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Firms' excess savings and the Dutch current account surplus: a stock-flow consistent approach

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Abstract

In the Netherlands firms' savings, i.e. retained profits, exceed investment at a national level. The resulting net savings are mainly held abroad. Moreover, there is a striking resemblance in the development of net savings of firms' on the one hand and the surplus on the current account on the balance of payments on the other. Both have increased to almost 10% of GDP in recent years. Next to that, the housing boom household net-savings have decreased prior to 2007 following the housing boom, accompanied by an increase in government net-savings. These trends reversed thereafter due to the bursting of the housing bubble.

We present a stock-flow consistent model of the firm to explain firms' excess savings, inspired by Hein (2012), and embed that in an open economy model with a banking sector which we have developed earlier. This enables us to model the preference of firms to invest in financial assets abroad and to analyse the close link between firms' excess savings and the current account surplus. As a consequence we also explain the close link between net household savings and government budget deficit. We present simulation results to illustrate the working of our model.

JEL Code: E44, E6, F45, G32

Key words: stock-flow consistent modelling, retained profits, current account surplus

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1 Introduction

A quite recent widely observed phenomenon is that firms' savings, i.e. retained profits, exceed investment at a national level. This holds in particular for large firms. This phenomenon is very visible in the Netherlands, where firms' savings increased from just above 10% of GDP in the early 1990s to above 20% in 2012, while firms' capital formation declined from around 13% of GDP in the early 1990s to around 10% in 2012. The resulting net savings are mainly held abroad. Moreover, there is a striking resemblance in the development of net savings of firms' on the one hand and the surplus on the current account on the balance of payments on the other. Both have increased to almost 10% of GDP in recent years.

Typical explanations for this phenomenon are that Dutch firms retain an extraordinarily high amount of profits, partly induced by tax motivations, and that investing in financial assets (abroad) generates a higher return than investing in "capital" (non-financial assets). Since the majority of retained profits is invested in take-overs and financial assets abroad, this enables the foreign sector through various channels to borrow sufficient money to finance their net-imports.

Traditional macro-economic models cannot analyse this phenomenon since they lack a proper model of the financial sector and underestimate the potential for interactions between the monetary and the real sphere (Muysken, 2014). Hein (2012) presents an interesting stock-flow consistent model of the firm to explain firms' excess savings, which is a valuable alternative to traditional and new Keynesian macroeconomic models. However, the model of Hein is a closed economy model without a banking sector and government. As a consequence the model does not explain (1) the preference of firms to invest in financial assets abroad, nor does it analyse (2) the close link between firms' excess savings and the current account surplus – or (3) the close link between net household savings and government budget deficit. For that reason we embed Hein's model of firm behaviour in a more elaborate stock-flow consistent model.

We have developed an open economy stock-flow consistent model, with a separate banking sector and government, in Meijers, Muysken and Sleijpen (2015) – MMS from hereon. In this paper we show how adding Hein's model of firm behaviour to that model enables us to explain the abovementioned phenomena observed for the Dutch situation. We also use this model to evaluate some policy proposals to improve economic growth.

After a review of the literature below, we present the stylised facts for the Dutch economy discussed above more in detail in section 2. In section 3 we present the full model – albeit with a simplified model of the household sector, in order to focus on the impact of firm behaviour. However, as is the case with most stock-flow consistent models this model is still analytically intractable and its properties can only be analysed numerically. We argue in section 4 that in order to evaluate the properties of the model properly, a sequential approach should be followed, starting with a version of the model without banking sector and concentrating on the real sphere only – in line with Hein (2012). The latter model is analysed in section 5 by means of numerical simulations. On the one hand we use this model to reproduce the stylised facts for the Netherlands, on the other hand we compare the results found with this model to the results presented in Hein (2012) and demonstrate the impact of adding a foreign sector and government to Hein his model. Section 6 concludes.

1.1 A survey of the literature

The emergence of 'financialisation' of the non-financial corporate sector has been widely observed and discussed for the United States. A representative study is Orhangazi (2008), who analysis firm savings for the period 1973 – 2003 and observes the increased accumulation of financial assets in this sector. He points out two possible channels. The first channel is through increased profit opportunities in financial assets which crowd out real investment, amongst others because of increasing share buy-backs and dividend payments. The increased use of share buy-backs – observed for instance by Evans (2015) – was induced by management incentives to increase share values and by tax facilities. The second channel is a shortening of the planning horizon and increasing uncertainty, as a consequence of participation in the financial markets – these features impede real investment, which inherently has a longer term horizon. These channels have been dubbed by Hein (2012) the 'preference channel' and the 'internal means of finance channel', respectively. A good survey of the literature on the US is provided by Köhler (2014).

Several studies have also observed a world-wide increase in financialisation of the non-financial corporate sector. A pioneering study is Stockhammer (2004), who observed increased financialisation not only in the US, but also in the UK and France. However, he does not observe this in Germany. Detzer and Hein (2015) point out that the regulatory changes facilitating financialisation were implemented later in Germany, in the 1990s. They update Stockhammer's analysis for Germany and find increased financialisation through both the 'preference' channel and the 'internal means of finance channel' discussed above. Alvarez (2015) provides a more recent overview for the developments in France. Both Köhler (2014) and Karabarbounis and Neiman (2012) provide evidence for a world-wide increased financialisation of the non-financial corporate sector.[1]

An interesting implication of this increased financialisation is that firms became less dependent on banks as Toporowski (2009) points out: "The loss of their best customers has turned banks to fee-related business in derivatives and debt obligation markets, and towards lending into the property market …. making banking markets much more fragile."(p. 151) Examples are German banks which have turned massively to lending money to foreign banks (Detzer and Hein, 2015; Kuzin and Schobert, 2015) and Dutch banks which started to issue excessive mortgages (Bezemer and Muysken, 2015). In both cases the banking sector had to be bailed out at great costs after the financial crisis.

There is only a limited literature on the macroeconomic implications of the increased financialisation of the non-financial corporate sector – see Toporowski (2009) for a broad overview of the social, economic and political consequences. Köhler (2014) provides an exhaustive overview of research linking increased financialisation to a decrease in the wage share. This overview illustrates that only few studies utilise formal macroeconomic models. For a model in the general equilibrium tradition we refer to Bassetto et al. (2014), who also provide a summary of the relevant literature in that tradition. An interesting feature of their model is that they distinguish between small firms and large corporations, where small firms can be hampered by credit crunches. However, Bassetto et al. (2014) assume infinitely living firms, which amongst others implies that "the timing of dividend payments does not matter. Whether dividends are kept by the firm as retained earnings or distributed and

[1] Köhler (2014) also links the decline in the wage share to increased financialisation, following Stockhammer (2009) who emphasises the role of bargaining power in a Kaleckian approach. Karabarbounis and Neiman (2012) do the same using a general equilibrium framework.

invested by firm owners, they yield the same rate of return .."(p. 58) and there is no stock-flow consistency "firm owners will not have unexpected capital gains (or losses) when [a] shock occurs. This allows us to only keep track of their total assets invested with third parties, without distinguishing between firm stock, funds invested with intermediaries, and government debt."(p. 58). Also their model has a balanced government budget in the steady state and refers to a closed economy.

Both Dos Santos (2005) and Michell and Toporowski (2011) argue that the financialisation should be analysed using stock-flow consistent models, SFC for short – see also Muysken (2014). An important reason is that these models "are based around the balance sheets of the various sectors of the economy, and incorporate detailed financial structure—thus considering explicitly the evolution of assets and liabilities and their associated money-flows." (Michell and Toporowski,(2011, p. 30) Moreover, as Dos Santos (2005, p.729) argues, "Contrarily to the intuition of many, a relatively large SFC model is very often more transparent than ones that try to describe the behaviour of 'economies as a whole' with a few equations. … one should never underestimate the need to shed light on the implicit and 'hidden' assumptions of these "parsimonious" models."

Unfortunately there are only a few studies on firms' savings that adhere to the stock-flow consistency tradition. Several of these studies present a stock-flow consistent framework, but do not develop a macroeconomic model. An example is Passarella (2012) who only uses the budget identities of the SFC-model, and builds a Minsky-inspired narrative around it. Another problem with Passarella's analysis is that he essentially uses retained profits to finance investment in real capital. Although firms can hold deposits at banks, it is not clear in his analysis why they should do this. We only found four SFC models which include firm savings in their analysis to analyse the impact of the fiancialisation of the non-financial corporate sector.

Michell (2014) presents a coherent agent-based SFC-model in which firms use retained profits to finance investment in real capital. However, "Firms are assumed to hold a stock of liquidity – bank deposits – in order to cope with unexpected shortfalls in demand."[2] If then "predicted liquidity exceeds desired liquidity, firms make no change to their borrowing and keep excess liquidity on their balance sheets."(p.12) Cyclical movements are caused by the Kaleckian interaction of the rate of profits and capacity utilization, which influence investment positively and negatively, respectively. However, there is an inherent tendency to monopolisation, which induces large firms to accumulate ever larger deposits leading to "Steindl's insight that monopoly firms tend to drain funds from the circular flow, thus increasing the fragility of competitive firms."(p. 6) Although a strong point of the analysis is that it endogenises the distribution of firm sizes, a drawback of this analysis is from our perspective that it ignores the two channels mentioned above through which financialisation has developed.

