of the service sector and labour force participation. The European Commission too advocates supply side policies for Germany that 'strengthen domestic sources of potential growth against the background of unfavourable demographic prospects' (European Commission, Alert Mechanism Report 2014, November 2013). In November 2013, the

[1] Throughout this paper, the term 'Euro Area' (EA) refers to the 17 countries that were members of the Euro Area in 2013. REA is an aggregate of the EA less Germany.

persistent German current account surplus triggered an 'In-Depth Review' by the EU Commission, under the Commission's 'Macroeconomic Imbalances Procedure'. The Review published in March 2014 concluded that the German surplus constitutes an 'imbalance' (see Box 1 on the Macroeconomic Imbalances Procedure below).[2]

The goal of this paper is to shed light on these policy issues, using a state-of-the-art macroeconomic model. Economic theory suggests that a country's current account reflects domestic and foreign macroeconomic and financial shocks, and the structural features of the domestic and foreign economies. An understanding of those shocks and structural properties is thus crucial for positive and normative evaluations of the current account, and for policy advice (Obstfeld and Rogoff, 1996; Kollmann, 1998, 2001, 2004; Obstfeld, 2012). This underscores the importance of analysing the current account using a structural model that captures the relevant shocks, and their transmission to the macroeconomy.

This paper therefore studies the German current account using an estimated Dynamic Stochastic General Equilibrium (DSGE) model with three countries: Germany, the REA and the ROW.[3] The model is estimated using quarterly data for the period 1995q1–2013q2. The model assumes a rich set of demand and supply shocks in goods, labour and asset markets, and it allows for nominal and real rigidities, and financial frictions.[4]

Several hypotheses about the causes of Germany's external surplus have been debated in the policy and academic literature. Those causes have mostly been discussed separately, although in reality these drivers can operate jointly. Our estimated model allows us to recover the shocks that drive the German external balance – and, hence, we can determine what shocks mattered most, and when. The model also allows us to assess what policy measures might best be suited for changing the German external surplus.

We devote particular attention to the following potential causes of the German external surplus: (1) In the run-up to the euro (1995–8), REA interest rates converged to German rates, an indication that the euro led to greater financial integration in Europe; it has frequently been argued (e.g. Sinn, 2010; Hale and Obstfeld, 2013) that greater financial integration triggered capital flows from Germany to the REA. (2) A second widely discussed factor was strong growth in emerging economies during the past two decades–German exports may have benefited particularly from rising demand for investment goods by emerging economies, given German's specialization in the

[2] The German external surplus has also widely been discussed in the media; see e.g. Krugman (2013).

[3] There are few empirical macro models for Germany. Pytlarczyk (2005) estimates a two-country DSGE model with 1980–2003 data for Germany and the Euro Area. His model is more stylized than our model. Pytlarczyk does not use data on the external balance. However, Pytlarczyk's parameter estimates share some of the broad features of our estimates, e.g. his results also support gradual demand adjustment (consumption habit persistence) and nominal stickiness. The Bundesbank has recently started to develop an empirical DSGE model of the German economy (Hoffmann *et al.*, 2014).

[4] Earlier applications of similar models can be found in in 't Veld *et al.* (2011), Kollmann *et al.* (2012) and Kollmann *et al.* (2013).

Box 1. The Macroeconomic Imbalances Procedure

Drawing lessons from the financial and economic crisis, the European Commission has strengthened macroeconomic surveillance by introducing the Macroeconomic Imbalances Procedure (MIP) in 2011. The aim of the MIP is to identify potential risks to macroeconomic stability at an early stage and to ensure that Member States adopt appropriate policies to prevent harmful imbalances and correct those that have already built up.

EU Regulation No 1176/2011 characterizes a macroeconomic imbalance as 'any trend giving rise to macroeconomic developments which are adversely affecting, or have the potential adversely to affect, the proper functioning of the economy of a Member State or of the Economic and Monetary Union, or of the Union as a whole'. Excessive imbalances are defined as 'severe imbalances that jeopardize or risk jeopardizing the proper functioning' of EMU.

The MIP adopts a graduated approach. The first step is a screening for potential imbalances against a scoreboard of 11 indicators, comprising the current account balance, the net international investment position, the real effective exchange rate, nominal unit labour costs, the export market share, the unemployment rate, house price developments, private sector credit, private sector debt, government debt and financial sector liabilities. The MIP scoreboard establishes threshold values for each indicator. The result of the screening by the European Commission is published in the annual Alert Mechanism Report (AMR). The violation of one or several threshold values provides an early warning and indicates the need for further analysis by the European Commission in the form of an In-Depth Review (IDR). On the basis of the IDR, the Commission determines whether imbalances, and excessive imbalances, exist.

If the European Commission concludes that excessive imbalances exist in a Member State, it may, in a third step, recommend to the European Council that the Member State concerned draw up a corrective action plan. After adoption of the recommendation by the Council, the European Commission and the European Council monitor its implementation. Repeated failure to take action can, in a fourth step, lead to financial sanctions.

The AMR of November 2013 concluded that an IDR for German was warranted due, in particular, to the breach of the current account threshold (the latter issues an alert when the three-year average of the current account balance as a percentage of GDP exceeds 6% or falls below −4%). The European Commission published its IDR on Germany in March 2014. It concluded that Germany is experiencing macroeconomic imbalances, which require monitoring and policy action, and argued for measures that strengthen demand and the economy's growth potential (European Commission, 2014). In June 2014, country-specific recommendations were issued to use the available scope for increased and more efficient public investment in infrastructure, education and research and to improve conditions that further support domestic demand.

production of those goods; strong growth in emerging economies may also have added to intra-EA imbalances by increasing competition for exports from the EMU periphery (e.g. Chen *et al.*, 2012). (3) The German labour market liberalization during the period 2002–2005 (which was driven i.a. by the growth of outsourcing by German firms to low wage countries, notably in Eastern Europe) has often been viewed as a factor that raised German labour supply, and restrained German wage growth, thereby boosting German competitiveness (e.g. Dustmann *et al.*, 2014). (4) Finally, it has been argued that depressed German domestic demand (as pointed out above), and thus a high saving rate, are key drivers of the German surplus; high saving may partly reflect German households' concerns about rapid population ageing, following pension reforms (2001–2004) that markedly lowered state-funded pensions, and created tax incentives for private retirement saving (Deutsche Bundesbank, 2011). Fiscal consolidation in Germany after the financial crisis may also have contributed to weak domestic demand (Lagarde, 2012; IMF, 2013*b*; in 't Veld, 2013).

Our empirical results suggest that all of these factors played a role in driving the German external surplus, but that their quantitative importance and timing differed markedly. Mono-causal explanations of the German surplus are, thus, insufficient: the surplus reflects a succession of distinct shocks.

According to the estimated model, greater financial integration (narrowing of the REA-German interest rate spread) had a positive effect on aggregate demand in the REA, which boosted REA and German GDP and raised the German current account. However, quantitatively, these effects are rather modest, and they operated mainly during the late 1990s and early 2000s; thus, REA-German interest rate convergence cannot explain the persistence of the rise of the German external surplus. We find that strong ROW growth contributed positively to German and REA GDP and net exports – the effect of ROW growth was stronger than that of interest rate convergence, and it mainly affected the German external balance between the early 2000s and the global recession. German labour market reforms had a marked effect on German GDP and the German current account after 2007; these reforms also had a positive, but much weaker, effect on REA GDP (due to stronger German demand for REA exports), and a weak negative effect on REA net exports. According to our estimates, positive shocks to German private saving strongly depressed aggregate demand in Germany after the mid-2000s and lowered German GDP, while raising the German current account; these shocks also stimulated aggregate demand in the REA (due to a fall in interest rates).

All in all, the key shocks that drove German real activity and the German current account only had a minor effect on real activity and inflation in the REA. In other terms, real activity in the REA was largely driven by domestic factors rather than by German economic conditions. The key supply and demand shocks that kept the German surplus at a high level likewise only had a weak effect on inflation in the REA. The model also allows us to make predictions about the future path of the German external balance. The rise in the interest rate spread between the REA and Germany since the sovereign debt crisis, and pressure towards labour market reform in the REA suggest a gradual reduction of the German current account surplus. Also the effects of labour market reforms enacted in Germany during the early 2000s are likely to be gradually eroded by higher German real wage growth, signs of which are already becoming visible (e.g. the German Federal Government elected in the Fall of 2013 has introduced a minimum wage law that will come into force on 1 January 2015). The German fiscal stance is also likely to become less restrictive, allowing a reversal of the trend decline in public investment. And given low interest rates in Germany, residential investment is also likely to pick up.

What light do these results shed on the policy debate about the German surplus? Our findings are consistent with the view that adverse shocks to domestic demand were key drivers of the surplus, especially after the mid-2000s. Our analysis also supports the official German view that strong external demand and German competitiveness gains (wage moderation and technological improvements) were important sources of the German external surplus. However, strong external demand and German competitiveness gains explain at most 1/3 to 1/2 of the surplus; strong external demand mattered mainly before the financial crisis, while wage restraint induced by labour market reforms contributed to the German surplus after the mid-2000s. The relative role of these factors has thus varied greatly across time. Positive shocks to the German saving rate have been especially important since the mid-2000s. The view that German labour market reforms represented 'wage dumping' at the expense of foreign economies (e.g. Flassbeck, 2012) is not consistent with our estimation results, due to the very modest effects of the reforms on real activity in the rest of the Euro Area.

Our analysis suggests that structural reforms to raise productivity and labour supply in the rest of the Euro Area would benefit the REA economies, and also lower the German external surplus. Boosting German government consumption would only have a modest stimulating effect on German GDP, on the German current account and on REA GDP. Increases in German government investment would boost German output much more, but would lead to an even more modest fall in the current account. Measures that raise German wages would lower German GDP and the German current account. Additional structural reforms to boost German aggregate supply would tend to further raise the German external surplus, in the short and medium term–which contrasts with the often-held view that such measures would lower the German surplus (see above).

In terms of related academic literature, it can be noted that several papers have analysed the dynamics of the current account using two-country DSGE models (e.g. Kollmann, 1998; Erceg *et al*., 2006); in contrast to the paper here, that literature has typically used calibrated (not estimated) models, and it has abstracted from housing markets and the key financial frictions considered in the present model. Jacob and Peersman (2013) study the determinants of the US current account deficit, using an estimated two-country model; that model too abstracts from housing and financial frictions. The paper here also differs from these studies, by considering a three-country setup. A key advantage of this setup is that a German trade surplus does not necessarily lead to a trade deficit of the same size in other EA countries (as would be the case in a standard two-

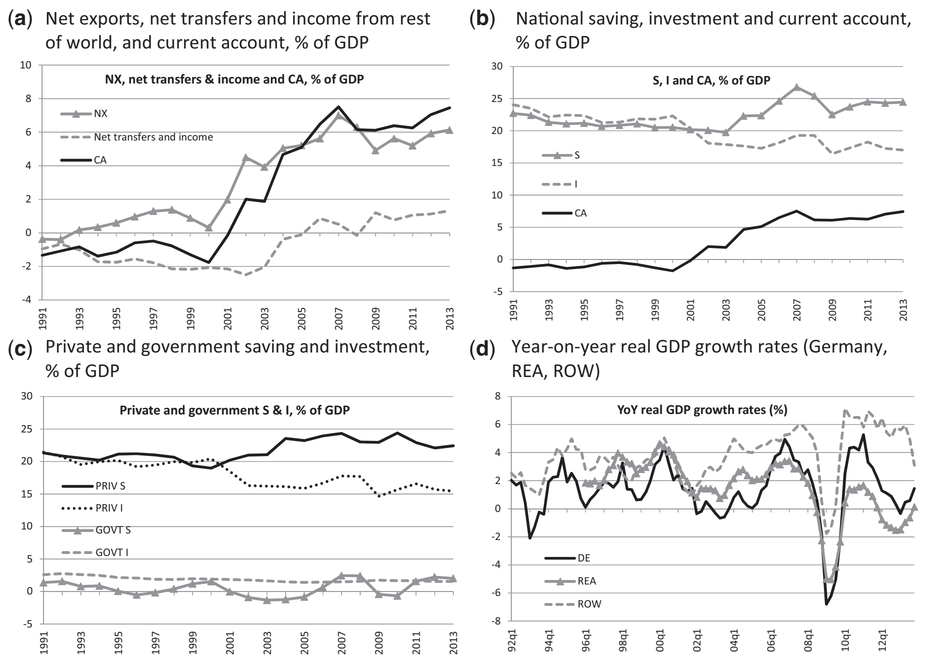


Figure 1. The German current account (CA), saving, investment and growth. (a) Net exports, net transfers and income from rest of world and CA, % of GDP; (b) national saving, investment and CA, % of GDP; (c) private and government saving and investment, % of GDP; (d) year-on-year real GDP growth rates (Germany, REA, ROW).

Sources: AMECO, Eurostat, own calculations.

country model). Empirically, the REA trade balance is not a perfect mirror image of the German trade balance. Also, the REA is a less important trading partner for Germany than the ROW; the share of exports to the REA in German exports fell from 46% in 1995 to 36% in 2012, while the share of the REA in German imports fell from 47% to 37%.

Section 2 describes the German external balance, and macroeconomic conditions in Germany, the REA and the ROW, in the period 1991–2012. Section 3 provides a brief overview of our model. Section 4 presents the model estimates. Section 5 discusses scenarios for the future path of the German external balance. Section 6 concludes.

2. MACROECONOMIC CONDITIONS AND THE GERMAN EXTERNAL ACCOUNT, 1991–2012

Germany's current account (CA) balance and trade balance (TB) in the period 1991–2012 are plotted in Figure 1a. The dynamics of the CA is closely linked to that of the TB (i.e. to net exports). After close-to-balance positions in the 1990s, the TB and the CA have been in persistent surplus since the early 2000s. The German TB and CA surpluses peaked at about 7% of GDP in 2007, receded to about 5%–6% in the global recession of 2008–2009, and reached 6%–7% of GDP in 2012; these persistent surpluses have led to a substantial positive international investment position, which amounted to

35% of German GDP in 2011. The balance on incomes and transfers shows a persistent increase (from about −2% to 1% of GDP) starting in 2003, but the overwhelming part of the rise in the German CA since the early 2000s is linked to the rise in net exports.

