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The corporate saving glut and the current account in Germany

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Abstract

We investigate, in the case of Germany, the positive correlation between the cyclical components of the corporate saving glut in the non-financial corporate sector and the current account surplus from a capital account perspective. Employing sign restrictions, our findings suggest that mostly labor supply, world demand and financial friction shocks account for the joint dynamics of excess corporate saving and the current account surplus. Household saving shocks, by contrast, cannot explain the correlation. We conclude that, explained through these factors, the corporate saving glut is an important driver of the cyclical component of the current account.

Keywords: Current account, corporate saving, macro shocks.

JEL codes: E32, F32, F45.

Non-technical summary

In this paper we investigate the response of the current account balance to macroeconomic impulses (shocks) by means of a vector autoregressive (VAR) model (Arias (2014), Breitenlechner et al. (2018), Uhlig (2005)). We focus on the analysis of the positive correlation between the German current account and corporate saving from a flow of funds perspective. In particular, the question being examined is to which extent economic shocks have favoured nonfinancial corporation (NFC) saving that was not invested domestically, but flowed abroad as capital exports. To identify the cyclical patterns in the data, a general equilibrium model (DSGE model) is employed, which determines the signs of the macroeconomic variables after the respective shock. These sign restrictions are then applied to the data in a second step. The main variables, i.e. the current account balance and NFC saving, are left unrestricted. Thus, for well-defined economic patterns, it is possible to investigate how these unrestricted variables behave. The model for deriving the sign restrictions is based on Chen et al. (2017) and Jermann and Quadrini (2012). Fundamental to the model is the assumption that companies need collateral to obtain loans and face adjustment frictions on dividends. NFC saving can be used to invest, to reduce debt, or to buy back outstanding shares. In the open economy VAR, the following non-exclusive hypotheses are tested based on the sign restrictions derived in the DSGE model:

1. Financial Friction Shock Hypothesis: This hypothesis suggests that more restrictive bank lending practices, such as a tightening of banking regulation, have a negative impact on corporate investment, and, as a result, companies save money internally to provide risk buffers against negative shocks (De Fiore and Uhlig (2015)).

2. Labor Supply Shock Hypothesis: This hypothesis states that a falling wage share in the NFC sector as a result of labor market reforms leads to higher company savings, as a smaller proportion of the revenues flows to wage earners (Berger and Wolff (2017), Chen et al. (2017)).

3. World Demand Shock Hypothesis: Another cause of a current account surplus is booming global demand, which increases the turnover of German companies (Kollmann et al. (2015)). If arising profits are only partially distributed to the owners and the expansion takes place with moderate wage dynamics, then there is an increase in corporate saving.

Our results show that the financial friction shock, labor supply shock and world demand shock account for around 40% of the variation in the current account dynamics after four quarters. We also find, apart from precautionary saving, that the global economy and the moderate wage developments in Germany have made a significant contribution to excess saving in the NFC sector. The resulting increased saving in the NFC sector was not absorbed by domestic investment. In this respect, corporate saving has had a significant impact on net capital exports.

From our analysis follow a number of policy implications: The prominence of financial friction shocks as a driver behind corporate net lending points to stability

and competition in the banking sector for lowering the excess of corporate saving relative to investments. Regarding labor supply shocks we conclude that while being a prominent driver in the years from 2005 to 2008, i.e. after the implementation of labor market reforms, labor cost relative to Germany's trading partners have started to adjust. While world demand shocks have remained an important driver of the current account also after the Global Financial Crisis, the international environment poses a potential vulnerability of the German economy to trade shocks which would be reduced by strengthening domestic demand sources. Finally, the relatively low domestic absorption of corporate savings points both to policies which encourage higher investments, for instance changes in corporate taxes and regulations, and to the need for increased public investment in infrastructure.

1 Introduction

The German current account rebounded from deficits during the 1990s to surpluses in the 2000s which have remained above 6% of GDP since 2011. According to the European Commission, this is a critical threshold signalling macroeconomic imbalances that may adversely affect macroeconomic stability.[1] The continued high surplus has ignited a heated debate across the Atlantic and within European policy circles, as Germany is repeatedly blamed for inflicting trade deficits on the United States and hindering economic re-balancing within the euro area due to anaemic growth in its domestic demand.[2]

In this paper, we study the business cycle drivers behind the cyclical component of the German current account surplus from a flow-of-funds perspective. We highlight the role of corporate saving in excess of corporate investment, known as the "corporate saving glut", and analyse its cyclical component.[3] This glut is one possible reason for weak domestic absorption and thus potentially explains why Germany exports capital on a large scale.

While private household saving as a share of GDP declined a slight 1 percentage point after 1995, gross corporate saving in the non-financial sector increased by 6 percentage points between 2000 and 2013. At the same time, corporate gross investment expressed as a share of GDP declined, which led to a corporate saving glut starting in 2003 (see Figure 1). Accordingly, the non-financial corporate sector – traditionally a net borrower – has become a net lender, endowed with excess saving, not absorbed by domestic investment or the fiscal deficit.[4] The German

[1] According to the European Commission, "The Macroeconomic Imbalance Procedure aims to identify, prevent and address the emergence of potentially harmful macroeconomic imbalances that could adversely affect economic stability in a particular Member State, the euro area, or the EU as a whole." See European Commission (2018).

[2] For an early critique by the US Treasury see U.S. Department of the Treasury (2013). The conflict has escalated recently under the Trump Administration, culminating in threats to put tariffs on car imports from Europe; see CNBC (2018).

[3] See Gruber and Kamin (2015) for details on G7 countries. See André et al. (2007) for OECD countries.

[4] The net lending position of the government also moved from deficit to surplus. This swing is quantitatively important, as deficits amounted to roughly 3 to 4 percentage points in the early

current account started to take off at around the same time. Figure 1 shows that the corporate saving glut has a large cyclical component ranging from minus to plus 25 percentage points around its trend. This displays a positive co-movement with the cyclical component of the current account ranging from minus to plus 2 percentage points of GDP. While related studies like Kollmann et al. (2015) do not explicitly address the saving behavior of corporates, we use this variable to identify the drivers of the cyclical components of the current account. The trends and cycles shown in Figure 1 are based on the estimation results as reported in Section 4 of this paper.

[Figure 1 approximately here]

The corporate saving glut is a well documented fact that can be observed in many countries (see Chen et al. (2017)). In Germany, however, the increase in corporate saving was, from a flow-of-funds perspective, large enough in quantitative terms to proactively enable capital exports. Chen et al. (2017) relate the secular trend increase in corporate saving to a decline in the real interest rate, the cost of investment and corporate income taxes. While they succeed in explaining the increase in corporate profits and shifts in the sectoral supply of funds, their model is somewhat counterfactual, as the observed data predict an increase in the investment ratio, whereas it has actually declined over the last few decades.[5] A study by Adler et al. (2019) relates the increase in corporate saving to the rise of intangible investment. As intangibles cannot be pledged as collateral, firms save funds internally and thus accumulate the resources required to finance investments in intangibles. Demographic factors are traditionally also taken into consideration when explaining the level of the current account (see International Monetary Fund (2019)).

2000s before becoming persistently positive from 2013 onwards, with an average quarterly surplus of 0.76 percentage points of GDP. By contrast, the surplus in the corporate sector from the second quarter of 2013 onwards was three times larger and accounted for 2.26 percentage points of GDP.

[5] In France and Italy in particular, the non-financial corporate sector remain a net borrower from a flow-of-funds perspective. In the United States, by contrast, the net lending position of corporates is positive. However, this is more than offset by the fiscal deficit and the historically low personal saving rate, especially in the period from 1998 to 2007 (see Gruber and Kamin (2015)).

To our knowledge, we are the first to study the German current account from a flow-of-funds perspective within an open-economy VAR framework. Focusing on the non-financial corporate sector allows us to assess the role of the corporate saving glut in terms of forecast and historical error variance decomposition's. The basic idea is that bringing the corporate saving glut into the picture gives additional sign restrictions that are otherwise neglected in related literature. To state our case we evaluate different hypotheses within an open-economy VAR model. In particular we test which drivers of the business cycle support a positive correlation between a corporate saving glut and current account surpluses (see Section 2 for details).

To judge the quantitative relevance, we apply a sign restriction approach as advocated by Rubio-Ramiréz et al. (2010) and Peersman and Straub (2009). We employ a DSGE model to derive robust sign restrictions that explicitly takes financial flows in the non-financial-corporate sector into account and gives a role to corporate saving. Building on Chen et al. (2017) and Jermann and Quadrini (2012), the model prominently features the equity dividend payout and debt repurchase behavior of the corporate sector. Due to the tax deductibility of capital depreciation and interest expenses, the firm is indebted when the level of corporate debt is tied to a collateral constraint as in Kiyotaki and Moore (1997). This constraint is subject to financial friction shocks that alter the amount of credit available. The model assumes that firms make investment decisions as they own the capital stock. Accordingly, the model is able to highlight the transmission of shocks to corporate saving as such saving can be used to fund investment, change the amount of debt outstanding or conduct equity operations. In the standard Smets and Wouters (2007) style of model, firms do not save as households own the capital stock and all profits are immediately distributed to households that own the firms. To that extent it is fundamental for us, to state our case, that firms make the real and financial saving decisions. The model accommodates business cycle fluctuations of the corporate labor share, which enables us to set additional restrictions to disentangle shocks. The labor share responds to the business cycle as firms operate a CES technology and financial frictions distort the distribution of income. As a guiding principle, we let the data speak for themselves in terms of the ability to support a positive correlation between the corporate-saving-to-investment ratio and the current account. While we restrict the corporate-saving-to-investment ratio to increase, the model remains tacit with respect to the current account. In concrete terms, in the baseline scenario we identify specifically financial friction shocks, labor market shocks, world demand shocks, household saving shocks and technology shocks. As illustrated in the following section these shocks can be linked to prominent hypotheses that explain the nexus of corporate saving, household saving and the current account.

Closest to our paper are Kollmann et al. (2015) who use Bayesian techniques to estimate a three-region DSGE model.[6] They find that the main drivers of the current account are shocks to the German private saving rate, shocks to world demand and labor market reforms. However, they do not decompose savings rates into sectors, meaning that they do not focus on corporate saving in the non-financial sector. Explicitly taking into account flows in the non-corporate sector and business cycle fluctuations in the corporate labor share allows us to set additional restrictions in our empirical analysis compared with Kollmann et al. (2015). Our findings suggest that labor supply shocks likely related to reforms, world demand shocks linked to the idea that German exporters meet the global demand in an expanding world economy better than other countries and financial frictions connected with the idea of a tightening of credit constraints in the non-financial sector help to explain the nexus between a corporate saving glut and the current account. In sum, the three identified shocks which follow the main hypotheses in the relevant academic and policy debate account for around 40% of the cyclical variation in the current account

[6]Somewhat loosely related to our paper are Tan et al. (2015) who investigate the nexus between corporate saving and current account imbalances in a cross-country panel framework including 66 countries. They report that, on average, firms in countries with a less developed financial system have a strong precautionary saving motive, which makes these countries more likely to run current account surpluses.

and the corporate saving glut in the baseline version of the model. These shocks have boosted gross saving in the German non-financial corporate sector without leading to a boom in gross domestic capital formation, which in turn has promoted weak domestic demand, and capital exports. Based on our identification strategy, we can dismiss a private saving shock as the main driver, although this is a popular candidate shock in the literature. Put differently, neglecting restrictions in the corporate sector biases results towards a private saving shock. This is an important finding in terms of policy implications.

2 Corporate Saving and Current Account Cycles in the Germany Economy

We believe it is a useful exercise to provide two definitions of gross corporate saving as two sides of the same coin. Looking at the national account from a *generation of income perspective* gross corporate saving is defined as [7]

$$\begin{aligned}\text{Gross Corporate Saving} = {} & \text{Gross Value Added} - \text{Labor Cost} - \text{Production Taxes} \\ & - \text{Net Interest} - \text{Taxes, Rent, and Other} - \text{Net Dividends,}\end{aligned} \tag{1}$$

where the gross corporate saving is the available resources after paying labor services, taxes, net interest and net dividends from gross value added. Looking at corporate saving from a *capital account perspective*, we can identify the following uses of saving

$$\text{Gross Corporate Saving} = \text{Gross Capital Formation} + \text{Net Lending} + \text{Other Uses,} \tag{2}$$

[7]See Data Documentation for data sources.

which are investment, net lending and other uses which comprise items of minor quantitative importance such as changes in inventories. We divide Equation (2) by gross capital formation to construct a variable that proxies a corporate saving glut.

$$\frac{CS}{CINV} = \left(\frac{\text{Gross Corporate Saving}}{\text{Gross Capital Formation}}\right) = \left(1 + \frac{\text{Net Lending} + \text{Other Uses}}{\text{Gross Capital Formation}}\right), \quad (3)$$

where values above one indicate that corporates save beyond the capital needs to finance investment, whereas values below one imply that corporates are net lenders. Increases in corporate saving itself, by contrast, might be investment driven and do not necessarily indicate a saving glut.[8]

To give a flavor of the correlation structure in the data Table 1 reports correlations of the cyclical components of the gross-corporate-saving-to-investment ratio with log GDP and the current account as a share of GDP. The cyclical components of the three time series are measured as the one-sided Hodrick-Prescott (HP) filtered series. Note, in Section (4.1), when we estimate the model, we do not use the one-sided HP-filter, but rather estimate the model in levels and log-levels. Two observations are clearly visible in the table. First, the correlations between the current account (share of GDP) and corporate saving (share of GDP) are positive and fairly high and consistent with the view that a saving glut in the corporate sector goes hand-in-hand with capital exports. Second, the corporate-saving-to-investment ratio is negatively correlated with the business cycle. This could be interpreted as being consistent with the idea that a saving glut in the corporate sector dampens domestic activity. Applying the band-pass filtering approach recommended by Baxter and King (1999) further confirms the findings.

[Table (1) approximately here]

[8]Empirically, the variable stayed permanently above 1 from the second quarter of 2009 while it went through at the early 2000s with a value of 0.62.