Ryoo (2015) introduces a SFC-model from a Kaldorian perspective where the profit share clears to adjust the goods market. Firms issue an exogenous amount of equity, which can be bought both by capitalists and workers. If capitalists buy relatively more shares, their income increases relative to that of workers due to higher dividend income. However, a relative decrease in workers' income will lead to a relative increase in capitalist's share holdings. These two mechanisms ensure a stable

[2] Surprisingly, the banking sector is not modelled explicitly. In case of bankruptcy of firms "the hit is proxied by reducing bank deposits held by the household sector".(p. 15)

steady state solution towards which the model converges. Ryoo (2015) focusses on the analytical properties of this steady state solution. He shows that the capitalsis' share of income and wealth increase with an increase in dividend payouts and equity buy backs, which is consistent with the 'preference channel' of financialisation discussed above. The capitalsis' share also increases with a shift in power relations in favour of top managerial pay – this is consistent with the 'internal means of finance channel' discussed above. A weak point in Ryoo's analysis is from our perspective that the amount of equity issued by the firms is exogenous and real investment is determined by savings behaviour.

Our analysis is much closer to that of Hein (2012) and Caverzasi and Godin (2015). Hein (2012) develops a Kaleckian SFC-model in which retained profits are endogenous and are used to finance retained earnings. A drawback of his model is that retained profits are not used to buy financial assets, except buy-backs of own shares. Thus Hein focusses on what is indicated by Köhler as the 'passive' dimension of financialisation of firms and ignores the 'active dimension' "in which firms become agile performers on the financial market via financial investments reflected in a rise of their financial income."(Köhler, 2014, p. 14). As a consequence the two channels which are distinguished above to explain financialisation are introduced in a quite artificial way. The 'preference channel' shows up as a decrease of the constant term in the investment function, representing 'animal spirits'. The 'internal means of finance channel' appears through the rentiers rate of return, which is "determined by the power struggle between managers and shareholders" (p. 47), but appears as an exogenously determined variable in the investment function. An interesting aspect of Hein his model is that it can be solved in an analytical way, which is very rare for SFC models. We elaborate the model of Hein further below, in section 3.

Caverzasi and Godin (2015) present a Minsky-inspired SFC-model that explicitly allows the use of retained profits to buy equity from other firms. These firms also hold deposits at banks as buffer stocks. The complexity of the model makes it difficult to analyse its properties carefully.[3] However, an important element is that firms choose a growth rate for their outstanding assets driven by expected returns. On the one hand this determines the expected need of external finance, since internal finance is found by subtracting the distributed profits, as a fixed share from total profits net of interest payments. Equities then are issued as a fixed share of external finance and the remaining part is covered by loans from the banking sector. On the other hand the outstanding assets then are distributed over physical capital and equity issued by other firms according to a Tobin portfolio model. The 'preference' channel then can be modelled as a change in the preference for physical capital relative to equity in the Tobin model; this causes inflation in the price of equities. The 'internal means of finance channel' is not explicitly recognized.

All models we have discussed thus far are closed economy models. As a consequence there is no potential relation between firm savings and the current account balance, which we observe below for the Netherlands in section 2. In an interesting paper Kuzin and Schobert (2015) observe this relationship for Germany and present a simple SFC model to analyse this. They point out that retained profits have diminished the role for banks in financing real investment and as a

[3] The model includes, next to firms, two types of consumers, rentiers and workers, who both own houses; a housing market with exogenous supply but endogenous house prices; and finally a banking sector aiming for a targeted leverage ratio, providing credit to both firms and workers. Somewhat surprising, there is no government.

consequence banks have turned to lend to foreign banks since “also retained profits need a source of financing. Export revenues of German firms are import expenditures abroad, which are financed by foreign credit to foreign non-banks. The funding for the foreign credit business increasingly took place abroad, but inside EMU. … Financing conditions considerably eased with the start of the monetary union in EMU countries, ..”(p.45) These developments facilitated on the one hand the strong rise in the current account surplus in Germany. On the other hand it increased the fragility of the financial system leading to its bail out in Germany in 2008. Surprisingly enough the SFC model Kuzin and Schobert (2015) present to illustrate their story does not contain a firm sector. They present a two-country model of the EMU (North and South) with households, government and a consolidated banking sector, including the central bank. The banking sector issues deposits to households (high powered money) and absorb government bills, both in their own country. Households also hold government bills. The adjustment mechanism is that “surpluses in the North correspond to deficits in the South financed by issuing new central bank money. … [which] leads to non-stationary balance sheet growth of the banking system.”(p.48) However, there are no firms in their model, which makes the model not very useful for our purpose.

In our analysis below we will take the model of Hein (2012) as a point of departure, since it models the macroeconomic implications of firm savings in an analytically tractable way. However, we will allow the use of retained profits to buy financial assets abroad. The latter implies that we also will include a foreign sector. Finally, to allow for financial fragility, we will also add a banking sector. The full model will be presented in section 3 below. But first we present the relevant stylized facts of the Dutch economy in section 2.

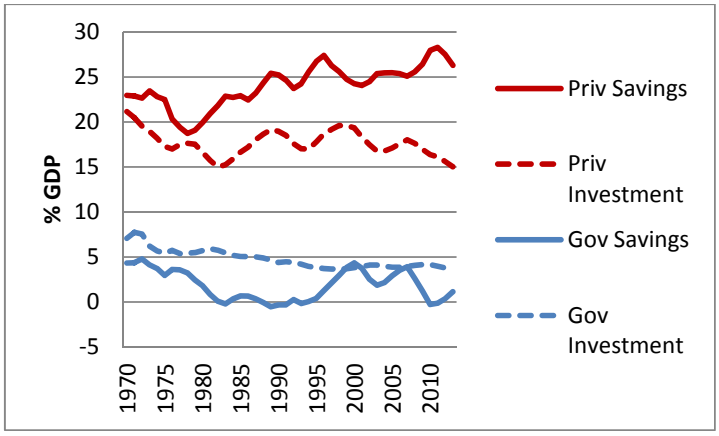
2 Stylised Facts

In this section we present some stylised facts for the Netherlands, with a focus on savings and investments. We show first that the majority of private savings is related to firms, in the form of retained profits. In section 2.2 we demonstrate how firms increasingly use these retained profits for acquiring assets abroad instead of investing them domestically.

2.1 The composition of net savings in the Netherlands[4]

Private savings in the Netherlands show an increasing gap relative to private investment as appears from Figure 1. While private investment fluctuates relative to GDP, with a distinct negative trend since 2000, private savings have increased since the early 1980s. Government investment shows a negative trend over the whole period, decreasing from 7% of GDP in 1970, to 4% of GDP in 2012, while government savings are considerably lower.

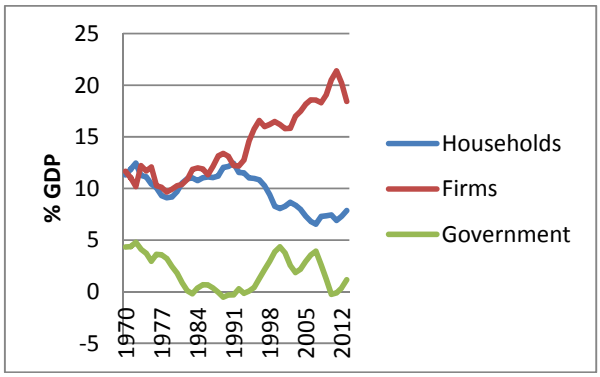
Figure 1 Domestic savings and investment



Source: AMECO

From Figure 2 one sees that private savings in the Netherlands initially were more or less equal. However, after 1990 household savings fell, while firm savings increased. The fall in household

Figure 2 Savings of domestic sectors

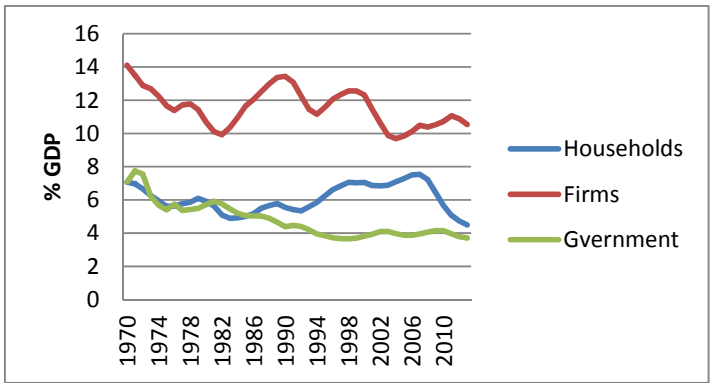


Source: AMECO

[4] This section relies on Bezemer and Muysken (2015).

savings can be explained by wage moderation and wealth effects on consumption of increasing house prices, as we elaborate in MMS (2014). The increase in firm savings follows from an increased preference for retained profits of multinational corporations in the Netherlands, induced by low taxes and low dividend payments (Leering and Schotten, 2012; Jansen and Ligthart, 2014). Investment of firms has been falling consistently since the mid-1980s; this is partly compensated by increasing investment of households. The latter led to a boom in the housing market, which collapsed in 2007, as we elaborate in MMS (2014).