2.1. Saving, investment and the German external balance

The CA equals the difference between gross national saving (S) and gross national investment (I): $CA = S - I$. Figure 1b plots German saving and investment, in % of GDP (Y). (All ratios of variables to GDP discussed in the following paragraphs are ratios of nominal variables.) The German investment rate (I/Y) had a slight downward trend in the 1990s; it fell markedly during the early 2000s, and thereafter fluctuated without trend around a mean value that was about 4 pps (percentage points) below the mean investment rate observed in the 1990s. The German saving rate (S/Y) closely tracked I/Y until the early 2000s, but rose markedly and persistently during the 2000s (by close to 4 pps between 2000 and 2012).[5] This divergence between saving and investment rates accounts for the sharp and persistent rise of the German CA in the early 2000s. Figure 1c shows that the persistent rise in the German CA is accounted for by a persistent rise in the private sector saving-investment gap. The German fiscal surplus (government S − I) fluctuated cyclically, but was essentially trendless (as a fraction of GDP), and thus did not contribute to the persistent rise in the German CA.

2.2. Real activity in Germany and in German export markets

Figure 1d plots year-on-year (YoY) growth rates of real GDP in Germany, the REA and the ROW.[6] Output growth fluctuations have been highly synchronized across these countries/regions. However, German real GDP grew noticeably less than REA and ROW GDP during 1995–2005. The gap in growth rates was especially sizable in 2002–2005. During that period Germany was sometimes referred to as the 'laggard of Europe' (Sinn, 2003). Since 2006, German GDP has grown faster than REA GDP, except during the Great Recession of 2009. ROW growth has markedly exceeded REA growth since the early 2000s.

[5] Disaggregation of private-sector saving into households saving and corporate saving shows that both components have risen in the 2000s. (Also, German household and corporate investment both have a downward trend, relative to GDP.) In our model, the corporate sector is owned by a financially unconstrained ('Ricardian') household (and acts in the interest of that household). Firms' entire cash flow is paid to the Ricardian household, i.e. there are no retained earnings. Thus, our model does not permit a meaningful discussion of how total saving is distributed between corporate and personal saving. Our analysis focuses hence on aggregate private saving. Empirically, the division of private savings between households and firms is heavily affected by taxation: a corporate tax reform in Germany in 2001 has favoured internal relative to external financing of corporate investment, and thus raised incentives for corporate savings (retained earnings); see Ruscher and Wolff (2012). The model here abstracts from these tax issues. Rising shares of corporate saving in private saving have been observed in many countries prior to the financial crisis (Karabarbounis and Neiman, 2012).

[6] ROW output is aggregate real GDP in 40 industrialized and emerging economies, including EU members who are not EA members; see Online Appendix.

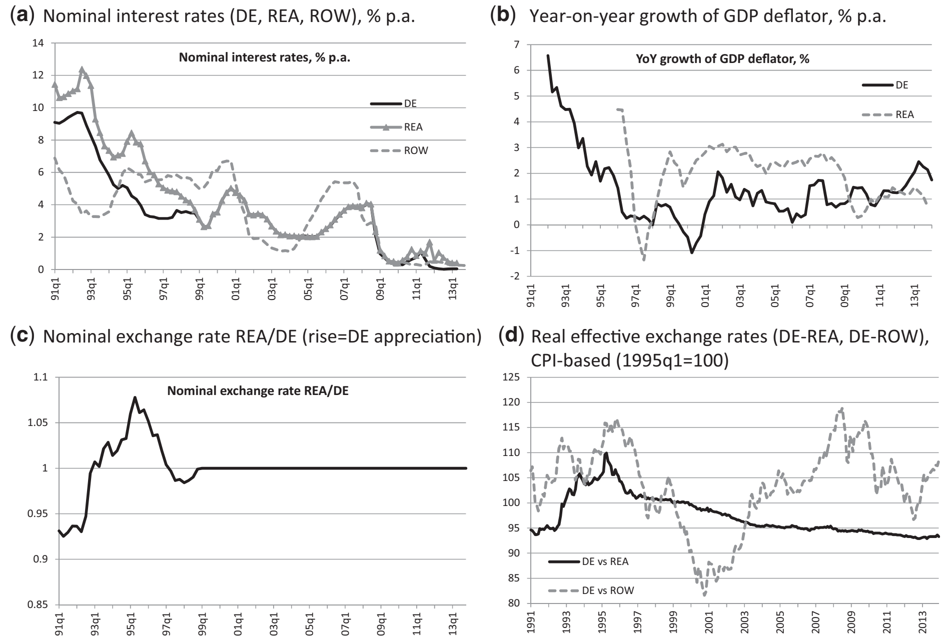


Figure 2. Interest rates, inflation and exchange rates. (a) Nominal interest rates (DE, REA, ROW), % p.a.; (b) year-on-year growth of GDP deflator, % p.a.; (c) nominal exchange rate REA/DE (rise = DE appreciation); (d) real effective exchange rates (DE-REA, DE-ROW).

Sources: Eurostat, Bundesbank, ECB, US Federal Reserve.

2.3. REA-German interest rate convergence

The creation of the euro eliminated exchange rate risk and reduced financial transaction costs across member countries. The date of the launch of the euro (1.1.1999) was announced by the European Council in December 1995. Until 1995, the nominal interest rate on short-term government debt was markedly higher in the REA than in Germany; see Figure 2a (mean REA-German interest rate spread: 2.3% p.a. in 1991–5). The German nominal interest rate had a flat trend between 1995 and 1999, while the REA nominal rate fell rapidly, and thus converged to the German rate. The REA-German nominal interest rate spread was (essentially) zero when the euro was launched in 1999. Between 1999 and the financial crisis, the interest rate spread remained very small; a positive spread emerged again after the eruption of the sovereign debt crises in some REA countries (2010).

2.4. Exchange rates and inflation

Due to strong domestic demand (fuelled i.a. by expansionary fiscal policy), the Deutsche Mark (DM) appreciated against REA and ROW currencies between German Reunification (1990) and 1995. The DM then depreciated against the REA until the

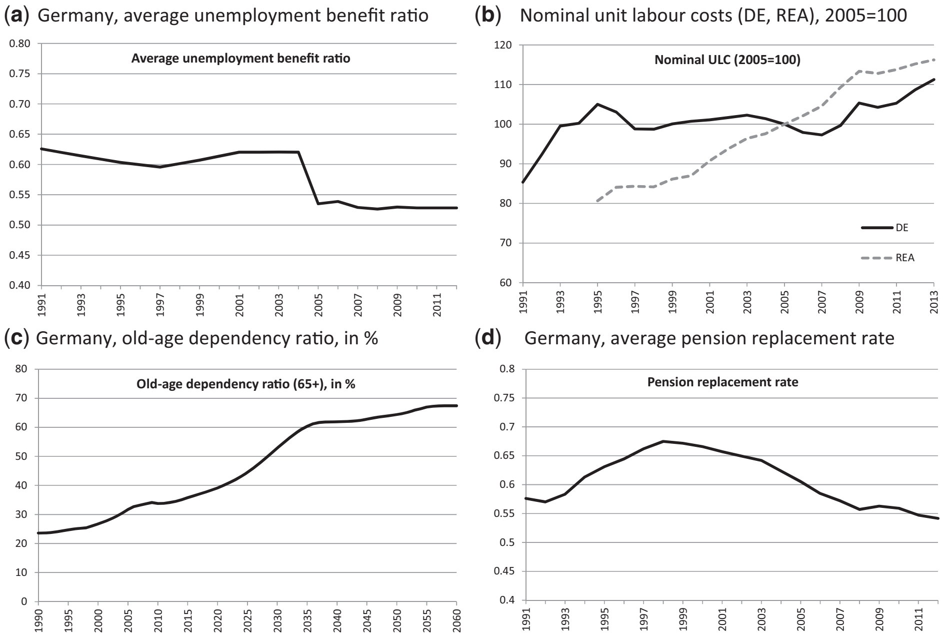


Figure 3. Unemployment benefits, unit labour cost, demographics and pensions. (a) Germany, average unemployment benefit ratio; (b) nominal unit labour costs (DE, REA), 2005 = 100; (c) Germany, old-age dependency ratio, in %; (d) Germany, average pension replacement rate.

Source: German Federal Statistical Office, Eurostat. Dependency ratios for period 2009–2060 are projections made in 2009 (c).

launch of the euro, but that depreciation only partly undid the strong post-Reunification appreciation (see Figure 2c).

It has been argued that Germany entered EMU at an overvalued exchange rate–and that hence low wage and price growth was needed to re-establish German competitiveness (internal devaluation) after the launch of the euro (e.g. Carton and Hervé, 2012). The path of the real exchange rate of Germany plotted in Figure 2d is consistent with that view. After the launch of the euro, German real depreciation vis-à-vis the REA has continued via lower German inflation (see Figure 2b): the average annual growth rate of the GDP deflator after 1999 was 0.75% in Germany, and 2.49% in the REA. The nominal (effective) exchange rate of Germany against the ROW depreciated much more strongly than the German-REA exchange rate, between 1995 and 2001; the German-ROW exchange rate then appreciated, by more than 70%, until 2008. Since the financial crisis, the external value of the euro has fluctuated widely, around a slight downward trend (Figure 2d). Due to nominal interest rate convergence, the lower German inflation implied that the German real interest rate was higher than the REA real interest during the first ten years of the euro. The financial crisis led to a marked reduction in REA inflation.

2.5. Labour market reforms

As a response to stagnant real activity in the early 2000s, the German government implemented a far-reaching labour market deregulation in 2003–2005 ('Hartz' reforms) that included a reduction in unemployment benefits and measures such as a reorganization of labour placement and of job training schemes to improve job matching. Figure 3a plots the German average unemployment benefit ratio (ratio of unemployment benefit to wage rate). The benefit ratio fell permanently in 2004–2005, from 62% to 53%. German labour market reforms arguably weakened the bargaining power of German trade unions. The fraction of wage earners who are union members fell steadily from 29% in 1995 to 18% in 2011 (OECD, 2013). It has been argued that the growth of outsourcing by German firms to low wage countries, notably in Eastern Europe, also reduced German trade union power (Dustmann *et al.*, 2014). These developments may have contributed to the very low growth of wages and of unit labour costs in Germany (see below) and thus to low German inflation, which raised the competitiveness of German exporters, relative to the rest of the EA.

2.6. Wages and unit labour cost

Nominal and real wage growth has been markedly lower in Germany than in the aggregate EA during most of the euro-era. Nominal unit labour cost (ULC, ratio of nominal compensation per employee to real GDP per person employed) was essentially flat between 1995 and 2007, or fell slightly and rose (by about 10%) after the financial crisis (Figure 3b). In contrast, nominal ULC rose steadily in the REA, between 1995 and 2008, but has been stable since then.

2.7. Demographics and pension reforms

One prominent candidate for explaining the German external surplus is population ageing. Empirical research by the IMF (2013b) provides evidence for a strong positive impact of projected ageing speed on the current account (CA) balance. Based on a sample of 49 countries (1986–2010), the IMF finds that a 1 percentage-point increase in the old-age dependency ratio (defined as the number of people aged 65 years and above, relative to the working age population) relative to the country average increases the CA balance by 0.2 percentage points. In Germany, the dependency ratio increased by 10 percentage points between the mid-1990s and 2012 (Figure 3c). Projections (German Council of Economic Advisors, 2011) point to an increase by around 20 percentage points within the next 20 years, due to the retirement of the post-war 'baby boom' cohorts. Importantly, the speed of population ageing is higher in Germany than in most other major economies. Higher future old-age dependency ratios imply lower future per-capita pension entitlements or higher future financing costs in a PAYG system, which both reduce future disposable income and provide an incentive to increase private savings.

In Germany, the pension replacement rate (ratio of the average pension to the average wage income per employee) has fallen by 13 pps between the late 1990s and 2012 (Figure 3d). Public pension reforms enacted in Germany between 2001 and 2004 stipulated a rise in mandatory public pension contributions and in the retirement age, as well as a reduction of pension benefits (these changes are being phased-in gradually); in addition, the reforms have provided new tax incentives for private pension saving (Deutsche Bundesbank, 2011).

3. MODELLING THE GERMAN CA: KEY RELATIONSHIPS

This section discusses the main relationships in our model that allow us assess the role of the key potential drivers of the German CA discussed in the previous section. We solve the model by linearizing it around a deterministic steady state; the linearized model is estimated with Bayesian methods, using quarterly German, REA and ROW data (seasonally adjusted) for the period 1995q1–2013q2. We begin our estimation sample in 1995q1 in order to include the pre-euro convergence of interest rates in our sample; by 1995q1 the creation of the euro was highly likely; the date of the launch of the euro was officially announced in December 1995, as mentioned above. (As a robustness check, we also estimated the model for 1999–2013; the key results remain unchanged.) An Online Appendix provides a complete description of the model and of the econometric methodology.

Our model builds on the EU Commission's Quest III model (Ratto *et al*., 2009), an empirical New Keynesian Dynamic General Equilibrium model with rigorous microeconomic foundations. Recently, much research effort has been devoted to the estimation of macroeconomic models of this type; see, e.g. Christiano *et al.* (2005), Kollmann *et al*. (2012), Kollmann *et al.* (2013), Kollmann (2013). This class of models is widely used for research and for macro policy analysis. The literature shows that this class of models captures well the key features of macroeconomic fluctuations in a range of countries – for example, these models typically generate second moments (standard deviations and correlations) of key macro variables that are close to empirical moments. This is also the case for the model here (see Online Appendix).

