



UNITED NATIONS
UNIVERSITY

UNU-MERIT

Working Paper Series

#2016-067

**The impact of quantitative easing in the Netherlands:
A stock-flow consistent approach
Huub Meijers and Joan Muysken**

Maastricht Economic and social Research institute on Innovation and Technology (UNU-MERIT)

email: info@merit.unu.edu | website: <http://www.merit.unu.edu>

Maastricht Graduate School of Governance (MGSoG)

email: info-governance@maastrichtuniversity.nl | website: <http://www.maastrichtuniversity.nl/governance>

Boschstraat 24, 6211 AX Maastricht, The Netherlands

Tel: (31) (43) 388 44 00

UNU-MERIT Working Papers

ISSN 1871-9872

**Maastricht Economic and social Research Institute on Innovation and Technology
UNU-MERIT**

**Maastricht Graduate School of Governance
MGSoG**

UNU-MERIT Working Papers intend to disseminate preliminary results of research carried out at UNU-MERIT and MGSoG to stimulate discussion on the issues raised.



The impact of Quantitative Easing in the Netherlands: a stock-flow consistent approach^{*}

Huub Meijers^a, Joan Muysken^b

Maastricht University

<version 7-12-2016>

Abstract

The Netherlands is a prosperous, small open economy with a large financial sector and a trade balance surplus. Current observations suggest that the quantitative easing (QE) initiated by the ECB has a strong impact on the financial sector and international capital flows, while the impact on economic growth is relatively weak in the Netherlands. We analyse these stylised facts using the stock-flow consistent (SFC) approach which builds on earlier work.

We develop an open economy SFC model for the Netherlands with an elaborated financial sector, including pension funds which invest to a large extent abroad, and recognise that firms invest a considerable part of their financial assets abroad. This enables us to explain that the direct effects of QE are relatively small due to substantial foreign selling of Dutch government bonds and recapitalisations of the financial sector. The indirect effects of QE are much stronger. They influence the economy through low interest rates and exchange rate appreciation, but have unintended consequences through increased housing prices and asset prices – the latter two are endogenous in our model.

We calibrate the model to mimic the observed stylised facts for the Netherlands and perform some policy experiments.

JEL Code: E44, B5, E6, F45, G21, G32

Key words: stock-flow consistent modelling, quantitative easing, current account surplus

^{*} We thank Olaf Sleijpen as well as the participants of the MIE-IPE seminar in Berlin (in particular Eckhard Hein and Arthur Tassarow) and the participants of the 20th Conference of the Research Network Macroeconomics and Macroeconomic Policies (FMM) in Berlin for many useful comments; the responsibility for possible errors remains with the authors.

^a Department of Economics, SBE, Maastricht University; UNU-MERIT.

^b Department of Economics, SBE, Maastricht University; UNU-MERIT, CofFEE-Europe.

Corresponding author: j.muysken@maastrichtuniversity.nl

1. Introduction

After the financial crisis in 2008 the Netherlands experienced a double-dip recession, in line with the Euro Area developments. Fiscal policy was dominated by concerns about government debt and aggravated the recession (de Grauwe and Yi, 2013; Stiglitz, 2016). Alarmed by these developments the ECB, and many central banks world-wide, have been following an expansionary monetary policy. However, the effects were very limited – growth in the Euro Area lagged behind that of the UK and the US. Moreover inflation continued to fall. As a desperate measure the ECB resorted to a policy of quantitative easing in 2015, long after the FED in the US and the Bank of England followed similar policies. In the Netherlands president Klaas Knot of De Nederlandsche Bank (DNB) was opposed to this measure and warned repeatedly against adverse effects to the Dutch economy (DNB, 2016b). The effects are on the one hand too high a mortgage burden for the already highly indebted households and too much debt for firms which are also highly indebted relatively to the Euro Area average. On the other hand the low interest rate poses problems for pension funds because of the increased liabilities, since these liabilities are discounted at the market interest rate. It also poses problems for banks and insurance companies because their profits decreased considerably due to the low interest margin.

A fascinating observation is that although the ECB has been injecting almost 8 per cent of GDP on an annual basis in the economy since early 2015, largely through the DNB, the effects are hardly visible in terms of higher growth and inflation in the Netherlands. The reasons for this are not yet well identified and the present paper intends to contribute to an analysis of the absent impact of QE. Our analysis will be based on the stock flow consistent approach, summarised in Godley and Lavoie (2007a), which promises a very interesting way to model the interaction between the monetary and the real sphere in a coherent framework. The explicit role of balance sheets and portfolios of financial assets of the various sectors in the model, together with the detailed impact of wealth effects on consumption, enables us to identify the impact of QE in detail. For instance the negative effects mentioned by DNB (2016b) which we summarised above can be explained from our analysis. We also identify the danger of a new house price bubble.

We have developed an open economy stock-flow consistent model, with a separate banking sector and government, in Meijers, Muysken and Sleijpen (2015) – MMS (2015) from hereon. In this paper we add a pension fund which invests to a large extent abroad, see also MMS (2014), and recognise that firms invest a considerable part of their financial assets abroad (MMS, 2016). This enables us to explain on the one hand the abovementioned phenomena observed for the Dutch situation and on the other hand that QE is not effective because most of the impact of QE leaks away – it either leaks away abroad or remains within the financial sector with no discernible impact on the real economy.

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. However, as is the case with most stock-flow consistent models this model is analytically intractable and its properties can only be analysed numerically. For that reason the model is analysed in section 4 by means of numerical simulations in order to reproduce the stylised facts for the Netherlands discussed above. In particular we focus on the channels through which QE leaks away to the financial sector and abroad. Section 5 concludes.

1.1 Survey of the literature¹

Quantitative Easing (QE) is a policy of purchasing assets (bonds), financed by central bank reserves, to stimulate aggregate demand (nominal spending).² The literature distinguishes between various channels through which QE is supposed to affect the economy. Next to a direct channel, resulting from an increase in money supply, there is also the portfolio rebalancing channel, induced by a rebalancing of portfolios by the private sector and a more favourable exchange rate. That is “asset purchases should lead to an increase of the prices of government bonds ... the implied rise in the value of portfolios and the lower cost of external finance should lead to a boost in consumption and investment spending in the economy.” (Bridges and Thomas, 2012, p. 5). Finally, Dunne, Everett and Stuart (2015) also mention the signalling channel, affecting expectations. We elaborate these channels below.

Transmission channels of QE

The direct effect of the QE policy follows from the central bank buying bonds from banks without a repurchase agreement, i.e. the bank does not have to repurchase the bonds. The banks then are supposed to use their increased bank reserves to increase lending and thus stimulate the economy (McLeay et al., 2014).³

The majority of the bonds will not be purchased directly from banks. In the domestic case the central bank buys assets from pension funds and banks will simply act as intermediary (Gros et al., 2015).^{4,5} Although the transaction in this way leads to increased money supply, the main impact of this transaction on the economy, if any, will be through increasing bond and equity prices, i.e. the portfolio rebalancing channel (Valiante, 2015).⁶ The empirical evidence with respect to the impact of this channel on investment, consumption and GDP growth is rather mixed – for two contrasting views see Gern et al. (2015) and Gagnon (2016).

An important aspect of the purchases in the secondary bonds market is that many assets are held abroad. For instance Valiante (2015) points out that the majority of eligible assets is held by non-banks in France and Italy as far as Euro Area countries are concerned. Next to that a large amount of

¹ This survey closely follows Muysken (2016).

² In the case of the Euro Area QE is represented by the expanded asset purchase programme and the vast majority of this programme will under the public sector purchase programme (PSPP) “through which bonds issued by euro area central governments, agencies and European institutions will be purchased in secondary markets.” (Dunne, Everett and Stuart, 2015, p. 70).

³ “...banks cannot directly lend out reserves. Reserves are an IOU from the central bank to commercial banks. Those banks can use them to make payments to each other, but they cannot ‘lend’ them on to consumers in the economy, who do not hold reserves accounts. ... the newly created reserves do not, by themselves, meaningfully change the incentives for the banks to create new broad money by lending.” (McLeay et al., 2014, p. 12)

⁴ However, one should realise that “There is a widespread view that banks will be the largest (potential) sellers of government securities to the ECB. But this remains to be seen. At any rate, banks did not hold large amounts of government bonds in the US and, to a lesser extent in the UK. In these two countries, the central banks thus bought the bonds from non-bank institutions, with banks being only intermediaries.” (Gross et al., 2015, p.7).

⁵ “In the UK most sales came from pension funds and other non-bank financial intermediaries. This might have been the result of a combination of moral suasion by the Bank of England on pension funds to sell at least part of their large holdings and the regulatory reasons for commercial banks to keep their holdings of government debt.” (Bridges and Thomas, 2012, p.8)

⁶ Valiante also stresses the importance of the signalling channel.

eligible assets is held outside the Euro Area. This might also be an important source of leakages countering the direct impact of the QE impulse as we elaborate below.

The signalling channel also works mainly through the foreign sector – see Lavoie and Daigle (2011) for an interesting analysis of expectations on exchange rate movements using balance sheets and a stock-flow consistent model.

From the literature we identify two types of leakages of the QE bond purchases which negatively affect the money shock or the stimulation of the economy: (i) effects which impair bank lending; and (ii) purchases of bonds from non-residents. Next to that we identify (iii) indirect effects following from low interest rates and exchange rates. We discuss these briefly.

Leakages which impair bank lending

Bridges and Thomas (2012) identify two effects of QE which worsen bank lending for the UK. The first effect is that banks use the favourable conditions to recapitalise themselves, i.e. issuing more equity (which for simplicity is assumed to be held by pension funds). In that case no money is created, in spite of the QE operation by the ECB. According to Bridges and Thomas (2012) the reparation of bank balance sheets implies a leakage of about 30 per cent of QE in the UK.

When discussing the second effect Bridges and Thomas (2012) observe for the UK that it is implausible that QE increased the supply of credit through the money multiplier.⁷ In their view it is more plausible that the demand for credit increased as a result of QE, for instance by private non-financial institutions (i.e. firms) issuing bonds and equity to pay down bank debt. This process accelerated the shift in the UK from bank finance to the capital markets. Bridges and Thomas (2012) find that the acceleration of the shift from bank finance to the capital markets implies a leakage of another 8 per cent.⁸

For both effects we could not find relevant figures for the Netherlands, but one should take into account that banks and pension funds in the Netherlands have a huge foreign exposure as we elaborate below.

Leakages resulting from buying bonds abroad

The purchase of domestic bonds held by non-residents is briefly discussed by Bridge and Thomas (2015) as a potential leakage of QE. However, they do not find any significant leakage from bond sales abroad. The preliminary findings on the current situation in the Euro Area are quite different and work mainly through the Intra Euro System Balances (Target2).

The most obvious purpose of Target2 is to facilitate cross-border payments resulting from importing and exporting goods and services. However, the purchase of domestic bonds held by non-residents will also influence Target2.⁹ In that respect Westermann (2016) elaborates on two mechanisms through which the Target2 balances are affected by QE: cross-border bond transactions and capital

⁷ This is in line with McLeay et al. (2014) who emphasise the intermediary function of banks and therefore categorically argue against a misconception of QE as facilitating the money multiplier.

⁸ Cizel et al. (2016) point out that the latter shift is also due to more intensive macro-prudential policy, which is focussed on the banking sector. They argue in favour of extending the policy beyond banking.

⁹ This point is elaborated extensively in Muysken (2016) who also surveys the discussion on Target2 imbalances initiated by Sinn and Wollmershäuser (2011).

flight. As for the first mechanism central banks purchase bonds from foreign as well as domestic holders. For instance, if the Bundesbank purchases a German bond from an Italian pension fund and this investor – after selling the bond – keeps the liquidity in Italy, this creates Target-2 balances. What actually happens is that the Bundesbank acquires bonds by increasing its liabilities to the Target2 system, but since the liquidity is kept in Italy, foreign banks can pay back advances to the foreign central bank.