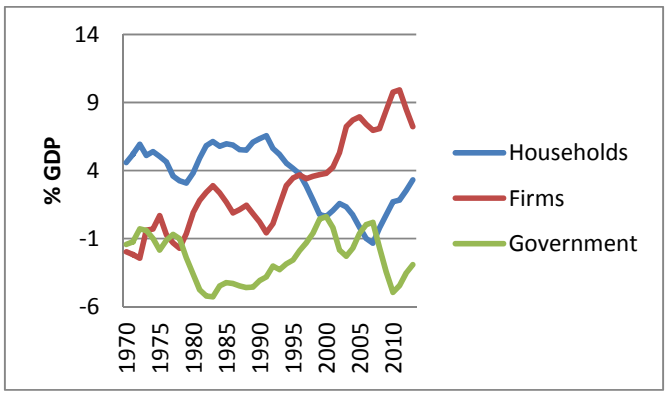
Figure 3 Investment of domestic sectors



Source: AMECO

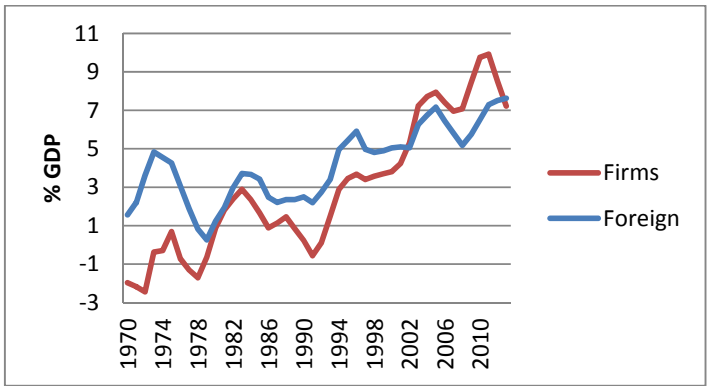
As a consequence of these developments, net savings of firms have been increasing over time, albeit with fluctuations. Net savings of households were stable till 1990 and fell dramatically afterwards till 2007. Finally, government net savings fluctuated strongly pro-cyclical, albeit with an increasing trend in the restoration period in the early 1980s, following the second oil crisis in 1979. These developments are illustrated in Figure 4. From that figure one also sees a remarkable feature, that household net-savings and government net-savings almost balance each other. The implication of this observation is that net savings of firms should be very close to net foreign savings, since the sum of net domestic savings and net-foreign savings is by definition equal to zero. Not surprisingly this feature can be clearly observed from Figure 5.

Figure 4 Net savings of domestic sectors



Source: AMECO

Figure 5 Firms net-savings and foreign net-savings



Source: AMECO

The observation that decreasing household net-savings correspond to increasing government net-savings can be explained on the one hand by the a-cyclical behaviour of consumption and the pro-cyclical behaviour of government deficits. Next to that the increase in housing prices till 2008 induced lower net-savings due to both wealth effects on consumption and increased investment in housing, which in turn also led to higher tax revenues. Finally tax incentives for the increasing number of (involuntary) self-employed persons also led to lower tax-revenues. These trends are reversed after 2007.

Firm savings, i.e. retained profits, are mainly concentrated at multi-national corporations. These corporations also channel their profits of foreign subsidiaries to the Netherlands due to tax motives. The majority of these profits is not invested in the Netherlands, nor paid out as dividend, but is used to buy foreign assets, including take-overs. These assets generate a relatively high return, hence high profits (net of taxes), which then are used to accumulate more foreign assets (Eggelte et al., 2014).[5] Through various channels this enables the foreign sector to borrow from the Netherlands in order to pay for their net-imports. This explains the co-movement of net savings of firms and foreign net savings, depicted in Figure 5.

The observations in Figures 4 and 5 also constitute the main stylised facts we want to analyse in our model:

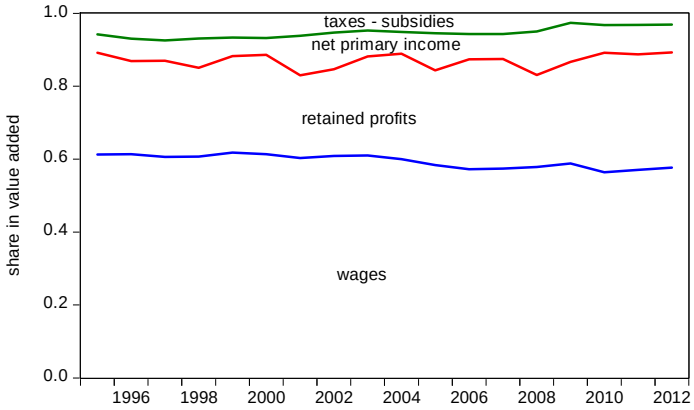
1. The decrease in household net-savings, prior to 2007, accompanied by an increase in government net-savings, and the reversal of these trends thereafter;
2. The increase in net-firm savings, accompanied by an increase in net-foreign savings.

[5] About 75% of the shares of multinationals in the Netherlands is owned by non-residents – the comparable figures in Germany and France are less than half of the Dutch share (Eggelte et al., 2014).

2.2 What happens to retained profits

The value added of corporations consists of (1) compensation of employees, (2) balance of primary income minus net property income, and (3) taxes minus subsidies on production.[6] The composition is presented in Figure 6.

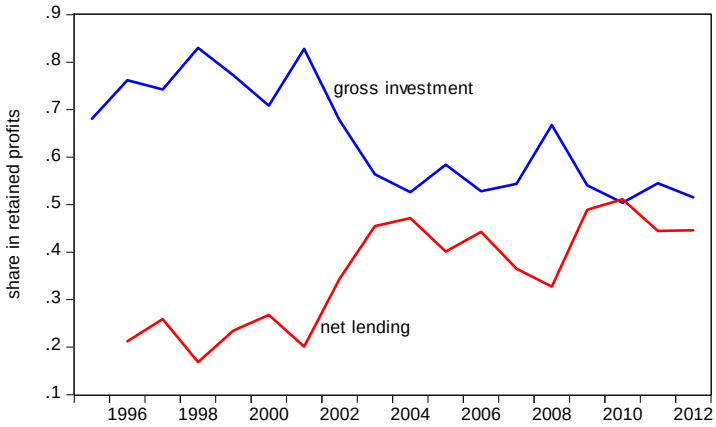
Figure 6 Composition of value added, 1995 – 2012 (cumulated)



Source: AMECO

We focus here on retained profits, which constitute almost 30% of gross value added. From Figure 7 one observes a clear shift over time from gross investment to net-lending. That is, instead of investing their retained profits in fixed capital, firms increasingly started to invest these profits in financial assets. This also can be observed in Figure 8: While the share of total liabilities relative to gross value added in firms remained relatively constant over time, the share of assets increased steadily.

Figure 7 Distribution of retained profits over investment and net-lending

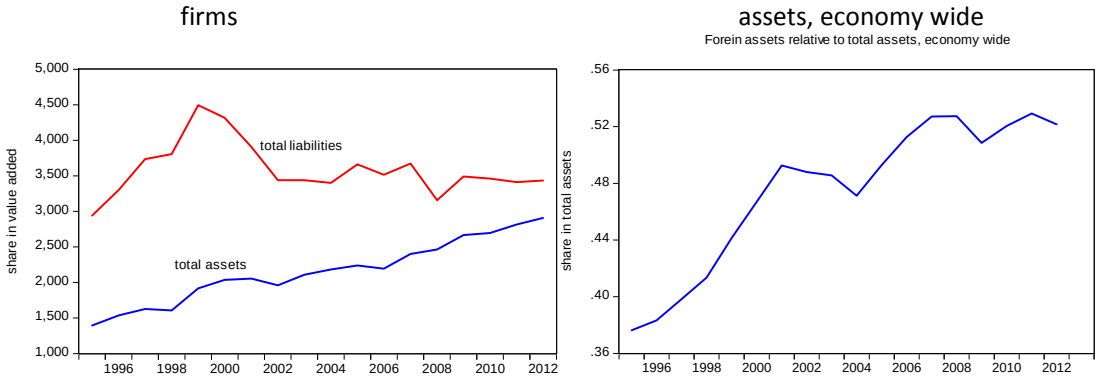


Source: AMECO

Figure 8 Financial assets and liabilities of

Figure 9 Foreign assets relative to total

[6] Net property income = Property income received minus Property income paid. This is negative in NL. It was 5% of value added in 1995 and increased cyclically to 11% in 2014. Taxes minus subsidies fluctuated form slightly positive, below 2% of value added till 2007, to mostly negative, but not exceeding -2% of value added after 2007. AMECO also corrects for the change in net equity of households in pension funds.