Our model assumes three countries: Germany, the REA and the ROW. The German block of the model is rather detailed, while the REA and ROW blocks are more stylized. The German block assumes two representative households: one household has a low rate of time preference and holds financial assets ('saver household'). The other household has a higher rate of time preference, and borrows from the 'saver household' using her housing stock as collateral. We assume that the loan-to-value ratio (ratio of borrowing to the value of the collateral) fluctuates exogenously, and that the collateral constraint binds at all times. This structure, with patient and impatient households and exogenous loan-to-value shocks, builds on Iacoviello and Neri (2010). Both households provide labour services to goods producing firms, and they accumulate housing capital – worker welfare depends on their consumption, hours worked and stock of housing capital. The patient household owns the German goods producing sector and the construction sector; in equilibrium, the patient household also holds financial assets (government debt, foreign bonds).

German firms maximize the present value of the dividend stream paid to the patient (capitalist) household. We assume that German firms rent physical capital from saver households at a rental rate that equals the risk-free interest rate plus an exogenous stochastic positive wedge; that wedge hence creates a gap between the marginal product of capital and the risk-free interest rate. This is a short-cut for capturing financial frictions facing firms (e.g. Buera and Moll, 2012). German firms export to the REA and the ROW. The production technology allows for variable capacity utilization and capital and labour adjustment costs; household preferences exhibit habit formation in consumption (i.e. sluggish consumption adjustment to income shocks). These model features help to better capture the dynamics of the German CA and of other German macro variables. The German block also assumes a government that finances purchases and transfers using distorting taxes and by issuing debt. The German block assumes exogenous shocks to preferences, technologies and policy variables that alter demand and supply conditions in markets for goods, labour, production capital, housing and financial assets.

The models of the REA and ROW economies are simplified structures with fewer shocks; specifically, the REA and ROW blocks each consist of a New Keynesian Phillips curve, a budget constraint for a representative household, demand functions for domestic and imported goods (derived from CESifo consumption good aggregators), and a production technology that uses labour as the sole factor input. The REA and ROW blocks abstract from productive capital and housing. In the REA and the ROW there are shocks to labour productivity, to price mark ups, and to the subjective discount rate, as well as monetary policy shocks, and shocks to the relative preference for domestic versus imported consumption goods.[7]

All exogenous variables follow independent univariate autoregressive processes. In total, 46 exogenous shocks are assumed. Other recent estimated DSGE models likewise assume many shocks (e.g. Kollmann, 2013), as it appears that many shocks are needed to capture the key dynamic properties of macroeconomic and financial data. The large number of shocks used here is also dictated by the large number of observables used in estimation (as the number of shocks has to be at least as large as the number of observables to avoid stochastic singularity of the model). In order to evaluate alternative hypotheses about the causes of the German external surplus, data on a relatively large

[7] We set each country's net foreign assets (NFA) at zero in steady state, and thus the steady state current account and net exports too are zero. The current account is expected to converge to its steady state, in the (very) long term. Our key estimation results (parameter estimates, estimated impulse responses and historical decomposition) do not depend on the assumption that steady state NFA is zero–results are robust to assuming non-zero steady state NFA (in a reasonable range). The reason for this is that convergence to the steady state is slow. Short- and medium-term model dynamics do not depend on the assumed NFA steady state. Thus, it is not possible to reliably estimate the steady state current account using a short sample period such as ours.

number of variables have to be used – we use data on 44 macroeconomic and financial variables for Germany, the REA and the ROW (see Online Appendix).

We now provide a (slightly) more detailed overview of key model components.

3.1. Monetary policy

Monetary policy in the Euro Area is described by an interest rate (Taylor) rule. The period t policy rate i_t^{EA} is set as a function of the lagged policy rate, of the year-on-year Euro Area inflation rate (GDP deflators), π_t^{EA}, of the year-on-year growth rate of Euro Area real GDP, $g_{Y,t}^{EA}$, and of a random disturbance.

$$i_t^{EA} = (1-\rho^i)\bar{i} + \rho^i i_{t-1}^{EA} + (1-\rho^i)[\tau_\pi^i(\pi_t^{EA} - \pi^{EA}) + \tau_Y^i(g_{Y,t}^{EA} - g_Y^{EA})] + \varepsilon_t^R. \tag{1}$$

The rates π_t^{EA} and $g_{Y,t}^{EA}$ are weighted averages of corresponding German and REA rates, using a German weight of $s = 0.275$ (average share of German GDP in EA GDP in the sample period). During the pre-EMU period (1995–8), our empirical measure of the Euro Area policy rate is the German policy rate, while after 1999 we use the ECB policy rate.[8] We allow for exogenous deviations of short-term German and REA bond rates from the EA policy rate, in order to capture fluctuations in intra-Euro Area risk premia.

3.2. Interest rate spreads

We assume that the uncovered interest rate parity conditions that link German, REA and ROW one-period sovereign bond rates are disturbed by exogenous shocks (e.g. McCallum, 1994; Kollmann, 2002):

$$i_t^{ROW} = i_t^{DE} + E_t \Delta \ln e_{t+1}^{ROW,DE} + \rho_t^{ROW,DE}, \tag{2}$$

$$i_t^{REA} = i_t^{DE} + E_t \Delta \ln e_{t+1}^{REA,DE} + \rho_t^{REA,DE}, \tag{3}$$

where $e_t^{j,k}$ is the nominal (effective) exchange between countries j and k, defined as the price of one unit of country-k currency, in units of the country-j currency. $\rho_t^{ROW,DE}$ and $\rho_t^{REA,DE}$ are exogenous stationary disturbances that drive wedges between the German interest rate and the ROW and REA rates, respectively; those wedges can reflect limits

[8] We assume that in 1995–8 (before the launch of the Euro), the Bundesbank set monetary policy for all countries in the (future) Euro Area. The parameters of the policy rule are assumed to be the same in 1995–8 and in 1999–2012 (any discrepancies between Bundesbank and ECB policy rules are thus captured by the residual of the policy rule). Assuming instead that pre-1999 the Bundesbank responds only to German output and inflation would be technically challenging, as this would introduce a break in the policy rule. Standard solution and estimation algorithms for linear(ized) models (as used here) require equations with time-invariant coefficients.

to arbitrage (due to transaction costs or short-sales constraints), biases in (subjective) expectations about future exchange rates or risk premia. In what follows, we will refer to $\rho_t^{ROW,DE}$ and $\rho_t^{REA,DE}$ as 'risk premia'. Since the introduction of the euro, $e_{t+1}^{REA,DE}$ has been constant. During the run-up to the euro (1995–8), the bilateral REA/German exchange rate only showed muted fluctuations (see Figure 2c). We assume that agents believed the REA/German exchange rate to follow a random walk during the 1995–8 transition period. This assumption allows to construct a time series for the German-REA risk premium: $\rho_t^{REA,DE} = i_{t+1}^{REA} - i_{t+1}^{DE}$.[9] We feed the REA-German risk premium into our model to assess the effect of the convergence of REA and German interest rates on macroeconomic variables and the German external balance. Our empirical measure of the ROW interest rate i_{t+1}^{ROW} is the short-term US government bond rate; the USD exchange rate is taken as our empirical measure of $e_{t+1}^{EA,ROW}$.

3.3. Investment in productive capital and firm financing conditions

In the model, German goods producing firms rent the physical capital stock from the patient (capitalist) households. Goods producing firms equate the marginal product of capital to the rental rate. As mentioned above, the rental rate equals the risk-free interest rate plus an exogenous random positive wedge. The production function is subjected to exogenous total factor productivity (TFP) shocks; the accumulation of production capital is affected by shocks to investment efficiency (e.g. Justiniano *et al.*, 2008).

3.4. Fiscal policy

The government purchases domestically produced and imported intermediate goods that are used for government consumption, and for investment in public capital; the government also pays unemployment benefits and pensions to households. Government spending is financed using taxes on consumption, labour income and capital income, and by issuing public debt. All government spending items and the tax rates are set according to feedback rules that link those fiscal variables to the stock of debt (in a manner that ensures government solvency), and to real output. The fiscal policy rules are also affected by exogenous autocorrelated disturbances.

[9] During the 1995–8 run-up to the euro, the (future) member countries already made a commitment to keep stable bilateral exchange rates. The Maastricht Treaty stipulated that a (future) member country of the Euro Area had to abstain from devaluing its currency for at least two years (before joining the EA), against any other member country. Hence, it seems reasonable to assume that expected REA/DE exchange rate depreciation was zero (or close to zero) in 1995–8. During this period, the REA nominal exchange rate appreciated slightly against the DM (by 3.85%). The compounded 1995-–98 REA-Germany interest rate differential was much greater: 8.77%. See Zettelmeyer (1997) and Ehrmann *et al.* (2011) for detailed analyses of German and REA interest rates during the run-up to the euro.

3.5. External demand conditions and foreign trade shocks

Consumption and investment goods are produced by combining locally produced and imported intermediate goods that are imperfect substitutes. The volume of German foreign trade, hence, depends on the relative price between German and foreign (REA and ROW) goods, and on domestic and foreign absorption. We use data on foreign real activity and on the foreign price level, in the model estimation. We refer to shocks to foreign real activity as 'external demand shocks', as these shocks affect the demand for German exports. The model also assumes preference shocks that shift the desired combination between domestic and imported intermediates, as well as shocks to the market power (mark up) of exporters.

3.6. Labour market reforms and wage restraint

In the model, the government pays unemployment benefits to unemployed workers (those benefits are equivalent to a subsidy for leisure). We capture German labour market reforms by treating the unemployment benefit ratio as an autocorrelated exogenous variable. We feed the historical benefit ratio (Figure 3a) into the model. We assume that German wages are set by a labour union that acts like a monopolist in the labour market. Union power, as manifested in the wage markup (i.e. markup of the real wage rate over workers' marginal rate of substitution between consumption and leisure) follows an autocorrelated exogenous process.

3.7. Shocks to private saving and household financial conditions

To capture the rise in German private saving, the model allows for exogenous shocks to households' rate of time preference, referred to as 'private saving shocks'. We also assume that the loan-to-value ratio faced by impatient households (borrowers) is time-varying.

3.8. Pensions

To keep the model simple, we assume infinitely lived German households (i.e. we do not consider overlapping generations). Each household has a fixed time endowment that is normalized at unity. That time endowment is used for market labour, leisure and retirement. We assume that time spent in retirement (R) is exogenous. In the empirical estimation, we take the fraction of the population in retirement as a proxy for R. The pension paid to a given household is modelled as a government transfer; the pension is proportional to R and the market wage rate, w: pension = rr*R*w, where the 'pension replacement rate' rr is an exogenous random variable. We use the empirical replacement rate (Figure 3d) as a measure of 'rr', in the model estimation.

4. RESULTS

The Online Appendix reports posterior estimates of all model parameters. The estimation indicates that the German steady state income share of financially unconstrained households ('savers') is high (0.54). German households exhibit relatively strong habit persistence (habit parameter: 0.70), and so do REA and ROW households (habit parameters: 0.67 and 0.90). German households have an intertemporal substitution elasticity below unity (0.58). The German (Frisch) labour supply elasticity is 0.82. German nominal wage and price stickiness is moderate: the average price-change interval is three quarters, while the average wage-change interval is two quarters. (Despite the modest degree of nominal wage stickiness, the impulse responses show that the real wage rate exhibits substantial sluggishness.) The substitution elasticity between domestic and imported products is high (2.11) in Germany, close to unity (1.13) in the REA and below unity (0.74) in the ROW.

To explain the key mechanisms operating in the model, we now present impulse responses to selected shocks. We then describe shock decompositions of historical time series, implied by the estimated model. All model properties are evaluated at posterior estimates (modes) of the model parameters. Other detailed estimation results are reported in the Online Appendix.

4.1. Impulse response functions

We now discuss dynamic responses to shocks that matter most for the German external balance. We begin by discussing shocks to German aggregate supply (shocks to German TFP, and to German unemployment benefits), and then discuss German saving shocks, shocks to German government consumption, a shock to the REA-Germany risk premium and a ROW demand shock.

4.1.1. Positive German supply shocks: TFP increase, unemployment benefit cut. Figure 4a shows dynamic responses to a permanent rise in German TFP. In the short-run, price stickiness and capital and labour adjustment costs prevent a rapid expansion of German output. Hence, the shock triggers a *gradual* increase in German GDP (the maximum response of GDP is reached five years after the shock), and of the German real wage rate. Due to habit formation in consumption (and because of the presence of collateral-constrained households), aggregate German consumption too rises very gradually – in fact more slowly than GDP; hence, the German saving rate (nominal saving/nominal GDP) rises. On impact, the German labour input falls slightly, due to the sluggish output adjustment–employment only rises with a four quarter delay. Productive investment in Germany too falls slightly, on impact, before rising. Importantly, investment rises less than GDP (due to strong investment adjustment costs) and, hence, the investment rate (nominal investment/nominal GDP) falls. The shock also leads to a gradual fall in the German price level, and to a depreciation of the