2.1 Wage Moderation and Labor Market Reforms

From 1995 to 2017 Germany witnessed a strong increase in employment of around 15 percentage points. While remaining more or less at the 1995 level from 1995 to 2006, employment took off after 2006 (Bundesagentur fur Arbeit (2018)). At the same time, unit labor costs plunged by over 10 percentage points (Berger and Wolff (2017)). Overall, the corporate labor share dropped by almost 12 percentage points from 63 to 51, in particular prior to the Great Recession, before increasing again to 57 in 2017. In the mid-1990s when globalization and skill-based technological change kicked in, the German Trade Union Federation showed a willingness to support wage moderation to prevent German industry off-shoring production to low-cost countries on a large scale.[9] However, the establishment of a global value chain and outsourcing, in particular to eastern Europe, depleted trade union membership and weakened their bargaining power (Dustmann et al. (2014))[10]. Nominal and real wage growth has been much lower in Germany than in other countries since 1995 (Berger and Wolff (2017)). The "Hartz IV Reforms" focusing on labor market deregulation that were enacted between 2003 and 2005, also contributed to wage moderation in Germany.

Equation (1) implies that a decline in the labor share increases corporate saving as funds are diverted less from gross value added. Therefore, we state the hypothesis that wage moderation and labor market reforms contributed to the rise in corporate saving in Germany and led to a corporate saving glut as domestic corporate investment as a share of GDP remained at historically low levels. This hypothesis basically builds on the notion that the rise in corporate saving and the decline in the corporate labor share are two sides of the same coin.[11]

[9]Early initiatives at the time were called "Bündnis für Arbeit".

[10]See Organisation for Economic Co-operation and Development (2013). See also Manger and Sattler (2019) who find that countries with coordinated wage-bargaining systems are able to moderate the increase in export prices relative to other countries, which results in a favorable trade balance or current account.

[11]The following papers also focus on the interrelationship between corporate saving and the decline in the labor share: Karabarbounis and Neiman (2014) and Chen et al. (2017).

2.2 Financial Friction Hypothesis

A second prominent hypothesis which we call the *financial friction hypothesis*, states that frictions in the credit supply provided to corporates by the financial sector play a key role in explaining the saving glut in the corporate sector. Corporates had to pay very high risk premia during the Great Recession of 2008/09 reflecting a shortfall of available funds at low rates of interest (De Fiore and Uhlig (2015)). Beyond that, there is an additional narrative that the tight banking regulation associated with Basel II and Basel III led to a more restrictive supply of credit as the banking industry retained earnings to strengthen balance sheets. Both arguments reflect the prominent role of the financial sector in shaping the business cycle. Adverse shocks to the available amount of credit, such as to the given amount of collateral, are a cause of recessionary shocks, where corporates cut back investment, hours worked and dividend payouts, and increase corporate saving. Following Jermann and Quadrini (2012) we call these shocks *financial friction shocks*.[12] In response to a tightening of credit constraints corporates have a saving motive to mitigate adverse financial friction shocks. Corporate saving may have also been fostered by a decline in relative investment prices. The fall in the relative price index of investment goods since the start of the 1980s is well documented. The downside of falling investment prices is that falling prices reduce the collateral value of capital and thus operate like financial friction shocks. The rise of corporates that use intangible capital at scale also has the same direction of travel as, in contrast to tangible capital, the financial industry may not accept intangibles as collateral (see Falato et al. (2013)). Adverse financial friction shocks are recessionary and constitute a negative correlation between GDP, investment and corporate saving, which orthogonalizes financial friction shocks from labor supply shocks. Accordingly, we test the hypothesis that financial friction shocks support the positive correlation between a corporate saving

[12] Schuler and Corrado (2019), among others, show the role of financial innovation shocks to bank lending and their links with the business cycle.

glut that goes hand-in-hand with capital exports.

2.3 World Demand and German Exports

A third hypothesis, which we call the *booming world demand hypothesis*, states that German exporters are better than others at meeting world demand with their products than other countries (see Schuknecht (2014)). In this view, Germany's current account surplus primarily reflects the high quality of German products. We test the hypothesis that a booming world economy boosts the corporate-saving-to investment ratio and gives rise to net capital exports. This hypothesis implicitly rests on the notion that revenues are not absorbed by a higher wage share. This view is supported by the DSGE model, which robustly indicates that the wage share declines after a shock to net exports. By focusing on the current account we explicitly view the operation of multinational firms through the lens of national accounts. This implies that production, profits and investment are only relevant for our analysis if export-related operations take place in Germany. This explicitly excludes the activities of a German subsidiary in China, for example. However, subsidiaries become relevant as far as they change the net foreign asset position and are a source of cross- border income streams.

We can identify net export shocks as they are orthogonal to financial friction shock that imply a negative co-movement between GDP, investment and the corporate-saving-to-investment ratio. They can also be disentangled from the labor supply shock as they are a demand-side disturbances whereas labor supply shocks are a supply-side disturbances predicting a negative correlation of output and prices.

2.4 Other Hypotheses

There are at least two other hypotheses. These include the view often known as the *private saving* or the *saving glut hypothesis*. This builds on the idea that the anaemic growth in domestic demand is the key to the German current account surplus. Seen from a flow-of-funds perspective, a positive saving shock in Germany – which reflects a fall in the rate of time preference – pushed domestic saving against the backdrop of belief of higher returns on investment abroad. This hypothesis follows similar lines to the concept of the "saving glut".[13] German private investors sought profitable investment opportunities in the European periphery and the US housing market in particular, while investment activity and consumption in Germany was low (see Maas et al. (2018)). This view also encompasses the notion that capital exports may reflect private household retirement savings plans corresponding to Germany's ageing population. In contrast to a financial friction shock, the saving glut shock implies a positive correlation between corporate saving, investment and GDP, which makes it relatively easy to disentangle the two shocks. The same argument applies to a world demand shock (see Section 3). To foreshadow results, we find no evidence to suggest that private household saving shocks were the driver behind Germany's capital exports (see Section 4.2).

To complete the picture, we also investigate the role of total factor productivity (TFP) shocks, as they are considered to be one of the main drivers of the business cycle.

3 Model

This section presents the DSGE model we use to derive robust sign restrictions for the corporate-saving-to-investment ratio.[14] Based on these restrictions the quantitative empirical analysis and inferences is performed by a structural VAR. The theoretical model builds on Jermann and Quadrini (2012), augmented by minimalistic

[13]The term "saving glut shock" originally referred to the idea that money was flowing uphill from China to the United States, due to the limited amount of financial instruments in China and hence an underdeveloped financial system. Ben Bernanke, a former Chair of the Federal Reserve, argued that these flows depressed saving rates in the United States as interest rates fell on capital markets in response to the increased amount of funds available. US housing and capital markets overheated as a consequence.

[14]For related literature that also follows a strategy of using robust sign restrictions, see for instance Peersman and Straub (2009) and Enders et al. (2011).

open-economy features. In particular, an exogenous demand shifter in the resource constraint reflects shocks to net exports. It should be noted, that the theoretical model by construction says nothing about the response of the current account to other shocks. The empirical VAR analysis, on the other hand, can explicitly capture the current account response. Accordingly, we let the data speak for themselves to investigate the nexus between a corporate saving glut and the current account.

To describe corporate saving, the model tracks corporate investment and debt repurchases (see Chen et al. (2017)). Consistent with empirical evidence dividend payouts adjust sluggishly to the business cycle, as demonstrated by Jermann and Quadrini (2012). The tax deductibility of interest expenses means that, firms prefer debt to equity; however, the volume of debt is tied to a collateral constraint that is subject to financial friction shocks. Financial frictions spill over to labor demand and investment decisions as firms are restricted by intra-period loan constraints. We also allow for shocks to labor supply in household preferences. These shocks are consistent with an increase in hours worked, while wages evolve below trend. A CES production technology explicitly allows for variations in the corporate labor share. This modelling choice is motivated by the stylized fact that the labor share declined rather than remaining constant between 1995 and 2018. To control for other shocks that drive the business cycle, we also identify technology shocks and private saving shocks. Controlling for these shocks is important as it is well known that linear combinations of omitted structural shocks might distort identified impulse response and forecast error variance decompositions.

3.1 Firms

Building on Chen et al. (2017) there is a continuum of symmetric firms in the [0,1] interval that operate a CES production technology

$$y_t(i) = a_t \left(\alpha_k k_{t-1}(i)^{\frac{\theta-1}{\theta}} + \alpha_n n_t(i)^{\frac{\theta-1}{\theta}} \right)^{\frac{\theta}{\theta-1}}, \qquad (4)$$

defining the flow of gross revenues $y_t(i)$. $k_{t-1}(i)$ denotes the capital stock that is operative in period t and $n_t(i)$ denotes hours worked, where households draw income from renting out labor services to firms. $\theta > 0$ is the elasticity of substitution between capital and labor, and α_k and α_n are free parameters to calibrate the labor share in particular.[15] a_t denotes total factor productivity that is assumed to follow an exogenous AR(1) shock, with $\log(a_t) = (1-\rho_a)\log(\bar{a}) + \rho_a a_{t-1} + \epsilon_{a,t}$ with $\epsilon_{a,t} \sim \mathcal{N}(0, \sigma_a)$ and $\rho_a > 0$. The CES technology implies that the corporate labor share $s_{L,t}(i)$ defined as

$$s_{L,t}(i) = \frac{w_t n_t(i)}{y_t(i)}, \tag{5}$$

is endogenous over the business cycle, where w_t defines the real wage. Firms own the stock of capital that evolves according to

$$k_t(i) = (1-\delta)k_{t-1}(i) + i_t(i) - \frac{\varrho}{2}\left(\frac{i_t(i)}{i_{t-1}(i)} - 1\right)^2 i_t(i), \tag{6}$$

where $i_t(i)$ denotes investment. δ is the quarterly depreciation rate and investment adjustment costs $S = \frac{\varrho}{2}\left(\frac{i_t(i)}{i_{t-1}(i)} - 1\right)^2 i_t(i)$ are modelled as in Christiano et al. (2005). The following equation holds: $S(0) = S'(0) = 0$ and $S(0)'' > 0$. Firms use equity and debt as sources of funds to finance their business. Debt, $b_t(i)$ is preferred to equity due to its tax deductibility, as demonstrated by the pecking order theory in Hennessy and Whited (2005). The effective gross interest rate R_t for raising long-term debt is

$$R_t = 1 + r_t(1-\tau), \tag{7}$$

where τ reflects the marginal tax benefit. We follow Jermann and Quadrini (2012) and assume that the wage bill $w_t n_t(i)$, payments to finance investment $i_t(i)$, dividend payouts to shareholders, $d_t(i)$, and net financial flows to bondholders, $b_t(i) -$

[15] See Cantore et al. (2015) for details on the calibration strategies for CES production functions. If $\alpha_k + \alpha_n = 1$, the Cobb-Douglas function is obtained in the limit for θ converging towards 1.

$b_{t+1}(i)/R_t(i)$, are settled in advance of production.[16] Accordingly, the firm needs to take up intraperiod loans according to

$$l_t(i) = w_t n_t(i) + i_t(i) + b_t(i) - b_{t+1}(i)/R_t + d_t(i), \tag{8}$$

and the flow of funds constraint reads

$$i_t(i) + \varphi\left(d_t(i)\right) + b_t(i) = (1-\tau)(y_t(i) - w_t n_t(i)) + \frac{b_{t+1}(i)}{R_t} + \delta\tau k_{t-1}(i), \tag{9}$$

where investment, equity operations $\varphi\left(d_t(i)\right)$ and debt servicing are funded out of gross operating profit after tax $(1-\tau)(y_t - w_t n_t)$, the tax shield $\delta\tau k_{t-1}$ and fresh debt $\frac{b_{t+1}}{R_t}$. The volume of short-term funds, $l_t(i)$, is restricted by a collateral constraint

$$\xi_t\left(k_t(i) - b_{t+1}(i)\left(\frac{1-\tau}{R_t-\tau}\right)\right) \geq l_t(i) = y_t(i). \tag{10}$$

ξ_t reflects financial friction shocks.[17] It is assumed to follow $log\left(\xi_t\right) = \left(1-\rho_\xi\right) log\left(\bar{\xi}\right) + \rho_\xi \xi_{t-1} + \epsilon_{\xi,t}$, where $\epsilon_{\xi,t} \sim \mathcal{N}(0, \sigma_\xi)$ and $\rho_\xi > 0$. Corporate dividend policy is guided by dividend smoothing (see Marsh and Merton (1987)). The enforcement constraint is always binding in a steady state due to tax benefits of debt. However, with uncertainty, a sequence of favourable shocks may lead to a non-binding constraint as firms anticipate favourable cash flows. In general, the constraint tends to bind if the tax rate, τ, is sufficiently large and the shocks are sufficiently small as documented in Jermann and Quadrini (2012). The commitment to shareholders to provide stable dividend streams in advance of production, given a binding collateral constraint, forces firms to adjust expenses for labor, investment and debt in response to business cycle shocks. To formalize the idea of financial frictions we follow Jermann and

[16] As the signs of equity operations d_t are not restricted to be strictly positive, negative signs denote equity buybacks or the issuance of new shares.

[17] Following Jermann and Quadrini (2012) ξ_t is the probability that the lender will be able to seize company capital in the event of bankruptcy and $1-\xi_t$ the probability that the lender will not be able to recover the loans.