Interestingly, Westermann observes that “Weidmann [the president of the Bundesbank] concluded that this changes the interpretation of Target-2 balances away from a signal of financial market tension towards a direct effect of QE”.¹⁰ A similar conclusion can be found in DNB (2016a), who point out that it was the funding stress of banks following the capital flight which led to the tensions in 2012. However, DNB (2016a) also observes that it is highly implausible that the Italian pension fund will keep the liquidity in Italy, also when Italian bonds are bought by the Banca d’Italia. As a consequence QE leads to a new wave of capital flight, when the domestic bond holder uses the acquired liquidity to buy foreign assets.¹¹ This mechanism is explicitly discussed by Minenna (2016).¹²

In the examples above we focussed on transactions within the Euro Area. However, the leakage effect of buying domestic bonds by national central banks can also happen outside the Euro Area. In that case the exchange rate will also be affected which leads to important secondary effects as we discuss below.

Indirect effects resulting from a low interest rate and exchange rate

Obviously QE is accompanied by a low interest rate which stimulates the economy through its positive impact on consumption and investment. As we already mentioned above DNB (2016b) points at the dangers of a mortgage burden for the households and too much debt for firms. Moreover the low interest rate poses problems for pension funds because of the increased liabilities, since these liabilities are discounted at the market interest rate. It also poses problems for banks because their profits decreased considerably due to the low interest margin.

An additional effect is that QE will lead to a depreciation of the Euro. The resulting impact of QE on the exchange rate is widely observed to be highly relevant for the Euro Area through its stimulating impact on net exports (Gros et al., 2015).

¹⁰ Actually Weidmann gave the example of Banca d’Italia buying Italian government bonds from a German resident. The resulting increase in Target2 assets for Germany then is not an indication of funding stress in Italy, opposite to the case in 2012.

¹¹ “If the Banca d’Italia purchases the bond domestically, and the previous bondholder uses the money to buy a house in Berlin, this will drive up Target-2 balances. The condition is that the previous house owner keeps the liquidity in the country and does not balance the transaction, for instance, by buying real estate in Italy.” Westermann (2016)

¹² “A new source of capital flows has emerged and become the primary driver of Italy Target2 negative net balance: a shift in Italy’s private non-banking sector from government and banking bonds to foreign shares and mutual funds.”(Minenna, 2016).

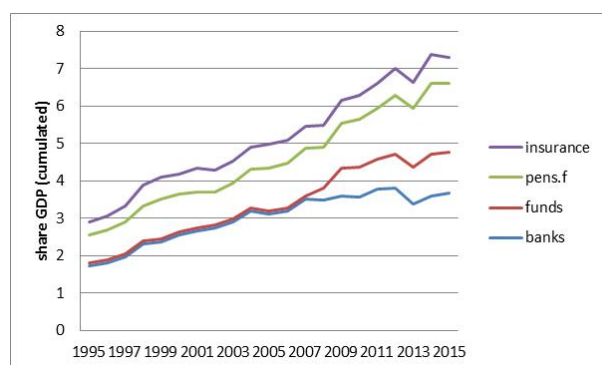
2. *The Dutch economy and quantitative easing in the Netherlands, some stylised facts*

In this section we present stylised facts for the Netherlands which will influence the choice of the sectors in our model, the composition of the balance sheet of each sector and the flows between the sectors. We will discuss the financial institutions in section 2.1, households, firms and government in section 2.2 and the foreign sector in section 2.3. We then conclude with a description of the role and potential impact of quantitative easing in section 2.4.

2.1 *Financial Institutions*

From Figure 1 one observes that the Netherlands has a very large financial sector compared to European standards: that is the assets of the Dutch financial sector are currently over 700 per cent of GDP whereas the average in the Euro Area is below 500 per cent. As is elaborated in Bezemer and Muysken (2015) this is mainly due to the presence of large pension funds (and investment funds, as we elaborate below).¹³

Figure 1 Total assets of financial institutions¹⁴
(relative to GDP, cumulated), 1995 – 2015



Source: DNB statistics

From the composition of the financial sector presented in Figure 1, one observes that the size of the banking sector (banks – MFIs in statistical terms) increased relative to GDP, from below 200 per cent in 1998 till above 350 per cent in 2008. However, after the financial crisis in 2008 it has stagnated around that level. Interestingly enough, this stagnation has initially been compensated by the increasing importance of investment funds (funds), which took over the role of banks in asset management for pension funds and households. Together total assets of banks and funds are at a level of almost 500 per cent of GDP.

The remaining part of the financial sector consists of pension funds and insurance companies, which together have increased consistently relative to GDP, from 150 per cent of GDP in 1998 to about 250 per cent in 2015. Given their importance for the financial sector in the Netherlands, we discuss the banking sector (MFIs) and the pension funds in more detail below.

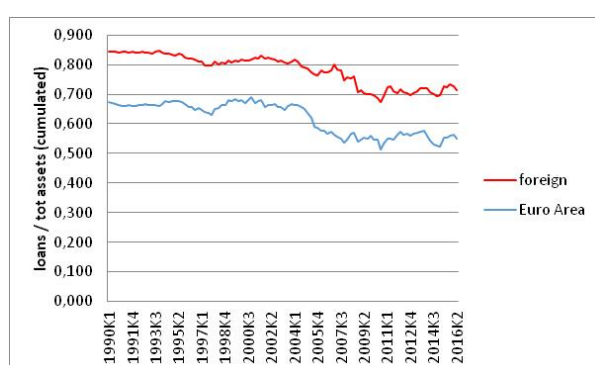
¹³ We ignore the so-called special financial institutions (SFI) which comprise both a large shadow banking sector and many companies (“brievensbus firma’s”) that are established in the Netherlands for tax reasons. The total assets (and liabilities) of these institutions vary in recent years between 500 and 600 per cent of GDP – see Bezemer and Muysken (2015) and CPB (2016) for concerns on the impact of these institutions on the financial system.

¹⁴ The fluctuations in the various statistics are due to definition changes.

The banking sector

The assets of MFIs mainly consist of loans as appears from Figure 2. These loans comprise around 70 per cent of total assets and the majority is issued within the Euro Area. In Figure 3 one observes that the total of outstanding loans is not covered by deposits.¹⁵ This is a manifestation of the so-called “deposit financing gap”. As we elaborate in MMS (2015) this gap poses a considerable problem for banks because outstanding debt is insufficiently matched by deposits, whereas other funding possibilities of banks have increasingly been constrained. In that case banks have to resort to foreign funding which is much more volatile and relatively expensive. About 20 per cent of foreign liabilities is borrowed outside the Euro Area.

Figure 2 Assets banking sector (MFI)
(cumulated), 1990:I – 2016:II



Source: DNB statistics

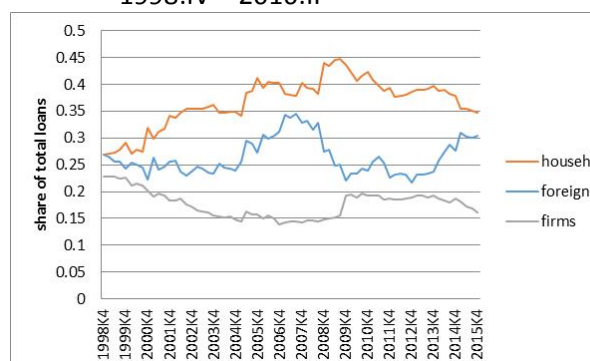
Figure 3 Loans and deposits of banks
1990:I – 2016:II



Source: DNB statistics

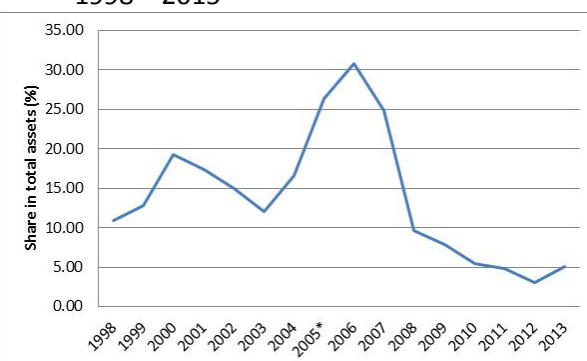
As appears from Figure 4, over 35 per cent of loans consists of mortgages (“househ”); loans to firms cover almost 20 per cent and abroad (“foreign”) between 25 and 30 per cent. As is elaborated in Bezemer and Muysken (2015) banks prefer to issue mortgages to households, which are considered to be safe investments and there is much discussion in the Netherlands that in particular small and medium sized firms are being discriminated against (credit squeeze). The relatively large share of loans abroad reflects the open orientation of the banking sector and the recent increase indicates capital flight from Southern Europe as we discuss in section 1.1.

Figure 4 Distribution of loans of banks
1998:IV – 2016:II



Source: DNB statistics¹⁶

Figure 5 Net open position of shares in banks
1998 – 2015



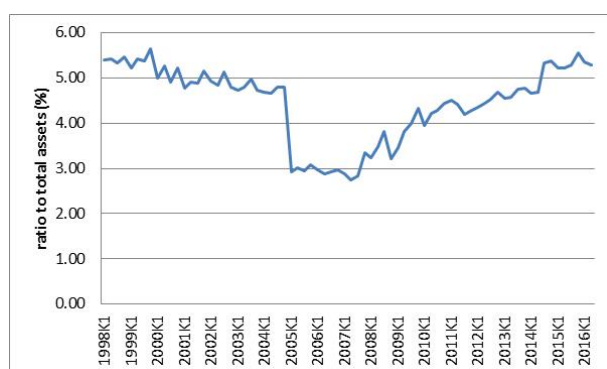
Source: DNB statistics

¹⁵ Deposits should be understood here to include savings accounts and related accounts.

¹⁶ The distribution of loans presented in the financial stability indicators has been supplemented with SPVs.

Banks also hold financial assets, partly for trading purposes and partly related to asset management. From Figure 5 one might conclude that accumulating financial assets by banks for trading purposes has decreased dramatically after the financial crisis.¹⁷ Also asset management has been taken over by investment funds as we elaborate below. A final observation relates to liabilities. After the financial crisis the capital ratio of banks has increased consistently till 2014 – see Figure 6. It is remarkable that this ratio has not increased further in the last years.

Figure 6 Capital ratio of MFIs, 1998:I – 2016:II¹⁸

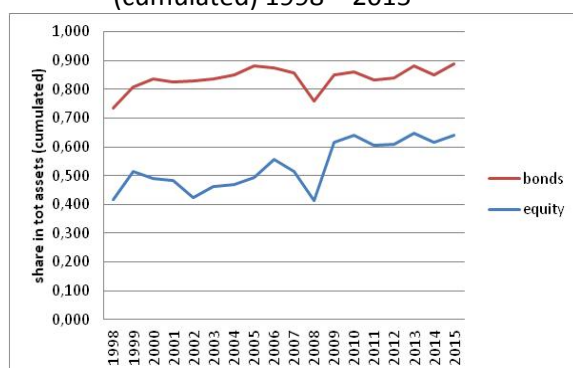


Source: DNB statistics

Pension funds

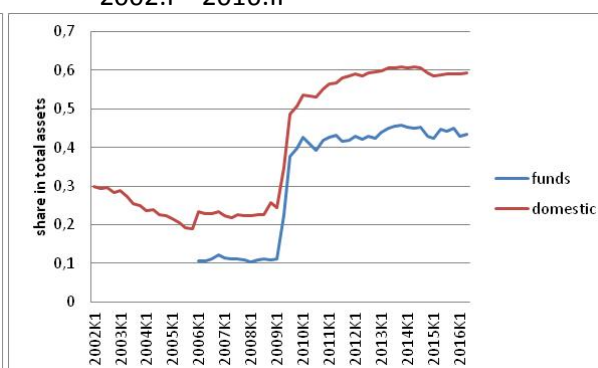
The Netherlands has a funded pension system according to which wage earners (and employers) are obliged to contribute to their pension fund by paying a premium based on their wage. When retiring, the pensioners receive a pension benefit. As a consequence the Netherlands has a very large pension sector.¹⁹ For that reason we elaborate the structure and problems of the pension funds below.