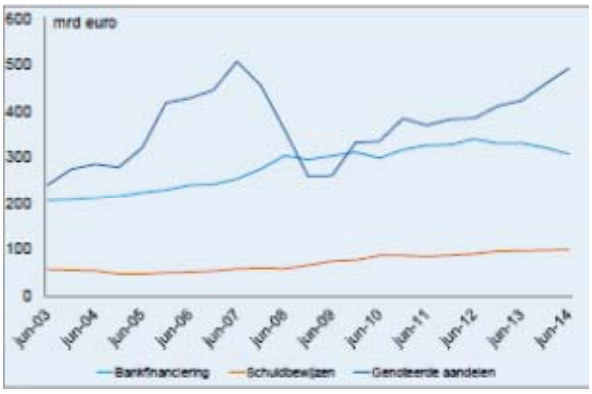


Source: AMECO

A question remains, however, the extent to which these assets have been invested abroad. From Figure 9 one sees that economy wide about 50% of the assets are invested abroad.

A final point concerns the distribution of assets over types of financial assets. As can be seen from Figure 10, the majority of assets consists of equity, although loans follow rather closely.

Figure 10 Distribution of assets of firms



Source: CPB, 2015, Figure 3.1. The lines refer to “Bank loans”, Debt certificates and “Equity”, respectively.

3 A stock-flow consistent model with savings by firms for the Dutch economy

The stock-flow consistent model for the Dutch economy is inspired by Hein (2012) as far a modelling of firm and consumer behaviour is concerned. Since we want to analyse the impact of the possibility of firms to invest part of their profits in foreign assets in relation to the current account, we extend the analysis to an open economy context and include a financial sector. In section 3.1 we present a model of firm behaviour where we extend Hein his model to allow for investment of retained profits in foreign assets. In section 3.2 we introduce household behaviour and in section 3.3 we apply Hein his insight that equilibrium between domestic savings and investment can be used to determine the share of total profits retained by the firm. In section 3.4 we introduce the foreign sector, in sections 3.5 and 3.6 the central bank and the banking sector, respectively, and in section 3.7 the government sector. These sections are based on our earlier analysis presented in Meijers, Muysken and Sleijpen (2015), MMS form hereon. Finally, a summary of the stock and flow relations of the model is presented in section 3.8.

3.1 Firm behaviour and foreign investment

We follow Hein in modelling both firm behaviour and wage and price setting. However, we extend his model to allow for investment of retained profits in foreign assets and introduce indirect taxes.

As we elaborate below, the capital stock ($p.K$) is financed by firms using domestically accumulated retained earnings (E_f), equity issued to households (E_h), and loans at banks (L). Moreover, firms hold part of their retained earnings in foreign assets (E_a). This constitutes the balance sheet of firms presented in Table 1. The net worth of firms is $V_f = E_f + E_a$.

Table 1 Balance sheet of firms

ASSETS		**LIABILITIES**	
Capital	$+p.K$	Loans	$+ L$
Equity acquired	$+ E_a$	Equity issued	$+ E_h$
		Total (net worth)	$+ V_f$

Retained earnings follow from profits. Profits from production FP result by deducting the wage bill WB and indirect taxes $T_i = \tau_i.p.Y$ from nominal income $p.Y$. Hence:

$$FP = p.Y - WB - T_i \quad (1)$$

Price p, net of indirect taxes τ_i, is set as a mark-up m on unit labour cost.[7] Unit labour cost are defined as nominal wages w times the exogenous labour-output ratio a. Hence:

$$p.(1 - \tau_i) = [1 + m].w.a \quad (2)$$

Given the labour-output ratio, employment N follows from $N = a.Y$, where Y represents real output. The wage bill then follows from:

$$WB = w.N \quad (3)$$

Nominal wages are exogenous.[8] Substitution of equations (2) and (3) in (1) shows that a positive mark-up guarantees positive profits.

When calculating total profits FT, we should include the returns on foreign assets E_a, next to nominal income $p.Y$. The rate of return on foreign assets ρ_a is exogenously determined. Hence:

$$FT = FP + \rho_{a,-1}.E_{a,-1} \quad (4)$$

Part of the total profits is kept as retained earnings, FU, and the remaining part is paid out as dividend or interest payments. Retained earnings therefore are given by:

$$FU = FT - \rho_{-1}.E_{h,-1} - i_{L,-1}.L_{-1} \quad (5)$$

where i_L represents the rate of interest on loans L and ρ is the return on equity E_h, both are exogenously determined.[9]

The retained earnings FU also constitute firm's savings S_f. They are not set as a fixed proportion of total profits, as in MMS amongst others, but follow from the decision of the firm on how to use its savings as we elaborate in section 3.3 below. In Hein's model firm's savings are solely used to finance the capital stock. However, as we have seen in section 2 firms also invest their savings in foreign assets. Using Tobin's portfolio model, we model the distribution of firm's savings over foreign assets and investment in capital as dependent on the rates of return of both. Hence the share of retained earnings invested abroad fu_a is given by:

$$fu_a = \lambda_0 - \lambda_1.r + \lambda_2.\rho_a \quad (6)$$

The return on capital r follows from $r = FP/pK$ – we exclude returns on foreign investment from total profits, since the remaining part of profits is attributable to investment in capital.

In line with Hein's analysis, gross investment is determined by four variables. First management's animal spirits, represented by a coefficient θ_0 – a higher value will lead to more investment.[10] The second variable is the utilization rate $u = Y/Y^p$, where Y^p stands for potential output, which is related to capital by the capital output ratio v, such that $K = \kappa.Y^p$. In contrast to Hein, the utilisation rate is

[7] Hein assumes a positive impact of the rate of return on equity ρ on the mark-up, i.e. $m'(\rho) > 0$ – we leave this out for simplicity. However, we include indirect taxes, which are ignored by Hein, since he does not include government in his analysis.

[8] We ignore in this version of the model the determination of unemployment and its potential interaction with wage determination and social security expenditures. That is left for further research.

[9] We discuss later a possibility to endogenise the return on equity ρ.

[10] We also allow for depreciation, which reduces the value of θ_0.

considered relative to normal utilisation u* – see also Zezza (2008) and MMS.[11] The third variable is the domestic profit share $h = FP/pY$ – again we exclude returns on foreign investment since the remaining part of profits is attributable to investment in capital. Obviously, a higher utilization rate and a higher profit share will lead to higher investment. Finally investment is negatively influenced by the costs of external funding, represented by $\gamma.\rho$ where $\gamma = (E_h + L)/pK$ is the share of external funding of investment.[12] Therefore we find:

$$g = I/p.K = \theta_0 + \theta_1.(u - u^*) + \theta_2.h - \theta_3.\ \gamma.\rho \qquad (7)$$

Gross investment is financed by domestically retained earnings $(1- fu_a).FU$, equity issued to households ΔE_h and loans from banks ΔL. As we elaborate below, households are willing to hold a certain amount of equity at the rate ρ. Since we assume that firms are willing to issue this amount of equity in order to finance investment, ΔE_h is given for firms as a source of finance of their investments.[13] As a consequence firms will borrow the remaining funds needed for investment from banks, hence:

$$\Delta L = p.\Delta K - (1- fu_a).FU - \Delta E_h \qquad (8)$$

3.2 The behaviour of households

Regarding households, we do not follow Hein's structure, distinguishing between rentiers and wage earners, but maintain one household sector. However, in line with Hein, we ignore for simplicity the presence of housing and pension wealth. The impact of these latter two factors on household behaviour is elaborated extensively in MMS.

The financial portfolio of households is kept as simple as possible. For that reason we ignore the possibility for households to hold government bonds and assume that they only hold equity issued by firms (E_h) and bank deposits (M), next to money (H_h). The resulting balance sheet of households is presented in Table 2.

Table 2 Balance sheet of the household sector

ASSETS		**LIABILITIES**	
High powered money	+ H_h		
Bank deposits	+ M		
Equities	+ E_h		
		Total (net worth)	+ V_h

[11] One could argue that this implicit in the constant term of the investment function employed by Hein.

[12] Strictly speaking the rate of return ρ only refers to equity financing, while the rate of interest on loans, i_L, should also be taken into account. However, we only use ρ for simplicity.

[13] If firms would use retained profits to buy back equity ΔE_h could be negative, we will elaborate this option in a next version of the model. Moreover, given the preference for equity financing over borrowing from banks it is reasonable to assume that holds $\rho < i_L$.