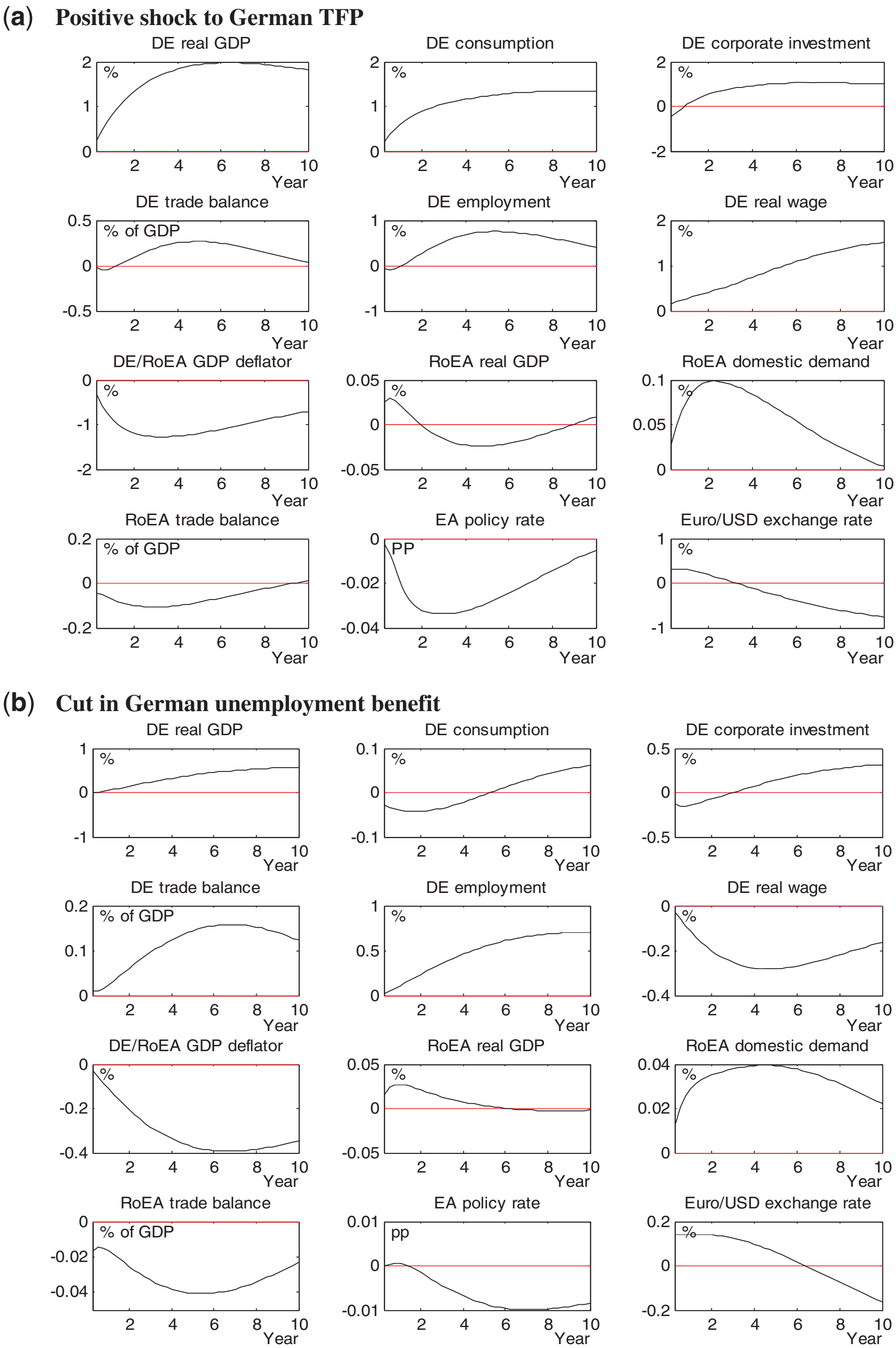
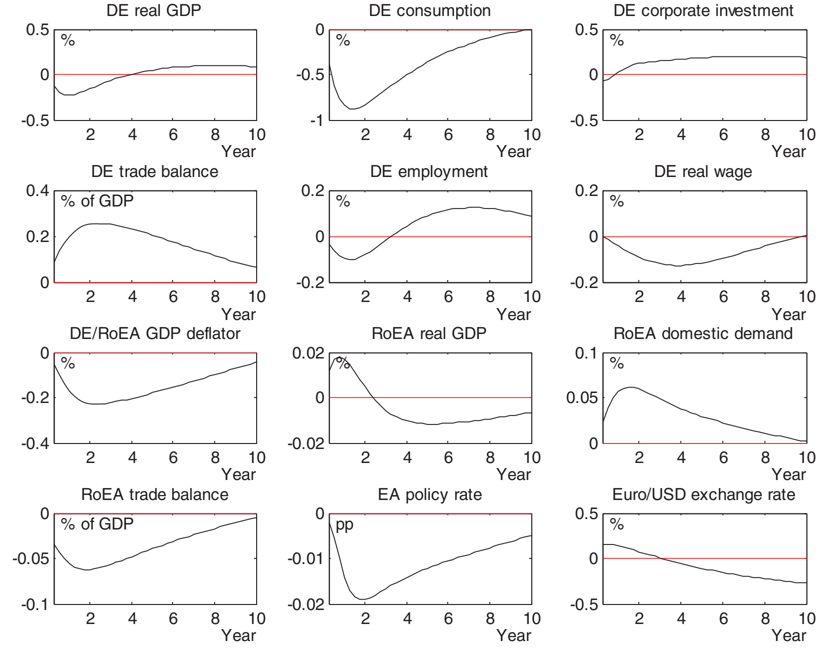


Figure 4. Dynamic responses to exogenous shocks. (a) Positive shock to German TFP (1 standard deviation innovation); (b) Cut in German unemployment benefit (permanent 1 percentage point reduction in unemployment benefit ratio);

(continued)

(c) Positive German saving shock (fall in rate of time preferences)



(d) Positive shock to German government consumption

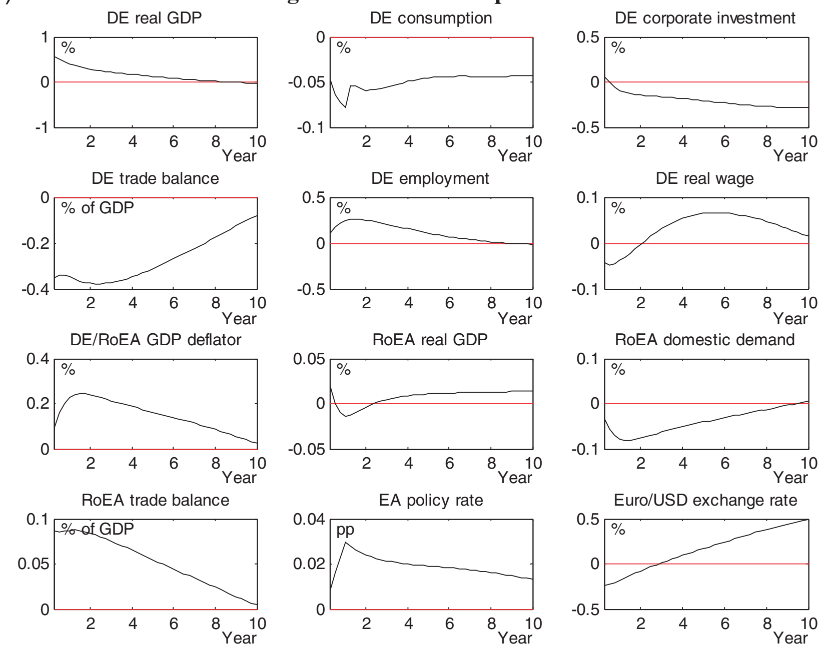
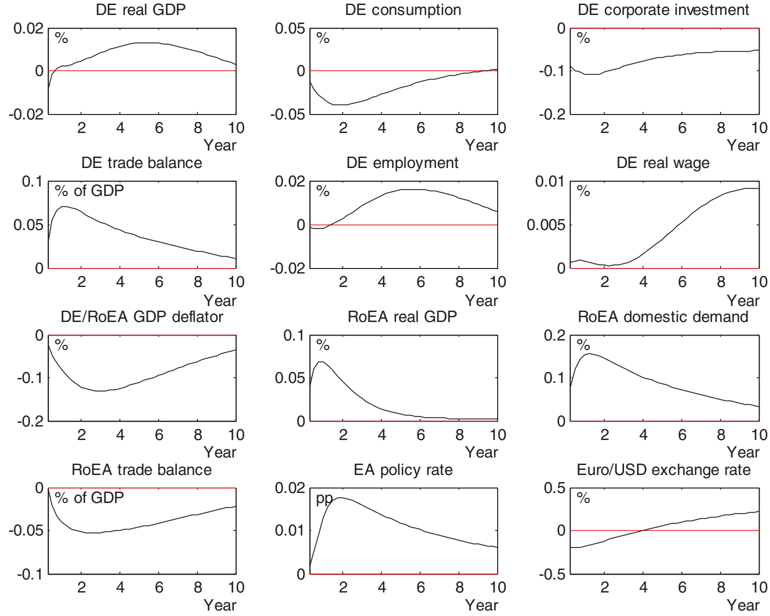


Figure 4 (continued)—(c) Positive German saving shock (negative 1 standard deviation innovation to the rate of time preference of German households); (d) Positive shock to German government consumption (1% of GDP innovation to government consumption);

(continued)

(e) Fall in REA-German risk premium



(f) Rise in Rest-of-World aggregate demand

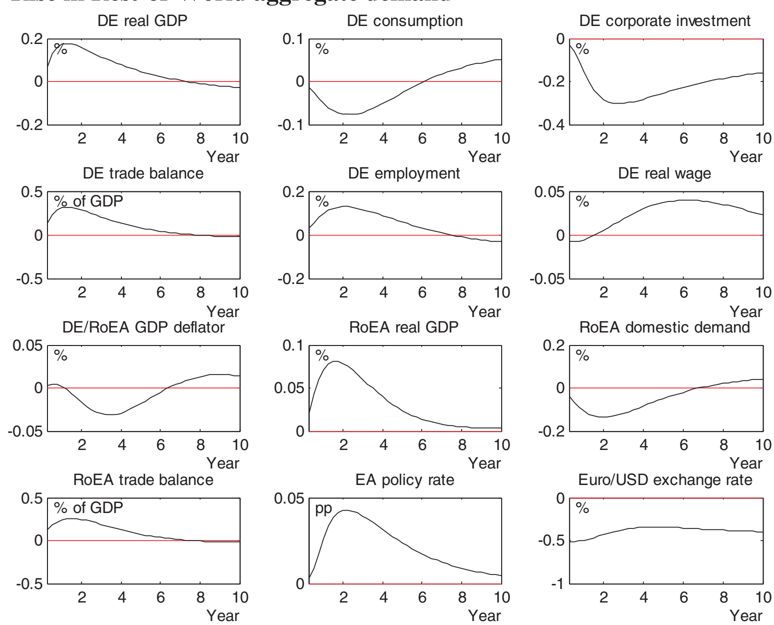


Figure 4 (continued)—(e) Fall in REA-German risk premium (1 standard deviation innovation to spread between interest rate on REA and German government bonds); (f) Rise in Rest-of-World aggregate demand (1 standard deviation innovation to the subjective discount rate of ROW agents).
Interest rate responses (% p.a.) are expressed as differences from unshocked path; trade balance responses are shown as % differences from unshocked path normalized by steady state domestic GDP; responses of other variables shown as relative % deviations from unshocked paths. A rise in the euro/USD exchange rate corresponds to a euro depreciation.

German real exchange rate vis-à-vis the REA. The policy interest rate falls, but only very slightly, as EA monetary policy targets EA-wide aggregate GDP and inflation. Due to the gradual fall in the German price level, the German (expected) real interest rate rises which also contributes to the initial fall in German productive investment. The sluggish rise in German absorption and the improvement in German price competitiveness (fall in the relative German/REA output price) implies that German net exports and the German current account (CA) rise persistently.[10] The rise in German net exports is accompanied by a persistent fall in REA net exports. Domestic demand in the REA increases, supported by the decline in the policy rate. The net effect on REA GDP is small–initially positive but then negative; note that the variation in REA GDP is markedly smaller than the rise in German GDP.

The predicted (medium term) fall in foreign GDP in response to a positive shock to home productivity is a common feature of open economy DSGE models (e.g. Backus *et al.* 1992; Kollmann, 2013). In contrast, the sign of the net exports response hinges on the speed of adjustment of consumption and investment, and is thus parameter-dependent. Our model estimates suggest very sluggish German consumption adjustment (strong habit effects) to a German TFP increase. In the absence of habit formation and credit constraints, absorption would initially rise more strongly than current GDP, due to consumption smoothing by local households who expect their future income to rise more than current income, and thus net exports and the CA would then fall (e.g. Obstfeld and Rogoff, 1996).[11]

Figure 4b reports dynamic responses to a German labour market reform – captured here by an exogenous permanent reduction in the German unemployment benefit ratio (unemployment benefit divided by wage income per employee). The benefit cut raises German labour supply, which lowers the real wage rate. It thus leads to an expansion of German employment, and of German GDP, and to an improvement in German competitiveness. Although the competitiveness gain is persistent, it is gradually eroded as real wages rise in the longer run (due to a long-run capital stock increase). The lower unemployment transfer payment reduces the consumption of collateral-constrained German households. Initially, aggregate consumption declines slightly, but rises weakly above the unshocked path after six years (due to the increase in GDP which raises the consumption of saver households). Thus, the German saving rate rises persistently. German investment falls, on impact, due to a rise in the German real interest rate, but

[10] The model also assumes investment (production capital) efficiency shocks. Qualitatively, the effects of those shocks are similar to the responses to a TFP shock. A positive German investment efficiency shock triggers a sizable fall in the relative price of investment goods, and hence that shock lowers the (nominal) investment rate; the shock also raises the German saving rate, and it thus improves the German current account.

[11] The other shocks discussed below (except the saving shock) too move the German GDP and trade balance (and current account) in the same direction. In the model, the German current account is thus procyclical, consistent with 1995–2013 data.

investment increases in the medium-term (although less than GDP), as the (permanent) rise in the German labour supply triggers a permanent rise in the German capital stock. The investment rate falls, hence, and the German external balance improves. REA output rises slightly in the short term, and then falls slightly below its unshocked path. REA net exports fall. The effects of this shock on German GDP and on German net exports are thus broadly similar to the responses triggered by a positive TFP shock.

Positive German aggregate supply shocks are, hence, a candidate for explaining the acceleration of German GDP growth after 2005. These shocks are also consistent with other salient facts about the German economy after 2005: a high trade balance (and CA) surplus, low inflation (relative to the REA) and a high saving rate.

4.1.2. Positive German private saving shock, shocks to pension replacement rate and to old-age dependency ratio. Figure 4c shows dynamic responses to a positive German private saving shock, namely a persistent fall in the German subjective rate of time preference. The shock triggers a long-lasting reduction in German aggregate consumption, and it hence raises the German saving rate. The resulting increase in the marginal utility of consumption raises households' (desired) labour supply, which induces a gradual fall in the German (real) wage rate, and in the German price level. Because of sluggish price and wage adjustment, the short- to medium-term response of German GDP and employment is, however, dominated by the fall in consumption – i.e. GDP and employment fall initially, before rising above their unshocked path (due to the increased labour supply). The shock triggers a fall in the policy interest rate; however, the fall in German inflation leads to an initial rise in the German real bond rate, and German investment falls on impact (but then increases). REA aggregate demand rises (due to fall in EA-wide policy rate), and REA net exports fall (also due to a fall in German demand for REA goods). Initially, the response of REA GDP is positive, but then REA GDP falls slightly below its unshocked path.

