Corporate Saving and Trade Imbalances: The Role of Investment Goods Exports*

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October 15, 2021

Abstract

The global trend of rising corporate saving is particularly strong in countries having large and persistent current account surpluses. This paper aims to contribute to the understanding of rising corporate saving and its nexus with trade imbalances by highlighting the role of investment goods exports for the case of Germany. Based on a two-country open economy, I show that the well-known decline in relative investment prices amplifies Germany's investment goods exports to emerging market economies resulting in rising corporate revenues and saving. Consequently, the fall in relative investment prices increases both corporate saving and trade surpluses as two sides of the same coin.

Keywords: Corporate saving, current account imbalances, open economy macroeconomics, relative price of investment goods, labor share

JEL Codes: E21, E25 F32, F34, F41

*I am very thankful to Johannes Pfeifer and Michael Krause for detailed comments and discussions. Moreover, I thank Behzod Alimov (discussant), Pablo Anaya, Kerstin Bernoth, Philipp Engler, Francesco Giovanardi, Matthias Gnewuch (discussant), Wouter J. den Haan, Robert Kollmann, Matthew Knowles, Jonas Löbbing, Helmut Lütkepohl, Fabian Seyrich, Jens Südekum, Mathias Trabandt and seminar participants at University of Cologne, University of Bonn, and Freie Universität Berlin, as well as participants at the Workshop on Macroeconomic Research 2021 in Krakòw and the IX Meeting on International Economics for their helpful comments and suggestions. Funding by Friedrich Ebert Foundation is gratefully acknowledged.

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1 Introduction

In recent decades, there have been two major trends in international macroeconomics. That is, the global imbalances in trade, and the global trend of corporate saving that is particularly strong in economies having large and persistent current account surpluses such as Germany, Japan and South Korea.[1] For the case of Germany, this paper shows in a two-country open economy model that rising investment goods exports from Germany to Emerging Market Economies (EMEs) impelled by the fall in the relative investment goods price, is a key variable that drives both trends and explains their interdependency. My model replicates the increases in Germany's corporate saving and trade surpluses and further stylized facts such as the decline in Germany's labor share.

Over the last three decades, the global sectoral composition of saving and lending has changed from a flow-of-funds perspective. The corporate sector has been accumulating excess saving over investment and has transitioned from being a net borrower towards becoming a net lender to the rest of the economy. Thereby, the rise in corporate profits has been outpacing the increases in dividends and investment. While the trend of rising corporate profits and saving took place in most advanced economies, it is particularly strong in economies having large and persistent current account surpluses such as Germany, Japan and, Korea (Dao and Maggi, 2018). Among these countries, the relationship appears to be especially pronounced in Germany as the current account has been recording surpluses since the year in which the corporate sector has been holding excess saving. Apart from this, the global imbalances in trade also raised interest in the literature and among policy debates with Germany being at its center, e.g., International Monetary Fund (2017).

To contribute to the understanding of trade imbalances, corporate saving and its interconnection, I provide a mechanism claiming that the decline in the relative investment goods price is the main driver of both trends. Germany is well-known for providing highly

[1] As common in the literature, the term 'corporate' only embraces non-financial corporates since the saving behavior of financial corporates is determined to a large extend by regulations.

specialized manufactured goods to the global economy that have become relatively cheaper due to efficiency gains in the production and reductions in distortionary trade policies (e.g., Greenwood et al., 1997, Lian et al., 2019). According to Dao et al. (2017) and Lian et al. (2019) the fall in relative investment prices has mainly originated in advanced economies and has boosted investment activities in EMEs over the last three decades through cheaper investment goods imports.[2] This can explain that Germany's persistent trade surplus is mainly driven by net exports of investment goods which have been in increasing demand from EMEs since the 1990s. Against this background, I argue that the fall in relative investment prices has strengthened EMEs demand for German investment goods as these have become more affordable and are required to converge towards industrial economies. Conversely, the rising demand for investment goods from EMEs translates into rising revenues and saving of German companies in terms of foreign claims.[3] This implies a price elasticity of demand larger than one for German investment goods such that the increasing demand overcompensates losses in revenues due to relatively decreasing prices. Given the strong negative correlation between Germany's relative investment prices and net investment goods exports, this assumption seems reasonable (see figure 1).

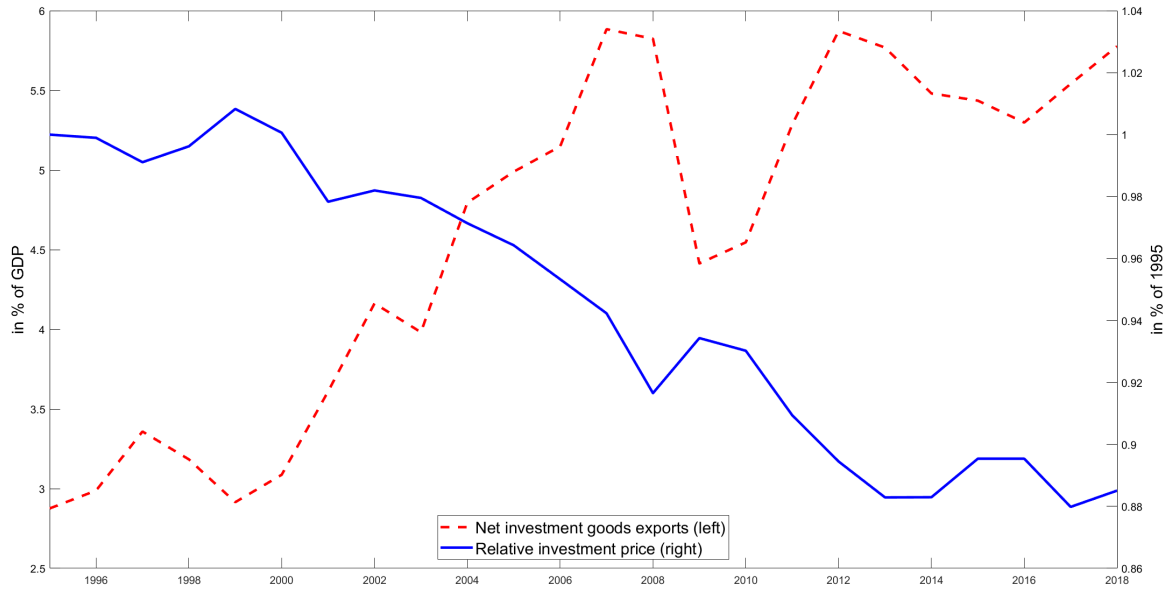
To provide evidence for this mechanism, I simulate Germany's fall in relative investment prices in a two-country open economy model calibrated for Germany and a representative emerging market economy, i.e., Poland. Among EMEs, Poland was Germany's largest trading partner in 2018. To account for the non-stationarity in the decline in relative investment prices, I analyze the transition from an initial equilibrium towards a terminal steady state, i.e., from 1995 to 2018.[4] As a result of the relatively cheaper investment goods, their exports

[2]Mutreja et al. (2018) provide evidence that the global investment good production is more concentrated than GDP, given that ten countries produce almost 80% of world capital goods, whereby EMEs and developing countries import most of their investment goods.

[3]Hereby, I abstract from an intermediary banking sector that translates German corporate saving into credit for foreign customers, though Dao and Maggi (2018) show that German corporate saving are mainly held in liquid assets such as deposits. However, since I am not interested in the implications of the foreign exposure in terms of rents or risks (e.g., Hünnekes et al., 2019), I assume the introduction of an intermediary not to be relevant for the nature of my mechanism and its results. In either way corporate excess saving are absorbed by the foreign economy as a result of rising exports.

[4]I exclude the early 1990s since the economic performances in these years were enormously biased by

Figure 1: Germany's net investment goods exports and the relative price of investment goods



Own figure. Source: World Integrated Trade Solution (WITS) and Federal Statistical Office of Germany.
Note, to be consistent with the model, the relative investment price is measured as the domestic producer price of investment goods divided by the domestic producer prices of consumption goods (for details see 3.)

to Poland rise and, consequently, revenues of German firms increase.[5] Through the rises in net exports, German corporates accumulate saving in terms of receivables against Polish companies. In addition to the rise in trade imbalances and corporate saving, the model shows that the fall in relative investment prices leads to a decline in Germany's labor share since it motivates firms to shift away from labor towards capital. The declining employment compensations further strength the rise in corporate (operating) profits and saving as proposed by Chen et al. (2017).[6] Altogether, my model is able to cover the variables' trends

Germany's reunification and the end of communist rule in Poland.