Figure 7 Composition assets pension funds²⁰ (cumulated) 1998 – 2015



Source: DNB statistics

Figure 8 Domestic share assets pension funds 2002:I – 2016:II



Source: DNB statistics

¹⁷ In this context one should realise that the banking sector in the Netherlands essentially consists of four large banks. Three banks have been bailed out after the financial crisis and two of these banks are still (dominantly) state owned.

¹⁸ The shift in 2004 is due to a change in definition as well as the jump in 2014.

¹⁹ Also the majority of the insurance consists of life insurances, which have a financing structure which is quite similar to that of pension funds.

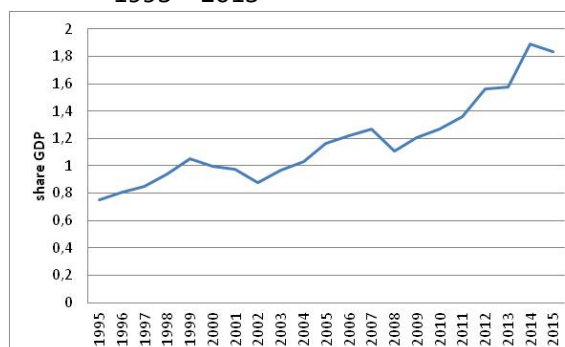
²⁰ The dip in 2008 is due to the fall in share prices. Since GDP growth dropped from 3.7 per cent in 2007 to 1.8 per cent in 2008 and – 3.8 per cent in 2009 this does not explain the sharp increase after 2008.

The composition of assets of pension funds is presented in Figures 7 and 8. As is illustrated in Figure 7 the share of equity in total assets of pension funds increased consistently over time – for a further discussion of the historical development see Bezemer and Muysken (2015). As we already discussed above, from 2009 onwards a substantial part of the portfolio of pension funds is handled by investment funds: the corresponding assets appear as equity on the balance sheet of pension funds. However, only 20 per cent of the portfolio of investment funds consists of bonds – hence equity remains dominant on the pension funds’ balance sheet.

Another characteristic of the assets of pension funds is the foreign exposure, as appears from Figure 8. Till 2008 the share of domestic assets of pension funds decreased till below 25 per cent of total assets. The increase till 60 per cent after 2008 is due to the introduction of investment funds, which are registered domestically. However, investment funds only invest about 20 per cent of their assets domestically. As a consequence indirectly the share of foreign assets remains about 75 per cent of the total assets of pension funds.

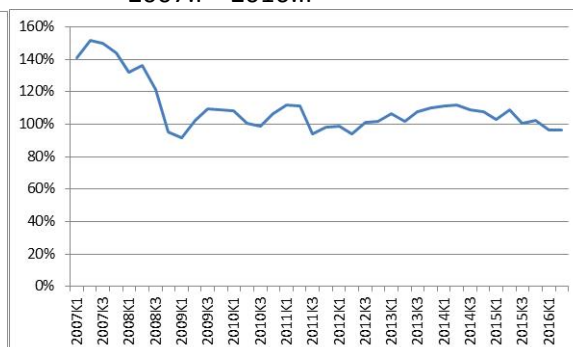
The liabilities of the pensions sector are predominantly liabilities to households. One should realise that future liabilities of pension funds are discounted at the market interest rate. This implies that a decrease in the interest rate then leads to higher liabilities on the balance sheet of the pension fund. Thus the low interest rate from 2008 onwards explains why the liabilities of the pension funds have increased dramatically after the financial crisis: from 120 per cent of GDP in 2007 to 180 per cent in 2015 – see Figure 9. As a consequence the reserve ratio of pension funds has fallen below the critical threshold of 110 per cent in recent years. This forced pension funds to increase contributions and decrease benefits. It also initiated a debate about the desirability and the nature of the funded pension system.

Figure 9 Liabilities pension funds
1995 – 2015



Source: DNB statistics

Figure 10 Reserve ratio pension funds
2007:I – 2016:II



Source: DNB statistics

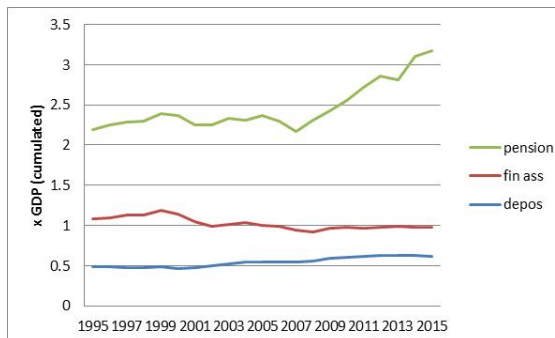
2.2 Households, firms and government

Next we present stylised facts on the balance sheets of households, firms and government.

Households: pension claims and the deposit financing gap

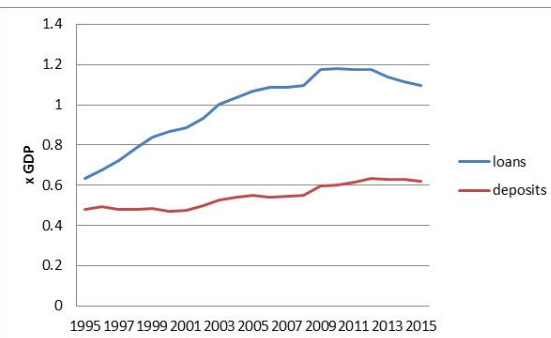
Ignoring homeownership, the assets of households consist of deposits, financial assets and claims on pension funds and life insurance – see Figure 11. The financial assets decreased to 40 per cent of GDP.²¹ This is consistent with the decrease in voluntary individual savings, which is related to the increase in housing prices as explained in MMS (2015). The forced savings due to the funded pension system contributed to large pension claims – over 100 per cent of GDP prior to 2008. The sharp increase in these claims (including life insurances) after 2008 follows from the low interest rate as we discussed above.

Figure 11 Assets households
(cumulated), 1995 – 2015



Source: CBS statistics

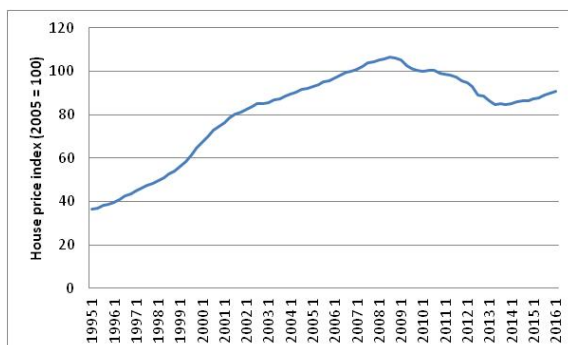
Figure 12 Liabilities households (and deposits)
1995 – 2015



Source: CBS statistics

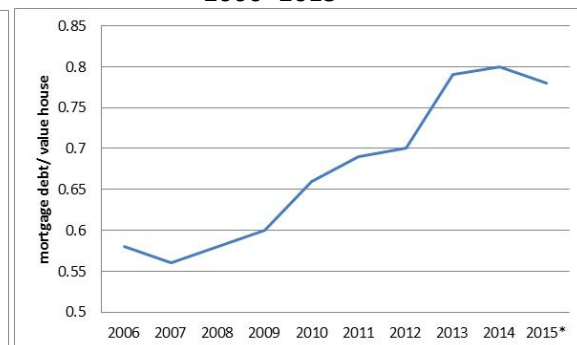
The liabilities of households consist predominantly of mortgages. Figure 12 reflects the increased mortgage burden, since loans consist predominantly of mortgages issued by banks. We also added deposits held by households to illustrate the deposit financing gap discussed above. The increase in the mortgage burden reflects increased house prices. Between 1995 and 2008 these prices increased by 250 per cent as can be seen from Figure 13. As we explain in MMS (2015) this reflects both the eagerness of banks and other financial institutions to provide mortgages and tax advantages which

Figure 13 House prices, 1995:I – 2016:II



Source: CBS statistics

Figure 14 Mortgage debt/value house
2006 -2015



Source: CBS statistics

²¹ Only 20 per cent of these assets are financed through investment funds – hence we ignore this for households.

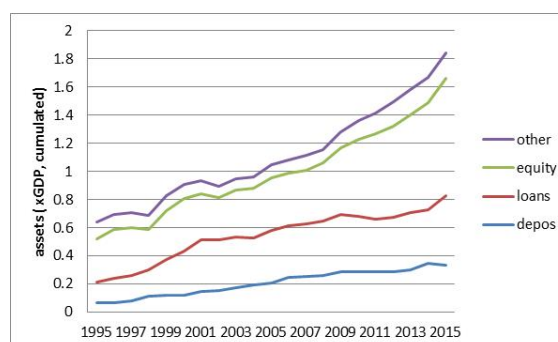
allow interest payments on mortgages to be deducted from pre-tax annual income. The house price bubble did burst after the financial crisis and house prices decreased after 2007. However, house prices started to increase again in 2013 fuelled by the low interest rates (and stagnating supply of new houses). DNB (2016b) is consistently warning against the potential dangers of low interest rates as we mentioned in section 1. This warning is also illustrated in Figure 14: the mortgage debt relative to the value of the house for house-owners with a mortgage has increased from 56 per cent in 2007 to 78 per cent in 2015. This increase reflects the decrease in house prices which started in 2007. In spite of the recent rebound of house prices, 32 per cent of all households in the Netherlands had a mortgage debt larger than the value of the house in 2016, compared to 13 percent in 2007.

A remarkable feature is that on the one hand households on average have a large mortgage debt, mainly held by banks, and on the other hand have a large claim on pension funds – compare Figures 11 and 12. An important issue in the discussion on the potential reforms of the funded pension system is to look for ways to net these assets and liabilities out, at least partially.

Firms: savings are invested in financial assets

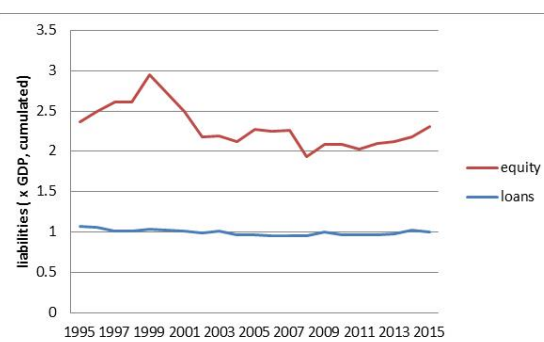
In a simple model of the economy the assets of firms consist of physical capital and deposits at banks and firm savings are invested in physical capital. However, from Figure 15 one observes that a considerable part of firm savings are invested in financial assets, both equity and loans. Moreover, the majority of these savings is invested abroad – see MMS (2016) for a further discussion.²² The financial liabilities of firms consist mainly of loans and equity – see Figure 16.

Figure 15 Financial assets firms
(cumulated), 1995 – 2015



Source: CBS statistics

Figure 16 Liabilities firms
(cumulated), 1995 – 2015



Source: CBS statistics

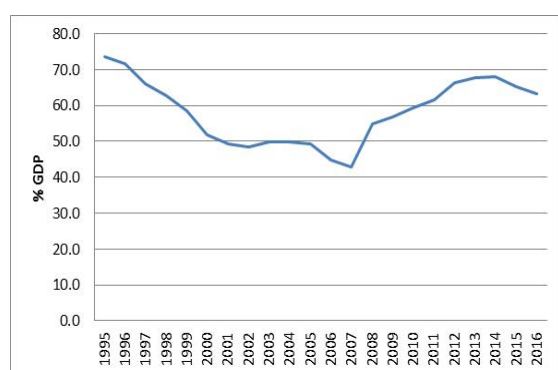
The majority of firm financial assets are held by multinational corporations and not by the small and medium firm enterprises. Bezemer and Muysken (2015) point out in that context that a dichotomy exists between these two types of firms. For the multinationals holds for instance that non-financial assets covered around 175 per cent of the value added over the period 2000 -2014, while the financial assets increased from 450 per cent in 2000 to 800 per cent in 2012.