Quadrini (2012) and use the following cost function as a shortcut

$$\varphi\left(d_t(i)\right) = d_t(i) + \kappa_d\left(d_t(i) - \bar{d}\right)^2, \tag{11}$$

where $\bar{d}$ denotes the steady state of dividends and κ_d scales the dividend adjustment cost. In a broader sense κ_d measures the flexibility of the firm in changing its funding structure in terms of equity versus debt. Accounting profit is

$$\Pi_t(i) = (1-\tau)\left(y_t(i) - w_t n_t(i)\right) - b_t(i)\left(1 - \frac{1}{R_{t-1}}\right) + \delta\tau k_{t-1}(i), \tag{12}$$

where $b_t(i)\left(1 - \frac{1}{R_{t-1}}\right)$ measures the implicit interest rate cost implied by the zero bond. Corporate saving is defined as profit minus dividends $s_t^c(i) = \Pi_t(i) - d_t(i)$. By subtracting Equation (9) from Equation (12), we get

$$s_t^c(i) = i_t(i) + \left(\frac{b_t(i)}{R_{t-1}} - \frac{b_{t+1}(i)}{R_t}\right). \tag{13}$$

Thus, in line with Equation (2) from a capital account perspective corporate saving is used to finance investment, changes in the level of outstanding debt and implicitly equity operations.[18] The optimization problem for the firm is to maximize the expected present value of the future dividend payouts:

$$E_t\sum_{k=0}^{\infty}\tilde{\beta}^k\Delta_{t+k}d_{t+k}(i), \tag{14}$$

where $\Delta_{t+k} = \frac{U_{c,t+k}(j)}{U_{c,t}(j)}$ is the marginal utility of households that own the corporate sector and $\tilde{\beta} = \zeta_{\beta,t}\beta$. $\zeta_{\beta,t}$ denotes an exogenous shock to the discount factor and logarithmically follows $\log(\zeta_{\beta,t}) = \rho_\beta\log(\zeta_{\beta,t-1}) + \epsilon_{\beta,t}$, where $\epsilon_{\beta,t} \sim \mathcal{N}(0,\sigma_\beta)$ and $\rho_\beta > 0$. The firm chooses $\{k_t(i), n_t(i), i_t(i), d_t(i), b_{t+1}(i)\}$ to maximize (14) subject

[18] Implicitly, it holds in steady state that corporate saving equals corporate investment $\bar{s}^c(i) = \bar{i}$, assuming a stationary corporate-debt-to-GDP ratio.

to Equations (4), (6), (9) and (10). Denoting the Lagrange multiplier attached to the capital accumulation equation with $\mu_t^k(i)$, $\mu_t^c(i)$ is associated with the flow of funds constraint and $\mu_t^f(i)$ is linked to the enforcement constraint. The first-order conditions for optimal firm behavior can be summarized as follows:

labor $n_t(i)$

$$\frac{\partial y_t}{\partial n_t} = \frac{w_t}{1 - \frac{\varphi'(d_t)}{1-\tau}\mu_t^c}, \tag{15}$$

capital $k_t(i)$

$$\begin{aligned} Q_t = E_t \left(m_{t+1} \frac{\varphi'(d_t)}{\varphi'(d_{t+1})} \left((1-\delta) Q_{t+1} + \frac{\partial y_{t+1}}{\partial k_t} \left(1 - \tau - \mu_{t+1}^c \varphi'(d_{t+1})\right) + \delta\tau \right) \right) \\ + \varphi'(d_t) \mu_t^c \xi_t \end{aligned} \tag{16}$$

investment $i_t(i)$

$$\begin{aligned} 1 = Q_t \left(1 - \varrho \left(\frac{i_t}{i_{t-1}} - 1 \right) \frac{i_t}{i_{t-1}} - \frac{\varrho}{2} \left(\frac{i_t}{i_{t-1}} - 1 \right)^2 \right) \\ + E_t \left(m_{t+1} \frac{\varphi'(d_t)}{\varphi'(d_{t+1}} Q_{t+1} \varrho \left(\frac{i_{t+1}}{i_t} - 1 \right) \left(\frac{i_{t+1}}{i_t} \right)^2 \right) \end{aligned} \tag{17}$$

bonds $b_{t+1}(i)$

$$R_t E_t \left(m_{t+1} \frac{\varphi'(d_t)}{\varphi'(d_{t+1})} \right) + \xi_t \mu_t^c \varphi'(d_t) \frac{R_t(1-\tau)}{R_t - \tau} = 1, \tag{18}$$

where $\mu_t^f = \frac{1}{\varphi'(d_t)}$ and $m_{t+1} = \beta E_t \left(\frac{\zeta_{\beta,t+1}}{\zeta_{\beta,t}} \frac{\Delta_{t+1}}{\Delta_t} \right)$ is the stochastic discount factor of shareholders. Symmetry holds in the corporate sector. In Equation (15) $\frac{\varphi'(d_t)}{1-\tau}\mu_t^c$, measures the distortions due to financial frictions, where $\varphi'(d_t) > 0$, $\mu_t^c > 0$ and tax distortions, $\tau > 0$. The marginal product of capital and labor are $\alpha_k \left(\frac{y}{k}\right)^{1/\theta}$ and $\alpha_n \left(\frac{y_t}{n_t}\right)^{1/\theta}$ respectively. Equation (18) reflects the fact that the collateral constraint tightens when the flexibility between equity and debt financing decreases, where $\varphi'(d_t) > 0$ (see Jermann and Quadrini (2012)). Equation (15) implies the following labor share

$$\frac{w_t n_t}{y_t} = s_{L,t} = \left(1 - \mu_t \frac{\varphi'(d_t)}{1-\tau}\right) \alpha_n \left(\frac{y_t}{n_t}\right)^{\frac{1-\theta}{\theta}}, \tag{19}$$

and reflects the fact that it responds to business cycle fluctuations due to the CES technology and to financial frictions $\varphi'(d_t) > 0$.

3.2 Households

There is a continuum of homogeneous households maximizing the expected lifetime utility. Homogeneity among households is assumed, as standard, due to ex-ante settled contracts to share risk. Risk sharing is engineered by contracts that draw on financial instruments born out of complete contingent claims markets (see Woodford (2003), Ch.2). Households own the firm sector and draw income from interest and dividend payments on its accumulated wealth and rent out labor services. The representative household maximizes its expected utility, which reads

$$E_t \sum_{k=0}^{\infty} \tilde{\beta}^k \left(\frac{(c_{t+k})^{1-\sigma}}{1-\sigma} - \nu \epsilon^{\nu}_{t+k} \log\left(1 - n_{t+k}\right) \right). \tag{20}$$

Consumption c_t increases utility, while labor n_t decreases utility. ϵ^{ν}_t is a shock to labor disutility, where $\log\left(\epsilon_{\nu_t}\right) = \left(1 - \rho_{\epsilon_\nu}\right) log\left(\bar{\epsilon}_\nu\right) + \rho \epsilon_\nu \nu_{t-1} + \epsilon_{\nu,t}$ with $\epsilon_{\nu,t} \sim \mathcal{N}(0, \sigma_\nu)$ and $\rho_\nu > 0$. ν is chosen to have steady state hours equal to 0.3. σ reflects the degree of risk aversion. $\tilde{\beta} = \zeta_{\beta,t}\beta$ denotes the discount factor as described beforehand. The budget constraint is

$$c_t + s_{t+1} p_t + \frac{b_{t+1}}{1+r_t} = w_t n_t + b_t + s_t \left(d_t + p_t\right) + t^h_t \tag{21}$$

where s_t denotes the amount of shares, p_t is the share price, and t^h_t reflects corporate taxes rebated to owners and the tax benefit of debt for firms with $t^h_t = \tau\left(y_t - w_t n_t\right) -$

$\delta\tau k_{t-1} + \left(\frac{b_{t+1}}{1+r_t}\right) - \left(\frac{b_{t+1}}{1+r_t(1-\tau)}\right)$. [19]

The household chooses $\{c_t, s_t, b_{t+1}, n_t\}$ to maximize (20) subject to equation (21). The first-order conditions for the household's optimization problem are given by.

bonds b_{t+1}

$$1 = E_t\left(m_{t+1}\frac{\zeta_{\beta,t+1}}{\zeta_{\beta,t}}\right)\left(\frac{R_t-\tau}{1-\tau}\right), \tag{22}$$

stocks s_{t+1}

$$p_t = E_t\left(m_{t+1}\left(p_{t+1}+d_{t+1}\right)\right), \tag{23}$$

labor $n_t(j)$

$$w_t = \frac{\nu\epsilon_t^{\nu}}{(1-n_t)}c_t^{\sigma}. \tag{24}$$

3.3 Equilibrium

The equilibrium of the model economy is described by a sequence of prices and quantities, where firms maximize their value and households maximize their life-time utility, the government budget constraint holds, and capital, labor and goods markets clear. In concrete terms, market clearing in goods market implies

$$y_t = c_t + i_t + nx_t, \tag{25}$$

where nx_t denotes a net export demand shifter[20] that is governed by an exogenous AR(1) shock, where $\log(nx_t) = \rho_{nx}nx_{t-1} + \epsilon_{nx,t}$ with $\epsilon_{nx,t} \sim \mathcal{N}(0, \sigma_{nx})$ and $\rho_{nx} > 0$. The government budget constraint satisfies

$$t_t^h + t_t^f = 0, \tag{26}$$

[19] In line with Jermann and Quadrini (2012), we treat the outstanding amount of aggregate shares as constant and normalized to one. With this in mind, inserting dividends d_t as defined by the flow of funds constraint of firms Equation 9 into Equation 21, it holds that all tax related cash flows, except the tax subsidy on debt, cancel out in the household sector.

[20] We have abstracted from the exchange rate, as relevant studies do not find that the exchange rate plays a major role in explaining growth in German exports, see for instance Danninger and Joutz (2008), Storm and Naastepad (2015), Neumann (2020) and Deutsche Bundesbank (1998).

with $t_t^f = -t_t^h = -\tau(y_t - w_t n_t) + \delta\tau k_{t-1} + \frac{b_{t+1}}{R_t} - \frac{b_{t+1}}{1+r_t}$, with transfers to households and firms netting out. The model satisfies a stationary equilibrium in which all (detrended) aggregate variables are constant according to the calibration strategy outlined in Section 3.6.

3.4 Generating Sign Restrictions

In line with Peersman and Straub (2009) and Enders et al. (2011), we take a first-order approximation of the equilibrium conditions around a deterministic steady state and generate sign restrictions. This is done by simulating the model impulses from a first-order perturbation solution to the estimated DSGE model based on 100,000 draws of parameter vectors from distributions commonly reported in DSGE models related to Germany (Albonico et al. (2017), Gadatsch et al. (2016) and Hristov (2016)).

To discriminate shocks at the first stage, at least one common and one opposed impulse response at a specified horizon should robustly prevail from the impulses by pairwise comparison to identify orthogonal shocks in the second stage in the data.

3.5 Exogenous Process

We implement the shock processes as follows. The *household saving shock* $\zeta_{\beta,t}$ is modelled as a shock to the stochastic discount factor m_{t+1} (see Sá and Wieladek (2015)). See Equation (20). A *financial friction shock* ξ_t is modelled in the same way as in Jermann and Quadrini (2012) as a shock to the collateral constraint (10). The *technology shocks* a_t are implemented in the production function, Equation (4). The labor *supply shock* ν_t enters Equation (24) and shifts the labor supply curve. A *shock to world demand* shifts the aggregate resource constraint in Equation (25).

3.6 Calibration Strategy

The calibration strategy is similar to Jermann and Quadrini (2012). We target the corporate-debt-to-(quarterly)GDP ratio, where 3.67 denotes the sample average in the non-financial corporate sector in Germany over the sample period from the first quarter of 1995 to the fourth quarter of 2017. Based on Equation (10), the parameter ξ is determined for each draw numerically such that Equation (27) holds.[21]

$$3.67 - \left(\frac{\xi}{1+r} / y \right) = 0, \tag{27}$$

To specify parameter distributions, we build on DSGE models estimated at a quarterly frequency that explicitly consider Germany such as Albonico et al. (2017), Gadatsch et al. (2016) and Hristov (2016). For some parameters, however, we need to rely on Jermann and Quadrini (2012), Gareis and Mayer (2019) and Smets and Wouters (2003), which are based on US and euro area data, due to a lack of alternatives. With respect to households we proceed as follows. The discount factor ranges from 0.9730 to 0.9926. In line with Jermann and Quadrini (2012), the lower end of the range reflects the annual steady state return from holding shares while, as default, the upper end of the range reflects the annual steady state return on the short-term risk-free rate. σ denotes the degree of risk aversion as in Smets and Wouters (2003), with a mean of $\sigma = 1.54$ and 5-95% bounds of $0.855 - 2.225$.[22] The time budget allocated to work is $n = 0.3$, where the preference parameter ν adjusts such that the target holds.

In the firm sector, consistent with Cantore et al. (2015) we calibrate the CES production function such that variations in the elasticity of substitution parameter θ do not shift the labor share. We set the steady state labor share $\bar{s}_L$ to 0.68, which is the sample average. With respect to the CES production function parameter θ we rely on a uniform distribution ranging from 0.95 to 1.25 to be sufficiently agnostic.

[21] Appendix A contains details on the steady state calibration.

[22] The cited studies employ log-utility and thus provide no guidance on how to specify an interval.

Chen et al. (2017) argue that the elasticity of substitution is above one with 1.25 to match cross-country covariation in trends in the labor share and the relative price of investment goods. By contrast, Autor et al. (2020) state that a number of empirical studies report values below one. Output is normalized to one in the steady state. We let the steady state TFP adjust such that the production function holds. The free parameter α_n adjusts such that θ is consistent with the targeted labor share. We proceed as follows for parameters related to the capital share and the depreciation rate. We set the quarterly depreciation rate to $\delta = 0.014$ consistent with Albonico et al. (2017), Gadatsch et al. (2016) and Hristov (2016). As the model does not comprise the notion of rental markets for capital, the implicit annual cost of capital can be stated as $R^k = (1 - \bar{s}_L)\frac{4 \times y}{k}$. The parameter α_k is set to 0.225 and scales the cost of capital which ranges from 0.072 to 0.199. This is in line with Chen et al. (2017) who report a value of 0.152. Consistent with Smets and Wouters (2003) we draw ϱ from a normal distribution with mean 6.920 and $5-95\%$ bounds with $4.912 - 8.898$. For the payout cost parameter, we build on Gareis and Mayer (2019) and set $\kappa = 0.69$ with $5 - 95\%$ bounds of 0.41 to 1.03, based on a euro area dataset. The corporate tax rate, τ, is set to 0.35 which reflects the average tax rate in place for Germany over the sample (see Spengel et al. (2007)).