[5]Empirical evidence provided by Lian et al. (2019) shows that the reduction in trade barriers in EMEs has been an important factor in allowing trade in investment goods to intensive and the lower investment goods prices to spill over from advanced to emerging economies. However, in my model, I refrain to design the reductions in trade barriers explicitly, but assume that these are priced into the import/export price of investment goods.

[6]The decline in the labor share bases on an elasticity of substitution between capital and labor larger than one that has been estimated by Karabarbounis and Neiman (2014) using cross-country data. However, the vast majority of studies find an elasticity of substitution below unity by drawing back on within-country data, e.g., Oberfield and Raval (2021). For my research, the approach of Karabarbounis and Neiman (2014) using multiple country data seems more appropriate given the international dimension of my model as discussed in section 4. Nevertheless, my main result, i.e., that the fall in relative investment prices induces an increase in investment goods exports from Germany towards EMEs, is robust for an elasticity of substitution smaller

in the data and, quantitatively, replicates the changes from 1995-2018 in investment goods exports from Germany to Poland, consumption, investment, corporate saving, and the fall of Germany's labor share quite well.

By emphasizing the role of the fall in relative investment prices and investment goods exports to understand Germany's trade balance surpluses, I formalize a mechanism that adds to the other potential explanations. E.g., these include the quality of German products, wage restraints, the labor market reforms in the beginning of the 2000s years, and the enhanced willingness of German households to accumulate savings in face of demographic changes (Kollmann et al., 2015). In a sense, my model provides a mechanism that partially explains the external demand shock that other studies emphasis as being an important driver of Germany's trade surpluses and the rise in corporate saving (Kollmann et al., 2015 and Klug et al., 2018). Moreover, since I stress out the importance of the decline in relative investment prices to explain the nexus between corporate profits, saving and trade surpluses, I extend the work of Chen et al. (2017) who study corporate saving in a closed economy.

Related literature. The trend of rising corporate saving has been extensively studied in the corporate finance literature by analyzing company's balance sheet data, e.g., Fritz Foley et al. (2007), Falato et al. (2013), Eisfeldt and Muir (2016), Begenau and Palazzo (2017). Thereby, Bates et al. (2009), Chen et al. (2017) and Dao and Maggi (2018) highlight the importance of uncertainty, rising profits and foreign sales for driving corporate saving. In a structural model, Armenter and Hnatkovska (2017) also provide evidence for the precautionary motive of saving. Chen et al. (2017) show that the rise in market power, the decline in interest rates and the fall labor costs account for the rise in corporate saving in a closed economy model that represents the world economy. In addition, Klug et al. (2018) emphasize the connection between corporate saving and trade surpluses by showing that net exports and excess corporate saving respond similarly to common shocks. In the same vein, Behringer and van Treeck (2019) provide empirical evidence for the connection between

than one in both countries.

corporate saving and trade surpluses. Furthermore, my work adds to the literature studying investment-specific technical change, e.g., Greenwood et al. (1997, 2000), Fisher (2006), Justiniano et al. (2010, 2011), Altig et al. (2011), Schmitt-Grohe and Uribe (2011), Dogan (2019) and Guerrieri et al. (2020). Closely related to my work, Dogan (2019) shows in a business cycle model that the fall in relative investment good prices accounts for a substantial part of trade fluctuations between the United States and Mexico. Complementary, I study the effects of the fall in relative investment prices on the trend of trade imbalance in a non-stationary model. As discussed above, I also add to the literature on the decline of the labor share, e.g., Blanchard (1997), Acemoglu et al. (2001), Elsby et al. (2013), Piketty (2014), Karabarbounis and Neiman (2014), Dao et al. (2017), Autor et al. (2020). Finally, my paper also adds to the literature that studies the effects of international trade of investment goods for economic development, e.g., Mutreja et al. (2018) and Lian et al. (2019).

The rest of the paper is structured as follows: Section 2 briefly introduces corporate saving and its nexus with trade imbalances. Subsequently, Section 3 describes the model, before section 4 provides the solution strategy and the calibration of the model. Section 5 provides a discussion of the results before section 6, finally, summarizes the findings of the paper.

2 Corporate Saving and Trade Imbalances

Before I discuss Germany's trend in corporate saving, I briefly define the term. Thereby, the distinction between corporates' gross saving and net lending becomes relevant.

Gross saving is defined as:

$$Gross\,Saving \;=\; Gross\,Profit \;-\; Dividends \tag{1}$$

Hence, gross saving equals retained profits from a balance sheet perspective. Gross

operating profit is defined as:

$$Gross\,Operating\,Profit\;=\;Revenues\;-\;Labor\,Costs, \tag{2}$$

whereby labor costs consist of employment compensations.

Finally, net lending is the amount gross saving that exceeds investment expenditures and which is either used to increase (reduce) financial assets (liabilities):[7]

$$\underbrace{\Delta Net\;Lending}_{\Delta Financial\;Assets-\Delta Financial\;Liabilities}\;=\;Gross\,Saving\;-\;Investment\,Expenditures \tag{3}$$

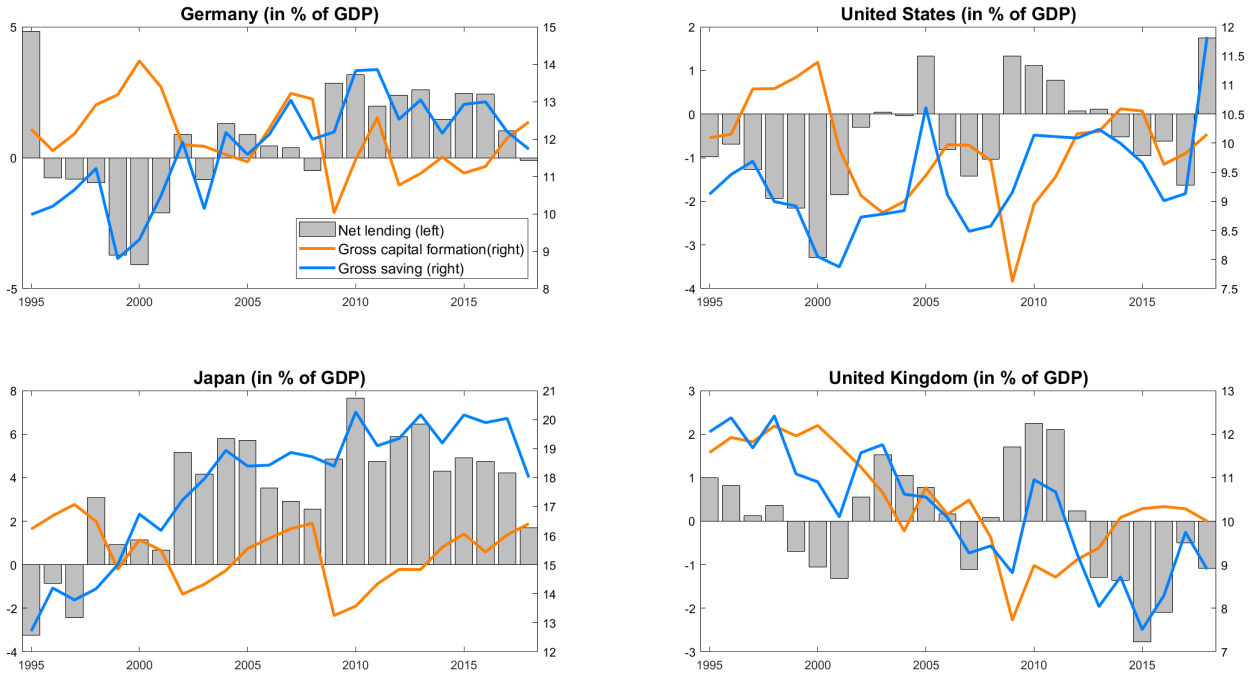
In the recent decades, the corporate sectors of current account surplus countries such as Germany, Japan, and South Korea (not shown) have experienced the largest rise in net lending. Among these countries, the relationship appears to be especially pronounced in Germany as the current account has been recording surpluses since the year in which the corporate sector has been holding excess saving (see figure 4). The increases in net lending in the surplus countries have been mainly driven by upward trends the gross saving rates and only to a small extent by declining investment expenditures (see figure 2). According to Dao and Maggi (2018) the increases in gross saving in these countries have been mainly due to higher profits that result from advances in gross value added and declining labor costs.[8]

In contrast, in current account deficit countries, corporate net lending have been mostly caused by falling investment expenditures while the respective corporate gross saving rate has remained more or less stable (US) or has even declined (UK), with the exception of the years following the global financial crisis.