²² Hardly any of these assets are financed through investment funds – hence we ignore this for firms.

Government: borrows mainly abroad

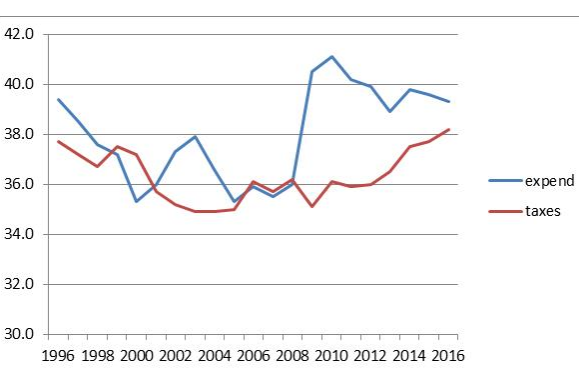
As in most countries government debt increased sharply after the financial crisis, partly due to the working of the automatic stabiliser and also to the bailing out of banks – see Figure 16. Government reacted by decreasing expenditures and increasing taxes as appears from Figure 17. Although one might argue that this exacerbated the recession and hence had an adverse effect on government debt,²³ debt started to decrease relative to GDP after 2014. In section 1.1 we discuss the question to

Figure 16 Government debt, 1995 – 2016



Source: CPB

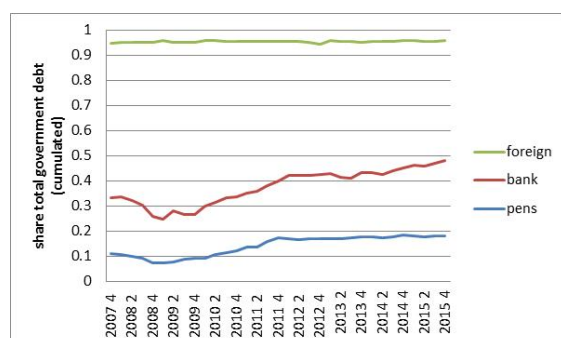
Figure 17 Expenditures and taxes, 1996 – 2016



Source: CPB

what extent the policy of quantitative easing by the ECB might have played a role. Finally an important observation is that the majority of government debt is held abroad – see Figure 18. The major domestic holders of bonds are banks and pension funds.

Figure 18 Holdings of government debt, 2007:IV – 2015:IV



Source: CBS statistics

2.3 The foreign sector

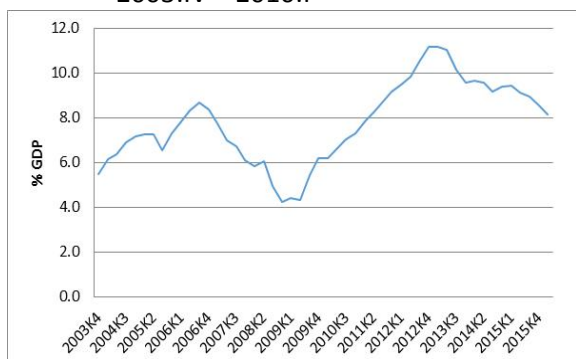
The Netherlands traditionally has a current account surplus. However, in recent years this has increased to unprecedented heights, above 10 per cent – see Figure 19. The recent fall to 8 per cent is due to lower profitability of firms (non-financial institutions): they generated less return on their foreign assets and also distributed considerably less profit to their foreign companies (DNB, 2016c).

An interesting observation is that when the cumulated current account surplus is compared to the net foreign asset position of the Netherlands strong divergences can be noted as appears from Figure 20. The difference between both lines should be attributed to valuation losses and gains on net

²³ See de Grauwe and Yi (2016) and Stiglitz (2016).

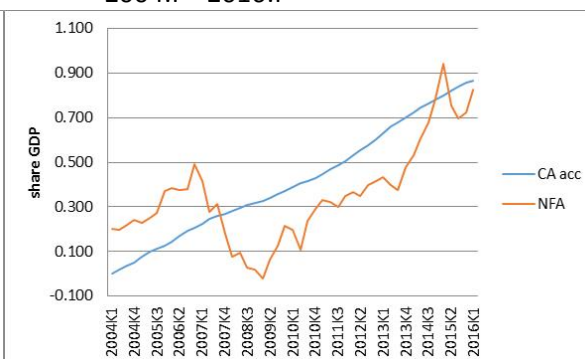
foreign assets. The dramatic fall in share prices in 2007 explains the decline in net foreign assets relative to the accumulated current account balances, whereas the recent increase in share prices explains the opposite development.

Figure 19 Current account surplus
2003:IV – 2016:I



Source: DNB statistics

Figure 20 Accumulated current account surplus
2004:I – 2016:I



Source: DNB statistics

From Figure 20 one also notes that net foreign assets are about 80 percent of GDP. Actually net external debt is reasonably close approximated by the net positions of securities plus direct investment (including SFIs). However, the SFIs are mainly related to direct investments, with a counterpart in securities (debt) and net out more-or-less. As a consequence we have a closer look at net direct investment (excluding SFIs) and net securities.

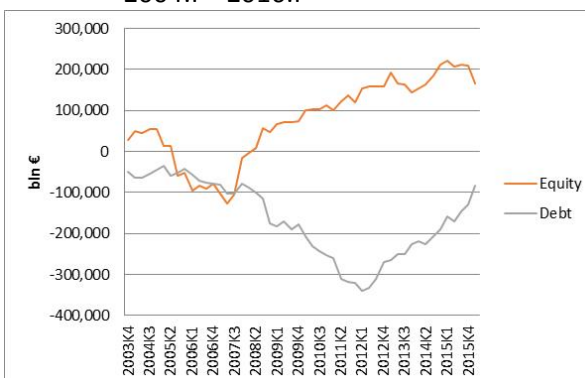
Net direct investments excluding SFIs have increased over time (both at market value and at book value) – see Figure 21. The net direct investments can also be mergers and take-overs (at too high a price – cf what happened in 2007). A remarkable occurrence is the stagnation in the period 2010 – 2014, followed by a sharp increase in 2015. From Figure 22 one observes that net securities have increased consistently (partly reflecting increased firm savings). An interesting development is the reversal in net debt (compensating the stagnation in direct investment in the period 2010 - 2014).

Figure 21 Net direct investment (excl. SFIs)
2003:IV – 2016:I



Source: DNB statistics

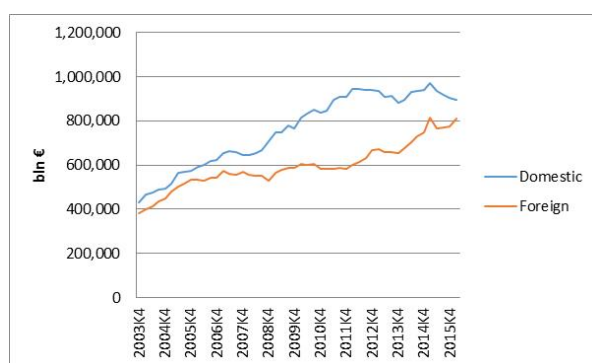
Figure 22 Net securities and net debt (excl. SFIs)
2004:I – 2016:I



Source: DNB statistics

The reversal in debt is due to stagnating foreign demand for domestic debt (domestic), while domestic demand for foreign debt (foreign) increases consistently – see Figure 23. The recent fall in foreign demand for domestic debt can probably be attributed to DNB buying domestic debt.

Figure 23 Domestic and foreign debt, 2007:IV – 2015:IV



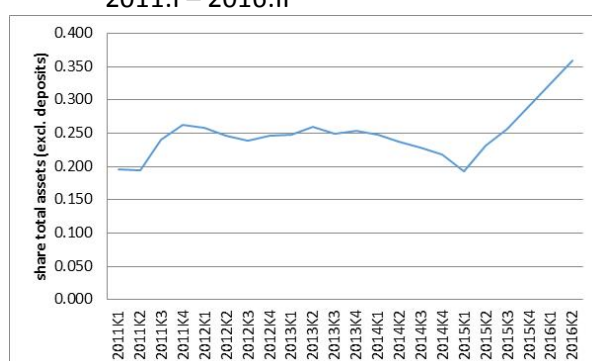
Source: DNB statistics

2.4 The impact of Quantitative Easing

As is elaborated in Muysken (2016) the QE operations are mainly carried out under the responsibility of the National Central Banks. That is each NCB buys bonds issued by its own government on the secondary market, according to the share of the various countries in the ECB's capital. However, the related profits (and risks) are not borne according to capital share, but accrue to the National Central bank.

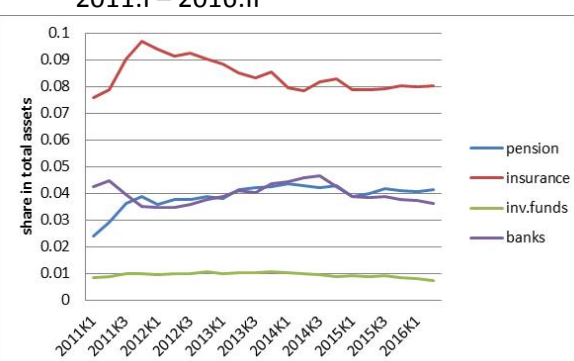
From Figure 24 one observes how the DNB started to issue government debt from 2015:I onwards. However, as Figure 25 illustrates, none of the financial institutions decreased the share of government debt in their portfolios.²⁴ The increase in government debt on the balance sheet of the ECB over the period 2015:I – 2016:II is € 39.758 bln, about 6 per cent of GDP, while the debt held by pension funds, insurance companies and investment funds over that period did not decrease – it increased even by € 1.254 bln. This illustrates that the intended direct impact on financial sector cannot be observed.

Figure 24 Government bond holdings DNB 2011:I – 2016:II



Source: DNB statistics

Figure 25 Government debt held by sectors 2011:I – 2016:II



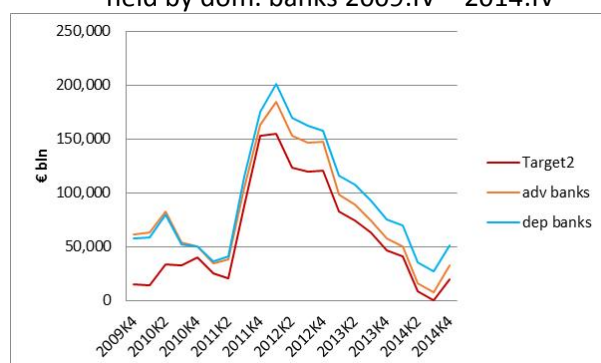
Source: DNB statistics

Taking a broader perspective, total assets of the DNB soared after the financial crisis. One observes from Figure 26 how after 2011 this was driven by the increase in Target2 balances – the main component of advances to banks issued by DNB (“adv banks” in the figure). The increase in Target2

²⁴ The share of the banking sector is for all Euro Area government debt.

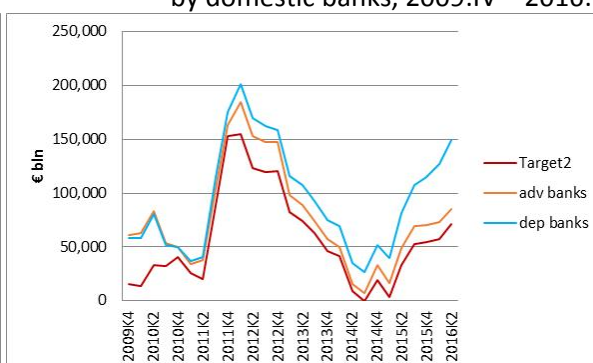
balances is a result from the capital flight from Southern Europe, as we discussed in section 1.1 – see also DNB (2016a). Effectively the foreign sector transferred money to the domestic banks, increasing their positions in those banks, at the expense of increased liabilities towards DNB, which appear as increased reserves (“Target2”) on the asset side of DNB’s balance sheet. The domestic banks in turn increased their deposits at DNB (or paid back advances), which appears as liabilities (“dep banks”) on the balance sheet of DNB. After the situation calmed down in 2014 we observe a new surge in Target2 balances coinciding with the QE programme from the first quarter in 2015 onwards. This phenomenon is further analysed in Figure 27.