A cut in the pension replacement rate too raises German GDP, the German saving rate (due to fall in consumption) and net exports. A positive shock to the old-age dependency ratio (i.e. to the number of German retirees) lowers German employment (due to labour supply reduction) and output; consumption and investment fall too, but more gradually than output, and thus German net exports (and the CA) fall. (Historical decompositions of the CA show that shocks to the pension replacement rate and to the number of retirees had a smaller role for the German saving-investment gap than rate-of-time preference shocks.)

4.1.3. German fiscal shocks. Figure 4d reports responses to a positive shock to German government consumption. The shock raises German GDP, but crowds out German consumption and investment, and it reduces German net exports, and raises REA output. A 1 euro rise in government purchases raises German output by 0.56 euro, lowers German net exports by 0.35 euro, and raises REA GDP by 0.02 euro. Thus, German expansionary fiscal policy lowers German net exports, but only has a very small effect on REA GDP. In order to reduce German net exports by 1% of GDP, a fiscal impulse worth 2.85% of GDP would be required, which amounts to a 15% increase in government purchases. In other terms, even very sizable fiscal policy shocks only have a modest effect on net exports (and on the CA). (Modest trade balance responses to fiscal shocks are also reported by other empirical studies; see, e.g. Corsetti and Müller (2006), Beetsma and Giuliodori (2011) and Bussière *et al.* (2010).) A positive shock to government investment has a stronger positive effect on domestic GDP than a rise in government consumption, and a weaker negative effect on the trade balance.[12]

4.1.4. Fall in spread between REA bonds and German bonds. Figure 4e shows dynamic responses to a persistent fall in the REA-German bond spread (risk premium) $\rho_t^{REA,DE} = i_{t+1}^{REA} - i_{t+1}^{DE}$. The shock triggers a persistent fall in the (nominal and real) REA interest rate, and a rise in the EA policy rate. REA absorption and GDP and the (relative) REA price level rise, while REA net exports fall. German GDP rises due to strong REA demand, and German net exports increase, while German investment and consumption fall persistently. Thus, the German investment rate falls while the saving rate rises. The effects on German and REA net exports are very persistent. These predictions are consistent with a number of developments in the run-up to the euro when the REA-German interest rate spread fell rapidly: namely rapid REA growth and a worsening of the REA trade balance. However, empirically German net exports were basically flat before the launch of the euro, which suggests that other factors must have off-set the effect of the spread shock on German net exports.

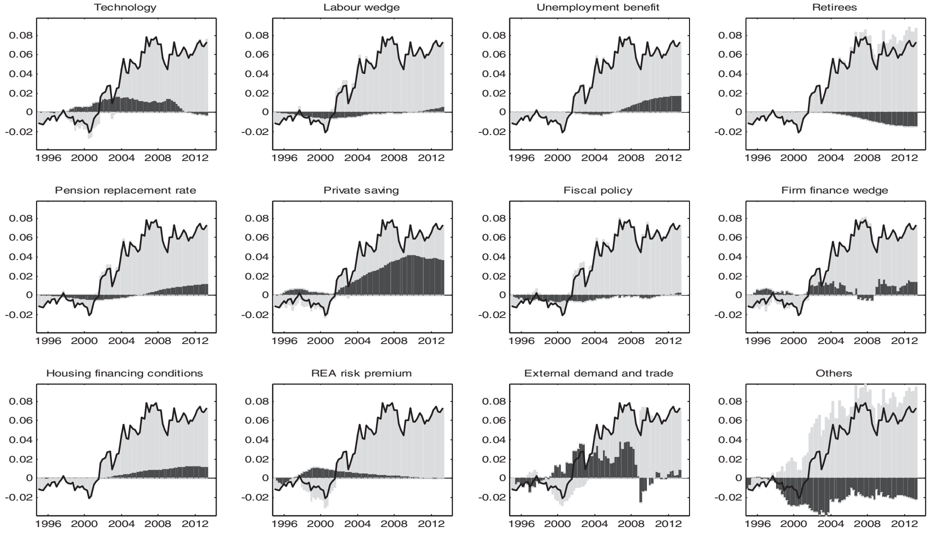
4.1.5. Positive shock to ROW (Rest of World) aggregate demand. Finally, Figure 4f shows responses to a rise in ROW aggregate demand triggered by a persistent rise in the ROW subjective discount rate. The shock raises ROW absorption, which increases demand for German and REA exports, and thus German and REA GDP rise. This triggers a rise in the EA policy rate, which reduces German investment by increasing financing costs. Again, the German investment rate falls, while the saving rate rises. ROW net exports fall, while German and REA net exports rise. Hence, the ROW real activity shock is consistent with high German net exports and low German investment.

4.2. Historical decompositions

To quantify the role of different shocks as drivers of endogenous variables, we plot the estimated contribution of the different shocks to historical time series. Figures 5a–d show historical decompositions of the following German macroeconomic variables: the

[12] The response of real activity is muted by a rise in the policy rate. When monetary policy is constrained by the zero lower bound, the interest rate fails to rise, and the GDP effects and cross-country spillovers are larger. See, e.g. Coenen *et al.* (2012), in 't Veld (2013) and Blanchard *et al.* (2014).

(a) German current account divided by nominal GDP



(b) German saving divided by nominal GDP

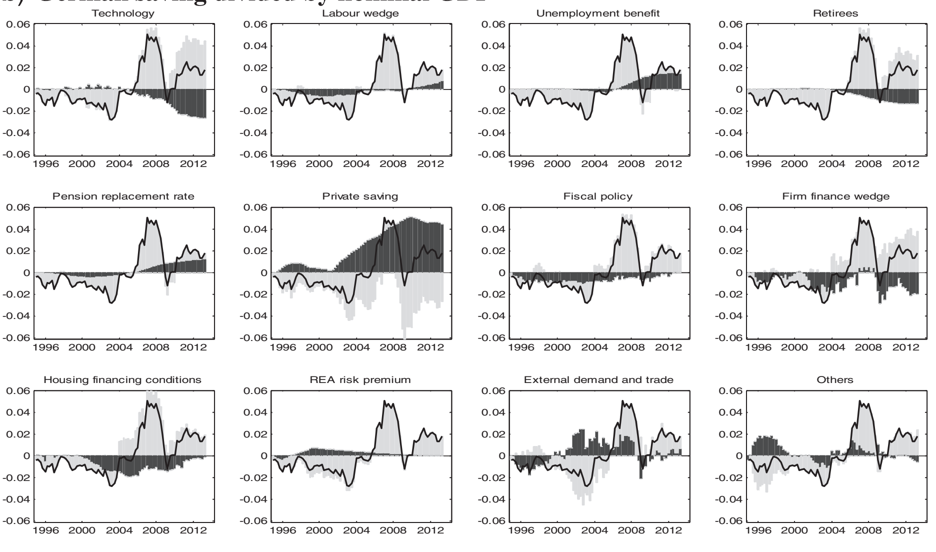


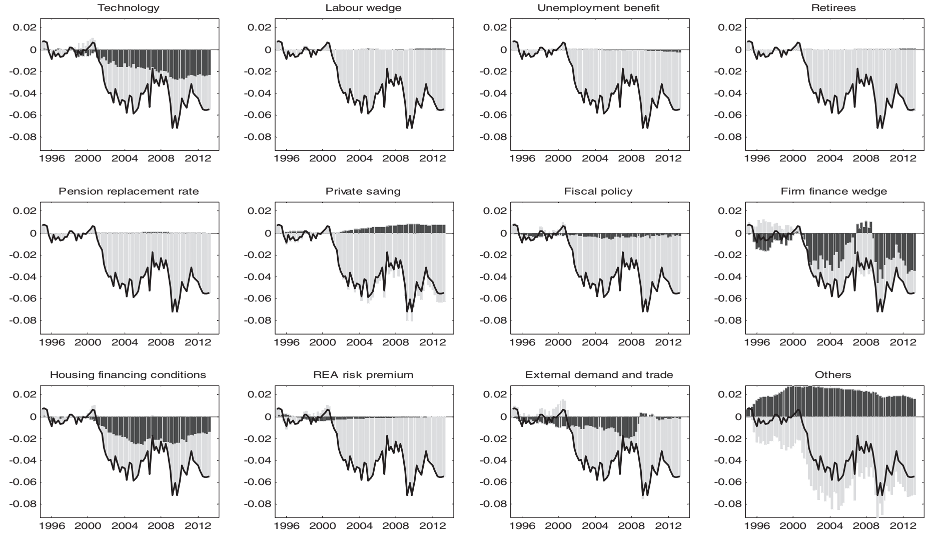
Figure 5. Historical decompositions of German macroeconomic variables. (a) German CA divided by nominal GDP; (b) German saving divided by nominal GDP;

(continued)

current account (divided by nominal GDP); the saving rate; the investment rate; year-on-year real GDP growth. Figures 6.a-6.b show decompositions of the REA trade balance (divided by REA nominal GDP) and of REA real GDP growth.

The black lines show historical data (from which steady state values have been subtracted). In each sub-plot, the vertical black bars show the contribution of a different group of shocks (see below) to the data, while stacked light bars show the contribution of

(c) German nominal investment divided by nominal GDP



(d) German real GDP, year-on-year growth rate

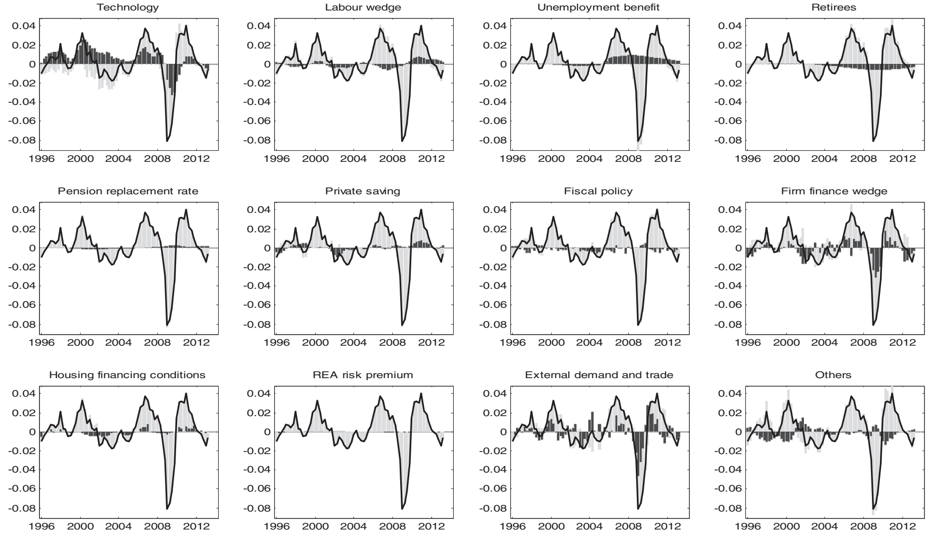


Figure 5 (continued)—(c) German nominal investment divided by nominal GDP; (d) German real GDP, year-on-year growth rate.

Notes: The black lines show historical data (from which steady state values have been subtracted). In each sub-plot, the vertical black bars show the contribution of a different group of shocks to historical data, while stacked light bars show the contribution of all remaining shocks. Bars above the horizontal axis represent positive shock contributions, while bars below the horizontal axis represent negative contributions. The sum of shock contributions equals the historical data. Contributions of the following (groups of) exogenous shocks originating in Germany are shown: (1) TFP and investment efficiency (sub-plots labelled 'Technology'); (2) Wage mark-up ('Labour wedge'); (3) Unemployment benefit ratio ('Unemployment benefit'); (4) Old-age dependency ratio ('Retirees'); (5) Pension replacement rate; (6) Subjective rate of time preference ('Private saving'); (7) Fiscal policy; (8) Firm finance wedge; (9) Household loan-to-value ratio and risk premium on housing capital ('Household financing conditions'). In addition, we show the contribution of disturbances to: (1) REA-German interest rate spread ('REA risk premium'); (2) Shocks originating in the REA and ROW, and shocks to the relative preference for German versus imported goods ('External demand and trade'). The remaining shocks are combined into a category labelled 'Other shocks'.

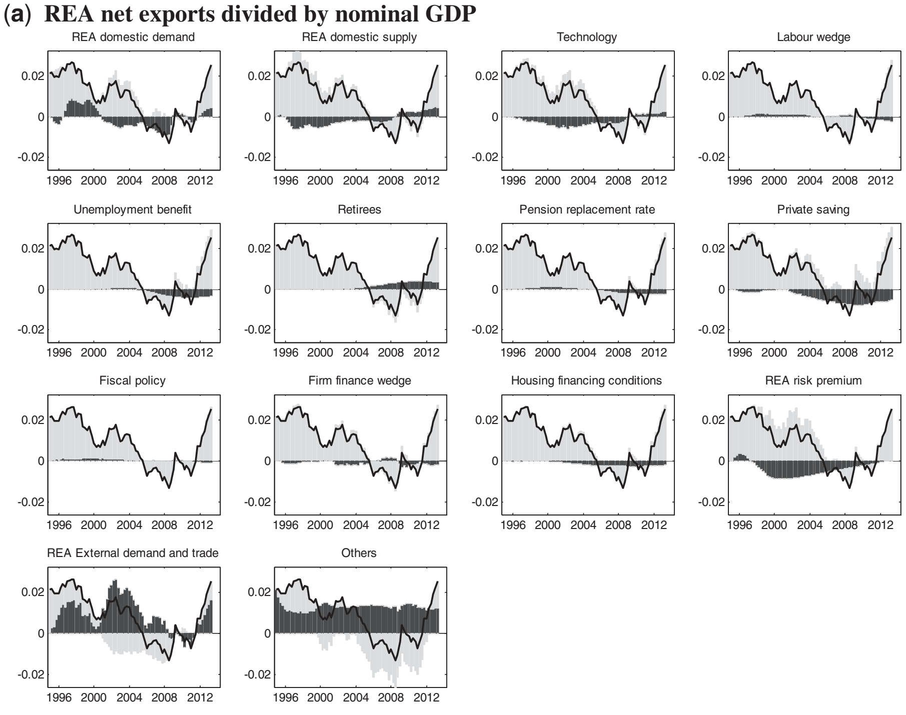


Figure 6. Historical decompositions of REA macroeconomic variables. (a) REA net exports divided by nominal GDP;

(continued)

the remaining shocks. Bars above the horizontal axis represent positive shock contributions to the variable considered in the Figure, while bars below the horizontal axis represent negative contributions. The sum of shock contributions equals the historical data.