In line with the literature – see MMS for a survey – demand for money H_h is a fraction of consumption and demand for assets M and E_h follows from a Tobin-type portfolio model.[14] Household wealth V_h is distributed over its assets components as follows:

$$H_h = v_1.p.C \quad (9)$$

$$E_h /(V_h - H_h) = \mu_0 - \mu_1.i_M + \mu_2.\rho - \mu_3.Y_{hd}/V_h \quad (10)$$

$$M = V_h - H_h - E_h \quad (11)$$

Here i_M refers to the interest on deposits and Y_{hd} refers to (nominal) disposable income of households. Due to the adding up constraint, bank deposits M are determined as a residual of household wealth V_h.[15]

The accumulation of household wealth follows from savings S_h by households. In line with equations (7) – (9), these savings are invested in the above mentioned assets:

$$S_h = \Delta V_h = \Delta H_h + \Delta M + \Delta E_h \quad (12)$$

Household savings are assumed to be a fraction s of disposable income of households Y_{hd}:[16]

$$S_h = s.Y_{hd} \quad (13)$$

The disposable income of households is found by deducting direct taxes paid by households T_d from household income Y_h. Hence:

$$Y_{hd} = Y_h - T_d \quad (14)$$

with

$$Y_h = WB + FB + \rho_{-1}.E_{h,-1} + i_{M,-1}.M_{-1} \quad (15)$$

$$T_d = \tau_d.Y_h \quad (16)$$

Where τ_d is the tax rate on income and *FB* are profits from the banking sector – the latter are distributed to the households as we explain in section 3.6. Finally, disposable income is either saved or consumed:

$$Y_{hd} = p.C + S_h \quad (17)$$

3.3 *Intermezzo: equilibrium between domestic savings and investment*

[14] Hein essentially assumes that households only hold equity as assets and therefore does not model any portfolio decisions.

[15] We ignore expectations here, but in a more elaborate version of the Tobin model, see for instance Godley and Lavoie (2007a), Zezza (2008) and MMS, demand for assets depends on expected returns, and demand for deposits then adjusts for mistakes in expectations, while expected demand for equity is realised.

[16] For simplicity we ignore here wealth effects and the impact of capital gains, which play an important role in a more elaborate analysis of household behaviour – see MMS.

In line with Hein's analysis, we look at the equilibrium between domestic savings and investment. In line with Hein's analysis domestic investment is given by equation (7), which we reproduce here:

$$g = I/p.K = \theta_0 + \theta_1.(u - u^*) + \theta_2.h - \theta_3.\gamma.\rho \quad (7)$$

We note that h is essentially determined by the exogenous mark-up: $h = (1 - \tau_i).m/(1 + m)$.

A crucial parameter in Hein his analysis is $\gamma = (E_h + L)/pK$ is the share of external funding of investment. Hein states that this share is given in the short run, but endogenously determined in the medium run by the equality between domestic savings and investment. Crucial here is the assumption that the medium run is characterised by steady state growth and hence a constant value for γ. We elaborate that notion for our analysis.

Domestic savings are given by $S = S_h + FU$ and are used to finance investment in capital. After some manipulation we find for the saving-capital rate:

$$\sigma = S/pK = [s.(1 - \tau_d)/m + 1]h.u/v + [s.(1 - \tau_d) - 1].\rho.\gamma' + \Phi.u/v \quad (18)$$

The structure of equation (18) is quite close to that used by Hein, with two exceptions, following from the introduction of a banking sector and investment abroad. The first exception is that Hein uses in equation (18) a similar variable $\gamma = (E_h + L)/pK$ as in equation (7), instead of $\gamma' = E_h/pK$ – the difference follows from the fact that firms in our model also borrow from banks. The second exception is the addition of $\Phi = \{s.(1 - \tau_d).i_{M,-1}.M_{-1} + (1- fu_a).(\rho_{ba}.E_{ba} - i_L.L_{-1})\}/Y$, which mainly follows from the fact that part of retained profits are invested abroad. In his analysis Hein $\Phi = 0$.

As Hein argues, stability of the model requires $\delta\sigma/\delta u > \delta g/\delta u$. This implies in our model:

$$[s.(1 - \tau_d)/m + (1- fu_a)]h/v + \Phi/v > \beta \quad (19)$$

The condition found by Hein imposes some restrictions on parameters which he derives analytically. However, given the presence of Φ and u_a, condition (19) is more complicated and parameter restrictions are hard to identify.

The simple structure of Hein his model allows him to derive the steady state value of g analytically. This also implies a certain value γ^* of γ, which he interprets as the equilibrium value of γ. That is, in Hein his model the share of external financing in investment γ^* is determined endogenously in the 'medium term', represented by a steady state solution of the model. Our version of the model cannot be solved analytically. However, we will calibrate the model such that a steady state value of g is found, together with a corresponding value of γ^*.

3.4 The foreign sector

The foreign sector is introduced in a simple way, following Godley and Lavoie (2007b). Next to consumption, investment and government goods, firms also produce net-exports ($X - IM$). This does not affect their balance sheet, however, nor does it affect their flow of funds. We assume exports X to be exogenous and imports IM to be proportional to GDP with a fraction im. Hence the trade balance is given by:

$$TB = X - IM = X - i_m.p.Y \quad (20)$$

Initially Godley and Lavoie do not discuss terms of trade and exchange rate issues. Here, we follow their ignorance of these issues – partly motivated by the knowledge that a lot of trade by the Netherlands is within the euro area.

Since foreigners hold bonds (B_{ba}) issued by banks, as we discuss in section3.6, these appear as assets in the balance sheet of the foreign sector. The liabilities of the foreign sector consist of foreign equity held by domestic firms and by foreign reserves (R) held by the Central Bank. Changes in these foreign reserves occur because of net exports and financial transfers due to dividends payments out of equity and interest payments on bonds, as we discuss in section 3.5. The balance sheet of the foreign sector is given in Table 3 below.

Table 3 Balance sheet of the foreign sector

ASSETS	**LIABILITIES**
Bonds (B_a)	Equity (E_a) Foreign Reserves (R) Total (net worth) (V_a)

The trade balance is part of foreign savings *Sa*, together with dividends paid to domestic firms on their foreign investment $\rho_a.E_a$ and interest received on bonds issued by domestic banks $i_a.B_a$:

$$S_a = i_{a,-1}.B_{a,-1} - TB - \rho_{a,-1}.E_{a,-1} \quad (21)$$

These savings deplete the foreign reserves held by the domestic Central Bank, taking into account bonds acquired from domestic banks net of equity issued to domestic firms:

$$\Delta R = \Delta B_{ba} - S_a - \Delta E_a \quad (22)$$

As Godley and Lavoie (2007b) emphasize, there is no inherent mechanism for a country with a trade surplus to converge to a balanced current account, as long as it is willing to accumulate ever more foreign debt. This situation is quite relevant for the Netherlands as is elaborated in MMS.

3.5 The Central Bank

Foreign reserves are assets in the balance sheet of the Central Bank. Following MMS we ignore the complications which follow from the fact that the euro area, including the Netherlands, is controlled by the European Central Bank and not by a National Central Bank – but including a Central Bank balance sheet is necessary for a proper modelling of the financial sector and the consistency of our analysis. We will use the 'neutral' term Central Bank in our analysis and refer to the ECB whenever appropriate.

Next to holding foreign reserves, the Central Bank provides advances (*A*) to banks and holds bills issued by the government, (B_c). The liabilities are high powered money (*H*) issued by the Central Bank, which is held by the public and banks. Since the revenues of the Central Bank (*FC)* are transferred to the government, the balance sheet of the Central Bank is closed without remaining net worth. As a consequence, the Central Bank balance sheet now looks as presented in Table 4.

Table 4 Balance sheet of the Central Bank

ASSETS	**LIABILITIES**
Advances to Banks (*A*) Treasury Bills (B_c) Foreign Reserves (R)	High powered money (H)

In line with MMS, ZDS, Zezza and Godley and Lavoie (2007a) we assume that supply of bills by the government is cleared by the Central Bank.[17] Also the Central Bank provides as much high powered money as is demanded by banks and households. As a consequence, the amount of advances provided by the Central Bank accommodates the demands from the other sectors:

$$\Delta A = \Delta H - \Delta B_c - \Delta R \qquad (23)$$

The revenues of the Central Bank are given by:

$$FC = i_{A,-1}.A_{-1} + i_{B,-1}.B_{c,-1} \qquad (24)$$

Here i_B is the rate on government bills set by the Central Bank, and i_A is the interest rate on advances. The latter is set as a mark-up on inflation such that the real interest rate on advances is a constant.[18]

3.6 The bank balance sheet

In line with common practice – see for instance ZDS – and our earlier analysis, the assets on the bank balance sheet contain the following items: High powered money (H_b) and Loans to firms (*L*). Liabilities are Bank deposits (*M*), Central Bank advances (*A*) and Bonds issued abroad (B_a).[19] The latter

[17] Obviously this is a simplifying assumption since the ECB is not allowed to do this. However, Draghi's famous statement that he will do "everything" to protect the Eurosystem against speculation comes close to this notion.

[18] This is in line with the assumptions of ZDS, Zezza and MMS. In a later version of the model we will introduce a Taylor rule and also experiment with a zero nominal interest rate.

[19] If we compare this to the simplified balance sheet of an ordinary bank, we note that interbank lending is ignored – this is a reasonable simplification. The latter also holds for simplification that banks are assumed not to hold treasury bills ($B_b=0$ – all bills are held by the Central Bank). Finally mortgages are ignored, the impact of mortgage lending on the deposit financing gap is elaborated in MMS.

recognises that banks finance their assets by borrowing from the financial sector, which we model by issuing bonds abroad.[20]

The profits of the banking sector are

$$FB = i_{L,-1}.L_{-1} - i_{M,-1}.M_{-1} - i_{A,-1}.A_{-1} - i_{ba,-1}.B_{ba,-1} \quad (25)$$

These profits are distributed to the households – we interpret these as bonus payments in excess of normal wages.[21] As a consequence banks are assumed to have no net worth. The resulting balance sheet is presented in Table 5.