[Table (2) approximately here]

For the other AR(1) coefficients, we draw on the distributions reported by Albonico et al. (2017), Gadatsch et al. (2016), Gareis and Mayer (2019), Hristov (2016) and Jermann and Quadrini (2012) and Pfeiffer (2017). For the financial friction and the labor supply shock, we specify a beta distribution ranging from 0.90 to 0.99. For the technology shock, we follow Gadatsch et al. (2016) and set the 5% bound to 0.797. The 95% bound is 0.99. For the world demand shock, we also choose a beta distribution with bounds of $0.90 - 0.99$. The estimated posterior of the AR(1) coefficient of the discount factor shock is stated in Albonico et al. (2017), given by a beta distribution with mean 0.87 and $5\%-95\%$ bounds of $0.76-0.95$. Hristov (2016) reports a beta distribution with a mean of 0.85 and $5-95\%$ bounds of 0.71-0.95. Jermann and Quadrini (2012) and Pfeiffer (2017) report bounds of $0.90-0.91$ and $0.92-0.98$ respectively. In conclusion, to be sufficiently agnostic we specified a beta distribution with $5-95\%$ bounds of $0.76-0.98$. As the sign of impulse-responses is invariant in our setting with respect to the size of the standard deviation of exogenous shocks we set them to 1, consistent with the assumption on structural shocks in the BVAR. Table 2 summarizes the parameter values used to simulate the impulses.

3.7 Shock Propagation

Figure 2 shows the baseline impulse responses to five structural shocks. To facilitate comparison across shocks, we require each shock to trigger an increase in the corporate-saving-to-investment ratio. The exercise comprises a financial friction shock, a labor supply shock, a world demand shock, a private saving glut shock and a TFP shock. The basic idea is that each disturbance can be disentangled from all other shocks by performing a pairwise comparison of the impulse response functions in terms of signs.

The first column in Figure 2 reflects the adjustment to a financial friction shock. Financial friction shocks move the corporate-saving-to-investment ratio and GDP in opposite directions. The emergence of a corporate saving glut goes hand-in-hand with a recession. A negative financial shock tightens the flow-of-funds constraint and firms downscale their business activities. A drop in collateral value causes long-term debt to decline and firms to partially offset the shortfall in funds by cutting dividend payouts (see Jermann and Quadrini (2012)). The countercyclical pattern of GDP, investment and the corporate-saving-to-investment ratio allows the financial friction shock to be disentangled from other shocks that predict a positive co-movement. We leave it to the structural VAR to reveal the current account response.

The second column shows the adjustment path of the economy in response to a labor supply shock. Typically the boom in the economy goes hand-in-hand with an increase in hours and a decrease in the real wage. The model predicts a decline in the labor share along the adjustment path. In contrast to a financial friction shock the labor supply shock implies a positive correlation between GDP and the corporate-saving-to-investment ratio.

The third column shows the impulses in response to a shock to net exports. The boom in the domestic economy leads firms to retain earnings and the wage share decreases. Excess funds are used to buyback outstanding debt, which leads to a decline in the corporate-debt-to-GDP ratio. As a shock to net exports is a demand-side disturbance, it can easily be disentangled from supply-side shocks. In contrast to a financial friction shock, it predicts a positive co-movement between GDP and the corporate-saving-to-investment ratio.

[Figure 2 approximately here]

The fourth panel in Figure 2 shows a private household saving shock. Essentially a household saving shock predicts a positive co-movement of investment and the corporate-saving-to-investment ratio. The shock can be identified by pairwise comparison as it predicts an increase in investment compared to financial friction, the world demand shock and an increase in prices compared to the supply shocks.[23]

The last column in Figure 2 shows that a positive TFP shock leads to a co-movement between corporate-saving-to-investment and GDP. Thus corporates accumulate profits in parallel with the expansion. In line with Jermann and Quadrini (2012), the

[23] Note, the restriction that the corporate-saving-to-investment ratio increases on impact is mildly violated as some parameter draws generate a negative impact multiplier. For alternative mutually exclusive restrictions that do not built on the impact restriction on the corporate-saving-to-investment ratio the results are robust. Still, if we do not set the impact restriction on the corporate-saving-to-investment ratio, the empirical impulse response in the VAR is significantly positive, even without the restriction. For this alternative identification scheme, however, a high number of draws from the Normal-Wishart posterior for the VAR parameters (A,Σ_ϵ) receive zero prior weight, even if only few restrictions of the DSGE model are mildly violated by the empirical impulse responses.

model predicts that hours move countercyclical to GDP, which helps to identify the shock by pairwise comparison with a labor supply shock. Obviously financial friction prevents GDP from expanding at a pace that fosters a positive gap in hours in the light of enhanced productivity. Due to the sluggish development of dividend payouts in parallel with the expansion corporate saving increase companies deleverage. The model implies that the labor share declines, which is consistent with results reported in Cantore et al. (2015).

[Table 3 approximately here]

The identified sign restrictions are summarized in Table 3. For the baseline scenario that comprises all five shocks we impose sign restrictions on the macro variables taken from the DSGE model for two quarters. As additional information, taken from outside the model, we draw on the general wisdom that, for demand-side disturbances, inflation and output move in the same direction, while for supply shocks, inflation and output move in opposite directions. We need to impose this additional restriction on impact to disentangle the world demand shock from the two supply-side shocks: the labor supply shock and the technology shock. The restrictions on debt repurchases and the wage share are not necessary to identify shocks. However, we still impose these restriction since imposing additional restrictions helps to detect the correct sign of the unrestricted impulse response functions as long as the additional restrictions are robustly predicted from the DSGE model. (Matthias (2007); Canova and Paustian (2011)).

4 Empirical Methodology

In this section, we empirically analyze the effects of aggregate shocks on the corporate-saving-to-investment ratio in Germany and their ability to support a positive correlation with the current account. We begin with a description of the data and the estimation strategy that is performed using Bayesian techniques. Then we present the method used to identify structural shocks via sign restrictions as proposed in Uhlig (2005) and summarize the empirical findings.[24]

4.1 Estimation and Data

Consider a reduced form VAR model

$$X_t = c + \sum_{j=1}^{P} A_j X_{t-j} + \varepsilon_t, \text{ where } E[\varepsilon_t] = 0 \text{ and } E[\varepsilon_t {\varepsilon_t}'] = \Sigma_\varepsilon. \tag{28}$$

where X_t is the vector of n endogenous variables and c is a $n \times 1$ vector of intercepts. A_j is a $n \times n$ matrix comprising the AR-coefficients at lag $j = 1, ..., P$, ε_t is a vector of residuals with covariance matrix $\Sigma_\varepsilon = E[\varepsilon_t {\varepsilon_t}']$, and X_t comprises the following n endogenous variables

$$\boldsymbol{X}_t = \left[\begin{array}{ccccccccc} \frac{CS_t}{CINV_t} & \text{GDP}_t & \text{GDP}^*_t & \text{CA}_t & \text{INV}_t & \frac{-\Delta b_t}{4y_t} & \text{GDPDEF}_t & \text{LS}_t & \text{HOURS}_t \end{array} \right]'. \tag{29}$$

An open-economy VAR framework is employed to reflect spillover effects from foreign country shocks into domestic aggregates (see for example Fratzscher et al., 2010; Sá and Wieladek, 2015). Accordingly, we combine German data and measures of global activity. Generally, we estimate the VAR in levels and log levels as defined below. Put differently, we do not detrend our data prior to estimation. GDP_t denotes the log level of the real gross domestic product deflated by the GDP deflator. $\frac{CS_t}{CINV_t}$ is the ratio of corporate-saving-to-investment. Due to data limitations, we backcast corporate saving from Q4 1998 to Q1 1995. [25] The motivation to backcast is threefold. First, we gain data points before the "take-off-phase" of the German current account such that the time series comes closer to reflecting a

[24] We thank Breitenlechner et al. (2018) for providing their codes and helpful suggestions.

[25] We backcast using a fully specified TRAMOS technique that combines the TRAMOS and SEATS seasonal adjustment tools (Gomez and Maravall, 1997). We used the JDemetra+ program, provided by the European Commission.

current account cycle. Second, backcasting gives an additional 20 data points per time series, meaning that the VAR estimation benefits in terms of degrees of freedom. Third, the German corporate sector was highly leveraged up to the early 2000s and financial constraints were tight. So adding this period seems promising as it provides more data points including variation in the tightness of financial conditions in the non-financial corporate sector. GDP_t^* is a measure of log global economic activity as provided by Kilian (2018). CA_t measures the current account (share of GDP). INV_t denotes the log-level of real investment. We include investment as an additional variable alongside the ratio of corporate-saving-to-investment to see if the saving glut is driven mainly by corporate saving or by investment. Debt repurchase $\frac{-\Delta b_t}{4y}$ denotes the quarter-on-quarter change in the corporate-debt-to-GDP ratio. $GDPDEF_t$ measures the log-level of the GDP deflator. LS_t denotes the labor share. $HOURS_t$ is the log-level of total hours worked. We estimate the VAR on quarterly data ranging from Q1 1995 to Q4 2017.[26] We estimate the VAR at P = 2 lags, however, results are robust with respect to lag length. In the Bayesian approach we follow Breitenlechner et al. (2018). The code implements an algorithm combining zero and sign restrictions based on Rubio-Ramiréz et al. (2010) and Arias et al. (2018) to identify structural shocks. For details see Appendix C.

4.2 Results

Figures 3 to 7 report the propagation of the identified shocks through the variables in X_t. As is customary, the shaded area comprises the median - dotted line- as well as the 16 and 84% quantiles of the posterior distribution of impulse responses. We also plot the close-to-median model (Fry and Pagan (2011)).[27]. We

[26] See Appendix B for a detailed description of the variables together with sources and data codes.

[27] We plot not only the median model, or pointwise-median model to be more precise, but also the close-to-median model to account for the critique by Fry and Pagan (2011). They make the point that the pointwise-median model is not based on a single estimated model, but is likely to comprise as many models as the length of the impulse response horizon. The close-to-median model, by contrast, plots the impulse responses from a single estimated model that minimizes the

report the dynamics for 20 quarters. It is important to remember that, we restrict the corporate-saving-to-investment ratio, while we let the data speak for themselves for the current account, which is left unrestricted.

[Figure 3 approximately here]

After a labor supply shock, the unrestricted current account is significantly positive for four quarters, with median impulse responses being positive over eight quarters (see Figure 3). Accordingly, the results support a positive correlation between the current account and the corporate-saving-to-investment ratio. GDP and hours increase in response to the shock. Interestingly, the model predicts a current account surplus, although the domestic economy booms, which suggests an increased competitiveness in the German economy. In parallel with the expansion, the labor share declines and firms deleverage. Although the economy booms investment activity is not significantly positive. Figure 4 shows the adjustment to a financial friction shock. The corporate-saving-to-investment ratio remains significantly positive for six quarters, well beyond the restriction horizon, which is two quarters. The current account as a share of GDP increases significantly for one quarter, with the median response remaining above zero for 12 quarters. The significant increase in debt repurchases in conjunction with the persistent drop in investment is consistent with the view that firms utilize the excess of savings over investment to deleverage. GDP and hours are significantly negative. Interestingly, inflation is marginally positive which might be due to cost channel effects in the light of higher funding costs.

[Figure 4 approximately here]

The world demand shock (see Figure 5) pushes the unrestricted current account to positive territory for ten quarters, while the median response remains positive over the whole forecast horizon. Interestingly, the shock implies a persistent decline

quadratic distance to the impulse responses of the pointwise-median model in the unrestricted labor share. Additionally The impulse responses have a typical demand shock pattern with a positive co-movement of GDP and inflation alongside the expansion.

[Figure 5 approximately here]

To sum up, we find that all three shocks are consistent with the view that a corporate saving glut goes hand-in-hand with capital exports. The analysis of the household saving shocks (see Figure 6) do not support the view that capital exports are driven by this shock. Examining the impulse responses, it becomes clear that the current account is distributed rather unsystematically in response to a household saving shock and does not enter distinctively positive regions. This result might not be so surprising, as household saving rates hardly changed over the sample period. However, this result conflicts with Kollmann et al. (2015), who identify the discount factor shock as the most important element explaining the current account in terms of historical variance decomposition. However, they do not distinguish between corporate saving and household saving in their analysis. To that extent, including corporate saving in the empirical analysis makes it possible to locate the sectoral origin of the shock.

[Figure 6 approximately here]

We report further results as technology shocks (see Figure (7)) are important factors shaping the business cycle. We find that positive TFP shocks also contribute to the positive co-movement between a corporate saving glut and a current account surplus. We find a very persistent positive response in the current account in response to the shock.

[Figure 7 approximately here]

As a common theme, we can report that, the labor share declines in response to a labor supply, a world demand shock and a technology shock. Therefore, as shown by Equation (2), one main driver behind the increase in corporate saving is a decline in the corporate labor share. Additionally, we do not find any support for a boom in investment in response to a positive labor supply and technology shock, which is consistent with the view that firms do not utilize available sources to invest despite the economy booming. The same holds true, although to a lesser extend, for world demand shocks, where the credible set does not rebound to positive territory.

[Table 4 approximately here]

Finally, we evaluate the importance of each shock with a forecast error variance decomposition. This indicates how much of the error variance in each variable can be attributed to the respective shock over a specified time horizon (see Table 4).[28] At a one-year horizon, labor supply, financial friction and world demand shocks together explain roughly 41.61% of the variation in the current account as a share of GDP and the corporate-saving-to-investment ratio. In relative terms, we find that the labor supply and the world demand shock have larger explanatory power than the financial friction shock for the current account. The financial friction shock, in turn, has a larger explanatory power for the corporate-saving-to-investment ratio. We do not find any evidence that the saving glut shock is quantitatively important for explaining the current account as the forecast error variance decomposition is below 5% at short horizons, whereas technology shocks can account for 10%. Technology shocks add considerably in terms of explaining movements in the current account (up to 10.34% at the four-year horizon) and the corporate-saving-to-investment ratio (up to 10% on impact).

[28]FEVDs are based on the median draw with 68% credible reported.

5 Historical Decomposition

Figure 8 shows a panel of historical compositions of the fluctuation in the measures for corporate net lending and the current account. The three identified shocks linked to the main hypotheses, i.e. financial friction shock, labor supply shock and world demand shock explain to a large extent the variation in the corporate-saving-to-investment ratio and the current account as a share of GDP. Household saving shocks and productivity shocks play a minor role. The amplitude of the cyclical component of corporate net lending is +/- 25% and for the current account as share of GDP +/- 2.5%-points. Compared to long-term movements of the underlying series these cyclical, or short-term, fluctuations are quite substantial.