Figure 26 Target2 balances and net deposits held by dom. banks 2009:IV – 2014:IV



Source: DNB statistics

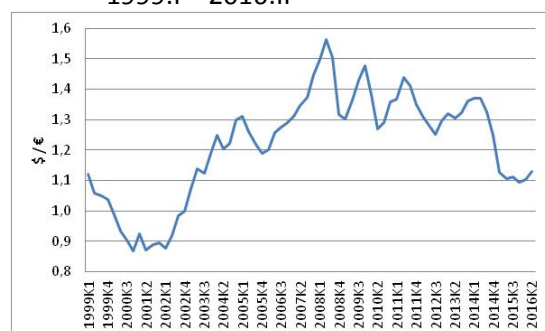
Figure 27 Target2 balances and net deposits held by domestic banks, 2009:IV – 2016:II



Source: DNB statistics

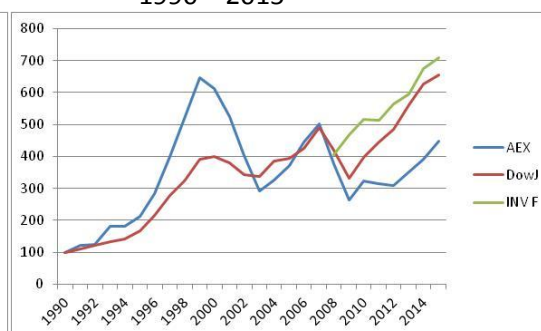
As can be seen from Figure 26 deposits of domestic banks (“dep banks”), liabilities at DNB, follow Target 2 closely till 2015 – this is consistent with the capital flight from Southern Europe. An interesting observation then is the growing gap between deposits of domestic banks from 2015 onwards – see Figure 27. This gap is filled by government bonds acquired by the DNB – see also Figure 24 above. As we explain in section 3.2 this is consistent with foreign selling of domestic bonds to DNB and replacing this by positions held at the domestic banks. In that case the deposits banks hold at DNB equal Target 2 balances plus government bonds held by DNB. We will also explain when we discuss QE in our model in section 3.2 that the increase in Target2 balances after 2015:1 can be interpreted again as capital flight: the extra funds made available abroad through QE by foreign central banks is invested domestically.

Figure 28 The exchange rate (\$/€) 1999:I – 2016:II



Source: DNB statistics

Figure 29 Stock indices 1990 – 2015



Source: DNB statistics

The indirect effects of QE appear through the various channels discussed in section 1.1, i.e. the mortgage burden for households and the development of house prices, the debt of firms and the decreased reserve ratio for pension funds. Two aspects which we have not presented yet are the depreciation of the Euro, which can be observed from Figure 28, and the increase in stock prices. The latter is presented in Figure 29 for the Dow-Jones index, the AEX index and from 2008 onwards returns on investment funds.

Table 1. Balance Sheets

	Households	Firms	Financial Sector	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	$+ B_h$		$+ B_{PF}$	$+ B_c$	$- B$	$+ B_a$	0
Capital		$+ p \cdot K$					$+ p \cdot K$
Bonds			$- B_{ba}$			$+ B_{ba}$	0
Equities	$p_e E_h$	$- p_e E_h + p_e E_{fa}$	$+ p_e E_{PFa}$ $- p_e E_{ba}$			$+ p_e E_{ba} - p_e E_{fa}$ $- p_e E_{PFa}$	0
Mortgages	$- MO$		$+ MO$				0
Houses	$+ ph.HS$						$+ ph.HS$
Foreign Reserves				$+ R$		$- R$	0
Total (net worth)	$+ V_h$	$+ V_f$	$+ V_{fs}$	0	$+ V_g$	$+ V_a$	$+ V_t$

Table 2. Social Accounting Matrix

	Prod.	Households	Firms	Financial Sector	Central Bank	Government	Capital Account	Foreign	Total
1. Production		$+ p \cdot C$				$p \cdot G$	$p \cdot \Delta K$ $+ ph \cdot \Delta HS$	$X - IM$	$p \cdot Y$
2. Households	$+ WB$		$+ FD$	$+ iM + FB$		$+ iB_h$			$+ Yh$
3. Firms	$+ FT$							$+ FFA$	$+ FT$
4. Financial Sector		$+ i.MO$	$+ iL$			$+ iB_b$		$+ FPFA$	$+ Yfs$
5. Central Bank				$+ iA$		$+ iB_c$			$+ Yc$
6. Government	$+ Ti$	$+ Td$	$+ Tf$		$+ Fc$				$+ Yg$
7. Capital Account		$+ Sh$	$+ Sf = FU$	0	0	$+ Sg$		$+ Sa$	S
8. Foreign				$+ i_B B_{ba} + Fba$		$+ iB_a$			$+ Ya$
TOTAL	$+ p \cdot Y$	$+ Yh$	$+ FT$	$+ Yfs$	$+ Yc$	$+ Yg$	$p \cdot \Delta K$ $+ ph \cdot \Delta HS$	$+ Ya$	

Wealth accumulation

$$\Delta Vh = Sh + \Delta pe.Eh(-1) + \Delta ph.HS(-1)$$

$$\Delta Vf = Sf + \Delta pe.Efa(-1) - \Delta pe.Eh(-1) + \Delta p.K(-1)$$

$$\Delta Vg = Sg$$

$$\Delta Va = Sa + \Delta pe.Eba(-1) - \Delta pe.Efa(-1)$$

$$\Delta Vfs = + \Delta pe.Epfa(-1) - \Delta pe.Eba(-1)$$

$$\Delta V = S + \Delta p.K(-1) + \Delta ph.HS(-1)$$

$$FD = \rho_e p_e E_h$$

$$FFA = \rho_{eo} p_e E_{fo}$$

$$FPFA = \rho_e p_e E_{pfo}$$

$$Fba = \rho_e p_e E_{ba}$$

Table 3. Accumulation and investment of savings

	Households	Firms	Fin. Sector	Central Bank	Government	Foreign	Total
Consumption	- p·C	+p.C+p.G			-p·G		0
Investment		+I + ph.ΔHS					I + ph.ΔHS
Net exports		+X - IM				-(X - IM)	0
Wages	+WB+Fb	-WB	-Fb				0
Taxes	-Td	-Tf -Ti			+Td +Ti + Tf		0
Interest Advances			-i _a .A	+i _a .A			0
Interest Deposits	+ i _m M		- i _m M				0
Interest Loans		-i _l L	+ i _l L				0
Interest Bills	+i _b .Bh		+i _b .Bb	+i _b .BC	-i _b .B	+i _b .Ba	0
Interest Bonds			-i _{ba} .Bba			+i _{ba} .Bba	0
Interest Mortgages	-i _{mo} .MO		+i _{mo} .MO				0
Dividends Firms/Banks	+FD	-FD	- Fba	- Fc	+Fc	+ FbA	0
Dividends Abroad		+FFA	+ FPFA			-FPFA-FFA	0
Savings	S _h	S _f (FU)	0	0	S _g	S _a	S
High powered money	+ ΔH _h		+ ΔH _b	- ΔH			0
ΔDeposits	+ΔM		-ΔM				0
ΔAdvances			-ΔA	+ΔA			0
ΔLoans		-ΔL	+ΔL				0
ΔBills	+ΔB _h		+ΔB _b	+ΔB _c	-ΔB	+ΔB _a	0
ΔBonds			-ΔB _b _a			+ΔB _b _a	0
Δ Mortgages	-ΔMO		+ΔMO				
ΔEquity	+p _e ΔE _h	+p _e ΔE _{fa} -p _e ΔE _h	+p _e ΔE _{PFa} -p _e ΔE _{ba}			+p _e ΔE _{ba} -p _e ΔE _{fa} -p _e ΔE _{PFa}	0
ΔReserves				+ΔR		-ΔR	0
ΔCapital	+ IH	+ I					+ I + IH

3. The model and quantitative easing

The model used in our analysis is based on the model we developed in MMS (2015). However, new elements are the extension of the financial sector with a pension system with large foreign investments and the introduction of financial assets of firms, which are also invested to a large extent abroad. Both elements contribute considerably to a proper understanding of the development of the Dutch foreign net assets position and the small impact of QE on the Dutch economy as we explain below. We first present the model in general terms in section 3.1 and then explain the channels through which QE affects the economy in section 3.2.

3.1 The model

In this section we will give a brief description of the model, focussing on those elements which are important to understand the impact of QE. A detailed overview of the model is presented in the appendix. We will present the model by discussing the balance sheet of the economy, together with the social account matrix and the matrix summarising the accumulation of investment and savings, presented in Tables 1 – 3 above.

Households

Starting with the household sector, income of households consists of wage income (including bonuses paid out by banks) plus interest and dividend earned on their financial assets minus taxes and interest paid on mortgages. We assume that households invest part of their savings in houses for which they have mortgages at the bank. Next households need high powered money for transactions. They invest the remaining part of their savings in equity issued by firms and government bills, the remaining assets are invested in deposits (cf. Figure 11 above). This covers the household columns in Tables 1- 3.

An important observation in MMS (2015) is that the high incidence of mortgages in the Netherlands observed for the Netherlands can be explained by both tax reduction on interest payments and eagerness by banks to provide mortgages (cf. Figure 14). Both elements play a role in our model to drive up house prices, which are endogenous in our model. A relevant aspect of the latter is that a lower interest rate for mortgages will also drive up house prices. This has two implications as we elaborate in MMS (2015). On the one hand consumption increased through the positive wealth effect of increasing housing wealth and through additional spending capacity financed by increased mortgages on existing houses. On the other hand, interest payments on mortgages will also increase and provide a countervailing impact on consumption through decreased disposable income. Our simulation results show that in the end the latter effect becomes dominant, which explains the housing bubble that occurred in the Netherlands (cf. Figure 13).

For the moment being we ignore the impact of pensions on household behaviour (but not on the financial sector, see below). We argue in MMS (2014) that although pension wealth of households is very large, it hardly plays a role – at least till recently – in the public debate and in the analysis of Dutch household behaviour. For instance, wealth inequality figures used in the public debate (e.g. following Piketty, 2014) are typically net of pension wealth.²⁵ Another example is that in studies of the impact of wealth on consumption behaviour, usually pension wealth is not included – see for

²⁵ See, for instance , WRR (2014, Ch. 4).

instance the current CPB macroeconomic model SAFFIER-II, which is used extensively in Dutch economic policy debates (CPB, 2010).

The influence of pensions on consumer behaviour is both negative (through increased collective savings) and positive (increased benefits with aging). Through both channels, the recent fall in the interest rate had a negative impact on consumption expenditures: it increased the liabilities of the pension funds, so that they had to increase their assets and hence collective savings (cf. Figure 11). Moreover, about 8 per cent of disposable income is 'collective savings', while 'individual savings' have been falling sharply from a height of 8 per cent in the mid-1980s – these savings have become negative in 2000 and consistently negative since 2003. We will include this insight in the next version of our model.

Firms

Firms net income consists of profits based on a fixed mark up on output prices and dividend earned on financial assets held abroad. Part of this income is used to pay taxes, interest on loans to banks and dividend to households. The remaining part, retained profits, constitutes firms' savings. Part of firms' savings is used to finance investment in capital. The remaining part of firms' savings, which is considerable – see also Figure 15 above – is invested in financial assets abroad. As we elaborate in MMS (2016) this explains the increase of the net foreign asset position in the Netherlands (cf. Figures 21 – 23).