Table 5 Balance sheet of the banking sector

ASSETS	**LIABILITIES**
Cash (H_b)	Deposits (M)
Loans to firms (L)	Advances Central Bank (A)
	Bonds (B_{ba})

With respect to banking behaviour we assume that for issuing deposits banks need to meet the reserve requirement:

$$H_b = v.M \quad (26)$$

The demand for loans by firms is fully accommodated by banks at a rate which is a fixed mark up on the rate on advances.

On the liabilities side, banks accumulate deposits held by households and advances provided by the Central Bank. The remaining gap is financed by borrowing from abroad. Bonds are available from the foreign sector at a relatively high rate, in principle to an unlimited amount.[22] Thus the following relationship does hold:

$$L/M = (1 + a - v) + B_{ba}/M \quad \text{or} \quad \Delta B_{ba} = \Delta L - (1 + a - v).\Delta M \quad (27)$$

Hence when deposits don't change, the increase in loans to firms should be financed by borrowing abroad.

With respect to the pricing decisions, we assume that the interest rate on deposits i_M is set as a fixed mark-up on the rate on advances i_A set by the Central Bank. The rate of loans to firms i_L is set as a fixed mark-up on the interest rate i_{Bba} paid for bonds issued abroad. Endogenising these mark-ups

[20] Bonds represent here all sources of outside financing. That banks borrow exclusively abroad is a simplifying assumption, which however emphasizes the stylized fact of strong foreign exposure of the Dutch financial sector elaborated in MMS.

[21] We ignore retained profits which can contribute to internal funds.

[22] This was the case till recently. In the current situation the foreign sector is rationing the available amount of credit, and the European Central Bank provides an unlimited amount of advances.

consistent with the analysis of Godley and Lavoie (2007a, Ch. 10) is left for further research. It seems reasonable to assume:[23]

$$i_A < i_M < i_{Bba} < i_L \quad (28)$$

3.7 The government

Government expenditures G are proportional to output, in line with ZDS. As a consequence growth in government expenditures is equal to output growth

$$g_G = g_{y,-1} \quad (29)$$

Taxes are proportional to the relevant bases as we discussed in equations (1) and (15) for value added and income taxes, respectively. The budget balance, together with profits from the Central Bank *FC* minus interest paid on government bonds $i_B.B_c$, constitute government savings S_g:

$$S_g = Ti + Td + FC - p.G - i_B.B_c \quad (30)$$

These savings, which usually are negative, are financed by supplying bills to the Central Bank, as discussed in section 3.5:

$$\Delta B_c = - S_g \quad (31)$$

Accumulated government debt therefore equals B_c, which is also the financial net worth of government.

3.8 The structure of the full model

The full model is summarized in Tables 6 – 8 in Appendix B. One aspect of the model is to present the consolidated balance sheet for the economy in Table 6. This balance sheet combines the balance sheets presented in Tables 1- 5 above. In order to close the model we assume (as discussed above) that firms close their balance sheet by borrowing from banks, realized bank deposits by households close the household balance sheet and that bonds issued by banks abroad (B_{ba}) close the bank balance sheet. Finally the Central Bank accommodates treasury bills (B_c) to clear the market for these bills and clears its own balance sheet by issuing advances.

Another way of looking at the structure of the model is to construct the social accounting matrix – see Table 7. This matrix presents a consistent schedule of all flows between sectors.

Value added in the production sector is obtained by producing consumption goods, government goods, net exports and accumulation of capital. The proceedings are paid to households as wages (WB), to firms as profits (*FT*) and to the government as indirect taxes (*Ti*). The profits of the firms, net of interest payments on loans to banks ($i_L.L$), are distributed to households as dividends (*FD*) or retained (*FU*). Retained profits constitute firm savings.

[23] Since positive profits imply $FB = [i_L.(1 + a - v) - i_M - i_A.a].M + (i_L - i_{ba}).B_{ba} > 0$, a sufficient condition is: $i_L.(1 + a - v) > i_M + i_A.a$.

Next to income from wages and dividends, households obtain interest on their deposits and government bills and get the remaining profits from banks. They use their income for consumption, income tax (*TD*). The remaining part of their income is saved.

Banks obtain interest income from loans to firms and pay interest on advances from the Central Bank, deposits held by households and bonds issued abroad. The remaining profits are presented to households in the form of bonus payments.

The foreign sector obtains income from imports by domestic and interest payments from domestic banks. This income is sent on exports and dividends paid out to domestic firms. The remaining part is saved.

Finally Table 8 shows in which way savings are accumulated (upper half) and invested (lower half). This provides a slightly different way of looking at the interrelations of the model.

4 A simplified version of the model

In section 3.3 we demonstrated that the model cannot be solved analytically, but we have to resort numerical solutions. Our experience with solving a SFC model in MMS has taught us that this type of models is highly complicated given the many interactions following from the flows between the various sectors and the dynamics between stocks and flows. To make sure that we understand the working of the model properly, we therefore prefer to start from a simple model and add complications along the way.

Inspired by the observation that the banking sector only plays an indirect role when one focuses on firm savings, as we discussed in section 1.2 above, we prefer to start with a version of the model without an explicit banking sector. An obvious starting point is Hein his model, which also doesn't have a banking sector. However we have added three important elements in our full model described above which we want to preserve (1) the recognition that firms do not only use retained profits for investment purposes, but also to invest in financial assets abroad; (2) obviously this also requires a foreign sector, which can lend to both firms and government, to compensate the current account surplus of the country; (3) a government which borrows from both households (rentiers) and the foreign sector to finance its budget deficit. The main features of this model can be understood from the balance sheet, social accounting matrix and allocation of savings, presented in Tables 9 -11 in the Appendix B. The full model is presented in the Appendix A.

5 The simulation results

In the base run we assume an exogenous growth of exports of 5% and no productivity growth. The parameters values are chosen to reflect the Dutch situation in those cases for which information was available. However, the parameter values of the behavioural equations of firms (investment function and share of assets abroad) and of rentiers (portfolio model) have been calibrated to find a reasonable outcome. Moreover, data on the various types of wealth also have been calibrated. The

simulation results are quite sensitive to the initial values of wealth. For that reason we would like to emphasise that the base run of the model does not fully describe a steady state but leads to constant growth rates for most of the important variables. Since the simulation results are presented relative to the base run, they illustrate the working of the model and lead to some interesting insights.

After initial fluctuations, the base run shows an output growth of 5% from period 1000 onwards,[24] a government deficit of 2% of GDP and a trade balance surplus fluctuating between 1 and 4% of GDP. Unfortunately the share of external funding in investment, γ, is not stable but declining slowly. This implies that we are not in the steady state described by Hein – see also section 3.3 above.

We simulated two shocks to the model, both affecting the share of retained earnings abroad fu_a. This share is given by equation (6) above, which we reproduce here:

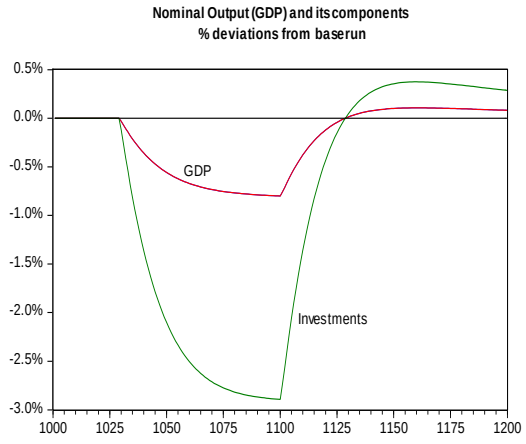
$$fu_a = \lambda_0 - \lambda_1.r + \lambda_2.\rho_a \qquad (6)$$

A higher return on capital r leads to more investment of retained earnings in physical capital, a higher rate of return on foreign equity ρ_a implies more investment of retained earnings in foreign assets.

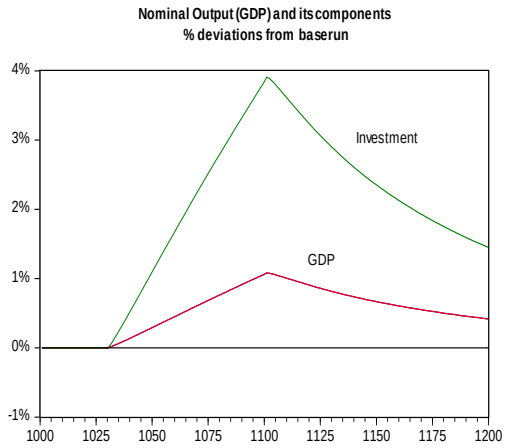
Our first simulation is an increase in the affinity to invest abroad (animal spirits), λ_0, for the period 1030 – 1100. This will increase fu_a over that period. As a contrast we investigate in our second simulation the impact of an increase in the rate of return on foreign equity, ρ_a, for the period 1030 – 1100. This will also increase fu_a over that period. The impact of both shocks to output growth and investment growth are presented in Figure 11.