[Figure 8 approximately here]

Regarding the historical shock decomposition of deviations in the corporate-saving-to-investment ratio in panel (a) of Figure 8 there are three main phases which are mainly impacted by financial friction shocks reflecting tightening credit constraints: First, after the dotcom boom from Q2 1998 to Q3 2001, in which financial friction shocks provided benign financing conditions and led to lower corporate net saving, the German non-financial corporate sector deleveraged in the period from Q4 2001 to Q1 2005. A second phase of deleveraging started with the Global Financial Crisis (GFC) in Q4 2008 and lasted until Q1 2011. A third phase, from Q1 2012 to Q1 2016, followed the euro area debt crisis and tightening capital regulation through the implementation of Basel III.

Panel (b) shows the historical shock decomposition of the deviations of the current account as a share of GDP and is mainly characterized by three phases: In a first phase from Q2 1999 to Q2 2001, the dotcom boom and accompanied relaxation of financing constraints translated into a negative effect on the current account as a share of GDP, visible via financial friction shocks. A second phase can be identified in the period from Q1 2006 to Q1 2008 in which the implementation of labor market reforms exerted a positive effect on the current account to GDP. The effect became stronger in combination with world demand shocks related to the booming world economy. Similar to the reaction of corporate saving to investment financial friction shocks mainly pushed the cyclical component of the current account to GDP in the phase from Q3 2008 to Q1 2016.

[Figure 9 approximately here]

In Figure 9 shows the historical decomposition regarding GDP in panel (a) and Investment in panel (b). Again three main phases can be identified. First, the dotcom boom driven by financing conditions pushed up the cyclical component of GDP and investment in the period from Q1 1999 to Q2 2001. In the aftermath of the dotcom boom household saving and financial friction shocks were a drag on GDP and investment in between Q3 2001 and Q1 2005 (in case of household saving up to Q2 2006). A second phase from Q4 2005 to Q2 2008 is characterized by the boom and following Global Financial Crisis from Q4 2008 to Q2 2010 which mainly reflected swings in financial friction and household saving shocks and their reversal. Finally, between Q2 2012 and Q4 2015 financial friction shocks had a negative effect on GDP and investment growth which was to a large extent compensated by household saving shocks.

6 Robustness Checks

In this section we present a number of robustness checks to support our results. To evaluate the robustness of the finding that the household saving shock adds little in terms of explaining current account dynamics and changes in the saving behavior in the non-financial corporate sector we include the household-saving-to-GDP ratio as an additional variable in the VAR. Concretely, we impose the restriction that after a household-saving shock the impulse response of household saving increases alongside with investment. Imposing this restriction does not lend more explanatory power to this shock as reported in Table D.4 in Appendix D. As another robustness check we add a zero restriction that in response to a labor supply shock the impulse response of global real economic world activity does not respond on impact. The argument is that a shock in the German labor market is Germany specific and that the spillover effect to the world economy is too small. By adding this zero restriction we do not allow contemporaneous interaction between world activity and the other variables.[29] The results obtained from the different identification set are closely comparable to the baseline results which supports the robustness of our results (see Table D.5 in Appendix D) . Note, in the Appendix D we present further robustness checks that the results are robust with respect to variations in the lag horizon, the sample period and alternative variables.

7 Conclusions and Policy Implications

Since the early 2000s, Germany's current account has witnessed a massive rebound into positive territory, increasingly making it the focus of policy debates as it is blamed for inflicting deficits on other trading partners, such as the United States. By now it is well understood that high surpluses give rise to protectionist tendencies. In this paper, we study the business cycle drivers behind the cyclical component of the German current account surplus from a flow-of-funds perspective. We high-light the role of corporate saving in excess of corporate investment, known as the "corporate saving glut", and analyse its cyclical component. To our knowledge, we are the first to investigate the nexus of a corporate saving glut and the current account through the lens of an open-economy VAR. We find that labor supply, world demand, and financial friction shocks can trigger a build-up in corporate saving in excess of corporate investment and thus generate capital exports outside Germany.

[29]The analysis is performed in a core model with only three shocks, financial friction shocks, labor supply shocks and world demand shocks, as the zero restriction dramatically increases computing time and makes it not feasible to estimate the model with five shocks.

By contrast, household saving shocks do not seem to make a difference in terms of the current account. Given that private household saving as a share of GDP declined slightly over the sample period this result is not surprising. In general, we find that, for a world demand, a financial friction and a labor supply shock, increases in the corporate-saving-to-investment ratio tend to go hand-in-hand with a decline in the labor share and weak investment dynamics. Our analysis strongly suggests that wage moderation and a domestic investment deficiency are key to understanding the issue. It also follows from the analysis that the fall in the labor share combined with booming exports are major drivers behind the German current account. A cyclical reversal of these developments, e.g. through lower world demand and a rising labor share could be expected to bring down the German current account surplus close to the 6% threshold in the Macroeconomic Imbalance Procedure.

From our analysis follow a number of policy implications:The prominence of financial friction shocks as a driver behind corporate net lending points to the important aspect regarding how firms can access financing for their investment projects. If funds became more easily available for firms through banks and capital markets, then this would imply that firms need less savings through retained earnings. This is particularly relevant in the case of intangible investments. Policies which increase stability and competition in the banking sector and in capital markets (such as Banking Union and Capital Markets Union) are therefore important in lowering the excess of corporate saving relative to investments.

Regarding labor supply shocks we conclude that while being a prominent driver in the years from 2005 to 2008, i.e. after the implementation of labor market reforms, they have mostly negatively affected the current account balance in the aftermath of the GFC and the euro area debt crisis. This provides evidence for the adjustment of labor cost relative to Germany's trading partners.

Given the German industry's exposed position in global production chains world demand shocks have remained an important driver of the current account also after the GFC. However, the international environment poses also a vulnerability as the German economy can suffer from trade shocks. Increasing the German economy's reliance on domestic demand sources would reduce this dependence.

Finally, the relatively low domestic absorption of corporate savings signals foregone investments. In order to encourage higher investments fiscal policy can reduce structural impediments to private investments by lowering the tax wedge or cutting excessive regulations in product markets and increase public investment in infrastructure.

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Table 1: Correlations of the Saving Glut with other Variables

	log GDP	**CA in % of GDP**
HP-filter, $\frac{CS}{CINV}$	-0.41***	0.56***
BK-filter, $\frac{CS}{CINV}$	-0.48***	0.52***

Note: The table reports correlations of the corporate-saving-to-investment ratio and corporate saving with log(GDP) and the current account with quarterly data. Series are computed with a one sided HP-filter with a smoothing factor of $\lambda = 1600$. We also report results from applying the Baxter-King filter. With period corresponding to highest frequency equal to 6, period corresponding to lowest frequency equal to 32 and number of terms in approximating moving average was set equal to 12. The data range is Q1 1995 to Q4 2017. See Appendix B for details.*** denotes significance at the 1% level.

Table 2: Parameter distributions

Parameter	Shape	Distribution		
		Mean	5%	95%
Preferences, technology, taxes				
CES production function, θ	Uniform	1.100	0.965	1.235
Risk aversion, σ	Normal	1.540	0.855	2.225
Discount factor, β	Uniform	0.983	0.974	0.992
		Calibrated		
Depreciation rate of capital, δ		0.014		
Production Technology: Capital, α_k		0.225		
Steady state work load, $\bar{n}$		0.300		
Corporate debt-to-GDP ratio, B/Y		3.670		
Corporate tax rate, τ		0.350		
Steady State labor share, $\bar{s}_{Lss}$		0.680		
Frictions				
Investment adjustment cost, ϱ	Normal	6.920	4.912	8.898
Payout Cost parameter, κ_d	IGamma	0.800	0.510	1.150
AR-coefficients				
AR(1) technology shock, ρ_a	Beta	0.877	0.797	0.990
AR(1) financial friction, ρ_ξ	Beta	0.954	0.900	0.990
AR(1) world demand shock, ρ_{wd}	Beta	0.954	0.900	0.990
AR(1) saving glut shock, ρ_β	Beta	0.890	0.763	0.973
AR(1) labor supply shock, ρ_ν	Beta	0.954	0.900	0.990

Note: The table displays the calibrated values and the parameter ranges employed to simulate the model. Range denotes interval from which parameter values are drawn for each simulation of the model.

Table 3: DSGE Sign Restrictions

	World Activity Shock	Financial Shock	Labor Market Shock	Saving Glut Shock	Tech. Shock
CS/CINV	↑	↑	↑	↑	↑
GDP	↑	↓	↑		↑
Hours			↑		↓
INV	↓	↓		↑	
Labor Share			↓		
DebtRep/GDP	↑	↑	↑		
Prices	↑		↓	↑	↓
World Activity	↑				
CA					

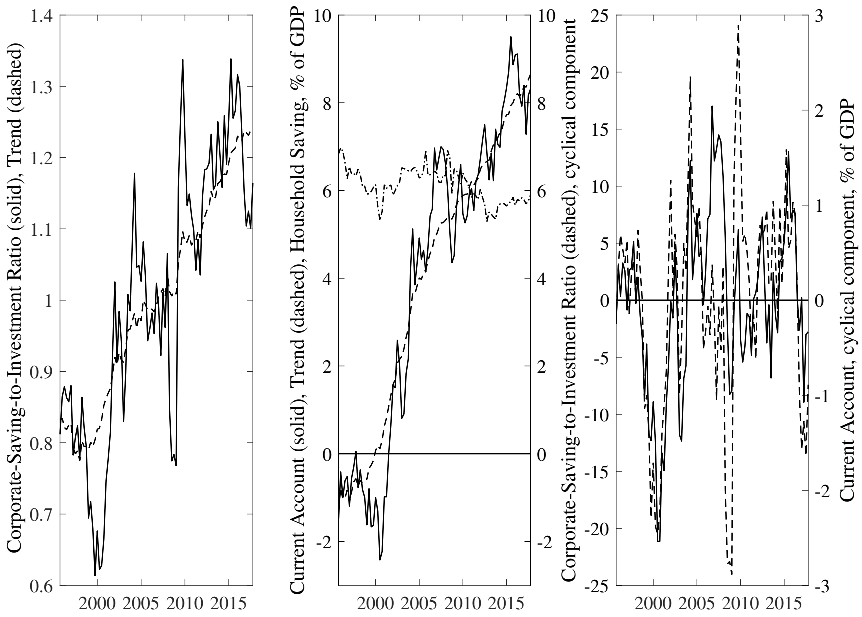
Note: The table reports sign restrictions based on the DSGE model. Note that ↑ and ↓ denotes, that the restriction was explicitly set. The restriction horizon is derived from the DSGE model. We take impact plus one for all variables except for prices where we just set the restriction on impact to disentangle supply from demand shocks.

Table 4: Forecast Error Variance Decomposition

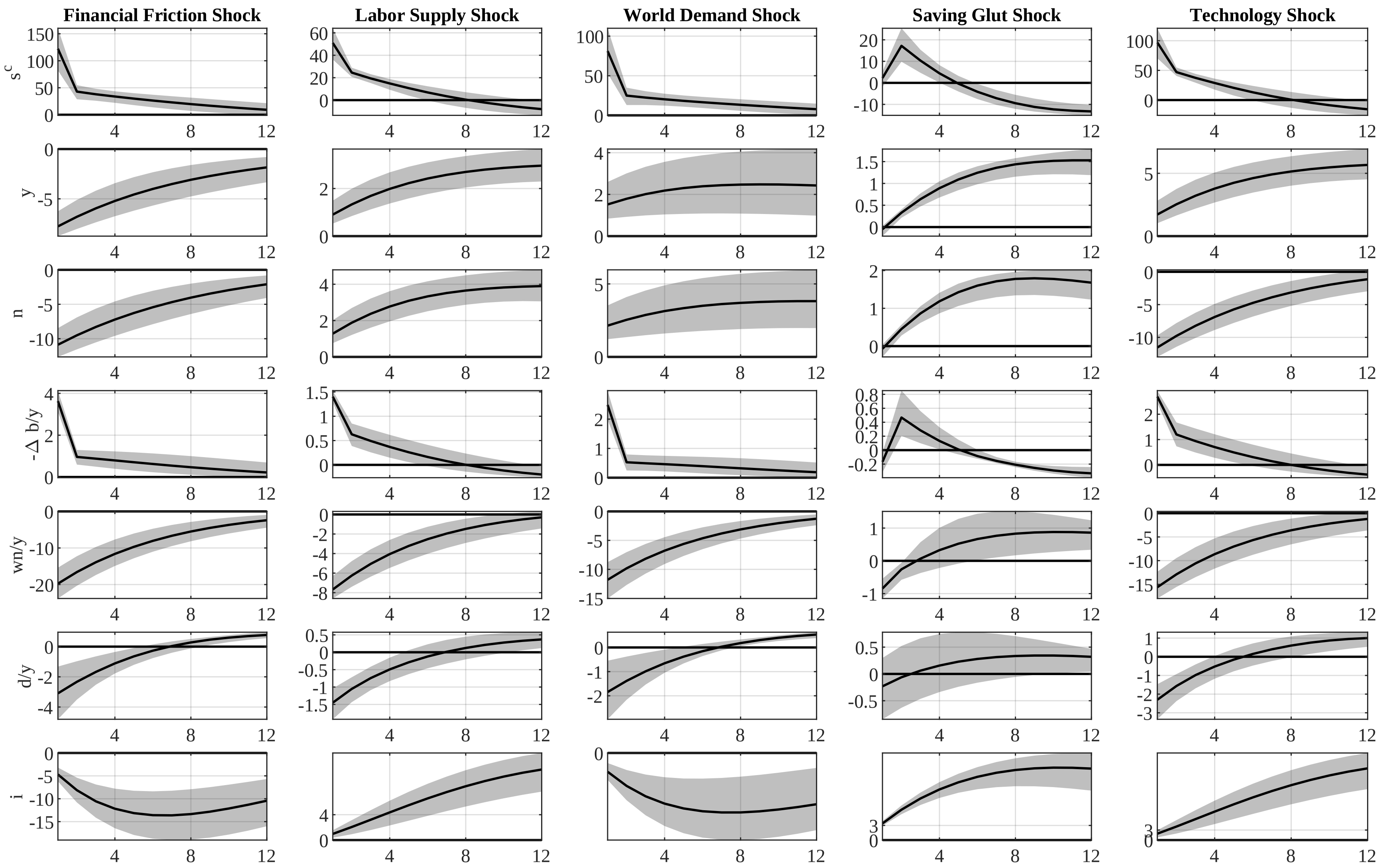
	Horizon	CA/GDP	CS/CINV	GDP
Labor Market Shock	Impact	15.13	8.13	5.43
		(3.17, 37.82)	(0.94, 21.64)	(1.13, 21.14)
	1 Year	14.24	6.43	5.11
		(4.33, 32.07)	(1.84, 13.77)	(1.44, 15.83)
	4 Years	10.88	6.80	8.24
		(4.90, 20.64)	(2.92, 15.25)	(3.25, 16.12)
Financial Friction Shock	Impact	4.10	11.03	23.68
		(0.47, 16.29)	(2.32, 27.50)	(6.21, 44.34)
	1 Year	6.94	21.99	26.00
		(1.76, 19.07)	(10.09, 35.85)	(8.49, 46.53)
	4 Years	8.68	20.83	19.00
		(3.78, 17.80)	(10.76, 31.39)	(7.42, 33.97)
World Demand Shock	Impact	22.38	15.65	1.04
		(8.37, 47.01)	(2.59, 35.52)	(0.15, 4.75)
	1 Year	22.30	15.68	2.40
		(10.73, 42.90)	(5.72, 22.06)	(0.64, 6.08)
	4 Years	18.15	12.40	4.31
		(8.88, 29.80)	(5.43, 17.02)	(1.40, 9.24)
Saving Glut Shock	Impact	2.70	7.61	5.37
		(0.25, 11.25)	(0.90, 23.97)	(0.50, 20.38)
	1 Year	3.98	7.05	9.58
		(1.04, 12.21)	(2.92, 15.91)	(2.22, 25.14)
	4 Years	6.93	8.88	12.11
		(2.68, 15.06)	(4.31, 16.64)	(3.66, 26.66)
Tech-nology Shock	Impact	7.15	10.21	2.89
		(1.02, 19.19)	(1.76, 26.55)	(0.45, 10.20)
	1 Year	6.46	6.41	2.67
		(1.84, 15.81)	(2.46, 15.21)	(0.74, 8.55)
	4 Years	10.34	7.84	4.52
		(4.35, 21.29)	(3.74, 15.79)	(1.25, 14.93)