Investment of firms is determined endogenously, depending on the cash-flow rate, the leverage ratio, Tobin's q and the utilisation rate. It is partly financed by retained profits (firms' savings) and the remaining part is financed by equity issued to households and loans from banks. We did model in MMS (2016) that the distribution of the firms' assets over financial assets abroad and capital depends on the relative returns. The distribution of equity and loans to finance capital were modelled in a similar way. However, in the present model these distributions are exogenous in order to keep the model manageable. On the other hand, both the price of equity and the return on equity are endogenous, which enables us to analyse the impact of low interest rates and QE on equity prices (cf. Figure 28). This explains the firm columns in Tables 1 – 3.

The financial sector

The financial sector in our model consists of banks and pension funds. As we have already discussed above banks issue mortgages to households and provide loans to firms. Next to that banks hold cash for transaction purposes. Part of the loans and mortgages are covered by deposits of households held at banks. However, this is not sufficient to finance all assets, which results in the so-called deposit financing gap discussed extensively in MMS (2015) – see also Figures 3 and 12. The deposit financing gap is considered to be problematic since the larger the gap is, the more banks have to rely on outside capital to finance their loans. In particular in the case of mortgages this is problematic, since mortgages are outstanding long-term commitments and outside capital is of shorter duration and more risky (often foreign) – see also Figure 4. This implies that the larger the deposit financing gap is, the more expensive financial resources for banks become. In our model outside capital consists of equity sufficient to satisfy the Basel norm. This equity is issued abroad and bonds are issued abroad to cover the remaining part of the deposit financing gap.

In order to keep the analysis manageable, the balance sheet of pension funds is kept very simple. It consists of liabilities due to the pension claims households have on these funds (cf. Figure 9). These liabilities follow from the obligatory contributions of households to these funds. Since the flow implications of these contributions complicate the model considerable and are not crucial in understanding the impact of QE we assume these liabilities to be exogenous. The net contributions of households are invested by the fund in treasury bills and equity abroad (cf. Figure 7) – both as a fixed proportion of the liabilities.

Finally savings of the financial sector are zero, since the profits of both banks and pension funds are distributed to the households in the form of bonuses and lower obligatory contributions. This explains the financial sector columns in Tables 1 – 3.

The Central Bank

In the present analysis 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 analysis of quantitative easing. Moreover, QE is controlled by the National Central Bank, as we discussed in section 2.4.

Next to holding foreign reserves, which we discuss below, the Central Bank provides advances to banks and holds all remaining bills issued by the government. The liabilities are high powered money issued by the Central Bank, which is held by the public and banks. Since the revenues of the Central Bank are transferred to the government, the savings of the Central Bank are zero. This explains the Central Bank columns in Tables 1 – 3.

Government

Government expenditures G are proportional to output, hence the growth in government expenditures is equal to output growth. Value added taxes and income taxes are proportional to the relevant tax bases. The budget balance, together with profits from the Central Bank minus interest paid on government bonds, constitute government savings. These savings, which usually are negative (cf. Figure 17), are financed by supplying bills to the various sectors of the economy. As mentioned above, the Central Bank holds all remaining bills issued by the government. This explains the government columns in Tables 1 – 3.

The foreign sector

The foreign sector is introduced in a simple way. Next to consumption, investment and government goods, firms also produce net-exports. We assume exports to be exogenous and imports to be proportional to GDP. As we have discussed above, foreigners hold bills issued by the government and bonds and equity issued by banks. The latter two follow from the demand by banks, which we assume will be satisfied. Demand for bills is determined endogenously. The liabilities of the foreign sector consist of foreign equity held by domestic firms and pension funds together with foreign reserves held by the Central Bank. The latter also include the Target2 balances.

The trade balance is part of foreign savings, together with dividends paid to domestic firms and pension funds on their foreign investment, as well as dividend received from banks, and interest received on bonds issued by domestic banks and government. These savings deplete the foreign reserves held by the domestic Central Bank, taking into account bonds acquired from domestic banks and government, net of equity issued to domestic firms and pension funds. As Godley and Lavoie (2007b) emphasise, 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 appears from Figure 20.

3.2 The impact of quantitative easing

The National Central Bank buys bonds from the secondary market. The various possibilities can be identified in our stock-flow structure summarised in Tables 1 – 3 above – for an elaborate description see Muysken (2016). We assume that the Central Bank always use the banks as intermediaries and finance the purchase of bonds by providing advances or issue deposits to the banks who then buy bonds and sell these to the Central bank.

The notion is then that banks use the advances to increase loans to firms and hence stimulate the economy. In terms of Tables 1 – 3 this implies:²⁶

$$-\Delta A = \Delta B_C = \Delta L = \Delta M_{\text{firms}} = -\Delta B_{XX} \quad (1)$$

The problem is that there always has to be a counter party XX who sells these bonds. As we have seen in section 2.4 of the stylised facts it is highly implausible that banks did sell bonds from their own portfolios nor did pension funds – see Figure 25 above. Hence the only plausible outlet is that these bonds are sold abroad. This is entirely consistent with the observation in Figure 26 above. In the ‘best’ scenario, the resulting transactions then should lead to:

$$\Delta B_C = \Delta L = \Delta M_{\text{firms}} = \Delta R = -\Delta B_a \quad (2)$$

assuming that the foreign pension funds invest the money abroad. The proceedings of the banks then should be lent to firms, which use these to invest in the capital stock.

However, it is much more plausible that foreign pension funds prefer to hold the deposits (in our model bonds issued by banks B_{ba}) in the domestic banks (DNB, 2016d). In that case the banks use the obtained funds to pay back advances (or increase deposits held at the Central Bank) and we find instead of equation (2) now:

$$\Delta B_C = -\Delta A = \Delta B_{ba} = -\Delta B_a \quad (3)$$

which implies that the banks do not stimulate the economy by providing loans to firms, but the money remains within the financial system. This observation is consistent with Figure 27 above, which shows that the gap between Target2 balances (R) and total deposits (B_{ba}) is covered by government bonds held by the NCB (B_C). The increase in Target2 balances can be explained in the same vein, resulting from funds that came available because of the foreign government buying their

²⁶ The deposits of firms at the banks M_{firms} are not part of Tables 1 – 3 since they are not relevant for our analysis, but these should increase.

bonds from the foreign pension funds. In that case the foreign bond holdings have been substituted for domestic financial assets. For instance:

$$(-\Delta B_{c, \text{FOR}}) \Delta B_{ba} = \Delta R = -\Delta A \quad (4)$$

This is consistent with the increase in Target2 balances following the QE operations, observed in Figure 27 above.

These observations explain why we do not observe the stimulating effects of QE because the money that is provided to banks remains within the financial system.²⁷

An obvious solution to this problem is that the Central Bank provides QE not through the banking system and the secondary bonds market, but by providing money directly to the public. A typical solution would be helicopter money or as proposed by Kloss and Muysken (2016) using the money to finance a job guarantee – see also Mitchell (2015). This alternative will be investigated when simulating the model in section 4.

4 Simulation results

The model as described above is used to analyse three scenarios as depicted in the stylised facts. To obtain a baseline solution the model is first “calibrated” using a plausible set of parameters. We used the parameters utilised in MMS (2015), but we also had to add some parameters. In the next version of this paper, our aim is to calibrate the model more carefully to the actual Dutch data and to estimate the most important parameters used. However, for the moment being we follow the usual practice of relying on commonly used parameters and we focus on the impact of shocks on the base-run outcome, instead of on the base-run itself – although the base-run should converge to a steady state. This implies that the simulation results are mainly used to illustrate the working of the model.

The stylised facts to be reproduced as baseline are a modest GDP growth, a slight government budget deficit and a trade surplus. To avoid exogenous export growth to dominate the growth in the model, we have assumed that export growth equals a fifteen-years moving average of past GDP growth. The baseline solution shows a positive annual growth rate of real GDP of 1.5 % even though labour productivity is kept constant. The government deficit stabilises at around 1.1% of GDP and government debt is 81% of GDP. Finally the trade surplus remains positive around 6% of GDP.

The simulations are carried out for over 2000 periods to let the model first (safely) converge to a relatively stable solution. All graphs start in period “40” representing the steady state and a shock is introduced in period “50”. The situation then is reduced to normal, i.e. the shock is neutralised, in period “90” and we show how the economy then stabilises again after 50 periods. To avoid unwanted effects coming from changes in exports, the exports resulting from the baseline simulation are used exogenously in the experiments. The three separate shocks introduced are (1) a decrease in the interest rate by 1 per cent point, which is the initial reaction of the central bank to the financial crisis; (2) a decrease in advances by lowering the required rate of advances held by banks, this mimics the QE reaction of the ECB; and finally (3) a lowering of taxes, which also mimics the proposal

²⁷ The leakage resulting from buying bonds by banks to recapitalise themselves is not plausible, the more so that we saw in Figure 6 that the banks did not increase their reserve ratio in the last two years.

of a job guarantee in this macroeconomic model. We will elaborate on the impact of these three shocks below.

4.1 The impact of low interest rates: bubbles

In this simulation experiment the base-run values of the interest rate of advances of 1% and of treasury bills of 2% are both lowered to 0% and 1%, respectively. From Figure 30 one sees that there is a strong positive impact on GDP growth initially. This follows from an increase in share prices resulting from an increased demand for equity in response to the lowering of the interest rate – see Figure 31. The increase in share prices then leads to higher investment because of Tobin's q and to higher consumption because of the wealth effect. The wealth effect on consumption is also stimulated by the increase in house prices in reaction to the low interest rate. Finally the increase in consumption and investment has a positive impact on the utilisation rate, which also stimulates investment.

Figure 30 Impact on GDP growth

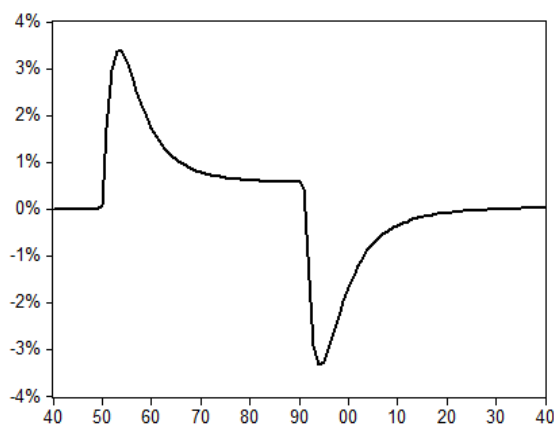


Figure 31 Impact on equity price

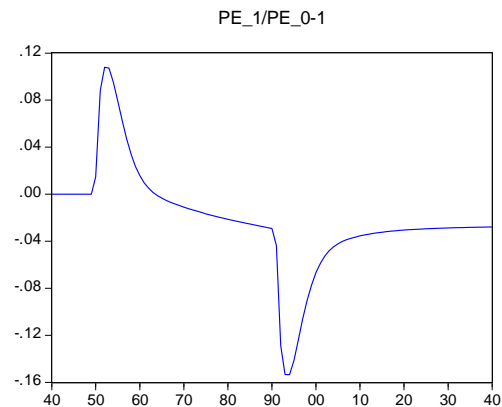


Figure 32 Impact on loans (L) and mortgages (MO)

firms

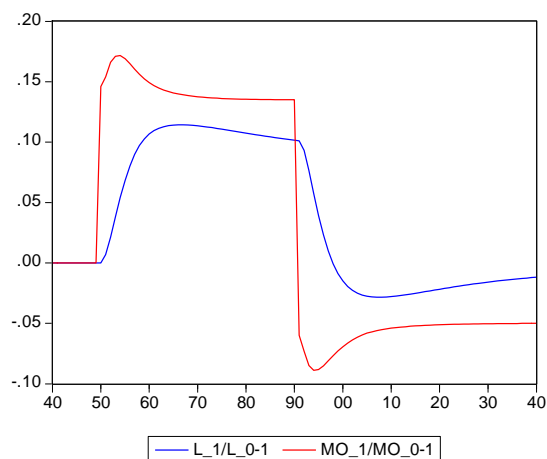
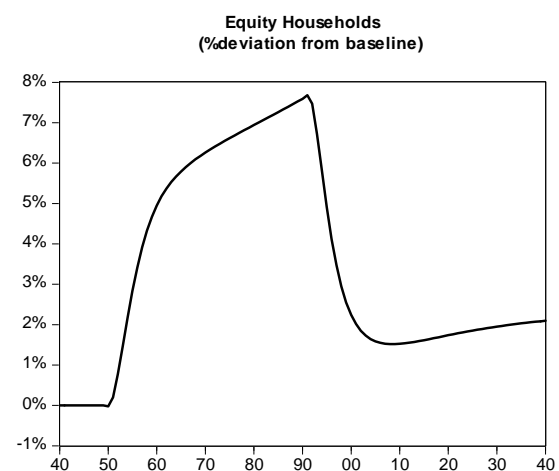


Figure 33 Impact on equity of



This initial effect is reversed, however, because the higher investment requires ever increasing loans see Figure 32. The latter also increase because of increasing share prices. This increases the leverage ratio of firms and has a negative impact on investment. Moreover, the higher investment also causes a higher demand for equity – see Figure 33 – which has a negative impact on share prices – see Figure 31. Finally, the increase in house prices leads to an increase in mortgages held by consumers – see Figure 32 – which has a negative impact on the wealth effect. Nonetheless, GDP growth remains at a higher level of about 0.8 per cent relative to the base run, once the initial euphoria has calmed down.