The decompositions of German variables in Figs. 5.a-5.d plot the contributions of the following (groups of) exogenous shocks originating in Germany: (1) TFP and investment efficiency (see sub-plots labelled 'Technology'); (2) wage mark up ('Labour wedge'); (3) unemployment benefit ratio ('Unemployment benefit'); (4) old-age dependency ratio ('Retirees'); (5) pension replacement rate; (6) subjective rate of time preference ('Private saving'); (7) fiscal policy; (8) firm finance wedge; (9) household loan-to-value ratio and risk premium on housing capital ('Housing financing conditions'). In addition, we show the contribution of disturbances to: (1) REA-German interest rate spread ('REA risk premium'); (2) shocks originating in the REA and ROW, and shocks to the relative preference for German versus imported goods ('External demand and trade'). The remaining shocks are markedly less important drivers of German variables, and are hence combined into a category labelled 'Other shocks'.[13]

[13] Also included in 'other shocks' are the 'base trajectories', i.e. the dynamic effects of initial conditions (predetermined states at the start of the sample).

(b) REA real GDP, year-on-year growth rate

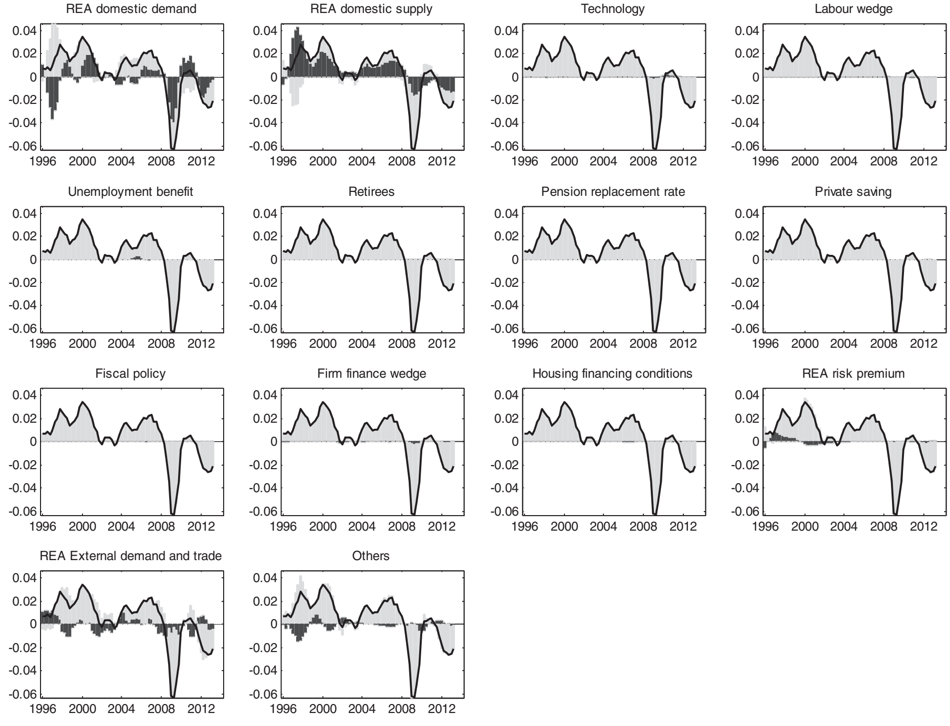


Figure 6—(continued). (b) REA real GDP, year-on-year growth rate.

Notes: The black lines show historical data (from which steady state values have been subtracted). In each sub-plot, the vertical black bars show the contribution of a different group of shocks to historical data, while stacked light bars show the respective contribution of all remaining shocks. Bars above the horizontal axis represent positive shock contributions, while bars below the horizontal axis represent negative contributions. The sum of shock contributions equals the historical data. Contributions of (1) 'REA domestic demand shocks' and (2) 'REA domestic supply shocks' are plotted. In addition, we show the contributions of the following shocks originating in Germany: (1) TFP and investment efficiency (sub-plots labelled 'Technology'); (2) Wage mark-up ('Labour wedge'); (3) Unemployment benefit ratio ('Unemployment benefit'); (4) Old-age dependency ratio ('Retirees'); (5) Pension replacement rate; (6) Subjective rate of time preference ('Private saving'); (6) Fiscal policy; (7) Firm financing wedge; (8) Household loan-to-value ratio and risk premium on housing capital ('household financing conditions'). Also shown are the contributions of: (1) REA-German interest rate spread ('REA risk premium'); (2) shocks originating in the ROW, and shocks to the relative preference for REA goods versus goods imported by the REA ('REA external demand and trade'). The remaining shocks are combined into a category labelled 'Other shocks'.

Figs. 6.a and 6.b (decompositions of REA net exports and GDP growth) show the contributions of the nine (groups of) shocks originating in Germany, as well as the contributions of the 'REA risk premium' shock and of 'REA external demand and trade' shocks (ROW aggregate demand and supply shocks, and shocks to the relative preference for REA goods versus goods imported by the REA).

The historical decomposition shows that the following shocks had a noticeable positive effect on the German CA, at different times: (1) positive German technology shocks, between the late 1990s and the global financial crisis; (2) the fall in the REA-German risk premium, between 1995 and 1999; (3) positive external demand shocks (strong

ROW and REA growth), especially in 2004–2008; (4) the 2003–2005 German labour market reforms (captured in the model by the reduced generosity of unemployment benefits); (5) sizable positive shocks to the saving rate, from 2004 to the end of the sample; (6) a rise of German firms' investment wedge, after the collapse of the dot-com bubble, and in the aftermath of the global financial crisis.

German technology shocks had a persistent negative effect on the German investment rate, according to the estimated model, and boosted the German CA by up to 1.5% of GDP during the early 2000s, i.e. during the phase during which the CA rose sharply. The positive contribution of technology shocks to the German CA between the early 2000s and the financial crisis mainly reflects the fact that these shocks lowered the German investment rate (see above discussion of impulse responses). During the 2009 financial crisis, TFP and investment efficiency fell noticeably in Germany – this explains why the influence of technology shocks on the German CA has been much weaker since the crisis.

Aggregate supply shocks were key drivers of German GDP: the booms in 2000–2001 and 2006–2007 are both accounted for by sizable positive supply shocks. Aggregate supply shocks also had a noticeable effect on German inflation: positive technology shocks in the first half of the sample period lowered German inflation; negative technology shocks during the Great Recession prevented a drop in inflation.

The convergence of REA interest rates to German rates had a persistent small but noticeable positive effect on German CA between the late 1990s and the mid-2000s (see Fig. 5.a). Interest rate convergence increased REA demand and thus REA imports from Germany. German aggregate demand fell, in response to convergence, which contributed to the rise in German saving.

As discussed above, interest rate convergence occurred rapidly after the creation of the euro had irrevocably been announced in late 1995 – interest rate convergence had ended when the euro was launched on 1.1.1999. This explains why the impact of interest rate convergence on the German CA was strongest between 1999 and 2002 (accounting for about 1% of the CA/GDP ratio). However, during that time the German CA was still negative – the CA actually fell slightly between 1998 and 2001. According to our estimates, interest rate convergence had a very small positive effect on German GDP (due to stronger REA demand for German exports), unit labour cost and inflation.

The convergence of REA interest rates to German levels had a markedly stronger negative effect on the REA trade balance – interest rate convergence contributed especially to the sharp fall in REA net exports in 1998–2001 (see Fig. 6.a). Interest rate convergence also contributed to the 1997–9 boom in REA activity (see Fig.6.b). According to one prominent hypothesis, REA-German interest rate convergence triggered a massive capital outflow from Germany that sharply lowered domestic German GDP and investment growth (e.g. Sinn, 2010, 2013). Our analysis does not support this view. The estimated model does suggest that interest rate convergence lowered investment in Germany and raised the German CA, but only by a modest amount. Also, the timing of interest rate convergence does not match the sharp rise in the German CA–the latter occurred several years after convergence. In closely related analyses, Hale and Obstfeld (2013), in 't Veld *et al*. (2014), Reis (2013) and Fernández-Villaverde *et al*. (2013) argue that the capital inflows experienced by Spain and other Euro Area periphery countries were largely driven by interest rate convergence. While our model estimates show that interest rate convergence mattered for the REA trade balance, we find that other shocks had an even more pronounced role for REA net exports – especially ROW demand shocks and domestic REA aggregate demand shocks (see below).[14]

The historical decomposition shows that strong external demand (from the REA and the ROW) in the 2000s contributed importantly to the increase in the German CA. In this period, German exports benefited from the boom in the REA and from strong ROW growth. In particular, due to her strong trade links with the new EU Member States, Germany benefited from the post-accession booms in those states. In the 2009 recession, the external demand contribution turned abruptly negative. Since the crisis, lower German net exports to the REA have been nearly fully offset by higher net exports to the ROW. The positive external demand shocks prior to the financial crisis essentially crowded out German consumption spending and investment. At the same time, stronger external demand has increased German inflation. Hence, the effect of strong world demand is mitigated by its impact on German trade competitiveness.[15]

The cuts in unemployment benefits introduced during the 2003–2005 labour market reforms raised German GDP, according to the model estimates. The labour market reforms raised household labour supply, and increased the German saving rate, but only had a negligible effect on the investment rate. Due to the sluggishness of German aggregate demand, the labour market reforms had a long-lasting positive effect on the German CA. The reforms contributed to a decline in unit labour costs, and thus increased German price competitiveness. Spillovers of German labour market reforms to REA real activity were very weak, but the reforms made a negative contribution to REA net exports. The sizable rise in the old-age dependency ratio is another important shock to the German labour market. In particular, it amounts to a negative labour supply shock – it lowered GDP and the saving rate, due to the sluggishness of consumption demand. Thus, positive shocks to the number of retirees worsened the German CA. In contrast, as discussed in a Box 2 below, a 'news shock' that raises the predicted future old-age dependency ratio improves the CA.

[14] It should be noted that the REA aggregate considered in the present paper includes a broader set of countries than the periphery countries studied by Hale and Obstfeld (2013), in 't Veld *et al*. (2014), Reis (2013) and Fernández-Villaverde *et al*. (2013).

[15] We simulated a counterfactual scenario assuming independent monetary policy in Germany and a flexible exchange rate between the Germany and the REA. According to our estimates, strong ROW demand has benefited both the Germany and the REA, and would thus only have had a minor effect on the German current account, under a floating exchange rate.

Box 2. Demographic news shocks and the German current account

Between 2000 and 2009, we identify a gradual increase of the contribution of the 'Private Savings' shock on the German CA surplus (see Fig. 5.a). This box explores to what extent this shock could reflect demographic 'news shocks' related to revised expectations about demographic trends and the cost of ageing.

Demographic pressure became an important topic in the political debate in Germany and resulted in three pension reforms (2001, 2003, 2004) – which raised awareness among the German population about looming demographic problems. These three pension reforms imply a combined decline of the pension replacement rate by about 20% until 2030 (Werding, 2013).

Though it is difficult to quantify the public's awareness about demographic pressures, demographic projections by the German Statistical Office, published every three years, provide information about revisions undertaken by professional demographic forecasters in the 2000s. As shown in Table B1, the projected old-age dependency ratios for years after 2020 were markedly revised upwards between 2003 and 2006.

Table B1. Germany – old-age dependency ratio projections, various vintages[a,b]

	1999	2001	2005	2008	2010	2020	2030	2040	2050	2060
2000 projection	25.4	:	:	:	33.1	35.9	46.9	56.2	56.0	:
2003 projection	:	27.5	:	:	32.8	36.8	48.2	55.3	56.4	:
2006 projection	:	:	31.7	:	33.6	38.7	52.2	61.4	64.3	:
2009 projection	:	:	:	33.7	:	39.2	52.8	61.9	64.4	67.4

Notes: [a]Number of persons aged 65+ years relative to persons aged 20 to 64 years in %.
[b]Assumptions: fertility rate 1.4, net migration 100,000 p.a., baseline life expectancy.
Source: Statistisches Bundesamt (2003, 2006, 2009, 2012).

Modelling the effects of demographic and pension news shocks

Both the revisions on demographic projections and the pension reforms signal a fall in future income to German households. Forward-looking households should respond to this by increasing their savings rate.

To quantify the impact of ageing-related news shocks, we use our model to compute the perfect foresight path of German CA implied by the 2003 projection of the German dependence ratio for the years 2006–2050. We compare that baseline path of the CA to the path implied by the 2006 demographic projection and by a gradual (linear) decline of the pension replacement rate by 20% until 2030. (The paths of the dependency ratio and of the replacement rate are assumed constant after 2050 and 2030, respectively). The first line of the Table B2 ('Scenario 1') below shows the difference between these two projected CA paths (as a % of GDP). That difference reflects the effect of demographic news on the CA.

An additional important aspect of demographic projections relates to the fiscal cost of ageing in terms of higher expenditure for health and long-term care. The EU Commission's Ageing Report (2009) projects that these old-age related fiscal expenditures will increase roughly by the same proportion as pension payments. We take account of this fiscal dimension of ageing by also considering an alternative scenario ('Scenario 2') that combines the news shocks about the dependency ratio and the replacement rate with the assumption that government consumption rises gradually (linearly) by 1% of GDP until 2050. This is a rough estimate (based on the 2009 Ageing Report) of extra ageing-related government consumption implied by the demographic news shock.