Figure 11 Output and investment growth

a increased affinity to invest abroad



b increased return on foreign equity



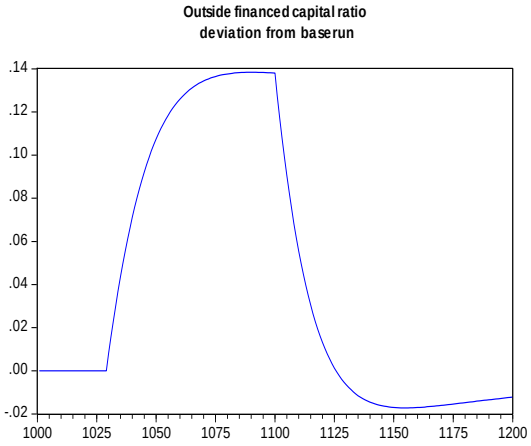
As one might expect, the increased affinity to invest abroad leads to lower investment since a higher share of retained earnings is invested abroad. The latter increases the share of outside financed capital, which has a negative impact on investment – cf. equation (7). This also leads to lower GDP growth. Moving to the second simulation, depicted in Figure 11b, it is therefore at first sight

[24] This is not primarily due to the export growth of 5%. Also for lower rates of export growth the model shows a growth rate of output of 5%.

surprising to find that an increase in the rate of return on foreign equity, which also increases the share of retained earnings invested abroad, leads to higher investment and GDP growth. The reason is that total profits also increase, see equation (4) above, because of a higher income from foreign assets. These increased profits are partly used to finance investment and thus reduce the need for outside financed capital, leading to an increase in investment. This is also illustrated in Figure 12. From the figure one sees that following an increased affinity to invest abroad, the share of external funding in investment has increased. The reason is that less retained profits are available for investment; hence more external funding is required. However, as can be observed from Figure 12 b, this is does not happen in the case of an increased return in foreign equity, because retained profits have increased.

Figure 12 Share of external funding in investment

a increased affinity to invest abroad



b increased return on foreign equity

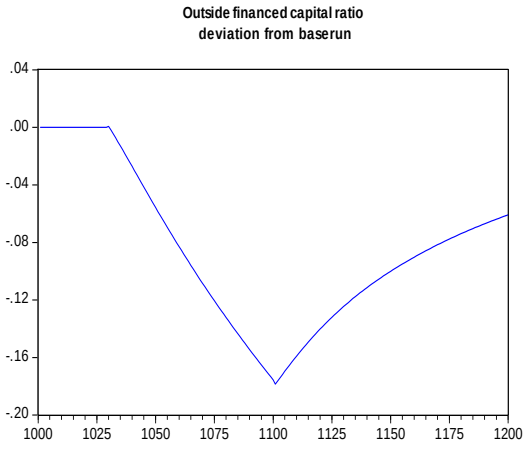
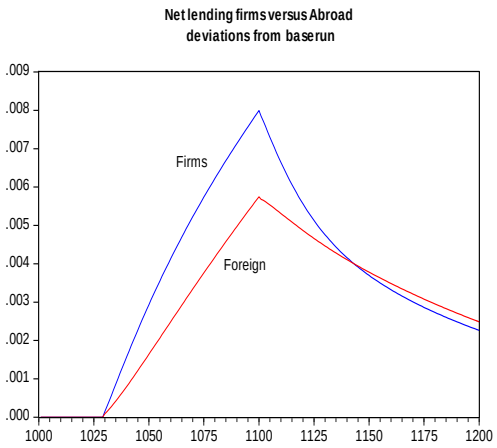
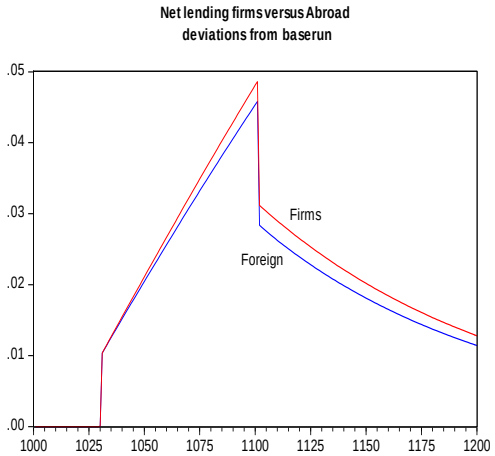


Figure 13 Net lending of firms and net lending abroad

a increased affinity to invest abroad



b increased return on foreign equity



As one might expect in both cases the net lending of firms abroad has increased because of the increased share of retained profits invested abroad. The impact is much stronger in the case of

increased return on foreign equity, as can be seen from Figure 13 b, because both the share of retained profits have increased and retained profits themselves. Interestingly enough, net lending abroad, mimics the net lending of firms in both cases, which is consistent with the stylised fact we observed for the Netherlands.[25] One should also realise that in both cases net lending abroad increases, although the balance of trade moves in opposite directions in line with the movement of GDP. To understand this latter phenomenon, we reproduce net lending abroad from equation (21), adapted to the simplified model, in the equation below:

$$-S_a = TB + \rho_{a,-1}.E_{a,-1} - i_{a,-1}.B_{fa,-1} - i_{a,-1}.B_{ga,-1} \qquad (21')$$

Since in the first simulation GDP decreases, the trade balance increases and net lending abroad increases. In the second simulation, GDP increases and hence the trade balance decreases. However, net lending abroad increases because the returns on foreign investment, $\rho_{a,-1}.E_{a,-1}$, increase more strongly than the decrease in the balance of trade.

6 Concluding remarks

We observed for the Dutch economy that net private savings have increased over time. However, contrary to popular belief this is not due to a strong inclination to save by Calvinistic households, but due to increased retained profits by firms which are invested abroad instead of in physical capital domestically. To explain this phenomenon, we have developed a stock-flow consistent model to incorporate the notion that firms invest a considerable part of their retained profits abroad. This model can also be used to explain the stylised fact for the Netherlands that net savings of firms move closely in line with net foreign savings.

The simulation results with the model show that the presence of a considerable amount of foreign assets held by firms can lead to large capital inflows, compensating the capital outflows due to a balance of trade surplus. However, we have also learned from the simulation experiments that a more careful calibration of the model is needed to obtain a complete steady sate solution in the base-run. That is left for further research. Moreover, the current model has been simulated while ignoring the interaction with the financial sector. Incorporating the financial sector in the simulation is another challenge left for further research. This holds in particular for extending the model to endogenise the rate of returns on equity and the interest rates on the financial markets.

[25] This can also be understood when one considers the net firm savings as defined in Table 11, which are $S_f - I = +\Delta E_a - \Delta B_{fa} - \Delta E_r$. The net savings abroad are - $S_a = +\Delta E_a - \Delta B_{fa} - \Delta B_{ga}$.

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Appendix A The simplified model of firm savings

Firm

Production structure

potential real output	Yp=K/p_v
growth rate real capital stock	gc = K/K(-1)-1
nominal stock of capital	Kn = p*K
demand for labour	N = Yc * p_a
utilisation rate	u = Yc/Yp
nominal output	Y = Ctot + I + Gov + Tb
real output	Yc=Y/p

Price setting

nominal wage rate (exogenous)	w = p_w
price level (mark-up p_m)	p=(1+p_m)*w*p_a

Profits and firm savings

total wage bill	Wb = w*N
gross nominal profits (excl. Fab)	Fp = Y - Wb
gross profit rate	h = Fp/Y = 1- 1/(1+p_m)
rate of profit	r = Fp/Kn = h*u/p_v
dividend payments from abroad to firms	Fa = p_rhoa(-1) * Ea(-1)
total profits firms	Ft = Fp + Fa
dividends to rentiers	Fd = p_rho(-1) * Er(-1)
retained profits firms (total savings)[26]	Sf =Ft-Fd-p_ibfa(-1)*Bfa(-1)

share of Sf invested in equity abroad[27]

Sfar = p_lambda0 - p_lambda1 * r + p_lambda2 * (p_rhoa-p_ibfa)

[26] We check that always Sf > 0.