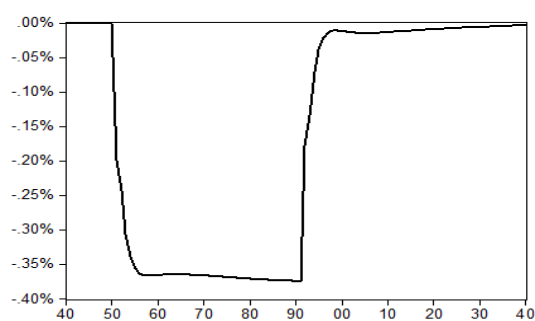
When the interest rates are increased again to their original level, the process described above is reversed and GDP stabilises on its original steady state path, although equity held by households and mortgages remain at slightly different levels.

4.2 The impact of QE: where does the money go?

The QE policy of the ECB is simulated by lowering the required rate of advances held by banks from 20% to 10%. As might be expected this is compensated by banks holding less advances, but more bonds, and the central bank holding more bills. However, the central bank does not obtain these bills from the banks but from abroad.

What happens is that the banks compensate the decrease in advances by issuing more bonds abroad and the foreign sector substitutes the domestic government bills for the bonds issued by banks. The model accommodates the changes in Central Bank advances in this way because we do not include deposits in our model explicitly. What happens more precisely is that the foreign sector sells the bonds to the central bank through the banks, but holds the proceedings as deposits at the banks in the domestic country – see also the discussion around Figure 27 and in section 3.2. Since advances are assumed to be net of deposits in our model, we do not see an increase in deposits from the foreign sector held by banks, but an increase in bonds issued by banks, held by the foreign sector. Moreover, the foreign sector does not sell its government bonds as a portfolio decision, but the transaction essentially results because domestic banks need to issue more bonds in our model, to compensate the decrease in advances. To model the underlying mechanism in a better way is a matter for further research. However, an interesting result of this simulation is that the QE transaction remains entirely within the financial system and that the money leaks abroad.

Figure 34 Impact on GDP growth



As Figure 34 illustrates, there is a small impact on GDP growth. The reason is that banks have a lower income because of the interest difference between advances and bonds issued. They have to pay a higher interest for these bonds, which has a negative impact on their income and hence on GDP.²⁸ However, this impact is negligible – only 0.35 % on GDP growth, while the increase in bonds issued abroad is 18.5%.

The process is reversed when the central bank increases its required rate of advances.

4.3 Helicopter money

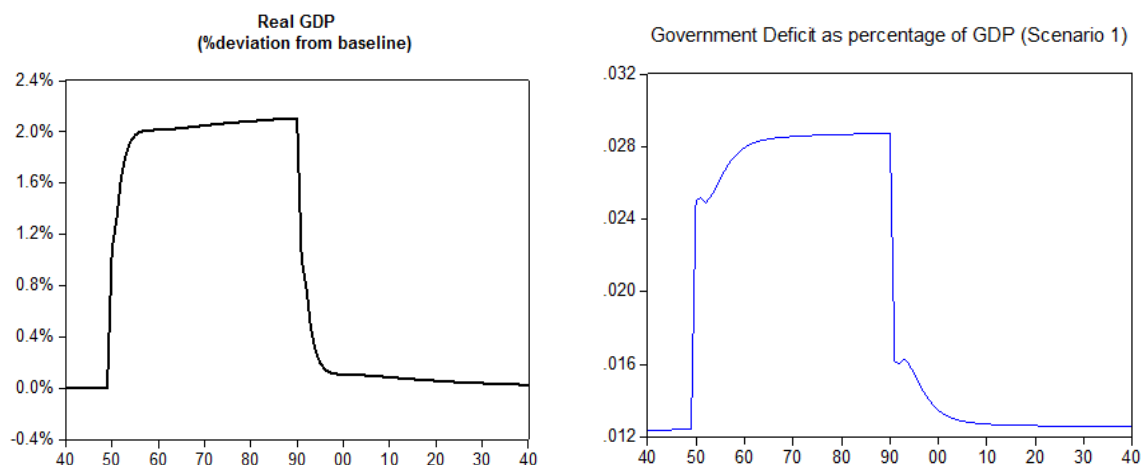
In this simulation taxes are lowered autonomously by the same amount as the ECB used for its QE operation in the previous experiment. That is, income taxes are lowered from 18 % to 16 % and the resulting fall in government revenues is compensated by bills held by the central bank. This is the closest we can introduce the process of helicopter money or a job guarantee in our model, since we do not model the distribution of income (or taxes or wages – the latter related to a job guarantee) in our model. That might be another direction of further research.

Not surprising the lower taxes have a strong impact on GDP growth as can be seen from Figure 35. This follows from the direct income effect on consumption and the stimulus provided to investment through the increased rate of capacity utilisation. The government deficit increases from 1.2% of GDP to almost 3% – see Figure 36. However, this increase in the deficit does not have a negative impact on the economy since the central bank finances this deficit.

Figure 35 Impact on GDP growth

Figure 36 Impact on government deficit

²⁸ This observation emphasises the necessity of a better model of what is actually going on, because why should banks not keep higher advances in this case.



The economy returns to its initial steady state when government decreases taxes again to their initial level.

Essentially the QE-operation is not run through the banks, as in the previous simulation, but through government in the current simulation. While the previous simulation shows that QE is hardly effective, since the money remains within the financial system and leaks abroad, the present simulations show that using the central banks to finance government instead of banks is highly effective to stimulate the economy. As we have already indicated when discussing the previous simulation this is partly a result of the structure of the model and also, as we indicated above, partly a result of the absence of distributional consequences in the model. However, the strong difference with the previous simulation clearly outlines important reasons why the current process of QE by the ECB might not be very effective. It also stimulates further research on using helicopter money, preferably through tax decreases or increased government spending – these might be much more effective in stimulating the economy.

5. Concluding remarks

In this paper we observed some interesting stylised facts for the Netherlands, which emphasise on the one hand a strong potential for interaction between the financial and the real sphere and on the other hand may help to explain why QE had hardly any impact on Dutch GDP growth. We show how the Netherlands has a very large financial sector in which pension funds play an important role next to the banking sector. A problem for the banking sector is the deposit financing gap, which forces the banking sector to cover its outstanding long term commitments, in particular mortgages, with short term funding or bonds, mainly taken from abroad. As a consequence the banks have to pay a relatively high interest rate and their source of financing is uncertain. This problem is aggravated by increasing house prices, which led to an explosive growth in mortgages (also stimulated by tax deductions on mortgage interest payments) and cumulated in a housing bubble. The bursting of this bubble, in conjunction with the financial crisis, did lead to a double dip in the recession and worsening government deficits.

In the aftermath of that crisis three additional problems manifested themselves in the Dutch economy. Household savings are mainly channelled through pension funds who invest to a large extent in financial assets abroad. However, the pension funds are confronted with ever increasing liabilities because of the low interest rate and because of the underestimation of the ageing problem, in particular the increasing life-time of many pensioners. Firm savings constitute a large part of domestic savings and are only to a small extent invested in physical capital. The majority is invested in financial assets and take-overs abroad. These phenomena and the low interest rate also contribute to an increase in equity prices. In addition the low interest rate has led to an increase in house prices. Finally, the Netherlands has a huge current account surplus which absorbs the foreign positions of pension funds and firms.

In our opinion the current macroeconomic models, including the new-Keynesian models, are not able to explain the stylised facts in a satisfactory way. In particular they do not provide a satisfactory perspective on the interaction between the real sphere and the financial sector, which is crucial in analysing the dynamics and the impact of QE. Nor can they explain in full the impact of the fluctuations in house and equity prices on the financial sector and the real sphere (and in particular on their interaction). We therefore present in section 3 a model in the stock flow consistent tradition which shows the importance of wealth effects in consumption, in relation to wealth accumulation, and takes into account the role of the financial sector in that process. To analyse the Dutch situation we have included a foreign sector in the model and we have elaborated the model of the banking sector considerably in order to be able to model the impact of QE.

The properties of this model have been analysed in simulations in section 4. We show how a decrease in the interest rate led to an increase in house and equity prices, which stimulates consumption through its wealth effect. It also stimulated investment because of the increase in both Tobin's q and capacity utilisation. However, the initial positive effect is reversed to some extent because of the increased borrowing necessary to facilitate investment. The latter also dampens the initial increase in the equity price. GDP growth follows these movements and stabilises at a higher level compared to the situation prior to the decrease in the interest rate.

QE is mimicked in a simulation where the central bank provides free deposits to the banks and in exchange for government bonds. We show that this operation does not lead to more loans provided to firms, hence investment and economic growth are not stimulated, although this was the original intention. Instead the money leaks abroad and the impact of the QE transaction remains entirely within the financial system. However, when QE is provided through the government by lowering taxes the last simulation shows that this has a strong impact on GDP growth. This follows from the direct income effect on consumption and the impact of the increased rate of capacity utilisation on investment.

Although the model in its current version already provides interesting insights, there are several shortcomings which need to be addressed in further research. A first priority is to calibrate the model using Dutch data and to estimate the parameters of the model from these data. This is a very new area of research in the tradition of stock-flow consistent modelling.

Also the behaviour of the financial sector should be elaborated in more detail. This concerns the decisions of banks to expand or restrain their activities, the portfolio decisions of pension funds and

the portfolio decisions of the foreign sector. All these decisions are related to the relevant interest rates which at this stage are exogenous in our model. These rates have to be endogenised.

A somewhat related issue is to model the problem of pension funds related to aging and low interest rates. The impact of both on the funded pension system implies that contributions and benefits have to be endogenised. Moreover we should model how that also affects household behaviour– we already modelled both aspects in MMS (2014) but were not able to find satisfactory calibration results.

Finally it would be important to include distributional aspects and also unemployment in the model. This can be done by distinguishing between rentiers and workers as far as employed persons are concerned – see Zezza (2008). Explicit attention to the unemployment problem implies that we should model the interaction of unemployment with wage formation and social security.

However, these issues are left for further research. For the moment we are content to be able to explain with a relatively simple model how the QE operation of the ECB through the banking system had no discernible impact on GDP growth in the Netherlands. In addition we show how using QE through government expenditures and taxes has a stimulating impact.

References

Bank of Ireland (2013), “How money is created and destroyed: A guide to the euro zone monetary system”, January 2013, Dublin.