Note: Results are in percentage and we report the 16% and 68% quantiles in brackets.

Figure 1: The Corporate Saving Glut and the German Current Account

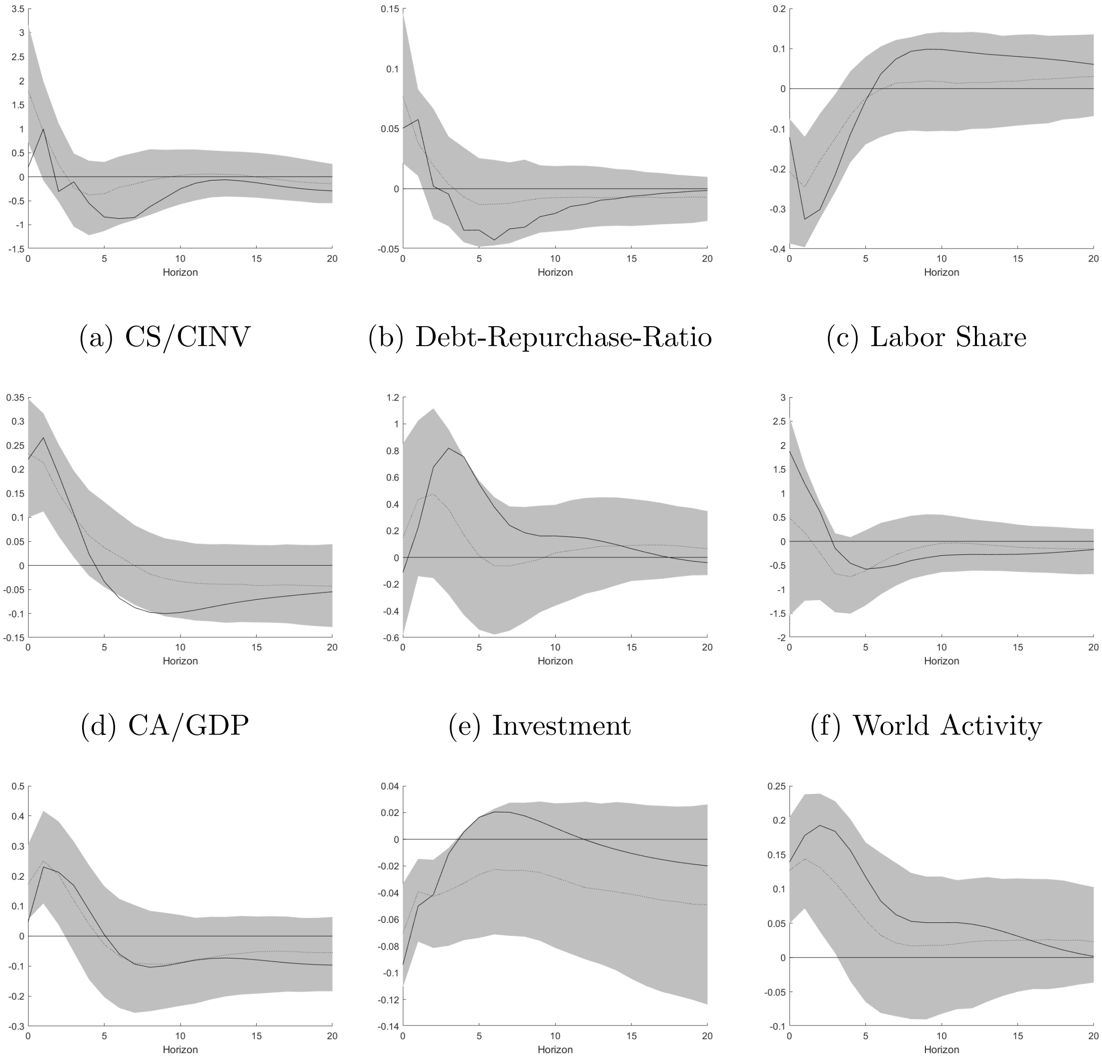


Note: Trends and cycles based on estimation results as in Section 4.



Note: Impulse response functions from the simulated DSGE model based on Table 2.

Figure 3: Labor Market Shock



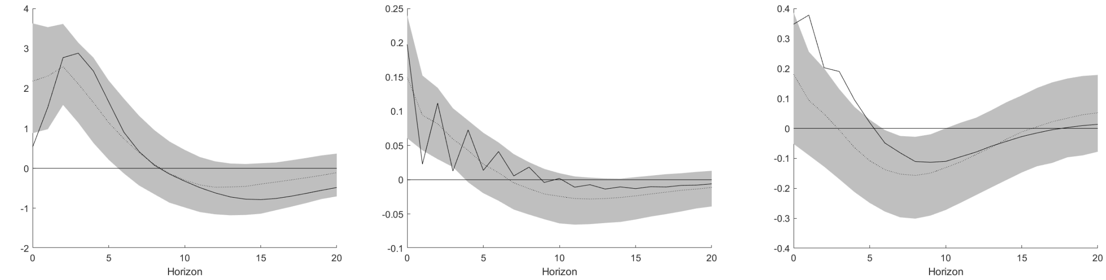
(a) CS/CINV (b) Debt-Repurchase-Ratio (c) Labor Share

(d) CA/GDP (e) Investment (f) World Activity

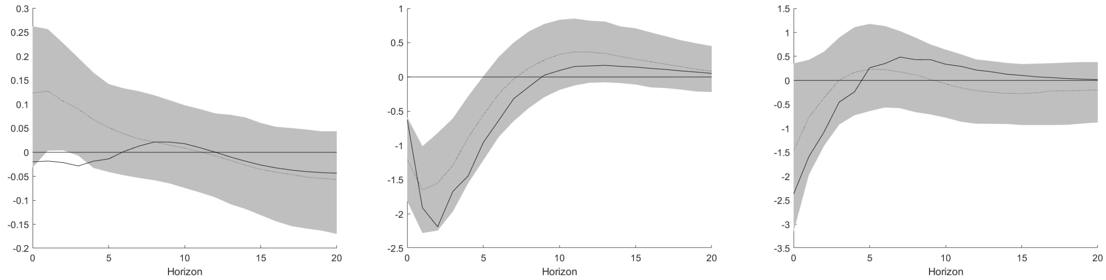
(g) GDP (h) Prices (i) Hours

Note: Impulse response functions from estimated VAR. Dotted line represents the median impulse response and solid line the close-to-median model. Shaded area represents 16 and 84% quantiles of posterior distribution.

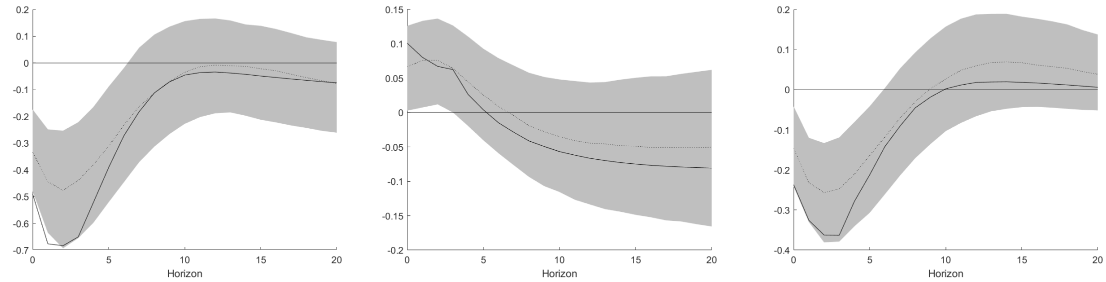
Figure 4: Financial Friction Shock



(a) CS/INV (b) Debt-Repurchase-Ratio (c) Labor Share



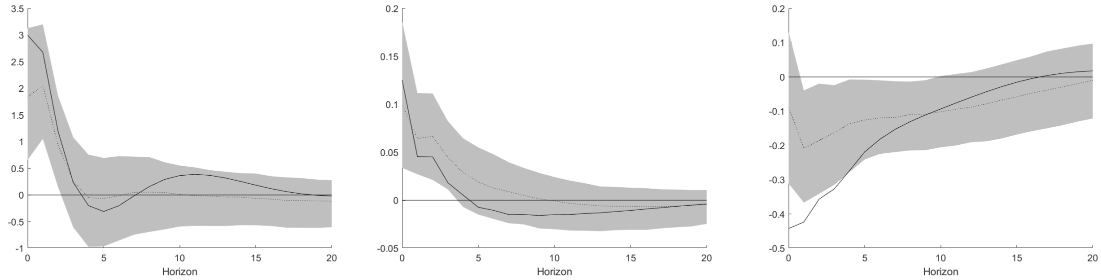
(d) CA/GDP (e) Investment (f) World Activity



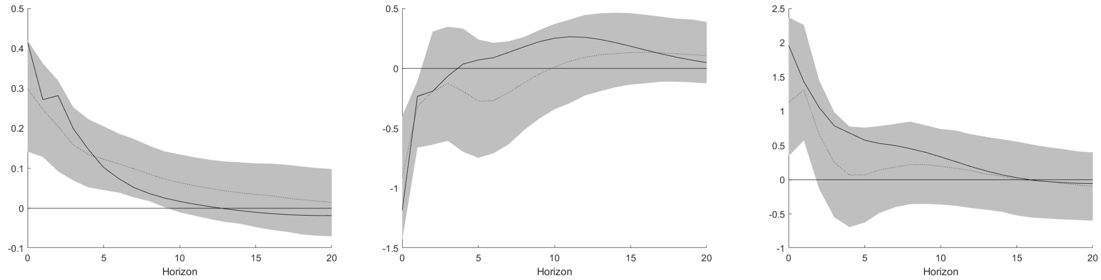
(g) GDP (h) Prices (i) Hours

Note: Impulse response functions from estimated VAR. Dotted line represents the median impulse response and solid line the close-to-median model. Shaded area represents 16 and 84% quantiles of posterior distribution.

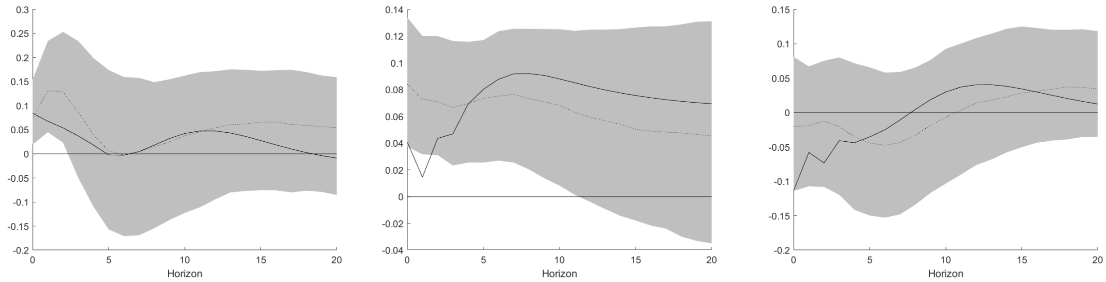
Figure 5: World Demand Shock



(a) CS/INV (b) Debt-Repurchase-Ratio (c) Labor Share



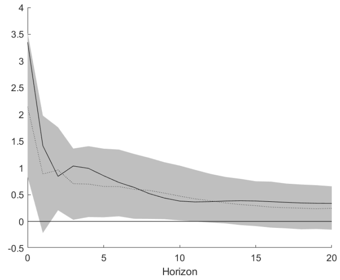
(d) CA/GDP (e) Investment (f) World Activity



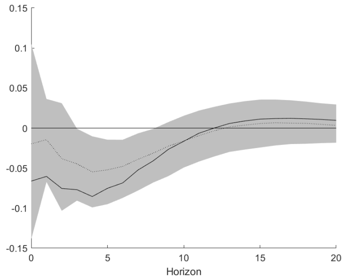
(g) GDP (h) Prices (i) Hours

Note: Impulse response functions from estimated VAR. Dotted line represents the median impulse response and solid line the close-to-median model. Shaded area represents 16 and 84% quantiles of posterior distribution.