[27] We assume Sfr <= 1, which implies that firms will in the aggregate not borrow in order to invest abroad. However, Sfr <0 is possible because firms can dissave, although dissavings can never exceed the stock of equity invested abroad.

amount of Sf invested in equity abroad	Sfa = Sfar * Sf
changes in firm equity held abroad	dEa = Sfa
stock of firm equity held abroad	Ea = Ea(-1) + dEa
amount of Sf invested in capital[28]	Sfi = (1-Sfar) * Sf
retained profits invested in Kn	dEf = Sfi
inside financed stock of capital	Ef = Ef(-1)+dEf

Investment and its financing

desired growth rate of Kn[29]

g = p_alpha + p_beta*(u(-1)-p_unorm) + p_tau*h - p_theta*p_rho*gamma

gross investment	I = g*Kn(-1)+ p_delta*Kn(-1)

financing of investment comes from part of retained profits, from equity issued to rentiers (dEr) and the remaining part by bonds abroad

stock of firm bonds held abroad	Bfa = Bfa(-1) + dBfa
financing of investment	dBfa = I - Sfi - dEr
outside finance-capital ratio	gamma = (Er + Bfa)/ Kn
development nominal capital stock	Kn =(1-p_delta)*Kn(-1) + I
wealth of firms	Vf = Kn + Ea - Er - Bfa

Consumers

Workers

workers total income	Yw = Wb
income taxes workers	Tw = p_tp* Yw
workers disposable income	Ydw = Yw – Tw
consumption of workers households	Cw = Ydw

[28] We require Sfar to be such that Sfi > I.
[29] We require g > - p_delta.

Rentiers

rentiers income	Yr = Fd + p_ibg(-1)*Bg(-1)
income tax rentiers	Tr = p_tp* Yr
disposable income rentiers	Ydr = Yr - Tr
consumption of rentiers households	Cr = (1-p_sr)*Ydr
savings of rentiers	Sr = p_sr*Ydr
wealth of rentiers	Vr = Vr(-1) + Sr
portfolio distribution rentiers[30]	ErVr = p_mu0 - p_mu1 *p_ibg + p_mu2 * p_rho
equity held by rentiers	Er = ErVr * Vr
change in that stock of equity	dEr = Er - Er(-1)
remaining part is in government bills	Bg = Vr - Er
change in rentiers stock government bills	dBg = Bg - Bg(-1)
total consumption	Ctot= Cw + Cr

Government

growth of government expenditures equal growth nominal capital stock

Gov = Gov(-1) * (1+g)

total tax income	Ttot = Tw + Tr
government income comes only from taxes	Yg = Ttot
government savings	Sg = Ttot - Gov - p_ibg(-1)*Bg(-1) - p_ibga(-1)*Bga(-1)
deficit	Gdef = - Sg
government debt financed by rentiers[31]	dBg = Gdef
remaining debt financed abroad	dBga = Gdef - dBg

[30] Rentiers put their savings in equity issued by firms and government bonds. We assume that in both cases there is sufficient demand.

[31] This is assumed to be large enough to meet rentiers demand.

government bills held abroad	Bga = Bga(-1) + dBga
government debt	Gd = Bg + Bga
wealth of government	Vg = -Bg – Bga

Foreign sector

exports	X = X(-1) * (1 + p_gx)
imports	IM = p_im * Y
trade balance	Tb = X - IM
income	Ya = p_ibfa(-1)*Bfa(-1) + p_ibga(-1)*Bga(-1)
foreign wealth	Va = Bga – Ea + Bfa
foreign savings	Sa = Ya - Tb – Fa

Closure of the model

Total savings	S = Sr + Sf + Sg + Sa
Equilibrium	S = I (redundant)

Appendix B Balance sheets and Accounting Matrices

Table 6. Balance Sheets

	Households	**Firms**	**Banks**	**Central Bank**	**Government**	**Foreign**	**Total**
High powered money	$+ H_h$		$+ H_b$	$- H$			*0*
Central Bank advances			$- A$	$+ A$			*0*
Bank deposits	$+M$		$-M$				*0*
Loans		$- L$	$+ L$				*0*
Bills				$+B_c$	$-B_c$		*0*
Capital		$+ p \cdot K$					$+ p \cdot K$
Bonds			$- B_a$			$+ B_a$	*0*
Equities	E_h	$E_a - E_h$				$-E_a$	*0*
Foreign Reserves				$+R$		$-R$	*0*
Total (net worth)	$+ V_h$	$+ V_f$	*0*	*0*	$-B_c$	$+V_a$	$+V_t$

Table 7. Social Accounting Matrix

	Prod.	**Households**	**Firms**	**Banks**	**Central Bank**	**Government**	**Capital Account**	**Foreign**	**Total**
1. Production		$+ p \cdot C$				$p \cdot G$	I	$X - IM$	$p \cdot Y$
2. Households	$+ WB$		$+ FD$	$+ i_m M + Fb$					$+ Yh$
3. Firms	$+ FP$							$+ FA$	$+ FT$
4. Banks			$+ i_l L$						$+ Yb$
5. Central Bank				$+ i_a A$		$+ i_{bc} B_c$			$+ Yc$
6. Government	$+ Ti$	$+ Td$			$+ Fc$				$+ Yg$
7. Capital Account		$+ Sh$	$+ FU$	*0*	*0*	$+ Sg$		$+ Sa$	S
8. Foreign				$+i_{ba} B_a$					$+Ya$
TOTAL	$+ p \cdot Y$	$+ Yh$	$+ FT$	$+ Yb$	$+ Yc$	$+ Yg$	I	$+Ya$	

Table 8. Accumulation and investment of savings

	Households	Firms current	Banks	Central Bank	Government	Foreign	Total
Consumption	- p·C	+p.C+p.G			-p·G		0
Investment		+I					I
Net exports		+X - IM				-(X – IM)	0
Wages	+WB+Fb	-WB	-Fb				0
Taxes	-Td	-Ti			+Td +Ti		0
Interest Advances			$-i_a.A$	$+i_a.A$			0
Interest Deposits	$+ i_mM$		$- i_mM$				0
Interest Loans		$-i_lL$	$+ i_lL$				0
Interest Bills				$+i_{bc}.Bc$	$-i_{bc}.Bc$		0
Interest Bonds			$-i_{ba}.Ba$			$+i_{ba}.Ba$	0
Dividends Firms	+FD	+FA-FD		- Fc	+Fc	-FA	0
Savings	S_h	S_f (FU)	0	0	S_g	S_a	S
High powered money	$+ \Delta H_h$		$+ \Delta H_b$	$- \Delta H$			0
ΔDeposits	+ΔM		-ΔM				0
ΔAdvances			-ΔA	+ΔA			0
ΔLoans		-ΔL	+ΔL				0
ΔBills				$+\Delta B_c$	$-\Delta B_c$		0
ΔBonds			$-\Delta B_a$			$+\Delta B_a$	0
ΔEquity	$+\Delta E_h$	$+\Delta E_a - \Delta E_h$				$-\Delta E_a$	0
ΔReserves				+ΔR		-ΔR	0
ΔCapital		+ I					+ I

Table 9 Simplified Balance Sheet

	Rentiers	**Firms**	**Government**	**Foreign**	**Total**
Bills	$+B_g$		$-B_g - B_{ga}$	$+B_{ga}$	*0*
Capital		$+ p \cdot K$			$+ p \cdot K$
Equities	E_r	$E_a - E_r$		$-E_a$	*0*
Bonds		$-B_{fa}$		$+B_{fa}$	
Total (net worth)	$+ V_r$	$+ V_f$	$+V_g$	$+V_a$	$+V_t$

Table 10 Simplified Social Accounting Matrix

	Prod.	**Workers**	**Rentiers**	**Firms**	**Government**	**Capital Account**	**Foreign**	**Total**
1. Production		$+ C_w$	$+C_r$		*G*	*I*	*X - IM*	*Y*
2. Workers	*+ WB*							$+ Y_w$
3. Rentiers				$+ F_d$	$+ i_{bg}B_g$			$+Y_r$
4. Firms	$+ F_p$						$+ F_a$	$+ F_t$
5. Government		$+ T_w$	$+T_r$					$+ Y_g$
6. Capital Account			$+S_r$	$+ S_f$	$+ S_g$		$+ S_a$	*S*
7. Foreign				$+i_{bfa}B_{fa}$	$+i_{bga}B_{ga}$			$+Y_a$
TOTAL	*+ Y*	$+ Y_w$	$+Y_r$	$+ F_t$	$+ Y_g$	*I*	$+Y_a$	

Table 11 Accumulation and investment of savings in the simplified model

	Workers	Rentiers	Firms current	Government	Foreign	Total
Consumption	$-C_w$	$-C_r$	$+C_w+C_r+G$	$-G$		0
Investment			$+I$			I
Net exports			$+X-IM$		$-(X-IM)$	0
Wages	$+WB$		$-WB$			0
Taxes	$-T_w$	$-T_r$		$+T_w+T_r$		0
Interest Bills/Bonds		$+i_{bg}.B_g$	$-i_{bfa}.B_{fa}$	$-i_{bg}.B_g-i_{bga}.B_{ga}$	$+i_{bfa}.B_{fa}+i_{bga}.B_{ga}$	0
Dividends Firms		$+F_d$	$+F_a-F_d$		$-F_a$	0
Savings	0	S_r	S_f	S_g	S_a	S
ΔBills/ΔBonds		$+\Delta B_g$	$-\Delta B_{fa}$	$-\Delta B_g-\Delta B_{ga}$	$+\Delta B_{fa}+\Delta B_{ga}$	0
ΔEquity		$+\Delta E_r$	$+\Delta E_a-\Delta E_r$		$-\Delta E_a$	0
ΔCapital			$+I$			$+I$

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