[7]I abstract form share buybacks since empirical evidence from Deutsche Bundesbank (2019) shows that retained profits of German corporates are not spend on equity buybacks.

[8]For the sake of the argument, I abstract from other potential factors that have also increased corporate profits in recent decades, such as falling interest rates, tax reductions, and rising mark-ups (Dao and Maggi, 2018, and Chen et al., 2017). Noteworthy, according to Deutsche Bundesbank (2019) Germany's tax reform in 2000 had no significant effect on the rise of corporate saving. Though, the reform harmonized tax rates for distributed and retained profits, as the latter had been previously taxed at a higher rate.

Figure 2: Cross-country decomposition of corporate net lending



Own figure. Source: Eurostat
Note, the outlier in Germany's corporate net lending in 1995 is due to capital transfers.

The following model shows that Germany's increasing investment goods exports to EMEs and declining labor costs impelled by the fall in relative investment prices can explain a considerable part of the rise in corporate profits and, thus, gross saving and net lending. Hence, my model provides a mechanism that explains that Germany's persistent trade surplus is mainly driven by net exports of investment goods which have been in increasing demand from EMEs since the 1990s (see figure 5 and 6).

Though, I focus on Germany, my mechanism could also be applied to Japan and South Korea as the corporate sectors in these countries also show an upward trend in saving, and as these countries also traditionally have surpluses in trade in investment goods. Remarkably, current account deficit countries such as the US and the UK, whose corporate sectors do not exhibit a clear upward trend in gross corporate saving, are traditionally net importers of investment goods.

3 The Model

This section describes the key elements of the two-country open economy model. The model consists of an advanced economy (home country) and an EME (foreign country). Both countries produce investment and consumption goods which are traded internationally. To allow for corporate saving, the firms own the capital stock and decide on investment and lending. The firms, in turn, are owned by the households. The firms can trade in international bonds with their foreign counterparts. To analyze the fall in relative investment prices in the home economy, I declare the consumption goods prices of both countries to be numerairs. The countries differ in size and in their relative investment prices but are isomorphic otherwise. The model description only contains the structure of the home economy. Thereby, foreign country variables are denoted by an asterisk.

3.1 Firms

Domestic production. There is a continuum of perfectly competitive firms, indexed on the unit interval. The representative firm produces output, y_t, by utilizing capital, k_t ,and labor, n_t, according to a constant-elasticity of substitution (CES) production function that exhibits constant returns to scale:

$$y_t = \left(\alpha k_t^{(\rho-1)/\rho} + (1-\alpha) n_t^{(\rho-1)/\rho}\right)^{\rho/(\rho-1)}, \tag{4}$$

where ρ and α display the elasticity of substitution between capital and labor and the distribution parameter, respectively.

Subsequently, the output is either transformed into domestic-produced consumption goods, c_t^{dp}, or domestic-produced investment goods, i_t^{dp}.

$$y_t = c_t^{dp} + \epsilon_{Ht} i_t^{dp}.$$

Thereby, one amount of output can be transformed into one domestic-produced consumption good, which implies a normalization of domestic consumption goods prices, Pc_{Ht}, to one. In contrast, the output can be transformed into $\frac{1}{\epsilon_{Ht}}$ domestic-produced investment goods, whereby ϵ_{Ht} denotes the domestic investment goods prices relative to domestic consumer prices, i.e., $= \frac{Pi_{Ht}}{Pc_{Ht}}$. As common in the literature, I interpret ϵ_{Ht} as the technology level in the production of consumption goods relative to investment goods. Consequently, a decline in ϵ_{Ht} implies an improvement in the technology of producing investment relative to consumption goods.

Domestic-produced consumption and investment goods are traded internationally. Hence, they are either used to satisfy domestic demand, c_{Ht}, i_{Ht}, or foreign demand, c^*_{Ht}, i^*_{Ht}. Taking together, the domestic market clearing condition reads:

$$y_t = c_{Ht} + \frac{(1-\eta)}{\eta} c^*_{Ht} + \epsilon_{Ht}\big(i_{Ht} + \frac{(1-\eta)}{\eta} i^*_{Ht}\big),$$

where η reflects the relative country size of both countries.

Given the production function (4) the firm maximizes output by minimizing the cost it has to pay to acquire labor, i.e., the wage, w_t. Thereby, the First Order Condition (FOC) with respect to n_t expresses the firm's labor demand given by:

$$w_t = z_t(1-\alpha)\left(\frac{y_t}{n_t}\right)^{1/\rho}$$

The labor share on output is defined as:

$$S_{Lt} = \frac{w_t n_t}{y_t}.$$

Intratemporal decision. The firm owns the capital stock and uses an investment bundle, i_t, that consists of a fraction ω^i of domestic produced investment goods, i_{Ht}, and a fraction

$(1-\omega^i)$ of foreign produced investment goods, i_{Ft}, to add to it.[9] Thereby, the law of motion of capital is given by:

$$k_{t+1} = (1-\delta)k_t + \left[1 - \frac{\vartheta}{2}\left(\frac{i_t}{i_{t-1}} - 1\right)^2\right] i_t, \tag{5}$$

Equation (5) incorporates investment adjustment costs following Christiano et al. (2005). The investment index, i_t, of the firm reads:

$$i_t = \left[\omega^{i\frac{1}{\sigma}} i_{Ht}^{\frac{\sigma-1}{\sigma}} + (1-\omega^i)^{\frac{1}{\sigma}} i_{Ft}^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{(\sigma-1)}},$$

where σ is the rate of substitution between goods produced in the home and foreign country. The preference measure of foreign-produced investment goods contains the degree of openness of the investment bundle, ψ^i, adjusted for the relative country size, i.e., $(1-\omega^i) = (1-\eta)\psi^i$.[10]

The corresponding investment-price index is defined as follows

$$\epsilon_t = \left[\omega^i \epsilon_{Ht}^{1-\sigma} + (1-\omega^i)\epsilon_{Ft}^{1-\sigma}\right]^{\frac{1}{1-\sigma}}$$

The Law of One Price holds such that:

$$\epsilon_{Ht} = \epsilon_{Ht}^* e_t,$$

and

$$\epsilon_{Ft} = \epsilon_{Ft}^* e_t,$$

where e_t reflects the nominal exchange rate, i.e., the price of one unit of foreign currency in terms of home currency.

Expenditure minimization given the investment price-index yields the demand functions

[9] The introduction of home bias in preferences breaks the purchasing power parity (PPP).

[10] See De Paoli (2009) and Dogan (2019) for a similar specification.

for domestic-produced investment goods and foreign-produced investment goods:

$$i_{Ht} = \omega^i \left(\frac{\epsilon_{Ht}}{\epsilon_t} \right)^{-\sigma} i_t,$$

$$i_{Ft} = (1 - \omega^i) \left(\frac{\epsilon_{Ft}}{\epsilon_t} \right)^{-\sigma} i_t.$$

Intertemporal decision. The company trades domestic non-contingent bonds, b_{Ht}, and foreign non-contingent bonds, b_{Ft}, whereby r_{t-1} and r^*_{t-1} indicate the remuneration of the domestic and foreign bonds, respectively. In the vein of Schmitt-Grohe and Uribe (2003), portfolio adjustment cots $\frac{\phi}{2}(b_{Ft} - \overline{b}_F)^2$ ensures stationary of the model with ϕ reflecting an adjustment parameter and $\overline{b}_F$ denotes the steady state value of the firm's foreign debt. Apart from paying wages to hire employers, the firm distributes dividends, d_t, to the households and adds investment to the capital stock in accordance to equation (5).