Because of their adverse real income effects, German households respond to the news shocks by increasing saving in order to smooth consumption over time. Habit persistence prevents a rapid adjustment of the savings rate, and the CA rises gradually by close to 3% of GDP over a period of five years, under Scenario 1. This sizeable effect is in the range of the estimated contribution of the 'private savings shocks' to the increase in the German CA during the mid-2000s, according to the historical decomposition reported in Fig. 5.a. The CA response depends on the fiscal cost of ageing; in Scenario 2, the peak effect of the news shock on the CA is about 10% stronger than in Scenario 1.

Table B2. Response of German CA (% GDP) to demographic news shock

	1	2	3	4	5	6	7	8	9	10
Scenario 1	0.9	1.9	2.4	2.7	2.8	2.8	2.7	2.6	2.5	2.3
Scenario 2	0.8	1.9	2.5	2.8	2.9	3.0	3.0	2.9	2.7	2.6

The contribution of German fiscal policy shocks to the German external surplus is estimated to be minor over the sample.[16] Only in the last year is there a small positive contribution of the fiscal consolidation to the trade surplus.

The contribution of shocks to the German firm financing wedge varies during the sample period. These shocks raised the German CA in periods of elevated financing costs, i.e. in the aftermath of dot-com bubble and of the global financial crisis. During those periods, firm financing shocks contributed to a fall on the German investment rate; these shocks also tended to lower the German saving rate, but markedly less than the investment rate. In contrast, firm financing shocks lowered the CA shortly before the

[16] Other empirical studies (for a range of countries) too report small estimates of the contribution of fiscal shocks to the variance of the trade balance; see, e.g. Adolfson *et al.* (2007).

financial crisis. Thus, shocks to firm financing costs do not explain the persistent German CA improvement.

Unlike other EA economies, Germany experienced a persistent fall in real house prices. According to the model, this was mainly driven by positive shocks to risk premia on German housing capital that shifted household spending from residential investment to consumption, thus inducing a fall in the German investment and saving rates, with a positive net effect on the German CA (see Figs. 5.b-5.c). This explains the persistent positive contribution of shocks to 'housing financing conditions' to the German CA surplus (Fig. 5a). In contrast, shocks to loan-to-value ratios faced by German households play a negligible role during the sample period.[17] Thus, lower household loan-to-value ratios are not an explanation for increased German saving.

Positive 'Private saving' shocks (i.e. negative shocks to the German subjective discount rate) account for an increasingly more important share of the German CA surplus after 2003. Note, especially, that these shocks explain more than half of the German CA surplus after 2008. The negative shocks to the German pension replacement rate had a positive but much more modest effect on the German CA, after 2006 (generating roughly a rise of the German CA of 1% of GDP).

The German 'Private saving' shock also contributed to low German inflation (as that shock depressed aggregate demand in Germany). This shock has furthermore contributed negatively to German GDP and labour cost growth; it had a negative effect on import demand and a positive impact on exports (due to external competitiveness gains).

As discussed in Section 2, demographic projections indicate that, in the coming decades, the old-age dependency ratio will rise further markedly, while the replacement rate will fall further. Furthermore, over time, projected dependency ratios have been revised upwards noticeably (see Table B1 in Box 2 above). For example, according to the 2000 projection of the German Federal Statistical Office, the predicted dependency ratio (number of persons aged 65+ years relative to persons aged 20–64 years) in the year 2020 was 35.9%. The prediction (for 2020) was raised to 36.8%, 38.7% and 39.2% in the 2003, 2006 and 2009 projections, respectively. Note that we do not feed German demographic variables predicted beyond the sample period into the model. Nor do we use information about the successive revisions in demographic projections. Hence, it seems plausible that, by abstracting from long-run demographic information, our model underestimates the true contribution of German population ageing for the German CA.

Ageing and pensions were subjects of intense public debate, in Germany, around the turn of the century–those debates led to deep pension reforms, in 2001–2004 (see Box 2). These public debates arguably raised awareness and concerns about demographic issues in the German public. (In addition, the pensions reforms provided new

[17] As mentioned above, the contribution of German ''Housing financing conditions' reported in Figures 5 and 6 summarizes the joint effect of shocks to the risk premium on housing capital and to the household loan-to-value ratio.

tax incentives for private pension saving – our model abstracts from these tax incentives.)

Illustrative simulations discussed in Box 2 suggest that an upward revision of long-term demographic projections has a sizable and persistent positive effect on the German CA. However, it would be technically challenging to estimate a model variant with shocks to long-run demographic information, i.e. with demographic 'news shocks' (especially as official demographic projections are only released every three years). We leave estimation of such a model for future research.

In summary, it seems plausible that the shocks to the German discount factor (that accounts for a high share of the rise in the German CA) might reflect information on long-term demographic trends that is not captured by in-sample demographic data. However, we cannot precisely quantify the contribution of those long-term demographic trends to the German CA surplus. The estimated negative shocks to the German subjective discount rate may thus also capture other adverse shocks to German consumption demand.

The major shocks that increased the German CA have tended to reduce REA net exports (see Fig. 6.a). For example, the German savings shocks had a large and persistent negative effect on REA net exports. In recent years, German labour market reforms, too, have tended to lower REA net exports (due to the positive effect of those reforms on German price competitiveness). German TFP shocks had persistent adverse effects on REA net exports until the financial crisis – however, after the crisis German TFP shocks have raised REA net exports. Another important factor which has contributed to the fall in REA net exports before the global financial crisis was the decline of the REA interest rate spread which has noticeably stimulated REA aggregate demand.

However, we also identify an important autonomous REA aggregate demand component, which especially from 2005 to 2008 has contributed strongly to a worsening of the external balance – that REA aggregate demand component was most likely associated with housing and asset booms in some REA countries.[18] With the collapse of those booms, the emergence of REA banking problems and REA fiscal consolidation, REA aggregate demand began to exert a less negative effect on REA net exports– and even has started to contribute positively to REA net exports from the beginning of 2012.

As shown in Fig. 6.a, ROW external demand fluctuations have also tended to boost REA net exports, especially during the years 2001–2006, and in 2012–2013 (during this period ROW GDP growth noticeably exceeded REA and German growth).

[18] Empirically, house price increases are often associated with a trade balance deterioration (e.g. Chinn *et al.* 2013; European Commission, 2012; Obstfeld and Rogoff, 2010). The REA block of the model here abstracts from housing (see above). As pointed out by a referee, the shocks to the REA subjective discount rate (assumed in the model) might capture the effect of REA house price bubbles.

REA GDP was largely driven by domestic aggregate supply and demand shocks (see Fig. 6.b). The spillovers of German shocks to REA GDP are relatively weak. It can be noted that REA and German aggregate supply shocks have tended to co-move positively. In contrast, Germany tended to experience negative aggregate demand shocks before the crisis, whereas the REA mainly received positive aggregate demand shocks, during that period. The poorer performance of the REA economy compared to the German economy since the financial crisis is to a large degree driven by adverse REA aggregate demand shocks. Labour market reform, too, has contributed to the better performance of Germany after the crisis (the unemployment rate has been falling in Germany after the crisis, while unemployment rose sharply in the REA).

5. SCENARIOS FOR THE GERMAN EXTERNAL BALANCE

Although uncertainty about future shocks makes it impossible to fully anticipate the further evolution of the German current account, we can characterize the likely impact of current drivers in the years to come. The historical decomposition shows that the contribution of the German private saving shock to the CA is slowly falling. It is likely that the savings rate will decline further, given the fact that high saving cohorts (population aged between 30 and 55 years) will decrease as a share of the total population. A factor holding back a faster decline in saving could be precautionary saving related to the financial and sovereign debt crises.

A further factor that might contribute to a gradual fall in the CA surplus is that German residential investment is likely to pick up in the near term, given low real interest rates in Germany. Although the tradable content of construction is low, this will raise non-housing consumption and hence reduce the CA, due to the complementarity between housing and non-housing consumption. The discussion above has focused on the reduction of the unemployment benefit replacement rates as a key element of the labour market reforms of the early 2000s. In the framework of our model, benefit reduction increases the labour supply. Due to the sluggish response of domestic demand, the labour supply expansion translates initially more into real wage declines than higher employment, which only increases gradually. The fall in wage and production costs improves the price competitiveness of German goods in foreign and domestic markets and improves the German CA. However, the model suggests that the positive effect of permanent labour market reform on the German CA is only temporary, since employment and associated wage increases stimulate domestic demand (private consumption). According to the model estimates, the CA increase reaches its maximum around seven years after the reform. After that, the CA declines gradually in response to growing domestic demand. This implies that the contribution of past labour market reforms to the CA surplus is likely to fall in future years. In addition, the policy debate in Germany about the distributional impact of the labour market reforms has led to the introduction of a minimum wage law by the German government, which is likely to further increase German wages. Moreover, structural reforms currently undertaken in

REA countries will boost REA growth and competitiveness, and accelerate the erosion of Germany's competitive advantage. The contribution of fiscal policy shocks for the German CA has been modest during the estimation period. However, in view of the current discussions in Germany about the need to raise public infrastructure investment, future fiscal policy too may contribute to a reduction in the German external surplus.

The German non-tradables (services) sector lacks competition (barriers to entry into the retail, crafts and health sectors), and it is sometimes argued that reforms boosting competition and productivity in the German non-tradables sector (services) would lower the German external surplus. The model here cannot be used to evaluate that view, as it does not include a non-tradables sector. However, several recent papers have studied the effects of structural reforms in the non-tradables sector (modelled as a positive shock to non-tradables productivity or a reduction in the mark ups changed by firms that produce non-tradables); see, e.g. Forni *et al.* (2010), Vogel (2011, 2014) and Gomes *et al.* (2013) who use rich DSGE models of open economies that closely resemble the model used here. These analyses suggest that reform in the non-tradables sector has a strong positive effect on GDP, but that the effect on net exports is modest – in fact, net exports may actually rise. The reason for this is that the domestic tradable good producing sector uses non-tradable inputs – hence, policy measures that boost the efficiency of the non-tradables sector improve a country's external competitiveness.[19]

6. CONCLUSIONS

We have developed a three-country DSGE model and estimated that model using quarterly 1995–2013 data for Germany, the rest of the Euro Area (REA) and the rest of the world (ROW). We used the model to analyse the causes of Germany's substantial and persistent current account surplus, and its effect on the REA. Our results show that simple mono-causal explanations of the German surplus are insufficient. The surplus reflects a succession of distinct shocks. According to our estimates, the most important factors driving the German surplus were positive shocks to the German saving rate and to ROW demand for German exports, as well as German labour market reforms and other positive German aggregate supply shocks. Those shocks had a noticeable negative effect on REA net exports, but only a modest effect on REA real activity. We expect the contribution of past German labour market reforms to the current account surplus to decline in future years as wage growth picks up again. Structural reforms in the REA would boost growth and improve external balances there, eroding Germany's

[19] Dustmann *et al.* (2014) show that low wage growth in the German non-tradables sector contributed to the competitiveness of the German exports sector–more than 70% of inputs used by the German exports sector are domestically produced. These strong domestic input linkages suggest that an aggregative model (without non-tradables versus tradables distinction) may be suited for understanding the German macroeconomy.

competitive advantage. Illustrative model simulations presented in this paper suggest that increased awareness about future demographic developments and pension generosity contributed to the German current account surplus. To the extent that this holds, it would not call for corrective policy actions. A more expansionary German fiscal policy would reduce the external surplus and help to achieve a rebalancing in the EA, albeit only by a modest amount.

Discussion

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Europe has experienced a large divergence in current-account positions since the creation of economic and monetary union (EMU) in 1999. In particular, Germany has seen a dramatic shift in the balance of its current account, from a roughly balanced position in the early 2000s to a surplus of more than 6% of GDP before the global financial crisis and to 7.3% in 2013. Does this divergence constitute a problem for the euro area? And what are the explanations for this pattern across euro area countries? These are important questions not just from an academic perspective, but they are also crucial for policymakers in understanding the origins of the European crisis and how they can deal with it.

The present paper concentrates on analysing the changes of Germany's current account over the past 20 years. It thus addresses not only an important policy issue, but it also makes a valuable academic contribution by using a state-of-the-art DSGE model, developed by and used at the European Commission, to analyse the drivers of Germany's current account. The paper is particularly valuable because it considers a rich set of potential determinants for Germany's current account. The paper is clear and to the point, and it will thus make a neat contribution to the academic debate.

The results of the paper are provocative. In essence, the results imply that Germany's current account can indeed be explained by a number of policy-induced shocks in the early 2000s in the context of Germany's Agenda 2010 reforms. These reforms cut social security benefits and made Germany's labour market more flexible. In other words, the findings of the paper mean that there is no misalignment or disequilibrium of Germany's current account. This argument has profound implications for the European policy discussion. It means that the investigation by the European commission of Germany – in the context of the macroeconomic imbalances procedure (MIP) – for having policy distortions that have led to an excessively large current account surplus, is basically unfounded.

This point illustrates both the strength and the weakness of the methodology applied in the paper. By construction, the DSGE model implies that the current account can never be imbalanced for a longer period of time, and that it returns to equilibrium quickly. It does not allow for a particular variable in the model, in this case the current account of Germany, to be out of sync with its long-run equilibrium. Hence, despite its strengths and advantages, the model has two fundamental weaknesses. The first one is that it imposes on the current account the assumption of equilibrium, without providing a rationale whether or not a particular value constitutes such a long-run equilibrium. Crucial in this regard is the interpretation of the steady-state values of the model and the question, whether they can be interpreted as an equilibrium.

The use of a reduced-form, behavioural model provides an alternative to the structural model of the present paper. The International Monetary Fund (IMF) has long used models that derive current-account benchmarks for a large set of countries over time, on the basis of empirical panel data models with a large set of potential determinants. These models show that there is no set or combination of potential determinants that could possibly explain the huge and persistent current account surplus of Germany since 2006. The long-run sustainable or equilibrium value of Germany's current account position in most of these behavioural models lies somewhere around 2% or 3% of GDP. These behavioural models have the advantage of being more agnostic: they allow for a much broader set of potential determinants and the relationship between the variables of the model is empirically determined.