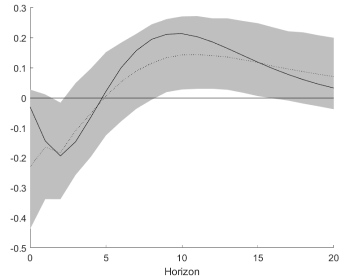
Figure 6: Household Saving Shock



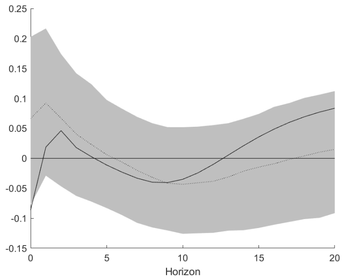
(a) CS/INV



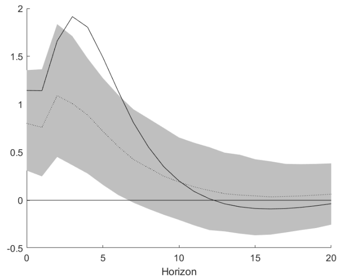
(b) Debt-Repurchase-Ratio



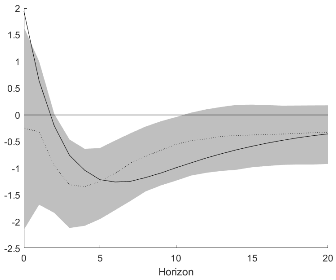
(c) Labor Share



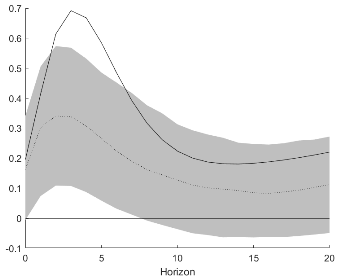
(d) CA/GDP



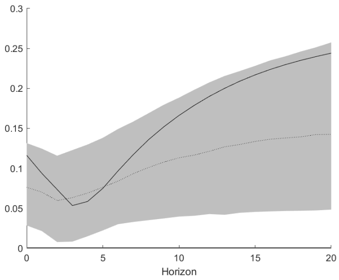
(e) Investment



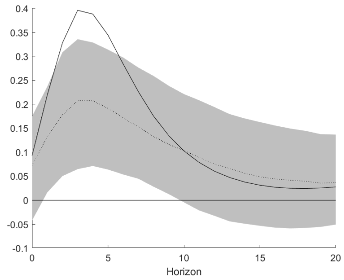
(f) World Activity



(g) GDP



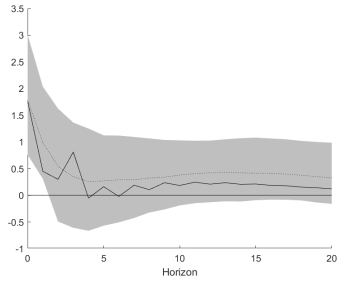
(h) Prices



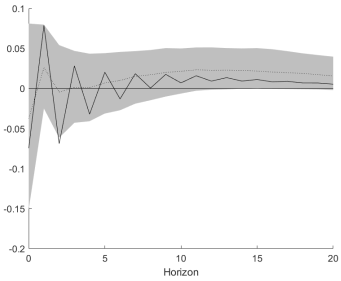
(i) Hours

Note: Impulse response functions from estimated VAR. Dotted line represents the median impulse response and solid line the close-to-median model. Shaded area represents 16 and 84% quantiles of posterior distribution.

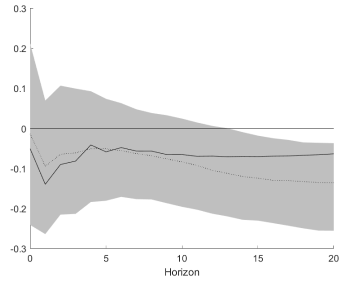
Figure 7: Technology Shock



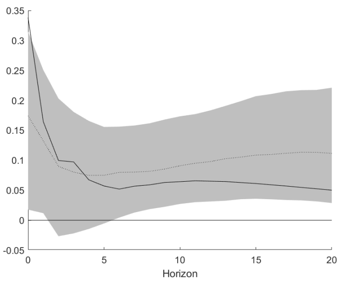
(a) CS/INV



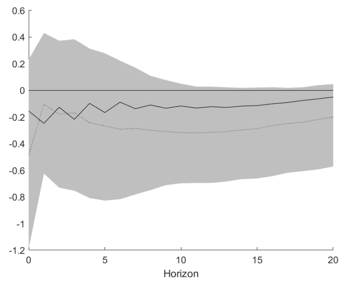
(b) Debt-Repurchase-Ratio



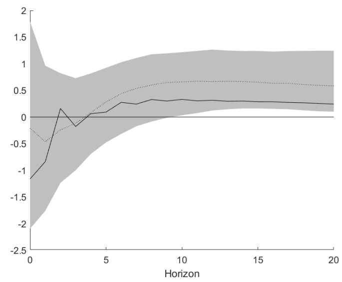
(c) Labor Share



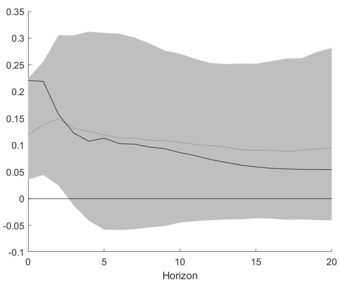
(d) CA/GDP



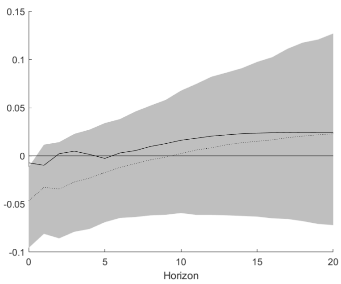
(e) Investment



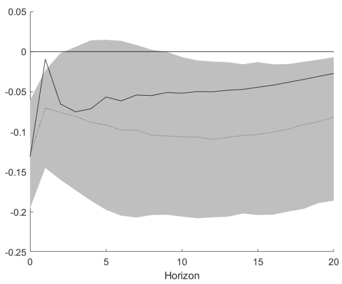
(f) World Activity



(g) GDP



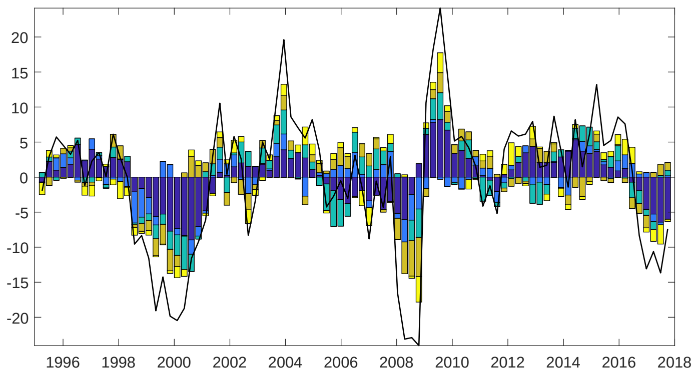
(h) Prices



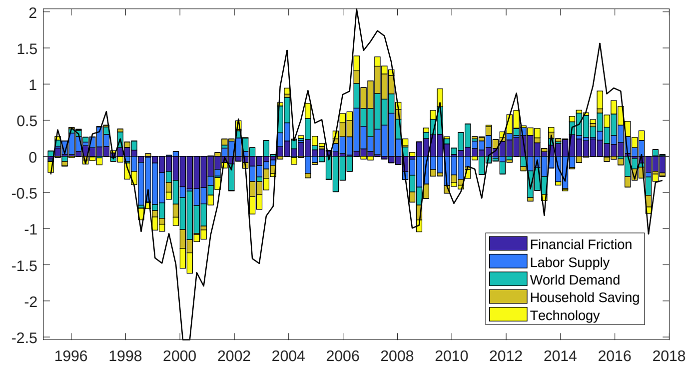
(i) Hours

Note: Impulse response functions from estimated VAR. Dotted line represents the median impulse response and solid line the close-to-median model. Shaded area represents 16 and 84% quantiles of posterior distribution.

Figure 8: Historical Decomposition: Corporate-Saving-to-Investment Ratio and Current Account in % of GDP



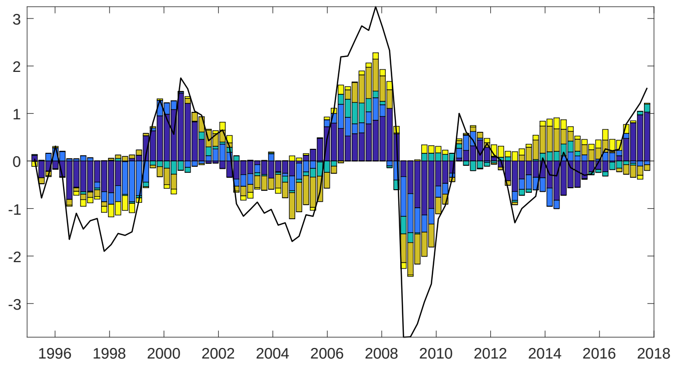
(a) Corporate-Saving-to-Investment Ratio



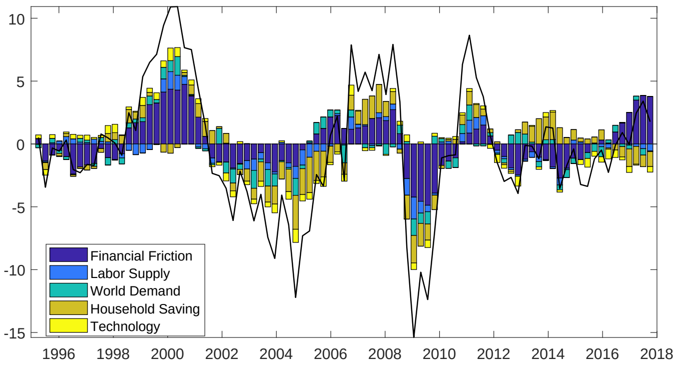
(b) Current Account in % of GDP

Note: Historical decomposition of quarterly data; for Corporate-Saving-to-Investment Ratio and Current Account in % of GDP percentage point deviations from trend are plotted.

Figure 9: Historical Decomposition: GDP and Investment



(a) GDP



(b) Investment

Note: Historical decomposition of quarterly data; for GDP and Investment percentage deviations from trend are plotted.

A Steady State Solution Strategy Using a CES Technology

The calibration strategy targets to reflect corporate debt to GDP ratio:

$$3.67 - \left(\frac{\xi}{1+r}/y\right) = 0 \tag{30}$$

which always holds by definition. To specify a well defined steady state we propose the following quasi recursive algorithm. Propose an initial

$$\xi = \bar{\xi} \tag{31}$$

and

$$R^k = \bar{R^k}. \tag{32}$$

The time budget allocated to work is $n = 0.30$ and output is fixed to $y = 1$. The gross interest rate is given by:

$$R = 1 + r(1-\tau), \tag{33}$$

The Lagrangian multiplier attatched to the enforcement constraint is

$$\mu^c = (1 - R\beta)/\left(\xi R \frac{(1-\tau)}{(R-\tau)}\right), \tag{34}$$

Scale parameter α_n is set in line with the steady state labor share.

$$\alpha_n = \frac{\bar{s}_L}{\left(1 - \frac{\mu}{1-\tau}\right)\left(\frac{y}{n}\right)^{\frac{1-\theta}{\theta}}}; \tag{35}$$

Capital is defined as

$$k = y/\left(\frac{(1 - \beta(1 - \delta + \delta\tau) - \xi\mu)}{\alpha_k \beta(1 - \tau\mu)))}\right)^{\theta}, \tag{36}$$

Investment reads

$$i = \delta k \tag{37}$$

Wages are

$$w = \alpha_n \left(\frac{y}{n}\right)^{1/\theta}\left(1 - \frac{\mu}{1-\tau}\right), \tag{38}$$

Corporate debt is

$$b = \left(\frac{y}{\xi} - k\right)\frac{(\tau - R)}{(1-\tau)} \tag{39}$$

Dividends are

$$d = -i + (1-\tau)(y - wn) - b + b/R + \delta\tau k \tag{40}$$

Household consumption

$$c = y - i \tag{41}$$

Labor disutility parameter

$$\nu = \frac{w(1-n)}{(c^w)^\sigma}. \tag{42}$$

Total factor productivity is

$$z = \frac{y}{\left(\alpha_k k^{\frac{\theta-1}{\theta}} + \alpha_n n^{\frac{\theta-1}{\theta}}\right)^{\frac{\theta}{\theta-1}}} \tag{43}$$

Equity price

$$p = \frac{d}{1-\beta} \tag{44}$$

The labor share reads

$$s_L = \frac{1-\mu}{1-\tau}\alpha_n \left(\frac{y}{n}\right)^{\frac{1-\theta}{\theta}}; \tag{45}$$

Corporate saving

$$s^c = i \tag{46}$$

Corporate accounting profits

$$\Pi_t = (1-\tau)(y - wn) + \tau\delta k + \tau b\left(1 - \frac{1}{R}\right); \tag{47}$$

Accounting profit share

$$s_\Pi = \frac{\Pi}{y} \tag{48}$$

The cost of capital can be defined as

$$R^k = (1 - s_L)\frac{4 \times y}{k} \tag{49}$$

Note, as we do not have the usual rental market assumption, we do not have a rental rate of capital that measures the cost of capital at the margin, but just R^k that measures the average cost of financing the capital stock owned by the firm.