I follow Chen et al. (2017) and assume that dividends are paid out according to a target level. Aligning dividends payments with this target allows me to incorporate dividend smoothing (Lintner, 1956) without explicitly modeling its causes, e.g., agency problems (Jensen, 1986), which is beyond the scope of this paper. The target level of dividends captures firm's revenues, y_t, and the value of capital, k_t:

$$d_t = \kappa y_t^{\kappa_r} (\epsilon_t k_t)^{\kappa_k}. \tag{6}$$

Altogether, the firm's flow of fund constraints reads:

$$\begin{aligned} y_t - w_t n_t - \epsilon_t i_t - d_t - b_{Ht} + (1 + r_{t-1}) b_{Ht-1} - rer_t b_{Ft} + \\ rer_t (1 + r^*_{t-1}) b_{Ft-1} - \frac{\phi}{2} rer_t \left(b_{Ft} - \overline{b}_F \right)^2 = 0 \end{aligned} \tag{7}$$

Thereby, the real exchange rate, rer_t, is expressed in consumption goods prices defined

below, and is defined by

$$rer_t = e_t \frac{Pc_t^*}{Pc_t},$$

Given that firms conduct investment and trade bonds, they optimize their present discounted value intertemporally:

$$\max_{k_{t+1}, n_t, i_t, d_t, b_{Ht}, b_{Ft}} \sum\nolimits_{t=0}^{\infty} \beta^t \frac{\lambda_{t+1}}{\lambda_t} d_t,$$

s.t. to the production function (4), the law of motion of capital (5), the target level of dividends (6), and the flow of funds condition (7).[11]

3.2 Households

The country is populated by a continuum of households, indexed on the unit interval. The representative household optimize her utility over consumption, c_t, and leisure, $(1 - n_t)$:

$$\sum\nolimits_{t=0}^{\infty} \beta^t \Big(log(c_t) + \Psi log(1 - n_t) \Big),$$

where the parameters β and Ψ reflect the discount factor and labor disutility, respectively.

The household is the owner (shareholder) of the representative firm and, thus, receives dividends, d_t. The household's budget constraint is

$$w_t n_t + s_t(d_t + p_t) = s_{t+1} p_t + c_t,$$

where w_t is the wage obtained for supplying labor, n_t, and s_t denotes the household's equity shares expressed in the market price of the shares, p_t.

[11] Since the firms are owned by the household, future profits are multiplied with the subjective discount factor of the households, $\frac{\lambda_t}{\lambda_0}\beta^t$, where λ denotes the Lagrange multiplier of the households optimization problem described below.

The Lagrangian of the maximization problem is given by:

$$L = \sum_{t=0}^{\infty} \beta^t \left(log(c_t) + \Psi log(1 - n_t) + \lambda_t \left[w_t n_t + s_t(d_t + p_t) - s_{t+1} p_t - c_t \right] \right)$$

Maximization leads to the labor supply condition and Euler equations:

$$\frac{w_t}{c_t} = \Psi \frac{1}{(1 - n_t)},$$

$$\frac{1}{c_t} p_t = \beta^t \frac{1}{c_{t+1}} (d_{t+1} + p_{t+1}).$$

The final consumption good is a bundle that contains, home-produced, c_{Ht} and foreign-produced, c_{Ft}, consumption goods:

$$c_t = \left[\omega^{c\frac{1}{\sigma}} c_{Ht}^{\frac{\sigma-1}{\sigma}} + (1 - \omega^c)^{\frac{1}{\sigma}} c_{Ft}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{(\sigma-1)}}.$$

Again σ declares the elasticity of substitution between home and foreign goods, and ω^c denotes the home bias that consists of the degree of openness in the consumption bundle, ψ^c, adjusted for the relative country size, i.e., $(1 - \omega^c) = (1 - \eta)\psi^c$.

The corresponding consumption price-index contains of home and foreign consumption goods prices, Pc_{Ht} and Pc_{Ft}, respectively, and reads:

$$Pc_t = \left[\omega^c Pc_{Ht}^{1-\sigma} + (1 - \omega^c) Pc_{Ft}^{1-\sigma} \right]^{\frac{1}{1-\sigma}}.$$

Finally, expenditure minimization yields the following demand functions for domestic-produced and foreign-produced consumption goods.

$$c_{Ht} = \omega^c \left(\frac{Pc_{Ht}}{Pc_t} \right)^{-\sigma} c_t,$$

$$c_{Ft} = (1-\omega^c)\left(\frac{Pc_{Ft}}{Pc_t}\right)^{-\sigma} c_t.$$

3.3 Trade balance, corporate saving and market clearing

The trade balance, tb_t is defined as exports less imports and reads as follows:

$$tb_t = \underbrace{\frac{1-\eta}{\eta}\epsilon_{Ht} i^*_{Ht} - \epsilon_{Ft} i_{Ft}}_{\text{net investment goods exports} = nxi_t} + \underbrace{\frac{1-\eta}{\eta} c^*_{Ht} - c_{Ft}}_{\text{net consumption goods exports} = nxc_t}$$

One can show for the trade balance, it holds that:

$$tb_t = b_{Ht} - (1+r_{t-1})b_{Ht-1} + rer_t b_{Ft} - rer_t(1+r^*_{t-1})b_{Ft-1} + \frac{\phi}{2} rer_t \left(b_{Ft} - \bar{b}_F\right)^2. \quad (8)$$

Bond market clearing requires that the share of domestic bonds held by the domestic firm, ηb_{Ht}, and the EME's firms $(1-\eta)b^*_{Ht}$, add up to zero:

$$\eta b_{Ht} + (1-\eta) b^*_{Ht} = 0.$$

Given the definitions provided in section 2, that is equation (1) to (3), the models counterpart of the variables of interest are defined as follows:

Gross operating profits, Π_t, read

$$\Pi_t = y_t - w_t n_t \quad (9)$$

Since corporate gross saving, s^c_t, is defined as gross operating profits less dividends, I solve the corporate flow of funds (7) for d_t and subtract it from gross operating profits (9) to obtain:

$$s^c_t = \epsilon_t i_t + b_{Ht} - (1+r_{t-1})b_{Ht-1} + rer_t b_{Ft} - rer_t(1+r^*_{t-1})b_{Ft-1} + \frac{\phi}{2} rer_t \left(b_{Ft} - \bar{b}_F\right)^2.$$

Finally, by subtracting nominal investment from gross saving, I obtain corporate net lending/borrowing, nl_t^c:

$$nl_t^c = b_{Ht} - (1 + r_{t-1})b_{Ht-1} + rer_t b_{Ft} - rer_t(1 + r_{t-1}^*)b_{Ft-1} + \frac{\phi}{2} rer_t \left(b_{Ft} - \bar{b}_F\right)^2. \quad (10)$$

Note that net lending (10) equals the trade balance (8). Hence, retained operating profits that are not spend on investment goods are lend to the foreign economy.

Finally the national account identity is defined as:

$$y_t = c_t + \epsilon_t i_t + tb_t.$$

4 Solution Method and Calibration

To account for the non-stationary in Germany's relative investment price decline, I let the domestic relative price in the home economy fall from an initial equilibrium towards a terminal steady state. For that reason, I solve the model under perfect foresight. Thereby, I let ϵ_{Ht} decline linearly from 1 in 1995 towards 0.89 in 2019 to approximate the decline in the Germany's domestic relative investment price observed in the data (see figure 7). Nevertheless, the normalization of ϵ_{Ht} to one in 1995 is an artificially constructed starting point, since the fall in relative investment prices has begun long before 1995 in the data. Consequently, the future decline in relative investment prices had already been fed into the expectations of households and firms at this point of time. To achieve comparability between my simulations and the data, I proceed as follows: First, I simulate my model starting at the exogenous equilibrium constructed for 1995 and save the results of the second simulation period. In a second step, I use these results as the endogenous starting point of a new simulation. Thereby, I set the domestic relative investment price in the foreign country, ϵ_{Ft} to one $\forall\, t$ given the stylized fact that the fall in relative investment prices originates mainly in advanced countries (Lian et al., 2019).