A second weakness is that the structural model of the paper can explain the evolution of Germany's current account only through variables that are included in the model. This may explain why the structural model of the present paper and the reduced-form models tell such a different story for Germany. Considering the current account from a saving-investment perspective shows why this may be important. German companies often complain about weaknesses in the public transport infrastructure and digital infrastructure, a lack of skilled labour, distorted competition, high and uncertain energy cost (due to the energy transformation towards renewables that Germany has embarked upon), and a high degree of uncertainty concerning the regulatory environment.

The structural model of the present paper does not consider such factors as potential drivers of Germany's current account. Of course, the DSGE model is already very rich and detailed for its class of models. But still an open question is how the empirical estimates of the paper changed, if such determinants could be included. In other words, it is inherently difficult to measure and include policy distortions in structural models like the current one. Yet, such distortions may be important for understanding the evolution of Germany's current account and that of its neighbours.

The paper raises a number of further queries. The impact of cyclical shocks such as to risk premia, fiscal policy and financing conditions are found to be highly persistent over time. This is unexpected, but could well have to do with the global financial crisis of 2008 and 2009 and the subsequent European crisis. Another interesting point coming out from the paper is the dynamics of Germany's saving rate, which has increased sharply since the early 2000s. The findings of the paper suggest that in particular a 'preference shock' explains much of this increase. It would be interesting to learn what the source of such a preference shock could be, and to what extent it is related to the crisis or other sources of uncertainty. The findings also imply that the investment efficiency in Germany has improved dramatically over the past decade, and also that German companies and households tend to be constrained financially (and possibly more so than in neighbouring countries). These are intriguing findings about which one would like to learn more in future research.

In summary, the paper is an ambitious one that addresses an important and highly topical policy issue. The structural model of the paper is constructed carefully and thoroughly. Its contribution lies in explaining the channels through which the structural reforms of the agenda 2010 in Germany in the early 2000s may have influenced Germany's saving and investment behaviour, and thus its current account. This is, no doubt, an important contribution of the paper. Future research should go further and relax some of the assumptions, address the issue of what constitutes a current account equilibrium, and extend the model to include additional policy distortions.

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There are various explanations for the rather spectacular increase of Germany's current account since 2000. These explanations include, for instance, interest rate convergence in the context of the introduction of the euro, German labour market reforms or depressed demand in Germany. For this reason, the attempt of the paper to quantify the effect of different causes within a large-scale DSGE model is particularly welcome. Moreover, as the model is estimated on euro area data it seems particularly suited to address the issue at hand.

The model features three 'countries': Germany, the Rest of the euro area and the Rest of the world. Some 40 shocks act as exogenous sources of fluctuations which eventually impact the German current account. Given this setup, it is hardly surprising that the paper rejects 'mono-causal explanations of the German surplus' as 'insufficient'. Still, the analysis permits to quantify the contribution of different shocks at each point in time. In this regard, the authors find that shocks to the German savings rate stand out: they explain more than half of the current account surplus after 2008.

Formally, these shocks correspond to exogenous variations of the subjective discount rate and, as such, may capture a number of alternative structural changes. The authors, for instance, assess informally to what extent saving shocks represent 'demographic news shocks'. According to this interpretation, Germans increase their savings as they become aware of looming demographic problems. This is a plausible interpretation. But there are others as well. To the extent that policy implications differ across interpretations, the scope of the results of the present study remains limited. In the following, I illustrate this by sketching three distinct interpretations of the 'saving shock' which are based on quite different views regarding the proper functioning of international financial markets.

The first interpretation is based on the intertemporal model of the current account which provides a benchmark for assessing current account developments from the perspective of the frictionless neoclassical model. In a nutshell, the model predicts a current account surplus as the result of an optimal adjustment to declining income prospects, which may, for instance, be the result of a declining labour force – itself the result of a broader demographic trend.

Importantly, what matters are the income prospects relative to the rest of the world. Engel and Rogers (2006) use this insight in applying a specific version of the intertemporal model to US data. Specifically, considering the year 2004, they show that a current account deficit of 7% may be the result of optimizing behaviour, provided that US GDP growth exceeds that in the rest of the world for some time.

Repeating the computation for Germany is instructive. In 2012, Germany's share of world output was about 5%, while its current account surplus amounted to some 7.5% of GDP. It turns out that such a large surplus may be optimal in the context of the intertemporal model if Germany's world output share will gradually decline to 4.6%.[20]

Given current trends, this scenario appears quite plausible. Figure 7 displays Germany's share in world output for the period 1996–2020. The solid line represents OECD data, with projections from 2013 to 2015 (shaded area). The dashed line, in turn, represents the projections implied by the 2012 current account under the intertemporal model, which appear reasonable in light of the earlier developments as well as of the OECD projections. In fact, the projection implied by the intertemporal model suggests a rather quick phasing out of the decline of Germany's share in world output. A larger and more pronounced decline would rationalize an even larger current account surplus.

Importantly, this calculation supports a benign view on Germany's current account surplus, at least as far as the functioning of international financial markets is concerned. Germany's share in world output may decline for a variety of reasons, demographic developments being one of several possible factors. Others factors may be developments in the rest of the world. In any case, a large current account surplus is the optimal response to this trend within the intertemporal model. Hence, the surplus as such does not call for corrective policy actions.

The second interpretation, instead, supports a less benign view of the functioning of financial markets. It starts from a simple observation: shocks to the discount rate impact savings decisions at the same margin as variations in interest rate spreads. All else equal, a country's savings increase if either discount rates decline or spreads on loan rates in the private sector increase. The latter, in turn, may reflect changes in the efficiency of financial intermediation.[21]

[20] World output is PPP-weighted OECD GDP plus that of Brazil, Indonesia, India and China (source: OECD Economic Outlook 94). The calculation assumes a discount factor of 0.98 and a persistence parameter for the AR(1) process which governs the adjustment to the long-run world output share of 0.7.

[21] See, for instance, the discussion in Woodford (2011).

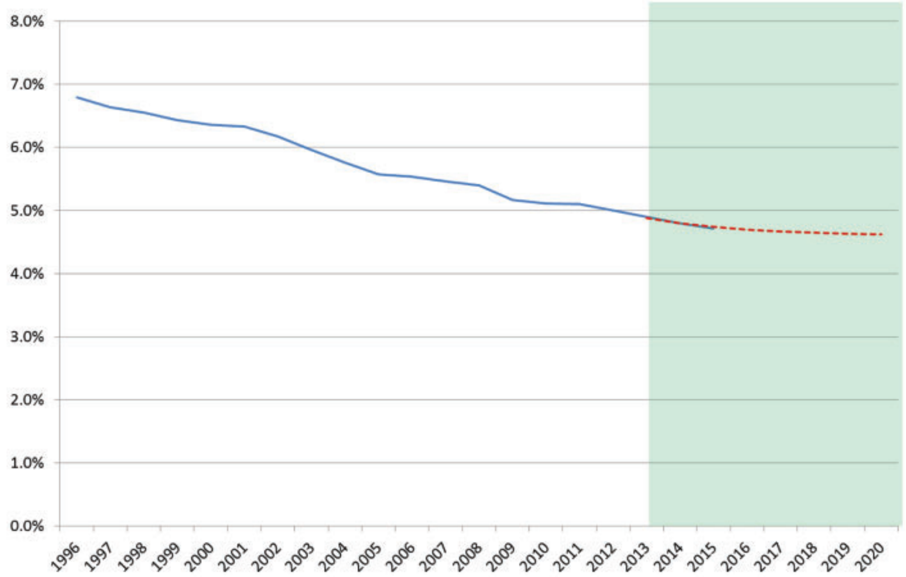

Figure 7. Germany's share in world output: actual data (solid line) versus projection implied by 2012 current account under intertemporal model (dashed line); shaded area indicates projection by OECD (World Economic Outlook 94).

The present paper does not allow for the possibility that saving decisions reflect variations in private-sector interest rate spreads. This is a shortcoming to the extent that there is time-series evidence which suggests that loan rates have been high in Germany relative to the rest of the euro area.[22] It is thus conceivable that what ends up being classified as a saving shock under the estimation procedure in the present paper is, in fact, lack of efficiency of financial intermediation.

Last, under a third interpretation it is the common monetary policy in the euro area which contributes to current account 'imbalances'. At least since the inception of the euro, many commentators have remarked on the lack of an appropriate monetary stance in some countries of the euro area. This, in turn, impacts saving and borrowing decisions through its effect on real interest rates. Quantitatively, this effect can be sizeable. To illustrate this, I consider a saving shock in the two-country model developed by Enders, Jung and Müller (2013). The model has been set up to quantify the effect of the euro on European business cycles. It has been calibrated to Germany and the rest of the euro area, rather than being estimated and abstracts from the rest of the world. Still, the model matches key features of the European business cycle remarkably well, both before and after the introduction of the euro.

[22] For instance, during much of the period 2009–2011, loan rates have been higher in Germany than in Italy, Ireland and Spain according to some measures provided by the ECB (Annualized agreed rate (AAR)/Narrowly defined effective rate (NDER), Credit and other institutions (MFI except MMFs and central banks) reporting sector – Loans, Total original maturity, Outstanding amount business coverage, Non-Financial corporations sector, Euro).

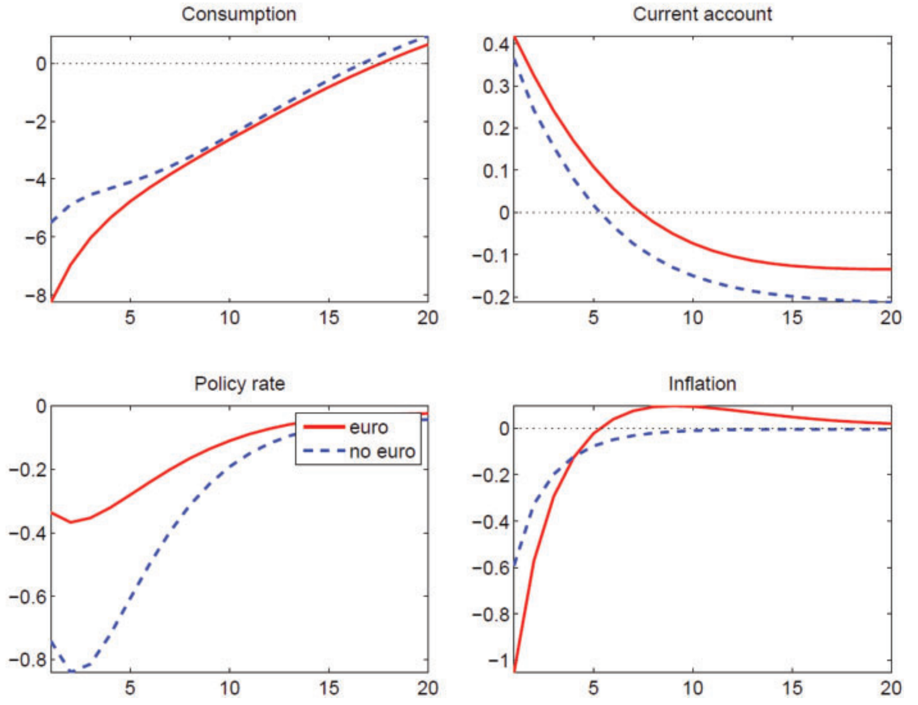

Figure 8. Effect of German saving shock in baseline scenario (solid lines) and counterfactual scenario w/o euro (dashed lines). Simulation based on Enders *et al.* (2013).

Figure 8 shows results from a model simulation, contrasting the adjustment to a saving shock in Germany under the baseline scenario with a common currency and a counterfactual scenario with independent monetary policies. Horizontal axes indicate quarters, vertical axes deviations from steady state. Private consumption in Germany falls in response to the saving shock (upper left panel). The effect is considerably smaller, however, in the absence of a common currency, reflecting a different monetary stance. The short-term nominal interest (policy rate) declines much more strongly under the counterfactual (lower left panel). As a result, the saving shock has a weaker deflationary impact in this case (lower right panel). Real interest rates thus decline much more in the counterfactual, thereby offsetting the saving shocks. Eventually, the current account is lower relative to the baseline scenario throughout the adjustment path (upper right panel). These simulations show that exchange rate regime may have a first-order effect on current account dynamics.[23]

[23] The present paper does not systematically analyse the role of the euro for current account developments, even though the underlying framework is well suited for such an analysis. The role of monetary policy is only analysed in the context of ROW shocks. In this regard it seems fairly limited, see footnote 16.

In sum, the paper makes an important contribution to the policy debate, notably by quantifying the role of different factors for the development of the German current account. Yet the most important factor turns out to be German saving shocks: a reduced-form shock to the extent that it is compatible with various structural interpretations. Importantly, these interpretations also differ in terms of policy implications, not least because they are based on different views regarding the efficient functioning of international financial markets as well as the common monetary policy in the euro area.

Panel discussion

Jeromin Zettelmeyer asked what the equilibrium current account would be and where it would converge if the system is let to play out. Robert McCauley told an old story where the German current account deficit would get to a certain size and German private sector would be unable to take all foreign exchange risk and the savings behaviour would reverse generating the current account surplus. He said that the model can also address that kind of story. Josep Pijoan-Mas emphasized the role of investment as a reason of high current account surplus in Germany. Replying to the comments, the authors said that investment does not have a persistent impact on the current account. They said that their intention is not really to estimate the equilibrium current account for Germany. When talking about normative implications, it is more the question of trying to assess the size of the spillover to the rest of the euro area countries. They said that one way in which this analysis can be taken forward, is to look at what level the German current account actually goes if they let model dynamics converge. The authors also stated that many other countries are doing pension reforms and this may be another reason for the normalization.

SUPPLEMENTARY DATA

Supplementary data are available at *Economic Policy* through Oxford Journals Online.

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