B Data Documentation

We draw on Eurostat, that provides: Corporate saving, household saving, corporate investment, compensation, export, import, primary and secondary income in millions of euro on a quarterly base. The relevant table code is $NASQ\_10\_nf\_tr$ and the source codes in the order as stated above are B8G, P5G, D1, P6, P7, IN1 and IN2. The corporate sector variables are extracted for non financial corporations, defined by the sectoral identifier S11. The household variable is extracted with the identifier $S14_S15$. The GDP, the GDP-Deflator and the Investment are extracted from Euro-

Variables are defined as follows:	
corporate-saving-to-investment ratio	$= (CS/CINV) \times 100$
output	$= LN(GDP) \times 100$
global activity	$= LN(GDP*) \times 100$
current account-to-output ratio	$= (CA/GDP)^{\times}100$
real exchange rate	$= LN(REER) \times 100$
$\frac{-\Delta b}{4y}$	$= ((DEBT(-1) - DEBT)/4 \times GDP) \times 100$
price level	$= LN(GDPDEF) \times 100$
wage share	$= (LABINCOME/NATINCOME) \times 100$
hours	$= LN(N) \times 100$

stat. The data source is $NAMQ\_10\_GPD$ and the data codes are B1GQ and P5G In table $NASQ\_10\_f\_BS$ linked to the data code F4 we find debt. Hours worked is in table $NAMA\_10\_a10$ with the data code EMP_DC. The national income is provided by the German Bundesbank with the Data Code BBNZ1.Q.DE.S.G.0025.A. The measure for logged global economic activity is taken from Lutz Kilian `http://www-personal.umich.edu/~lkilian/kilian_correction.pdf`

C Algorithm

In the Bayesian approach we follow Breitenlechner et al. (2018) and estimate the reduced form coefficients using an uninformative Normal-Inverse-Wishart prior, and obtain the posterior distribution, which is again a Normal-Wishart density with the location parameters $A = [A_1, ..., A_L]'$ and the covariance matrix Σ_ε (see, Uhlig (1994) and, Uhlig (2005). The code implements an algorithm combining zero and sign restrictions based on Rubio-Ramiréz et al. (2010) and Arias et al. (2018) to identify structural shocks. For each draw from the distribution of the reduced-form parameters, we take the Cholesky factor of $\Sigma_\varepsilon = PP'$ and use random orthonormal matrices Q (where $Q'Q = I_n$) to obtain alternative decompositions $\Sigma_\varepsilon = PQQ'P'$, and orthogonal, structural shocks $u_t = (PQ)^{-1}\varepsilon_t$, with $E[u_t u_t'] = I_n$. Specifically, the algorithm keeps on drawing Q matrices until either at least a permissible transformation is found or a maximum number of 500 draws of the matrix Q is reached, at which point the code proceeds without retaining any model. For the zero restrictions to hold, the Gram-Schmidt algorithm is employed and the matrix Q is constructed recursively. We keep on drawing from the candidate models of the posterior distribution of reduced-form posterior until, at a minimum, 1,000 permissible SVAR representations are found that satisfy the sign restrictions. Since the system is set-identified, the prior is only flat over the reduced-form coefficients but not necessarily over the structural coefficients. This is because the decomposition of the variance-covariance matrix Σ_ε using random orthogonal matrices Q (where $Q'Q = I$) incorporates an implicit prior distribution (Baumeister and Hamilton (2014)).

D Further Robustness Checks

We have run the simulations also with a variation of lag horizons. There is no visible change in the responses. We conclude that our results are therefore robust with respect to lag length. While we estimate the reduced form VAR using two lags in the baseline specification to impose, we can report here results for different lag length. Thus, we replicate the baseline estimation using three lags. Table D.1 shows the FEVDs with respect to labor supply, financial friction, world demand, household saving and technology shocks. The results obtained from the different lag specification are closely comparable to the baseline results which supports the robustness of our results.

As a further robustness check we have re-estimated the model over the sample period Q1 1999 to Q4 2017. The idea is, that we estimate the VAR without the backcasted data. As the Table D.2 shows, the results are largely invariant to the change in sample period. As an additional robustness check we exchange the aggregate wage share by the wage share in the non-financial corporate sector. As Table D.3 reveals, our analysis is also robust with respect to that exercise.

Table D.1: FEVD: Robustness Lag Length: 3-Lags

	Horizon	CA/GDP	CS/CINV	GDP
Labor Market Shock	Impact	15.72	8.25	6.02
		(3.88, 35.88)	(1.12, 23.76)	(0.72, 20.75)
	1 Year	14.74	6.30	6.93
		(5.58, 29.44)	(2.48, 13.19)	(1.58, 18.98)
	4 Years	12.73	7.75	8.67
		(6.57, 22.02)	(3.99, 13.54)	(3.61, 16.72)
Financial Friction Shock	Impact	4.57	9.49	24.13
		(0.43, 17.60)	(1.53, 27.83)	(6.85, 48.23)
	1 Year	7.29	20.17	21650
		(1.96, 19.49)	(9.07, 33.74)	(6.46, 43.11)
	4 Years	8.62	17.82	16.98
		(3.84, 16.51)	(9.44, 28.14)	(7.47, 31.84)
World Demand Shock	Impact	22.35	12.71	1.07
		(7.47, 45.30)	(2.01, 34.25)	(0.11, 4.80)
	1 Year	21.36	13.38	1.72
		(7.98, 39.54)	(4.92, 25.98)	(0.55, 5.26)
	4 Years	16.54	10.96	4.60
		(8.07, 28.18)	(5.47, 18.71)	(1.77, 9.22)
Saving Glut Shock	Impact	2.86	7.88	6.87
		(0.31, 12.24)	(1.17, 22.03)	(0.57, 24.96)
	1 Year	4.79	7.05	12.82
		(1.69, 13.64)	(2.92, 15.91)	(2.28, 32.89)
	4 Years	7.88	9.49	13.15
		(3.65, 14.53)	(4.55, 16.50)	(4.70, 26.79)
Tech-nology Shock	Impact	6.53	8.48	2.18
		(0.73, 21.46)	(1.17, 23.87)	(0.20, 8.73)
	1 Year	5.89	6.06	3.03
		(1.98, 15.29)	(2.20, 13.58)	(0.79, 8.51)
	4 Years	11.06	8.57	5.84
		(5.39, 18.91)	(4.43, 14.86)	(2.10, 14.09)

Note: Results are in percentage and we report the 16% and 68% quantiles in brackets.

Table D.2: Robustness Subsample Period 1999-2017

	Horizon	CA/GDP	CS/CINV	GDP
Labor Market Shock	Impact	17.51	10.08	14.69
		(4.54, 36.57)	(1.74, 27.20)	(3.04, 35.48)
	1 Year	15.32	7.50	9.66
		(5.31, 30.14)	(2.87, 15.94)	(2.85, 24.41)
	4 Years	11.75	7.75	8.56
		(4.71, 23.02)	(3.20, 15.03)	(3.63, 18.46)
Financial Friction Shock	Impact	2.55	7.42	13.32
		(0.22, 12.00)	(0.98, 22.76)	(1.83, 35.29)
	1 Year	4.61	14.98	14.16
		(1.37, 14.32)	(6.28, 28.34)	(3.33, 34.78)
	4 Years	6.91	15.05	12.76
		(2.62, 15.50)	(7.20, 26.90)	(4.39, 28.24)
World Demand Shock	Impact	21.26	12.43	1.92
		(6.95, 41.38)	(2.31, 31.69)	(0.18, 7.56)
	1 Year	21.12	13.97	3.28
		(8.10, 38.61)	(5.37, 27.15)	(0.81, 9.65)
	4 Years	19.19	11.73	5.22
		(9.66, 33.92)	(5.69, 21.26)	(1.97, 11.95)
Saving Glut Shock	Impact	3.26	8.71	8.37
		(0.28, 13.54)	(1.34, 24.59)	(0.98, 26.61)
	1 Year	4.96	8.45	17.33
		(1.60, 14.38)	(3.45, 17.08)	(4.51, 39.88)
	4 Years	6.83)	10.61	19.11
		(2.75, 15.59)	(4.72, 19.24)	(7.36, 37.57)
Tech-nology Shock	Impact	6.79	10.34	4.27
		(0.73, 24.89)	(1.66, 27.36)	(0.53, 14.41)
	1 Year	8.36	8.13	1.93
		(2.18, 23.10)	(2.73, 17.69)	(0.58, 5.72)
	4 Years	10.76	7.92	3.46
		(3.53, 22.19)	(3.16, 16.12)	(1.35, 8.93)

Note: Results are in percentage and we report the 16% and 68% quantiles in brackets.

Table D.3: FEVD Corporate Wage Share

	Horizon	CA/GDP	CS/CINV	GDP
Labor Market Shock	Impact	11.48	9.31	6.50
		(1.34, 31.44)	(1.73, 24.02)	(0.73, 23.45)
	1 Year	12.70	6.95	6.81
		(3.38, 28.84)	(2.55, 14.93)	(1.80, 18.80)
	4 Years	10.91	7.37	7.06
		4.45, 21.27	(3.60, 13.75)	(2.72, 14.95)
Financial Friction Shock	Impact	5.51	12.06	23.17
		(0.57, 18.28)	(2.16, 29.83)	(6.54, 46.80)
	1 Year	7.90	21.78	20.48
		(1.88, 22.10)	(10.26, 35.51)	(5.78, 44.30)
	4 Years	9.31	19.20	15.72
		(3.24, 20.07)	(10.27, 30.10)	(5.82, 32.88)
World Demand Shock	Impact	19.91	15.03	1.68
		(4.28, 44.72)	(3.28, 33.28)	(0.15, 6.88)
	1 Year	18.82	14.52	2.12
		(5.71, 39.59)	(5.57, 27.74)	(0.72, 6.20)
	4 Years	17.03	12.17	3.99
		(7.10, 31.11)	(5.71, 20.96)	(1.39, 9.90)
Saving Glut Shock	Impact	2.67	6.66	5.33
		(0.25, 12.23)	(0.90, 19.68)	(0.54, 19.92)
	1 Year	4.16	6.33	11.60
		(1.25, 12.61)	(2.47, 14.15)	(2.27, 31.11)
	4 Years	6.66)	8.52	13.59
		(2.69, 14.50)	(3.84, 16.06)	(3.86, 29.31)
Tech-nology Shock	Impact	6.45	8.70	3.48
		(0.67, 22.10)	(1.34, 24.16)	(0.43, 11.30)
	1 Year	5.59	5.95	2.88
		(1.53, 17.79)	(2.13, 14.23)	(0.87, 8.69)
	4 Years	9.60	7.66	4.91
		(3.66, 19.77)	(3.19, 16.02)	(1.52, 13.01)

Note: Results are in percentage and we report the 16% and 68% quantiles in brackets.

Table D.4: FEVD Household Saving

	Horizon	CA/GDP	CS/CINV	GDP
Labor Market Shock	Impact	13.65	7.98	5.63
		(2.71, 29.79)	(1.20, 22.95)	(0.62, 20.49)
	1 Year	13.31	6.39	8.50
		(3.98, 26.35)	(2.43, 13.78)	(2.52, 22.00)
	4 Years	10.30	7.15	8.30
		(4.80, 19.53)	(3.42, 13.21)	(3.24, 18.20)
Financial Friction Shock	Impact	4.67	11.57	23.13
		(0.49, 17.34)	(1.86, 29.28)	(7.02, 45.55)
	1 Year	7.02	20.03	20.49
		(1.66, 18.78)	(9.73, 34.00)	(6.00, 40.88)
	4 Years	8.27	18.26	15.35
		(2.94, 16.41)	(9.80, 28.60)	(6.05, 27.66)
World Demand Shock	Impact	19.86	12.73	0.97
		(4.71, 39.93)	(2.11, 29.48)	(0.08, 4.40)
	1 Year	19.41	13.32	3.07
		(5.97, 35.15)	(4.77, 24.92)	(0.84, 7.91)
	4 Years	16.72	10.97	4.25
		(6.67, 27.16)	(4.92, 19.16)	(1.58, 9.53)
Saving Glut Shock	Impact	2.45	3.59	3.44
		(0.25, 10.05)	(0.38, 13.43)	(0.30, 14.52)
	1 Year	4.29	5.30	6.78
		(1.37, 12.51)	(1.92, 11.07)	(1.35, 20.88)
	4 Years	6.97)	8.52	6.89
		(2.85, 14.62)	(3.84, 16.06)	(2.38, 15.19)
Tech-nology Shock	Impact	6.68	8.66	2.81
		(0.67, 22.51)	(1.55, 23.81)	(0.27, 10.96)
	1 Year	6.86	5.92	2.59
		(1.56, 18.80)	(2.13, 13.53)	(0.83, 6.75)
	4 Years	9.06	8.61	4.36
		(3.34, 19.37)	(3.10, 13.40)	(1.54, 11.81)

Note: Results are in percentage and we report the 16% and 68% quantiles in brackets.

Table D.5: FEVD: Zero Restriction

	Horizon	CA/GDP	CS/CINV	GDP
Labor Market Shock	Impact	17.22 (4.43, 37.32)	10.92 (1.69, 29.73)	7.06 (1.01, 23.81)
	1 Year	17.03 (5.85, 32.30)	7.40 (2.53, 17.24)	5.03 (1.30, 17.24)
	4 Years	12.45 (5.76, 23.02)	7.38 (3.32, 14.60)	6.05 (2.36, 13.59)
Financial Friction Shock	Impact	4.66 (0.39, 17.47)	10.54 (1.45, 28.83)	22.47 (6.72, 44.42)
	1 Year	6.58 (1.51, 19.53)	19.68 (9.27, 34.29)	23.79 (6.67, 44.40)
	4 Years	8.39 (3.54, 18.10)	19.38 10.18, 30.95)	18.09 (6.51, 34.80)
World Demand Shock	Impact	23.20 (6.72, 45.79)	15.73 (3.01, 37.82)	1.08 (0.08, 5.07)
	1 Year	22.99 (7.81, 41.05)	15.56 (5.61, 29.68)	1.98 (0.51, 5.76)
	4 Years	18.80 (8.68, 32.89)	12.27 (5.80, 21.59)	3.57 (1.40, 8.50)

Note: Results are in percentage and we report the 16% and 68% quantiles in brackets.

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