The model is calibrated at an annual frequency. The structural parameters apply for both countries, except for the relative country size and the parameters defining the trade shares as discussed below. Given that only the relative investment price changes over time, the structural parameters are identical in the initial starting point and the terminal steady state. I assume that the discount factor $\beta = 0.95$, implying an annual equilibrium interest rate, $\overline{r}$, of 5.3. The labor disutility parameter, Ψ, is set to achieve a steady state labor input, n_t, of 0.3. I set the depreciation rate of capital, δ, to 0.1 that consists with an annual depreciation rate of 10%. According to the estimated value in Karabarbounis and Neiman (2014), the elasticity of substitution between capital and labor, ρ, is set equal to 1.25. This value differs from the estimates of the majority of studies which find an elasticity of substitution below one, e.g., Pol (2004), Chirinko and Mallick (2017) and Oberfield and Raval (2021). However, most these studies draw back on within-country data, whereas Karabarbounis and Neiman (2014) use cross-country variations for their estimates. Given the global dimension of the decline in the labor share and the international dimension of my model, the approach of Karabarbounis and Neiman (2014) appears more appealing for my research.[12] I set the values of the parameters of the dividend target function according to Chen et al. (2017) who derive these from firm level data. In this sense, κ is set to 0.17 and the dividend elasticities of revenues, κ_r, and fixed capital κ_k, are set to 0.63 and 0.05, respectively.

The relative country size of Germany, η, is set to 0.82 to match the average GDP per capita differences between Germany and Poland from 1995 until 2018. The average shares of consumption and investment goods imports on total consumption and investment expenditures from 1995 until 2018 define the openness parameters for both countries, respectively,

[12]My main result, that the fall in relative investment prices increases investment goods exports/corporate net lending, is robust for a substitution elasticity smaller than one in both countries. Nevertheless, the increase in the labor shares of such parametrization is at odd with German data and causes German company profits to shrink in the model. Most of the alternative explanations cannot explain the global decline in the labor share as they focus on the US. E.g., Autor et al. (2020), claim that rising corporate market power has caused the labor share to fall. In contrast to the US, however, there is no evidence of increasing market concentration in German data (e.g., McAdam et al., 2019, Heidorn and Weche, 2020).

as follows: For Germany, ψ^i and ψ^c, are set to 0.01 and 0.004, while $\psi^{*,i}$ and $\psi^{*,c}$ are set to 0.14 and 0.03, respectively. These calibrations adjusted for the relative country size result in home biases of Germany's investment and consumption sector of $\omega^i = 0.99$ and $\omega^c = 0.99$. Poland's investment and consumption sectors, on the other hand, exhibit home biases of $\omega^{*,i} = 0.88$ and $\omega^{*,c} = 0.97$, respectively. I set the import demand elasticity for investment goods, σ_i, and consumption goods, σ_c, equal to 2.4, i.e., the import demand elasticity for machinery estimated by Feenstra et al. (2018).[13] Finally, I choose the portfolio adjustment cost term, ϕ, to equal the value used in Schmitt-Grohe and Uribe (2003), that is, 0.00074.

5 Results

Figure 5 displays the results caused by the simulated linear decline in Germany's relative investment prices between 1995 and 2018 (panel 1). The figure displays the model's simulations (blue solid line) and plots them against the variables' trends in the actual data (red dashed line). The trends are extracted with the Hodrick–Prescott filter. Since the model can not explain the cyclical components before and after the great financial crisis, I apply a relatively high smoothing parameter, i.e., $\lambda = 2000$.[14]

Except for the relative investment price, all changes are expressed as percentage points deviations from the respective endogenous starting points. Due to the introduction of the Euro, there is no proper empirical counterpart for the model's bilateral exchange rate for most of the years. Therefore, no data of the exchange rate is plotted in panel 2.[15]

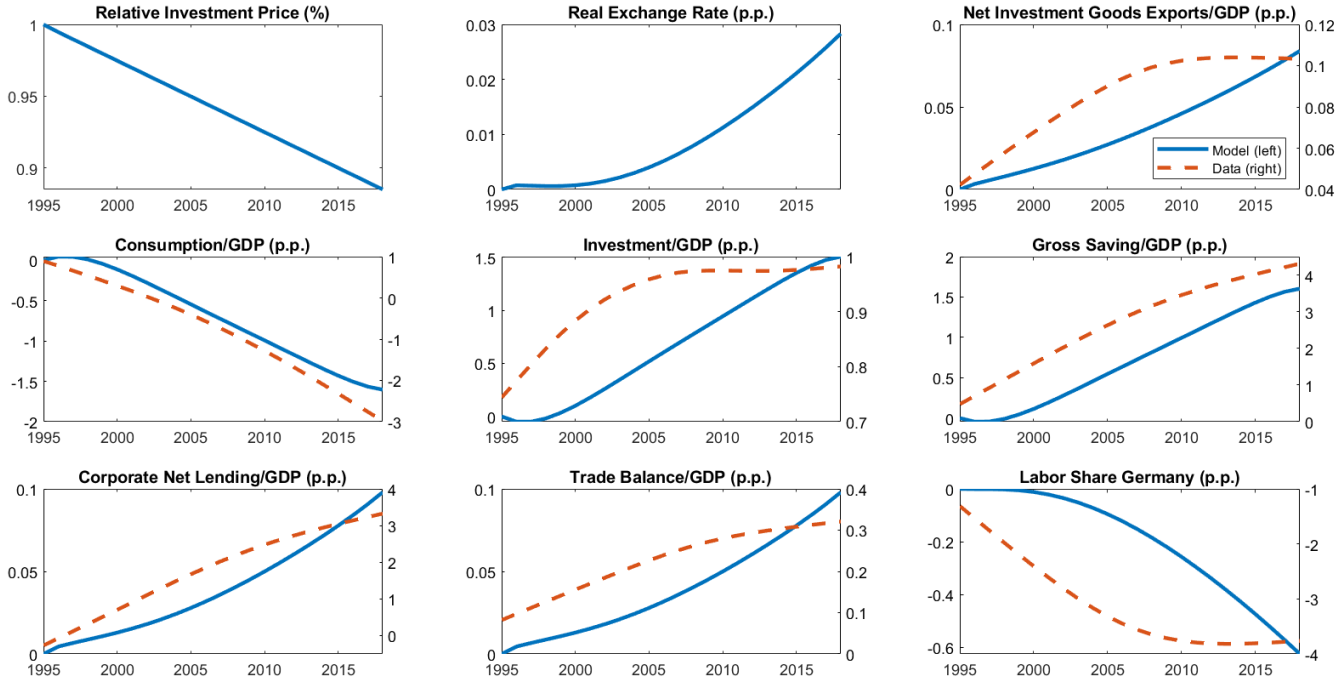
[13] To match short run fluctuations in the data, international DSGE models set the import demand elasticity mostly between 0.5 and 1.5, e.g., Backus et al. (1994) and Corsetti et al. (2008). However, Yi (2003) shows that business cycles models need a much higher import elasticity of around 12 to match long-term developments such as long-term growth in trade. Empirical evidence of the trade literature that also focuses rather on long-term developments also identifies import elasticities larger than 1.5 that range up to 12 (Ruhl, 2008). Since my model does not cover short-term fluctuation but long-term developments in trade, I choose the import demand elasticity in accordance to the trade literature rather than the international business cycle literature.

[14] By choosing $\lambda = 2000$, the trend in the relative investment price would also become linear when using the Hodrick–Prescott filter.

[15] Although Germany is the largest country in the European monetary union, it is not reasonable to assume that the real exchange rate of the Euro against the Zloty is mainly driven by the relative investment

Since the core of my analysis is based on the fall in relative investment prices, I focuses only on investment expenditures potentially impelled by capital-augmenting technological progress, i.e., investment in machinery, equipment and other products (Greenwood et al., 1997, Lian et al., 2019).[16] Altogether, these investments account for more than 70% of corporate investment. Consequently, also corporate gross saving is net of investment in structure.[17]

Figure 3: Germany's net investment goods export and the relative price of investment goods



The existence of home biases in the investment and consumption bundles breaks with purchasing power parity. This explains why the real exchange rate depreciates in response to the decline in relative investment prices. Consequently, German investment goods become more affordable internationally and their exports to Poland increase over time. The rise in

price in Germany.

[16]Details about the measurement of the variables can be found in the data documentation (section 9).

[17]In the national account definition (3), gross saving comprises of net lending and capital expenditures, i.e., gross capital formation. Given the minor importance of changes in inventory and net acquisition of valuables, I only focus on gross fixed capital formation.

net investment goods exports overcompensates the decline in net consumption goods exports (not shown), and drives the total trade balance that converges towards a higher terminal steady state. Given that consumption becomes relatively more expensive over time, the share of consumption spending on income declines and, consistently, the share of capital expenditures on GDP surges. Altogether, gross operating profits (not shown) increase in the long run such as corporate gross saving. Remarkably, corporate gross saving increase beyond the expansion of investment as emphasized by the increase of corporate net lending that mainly mirrors the rise in net investment goods exports. Furthermore, the lower relative investment prices decreases the cost of capital and, hence, incentives firms to shift away from labor towards capital which causes the labor share to fall. The declining labor cost for companies additionally boosts corporates' profits and gross saving.

All-embracing, my model replicates the long run trends in the data quite well. The model's fall in the relative investment prices causes long-term increases in the trade balance, net investment goods exports, capital expenditures, operating profits, gross saving and corporate net lending. In addition, the model captures the downward trend of the share of consumption expenditures on Germany's GDP as well as the decline of Germany's labor share.

Table 1 provides evidence on the model's performance in replicating the changes in the data quantitatively. Thereby, the changes of the variables in the data are compared with the changes generated by the model. The variables are expressed as a share of GDP, whereby row 1 contains the differences between the variables' averages from 1995-1998 and 2015-2018 in the data, while row 2 comprises the variables' changes in the model, i.e., the difference between the variables' endogenous starting points and the variables' final steady state values.

The model replicas the changes in Germany's net investment goods exports to Poland and the small rise in capital expenditures quite well. The restrained investment activities of advanced economies in times of falling investment prices appears puzzling. According to Chen et al. (2017), the share of global investment expenditures on global GDP even de-

Table 1: Model results vs data: Change of variables over time

1995-2018 Δ	$\frac{NXI}{Y}$	$\frac{\epsilon I}{Y}$	$\frac{NL^C}{Y}$	$\frac{S^C}{Y}$	$\frac{C}{Y}$	$\frac{WL}{Y}$	$\dagger\frac{NL^C}{Y}$	$\dagger\frac{S^C}{Y}$
1. Data	0.1	0.9	1.9	2.8	-3.8	-2.0	1.9	2.8
2. Model	0.1	0.9	0.1	1.0	-1.1	-1.1	0.9	1.7

The variables NXI, ϵI, S^C, NL, C and WL denote net investment goods exports, nominal investment, gross corporate saving, corporate net lending, private consumption and Germany's labor share, respectively. All variables are expressed as a share of GDP. Row 1 contains the differences between the variables' averages from 1995-1998 and 2015-2018. Row 2 comprises the variables' changes in the model, i.e., the differences between the variables' endogenous starting points and their final steady state values. Column seven and eight entail the extrapolated shares of corporate net lending and gross saving on GDP denoted by †. The extrapolation is based on Germany's most important 20 EMEs trading partners as described below.

creased between 1980 and 2013, despite falling global relative investment prices. Possible explanations could be aging societies in advanced economies, or increasing returns to scale in industrial production given that machines are becoming more and more efficient. Nevertheless, to determine the reasons for slacked investment in advanced economies is beyond the scope of this paper. Apart from that, the fall of the relative investment price explains almost a third of the decline in consumptions expenditures and around the half of Germany's labor share decline. The latter is in line with the findings of Dao et al. (2017) and Karabarbounis and Neiman (2014). The remaining portion of the decline in labor share can probably be attributed to other potential factors such as the outsourcing of labor abroad or the declining influence of trade unions (e.g., Dao et al., 2017).

With regard to the changes in the corporate sector's net lending and gross saving, it is important to stress out that the data refer to the aggregate of all German non-financial companies, and not only to the companies that trade investment goods with Poland. Given that the model is calibrated for only one representative EME, the model's increases in net lending and gross saving only explains small portions of the variables' changes in the data. Thereby, the increase in gross saving is mainly driven by expanding domestic investment expenditures.

Column seven and eight display the changes in the extrapolated shares of corporate net

lending and gross saving on GDP which is based on Germany's 20 most important EMEs trading partners.[18] To perform the extrapolation, I ran the model for each country separately. Necessarily, for every country, I adjusted the relevant parameters of the model according to the data, i.e., the relative country size, the openness parameters and the respective home biases. As a result of the extrapolation, the model's changes in net lending and gross saving increase substantially. In particular, the extrapolated change in net lending explains almost half of the rise in the data which appears reasonable given that EMEs account for almost half of Germany's net investment goods exports.

6 Conclusion and Outlook

In this paper, I show in a two-country open economy model that rising investment good exports from Germany to EMEs impelled by the fall in relative investment goods prices, is the key variable that drives two major trends in international macroeconomics and explains their interdependency. These are the global imbalances in trade and capital flows, and the global trend of corporate saving that is particularly strong in economics having large and persistent current account surpluses. My model replicates the increases in Germany's corporate saving and trade surpluses and further stylized facts such as the declines in Germany's labor share. Quantitatively, the model captures the changes from 1995-2018 in the data quite well by taking into account that Poland only symbolizes one representative emerging market economy with which Germany trades. The extrapolated change in net lending for Germany's 20 most important EMEs trading partner even explains almost half of the rise in the data. This appears reasonable given that EMEs account for almost half of Germany's net investment goods exports. In principal, my mechanism can also be applied to other countries that have large and persistent current account surpluses such as Japan and Korea, as these are also net exporters of investment goods.

[18] These include Algeria, Argentina, Belarus, Brazil, Chile, Colombia, Croatia, Egypt, Georgia, India, Iran, Mexico, Morocco, Poland, Romania, Russia, Serbia, Slovak Republic, Turkey and Ukraine.

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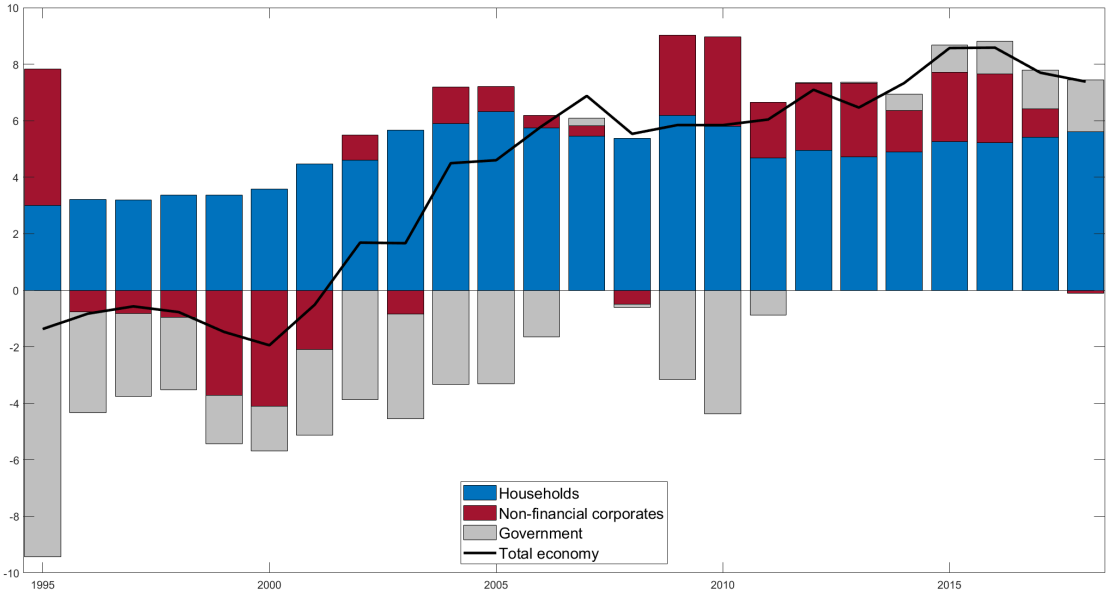
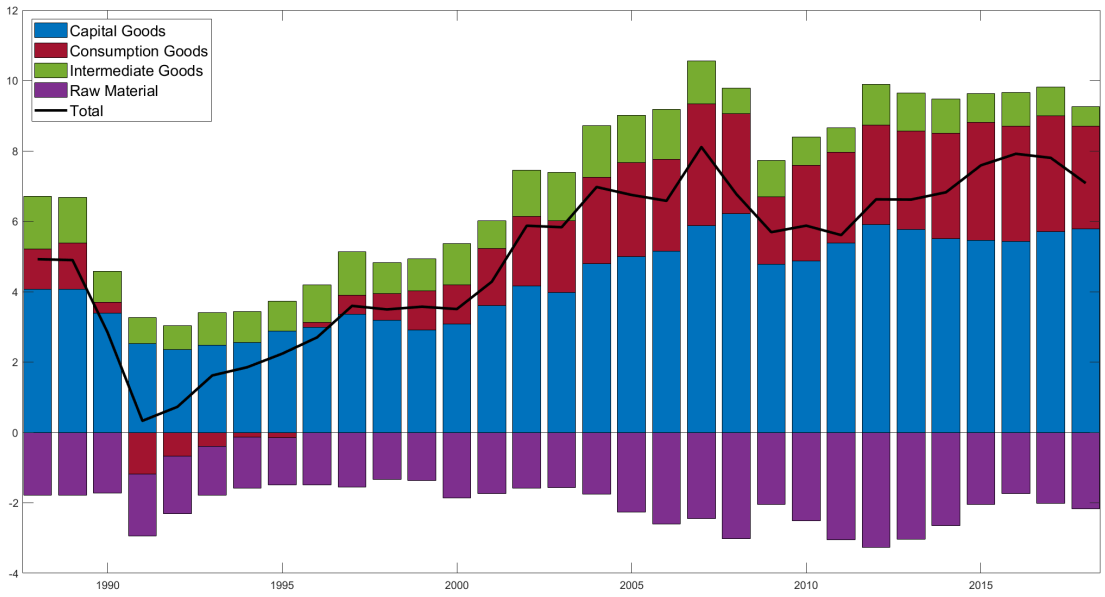
7 Appendix

Figure 4: Sectoral composition of Germany's net lending (in % of GDP)



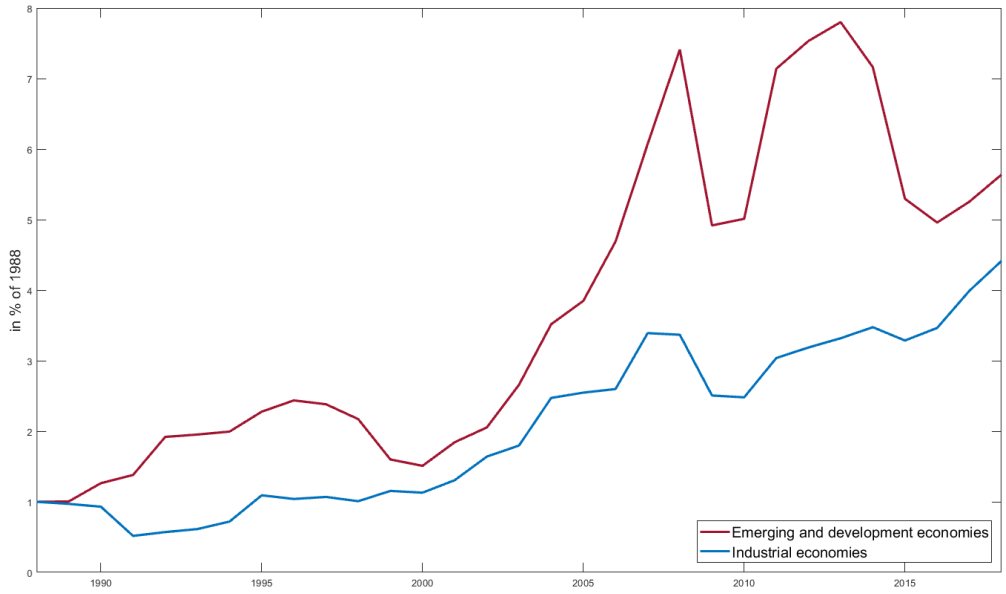
Own figure. Source: Eurostat. The outlier in gross corporate saving in 1995 is due to capital transfers.

Figure 5: Composition of Germany's net exports (in % of GDP)



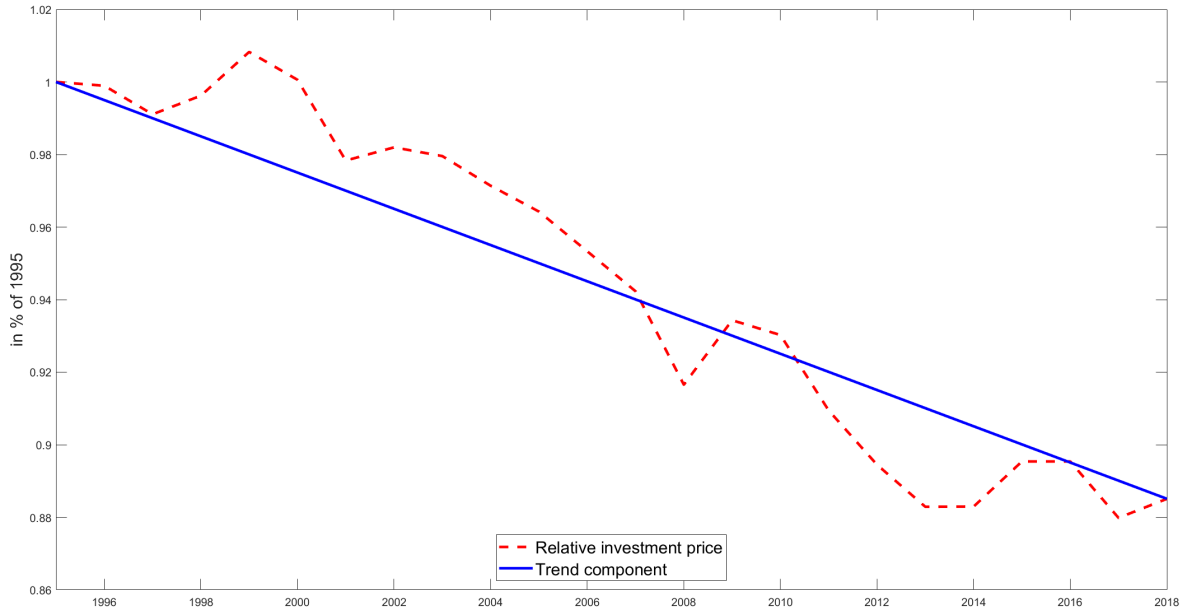
Own figure. Source: World Integrated Trade Solution (WITS) and Federal Statistical Office of Germany.
Note, the distinction of goods into different categories is not straightforward. E.g., vehicles are counted as consumption goods in this statistic, though a large portion of German vehicles are sold to companies and therefore could also be counted as investment goods. This would further increase the importance of investment goods for driving Germany's trade surpluses.

Figure 6: Germany's net investment goods exports by destination



Own figure. Source: World Integrated Trade Solution (WITS) and Federal Statistical Office of Germany.
The allocation of industry and emerging markets has followed that of the fiscal monitor database of the IMF. Consequently, China has been counted among the emerging market economies.
The temporary decline in net investment goods exports to industrial countries in the 90s is biased by Germany's reunification. Net exports to EMEs have been risen more strongly than net export to advanced economies. Although, the capital stock of EMEs is considerable smaller than that of advanced economies and requires less imports to compensate for deprecations.

Figure 7: Germany's relative investment price and its trend component



Own figure. Source: Federal Statistical Office Germany

8 Equilibrium equations

Firms

Production:

$$y_t = \left(\alpha k_t^{(\rho-1)/\rho} + (1-\alpha) n_t^{(\rho-1)/\rho}\right)^{\rho/(\rho-1)}$$

Labor demand:

$$w_t = z_t(1-\alpha)\left(\frac{y_t}{n_t}\right)^{1/\rho}$$

Law of motion of capital:

$$k_{t+1} = (1-\delta)k_t + \left[1 - \frac{\vartheta}{2}\left(\frac{i_t}{i_{t-1}} - 1\right)^2\right] i_t$$

Final investment good:

$$i_t = \left[\omega^{i\,\frac{1}{\sigma}} i_{Ht}^{\frac{\sigma-1}{\sigma}} + (1-\omega^i)^{\frac{1}{\sigma}} i_{Ft}^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{(\sigma-1)}}$$

Investment price index:

$$\epsilon_t = \left[\omega^i \epsilon_{Ht}^{1-\sigma} + (1-\omega^i)\epsilon_{Ft}^{1-\sigma}\right]^{\frac{1}{1-\sigma}}$$

Demand for domestic-produced investment goods:

$$i_{Ht} = \omega^i \left(\frac{\epsilon_{Ht}}{\epsilon_t}\right)^{-\sigma} i_t$$

Demand for foreign-produces investment goods:

$$i_{Ft} = (1-\omega^i) \left(\frac{\epsilon_{Ft}}{\epsilon_t}\right)^{-\sigma} i_t$$

Dividend target level:

$$d_t = \kappa y_t^{\kappa_r} (\epsilon_t k_t)^{\kappa_k}$$

Budget constraint:

$$y_t - w_t n_t - \epsilon_t i_t - d_t - b_{Ht} + (1+r_{t-1}) b_{Ht-1} - rer_t b_{Ft} + rer_t (1+r^*_{t-1}) b_{Ft-1} - \frac{\phi}{2} rer_t \left(b_{Ft} - \bar{b}_F\right)^2 = 0$$

Capital Euler equation (capturing dividend smoothing):

$$q_t = \beta \frac{c_t}{c_{t+1}} \left((1-\delta) q_{t+1} + \alpha \left(\frac{y_{t+1}}{k_{t+1}}\right)^{\frac{1}{\rho}} - \kappa \kappa_r (y_{t+1})^{(\kappa_r - 1)} \alpha \left(\frac{y_{t+1}}{k_{t+1}}\right)^{\frac{1}{\rho}} (\epsilon_{t+1} k_{t+1})^{\kappa_k} - \kappa y_{t+1}^{\kappa_r} \kappa_k (\epsilon_{t+1} k_{t+1})^{\kappa_k - 1} \epsilon_{t+1} \right)$$

FOC w.r.t. investment:

$$\epsilon_t = q_t \left(1 - \left(\frac{\psi}{2}\right) \left(\frac{i_t}{i_{t-1}} - 1\right)^2 - \psi \left(\frac{i_t}{i_{t-1}} - 1\right) \frac{i_t}{i_{t-1}} \right) + \beta \frac{c_t}{c_{t+1}} q_{t+1} \psi \left(\frac{i_{t+1}}{i_{t-1}} - 1\right) \left(\frac{i_{t+1}}{i_t}\right)^2$$

Euler equation w.r.t domestic bonds:

$$\frac{1}{c_t} = \beta^t \frac{(1+r_t)}{c_{t+1}}$$

Euler equation w.r.t. foreign bonds:

$$\frac{1}{c_t} (1 + \phi (b_{Ft} - \bar{b}_F)) = \beta^t \frac{(1+r^*_t)}{c_{t+1}} \frac{rer_{t+1}}{rer_t}$$

Gross operating profits:

$$\Pi_t = y_t - w_t n_t$$

Gross saving:

$$s^c_t = \epsilon_t i_t + b_{Ht} - (1+r_{t-1}) b_{Ht-1} + rer_t b_{Ft} - rer_t (1+r^*_{t-1}) b_{Ft-1} + \frac{\phi}{2} rer_t \left(b_{Ft} - \bar{b}_F\right)^2$$

Net lending:

$$nl^c_t = b_{Ht} - (1+r_{t-1}) b_{Ht-1} + rer_t b_{Ft} - rer_t (1+r^*_{t-1}) b_{Ft-1} + \frac{\phi}{2} rer_t \left(b_{Ft} - \bar{b}_F\right)^2$$

Households

Utility:

$$U(c_t, n_t) = log(c_t) + \Psi log(1 - n_t)$$

Budget constraint:

$$w_t n_t + s_t(d_t + p_t) = s_{t+1} p_t + c_t$$

Labor supply:

$$\frac{w_t}{c_t} = \Psi \frac{1}{(1 - n_t)}$$

Euler equation w.r.t shares:

$$\frac{1}{c_t} p_t = \beta^t \frac{1}{c_{t+1}} (d_{t+1} + p_{t+1})$$

Final consumption good:

$$c_t = \left[\omega^{c\frac{1}{\sigma}} c_{Ht}^{\frac{\sigma-1}{\sigma}} + (1 - \omega^c)^{\frac{1}{\sigma}} c_{Ft}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{(\sigma-1)}}$$

Consumption price-index:

$$Pc_t = \left[\omega^c Pc_{Ht}^{1-\sigma} + (1 - \omega^c) Pc_{Ft}^{1-\sigma} \right]^{\frac{1}{1-\sigma}}$$

Demand for domestic-produced consumption goods:

$$c_{Ht} = \omega^c \left(\frac{Pc_{Ht}}{Pc_t} \right)^{-\sigma} c_t$$

Demand for foreign-produced consumption goods:

$$c_{Ft} = (1 - \omega^c) \left(\frac{Pc_{Ft}}{Pc_t} \right)^{-\sigma} c_t$$

Trade balance and market clearing

Trade balance:

$$tb_t = b_{Ht} - (1 + r_{t-1})b_{Ht-1} + rer_t b_{Ft} - rer_t(1 + r^*_{t-1})b_{Ft-1} + \frac{\phi}{2} rer_t \left(b_{Ft} - \bar{b}_F\right)^2$$

Bond market clearing:

$$\eta b_{Ht} + (1 - \eta) b^*_{Ht} = 0.$$

Domestic market clearing condition:

$$y_t = c_{Ht} + \frac{(1-\eta)}{\eta} c^*_{Ht} + \epsilon_{Ht}\big(i_{Ht} + \frac{(1-\eta)}{\eta} i^*_{Ht}\big)$$

Law of one price :

$$\epsilon_{Ht} = \epsilon^*_{Ht} e_t,$$

National account identity:

$$y_t = c_t + \epsilon_t i_t + tb_t.$$

9 Data documentation

- 1. Relative Price of Investment: The producer price of investment goods divided by the producer price of consumption goods. Data: Federal Statistical Office of Germany. Code: 61241-0003.

- Net investment goods exports: Calculated as the difference between Germany's investment goods exports to Poland and Germany's investment goods imports from Poland. Source: World Integrated Trade Solution (WITS).

- Consumption: Private Consumption expenditure. Data: Federal Statistical Office of Germany. Code: 81000-0020.

- Investment: Measured as the sum of non-financial corporates' gross fixed capital formation in machinery and equipment and gross fixed capital formation in other products, i.e., non-financial corporates' gross fixed capital formation net of gross fixed capital formation in structures. Source: The data were provided by Federal Statistical Office of Germany on request.

- Operating profits: Calculated as the difference between non-financial corporates' gross value added and labor compensations. Data: Federal Statistical Office of Germany. Code: 81000-0124.

- Gross Saving: Calculated as the difference between non-financial corporates' gross saving and gross fixed capital formation in structures. Code: 81000-0124.

- Corporate Net Lending: Calculated as the difference of non-financial corporates' gross saving and NFC gross fixed capital formation in equipment and other products. Code: 81000-0124.

- Trade Balance: Calculated as the difference between Germany's exports to Poland and Germany's imports from Poland. Source: World Integrated Trade Solution (WITS).

- Labor Share Germany: Share of Labor Compensation in GDP. Source: FRED Database available through the Federal Reserve Bank of St. Louis. Code: LABSHPDEA156NRUG.

- Relative Investment Price Poland: I refer to the Penn World Tables (PWT) to obtain Poland's relative price of investemt (Feenstra et al., 2015). Nevertheless, the PWT data are expressed using purchasing power parity exchange rates. To obtain Poland's relative price of investment measured at domestic prices, I follow Restuccia and Urrutia

(2001) and divide the PWT relative price of investment by the US relative price of investment and multiply this ratio by the ratio of the US investment price deflator to the US personal consumption deflator (both obtained from BEA, BEA Account Codes: DPCERD and A006RD).

- Labor Share Poland: Compensation of employees divided by GDP. Source: Eurostaat. Online data code: $NAMA\_10\_GDP$.