Bezemer, D. and J. Muysken (2015), Financialization and the Financial and Economic Crises: The Case of The Netherlands, *FESSUD Studies in Financial Systems No 33, May 2015*

Bridges, J. and R. Thomas (2012), “The impact of QE on the UK economy — some supportive monetarist arithmetic”, Working Paper No. 442, Bank of England

CPB (2010), “SAFFIER II: 1 model voor de Nederlandse economie, in 2 hoedanigheden, voor 3 toepassingen”, CPB document No. 217, Centraal Planbureau, Den Haag.

CPB (2016), “CPB Financiële risicorapportage 2016”, Centraal Planbureau, The Hague.

Cizel, J., J. Frost, A. Houben, P. Wiertz (2016), “Effective macroprudential policy: Cross-sector substitution from price and quantity measures.” DNB Working Paper No. 441.

De Grauwe, P. and Y. Ji (2012), “Self-fulfilling crises in the Eurozone: an empirical test”, *Journal of International Money and Finance*, Vol. 34, April, pp. 15–36.

DNB (2016a), “DNB's balance sheet grows due to stimulus measures”, Statistical News 3-8-2016, De Nederlandsche Bank, Amsterdam.

DNB (2016b), “Financial Stability report - Spring 2016”, De Nederlandsche Bank, Amsterdam.

DNB (2016c), “Current account surplus declines due to lower profitability of participating interests”, Statistical News 23-9-2016, De Nederlandsche Bank, Amsterdam.

DNB (2016d), "Target2 imbalances reflect QE and persistent fragmentation within the euro area", Themes 16-6-2016, De Nederlandsche Bank, Amsterdam.

Dunne, P., M. Everett and R. Stuart (2015) "The Expanded Asset Purchase Programme – What, Why and How of Euro Area QE", Quarterly Bulletin 03 / July 15, Bank of Ireland, Dublin.

Gagnon, J. E. (2016), "Quantitative Easing: An Underappreciated Success", Policy Brief, PB16-4, Peterson Institute for International Economics, Washington.

Gern, K.-J., N. Jannsen, S. Kooths, and M. Wolters (2015), "Quantitative Easing in the Euro Area: Transmission Channels and Risks", *Intereconomics*, 2015, No. 4, pp. 206 – 212.

Godley, W. and Lavoie, M. *Monetary Economics: An Integrated Approach to Credit, Money, Income, Production and Wealth*. London: Palgrave Macmillan, 2007a.

Godley, W. and Lavoie, M., A simple model of three economies with currencies: the Eurozone and the USA. *Journal of Economics*, 31: 1-23, 2007b.

Gros, D., C. Alcidi and W. P. De Groen (2015), "Lessons from Quantitative Easing: Much ado about so little?", CEPS Policy Brief No. 330, Brussels.

Klosse, S. and J. Muysken (2016), Curbing the Labor Market Divide by fostering Inclusive Labor Markets through a Job Guarantee Scheme," *Psychosociological Issues in Human Resource Management* 4(2): 185–219

McLeay, M., A. Radia and R. Thomas (2014), "Money creation in the modern economy", Quarterly Bulletin 2014 Q1, Bank of England

Meijers, H., J. Muysken and O. Sleijpen (2014), The Dutch balance sheet recession: a stock-flow consistent approach, *Paper presented at FMM 2014*, Berlin.

Meijers, H., J. Muysken and O. Sleijpen (2014a), The deposit financing gap: another Dutch disease, *UNU-Merit Working Paper series 2014-071*, pp. 1-32.

Meijers, H., J. Muysken and O. Sleijpen (2015), The deposit financing gap: another Dutch disease, *European Journal of Economics and Economic Policies: Intervention*, Vol. 12 No. 1, 2015, pp. 32-50.

Meijers, H., J. Muysken and O. Sleijpen (2016), Firms' excess savings and the Dutch current account surplus: a stock-flow consistent approach, *European Journal of Economics and Economic Policies: Intervention* (forthcoming).

Minenna, M. (2016), "Disentangling the nature of Italy's capital flights", *Sober Look*, May 9, 2016.

Mitchell, W. (2015), *Eurozone dystopia*, Edgar Elgar.

Muysken, J. (2016), Money Creation and Quantitative Easing, *UNU-Merit Working Paper series* (forthcoming).

Piketty, T. (2014), *Capital in the 21st Century*, Harvard University Press.

Sinn, H-W. and T. Wollmershäuser (2011), “Target Loans, Current Account Balances and Capital Flows: The ECB’s Rescue Facility”, *CESifo Working Paper* No. 3500.

Valiante, D. (2015), “The ‘Visible Hand’ of the ECB’s Quantitative Easing”, CEPS Working Document No. 407, Brussels.

Westermann, F. (2016), “Unwelcome side-effects of quantitative easing”, The OMFIF Commentary, *the Official Monetary and Financial Institutions Forum*.

WRR (2014), *Hoe ongelijk is Nederland?*, Wetenschappelijke Raad voor het Regeringsbeleid, The Hague.

Stiglitz (2016), *The Euro: How a Common Currency Threatens the Future of Europe*, W.W. Norton.

Zezza, G., “U.S. Growth, the Housing Market and the Distribution of Income”, *Journal of Post Keynesian Economics* (vol. 30, no. 3), 2008, pp. 375 – 401.

Appendix A A detailed description of the model

In this appendix we present a detailed overview of the model used in our analysis. Most elements have already been presented in MMS (2015), hence the appendix overlaps considerably with MMS (2015a) – the underlying working paper. However, new elements are the extension of the financial sector with a pension system with large foreign investments and the introduction of financial assets of firms, which are also invested to a large extent abroad. Both elements contribute considerably to the a proper understanding of the development of the Dutch foreign net assets position and the small impact of QE on the Dutch economy. In the following sections we will explicitly point out the new elements in addition the analysis of MMS (2015).

A1. The financial sector and the Central Bank

In our model the financial sector consists of banks and pension funds, next to the Central Bank. We describe briefly the various sectors.

The Central Bank

Next to holding foreign reserves R , which include Target2 balances, 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 both the public and banks.

The Central Bank provides as much high powered money as is demanded by banks and households and as much bills as demanded by the government. The amount of advances can be used as a policy instrument under QE,²⁹ but in normal times the advances are provided to satisfy the banks' need – see equation (A3) in the section on the banking sector. We discuss the foreign reserves in section A3 and explain why these also close the balance sheet of the Central Bank. The resulting balance sheet is presented in Table A1.

Table A1 Balance sheet of the Central Bank

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

Since the revenues FC of the Central Bank are transferred to the government, the balance sheet of the Central Bank is closed without remaining net worth – see Table A1. The revenues of the Central Bank are given by:

$$FC = i_{A,-1} \cdot A_{-1} + i_{B,-1} \cdot B_{c,-1} \quad (A1)$$

²⁹ As we explain in the main text, advances are taken net of deposits by banks held at the central bank.

Here i_B is the rate on government bills set by the Central Bank and i_A is the interest rate on advances. Both interest rates are set exogenous in real terms, r_B and r_A respectively,. The nominal rates then take expected inflation into account, which in the current version of the model is zero.

The Banking Sector (MFIs)

In our analysis banks finance their assets not only by holding deposits M from households and advances A from the Central bank,³⁰ but also to a considerable extent by borrowing from the foreign sector. The latter is done by issuing equity $p_e \cdot E_b$ and bonds B_{ba} .³¹ Here p_e is the nominal price for equity. The main assets held by the bank are loans L issued to firms and mortgages MO issued to households. Next to that banks also hold high powered money B_{ba} .³²

For issuing deposits M banks need to meet the reserve requirement by holding sufficient high-powered money H_b :

$$H_b = v_{res} \cdot M \quad (A2)$$

Regarding the other two items on the asset side, we assume that both the demand for mortgages by households MO and loans by firms L are fully accommodated by banks.

Turning to the liabilities side we assume that the demand for deposits M by households is also fully accommodated by banks. With respect to advances there is a ratio between advances and deposits, v_{CB} , implicitly imposed by the Central Bank:

$$A = v_{CB} \cdot M \quad (A3)$$

Equity is such that the leverage ratio, which is tier 1 capital/risk-unweighted long lending, should exceed a fixed proportion of the total liabilities of the banking sector, v_{bas} , determined by the Basel requirements. Hence:

$$p_e \cdot E_{ba} = v_{bas} \cdot (M + A + B_{ba}) \quad (A4)$$

The remaining gap on the liabilities side is financed by borrowing B_{ba} from abroad. Bonds are available from the foreign sector at a relatively high rate i_{ba} , in principle to an unlimited amount. The resulting balance sheet is presented in Table A2.

With respect to the pricing decisions, we assume that the interest rates on loans i_L , and deposits i_M , are set as a fixed mark-up on the rate on advances set by the Central Bank. Similarly, the rates on mortgages i_{MO} and bonds issued i_{ba} are fixed mark-ups on the interest rate on treasury bills. The equity price p_e is determined endogenously – see equations (A37) and (A38) in the discussion of the firm sector.

³⁰ The advances are net of deposits held by banks at the Central Bank – as a consequence they can even become negative.

³¹ Bonds represent here all sources of outside financing. That banks borrow exclusively abroad is a simplifying assumption, which however emphasises the stylised fact of strong foreign exposure of the Dutch financial sector.

³² As we discuss below bonds issued by the government are held in the financial sector by pension funds.

All profits of the banking sector FB are distributed to the households – we interpret these as bonus payments in excess of normal wages.³³ Since we ignore retained profits which can contribute to internal funds, net worth of banking is in principle zero. However, since banks' equity appears as a liability on the balance sheet, valuation gains and losses may occur. This will affect the balance sheet because equity is booked at market value. Therefore we also introduce net worth of banking V_b , which accumulates and decumulates with valuation gains and losses. Hence holds:

$$\Delta V_b = -(\Delta p_e) \cdot E_{ba} \quad (A5)$$

This aspect has been ignored in MMS (2015).

Table A2 Balance sheet of the banking sector

ASSETS		LIABILITIES
Cash (H_b)		Deposits (M)
		Advances Central Bank (A)
Long lending	<ul style="list-style-type: none"> • mortgages (MO) • firms (L) 	Bonds (B_{ba})
		Equity ($p_e E_{ba}$)
		Total (net worth) (V_b)

Pension funds (OFIs)

As already mentioned in the introduction to the Appendix, MMS (2015) does not recognise the existence of a pension fund. In order to keep the analysis manageable, the balance sheet of pension funds is kept very simple. It consists of liabilities L_{PF} due to the pension claims households have on these funds. These liabilities follow from the obligatory contributions of households to these funds. Since the flow implications of these contributions complicate the model considerable and are not crucial in understanding the impact of QE we assume these liabilities to be exogenous. That is, the net contributions of the households $contr_{PF}$ are exogenous and add to the liabilities:³⁴

$$\Delta L_{PF} = contr_{PF} \quad (A6)$$

The net contributions are invested by the fund in treasury bills B_{PF} and equity abroad $p_e E_{PF}$, which both constitute the assets of the pension fund. For simplicity we assume that a fixed proportion of the liabilities is invested abroad and the remaining part is invested in treasury bills:

³³ The profits are given by $[(1 - \text{tax rate}) \cdot (\text{income from lending} - \text{costs of borrowing}) - \text{dividends on equity}]$. In case of losses no profits are distributed to the households and equity is issued to compensate for these losses.

³⁴ In MMS (2014) we developed a model with an endogenous pension system, but we did not succeed in calibrating that model to obtain reasonable steady state results.

$$p_e \cdot E_{PF} = v_{PF} \cdot L_{PF} \quad (A6a)$$

$$B_{PF} = (1 - v_{PF}) \cdot L_{PF} \quad (A6b)$$

Since for the moment being we assume these liabilities to be exogenous, B_{PF} and $p_e E_{PF}$ are also exogenous. The resulting balance sheet is presented in Table A3.

Table A3 Balance sheet of Pension Funds

ASSETS	LIABILITIES
Treasury Bills (B_{PF})	Liabilities (L_{PF})
Equity ($p_e E_{PF}$)	Total (net worth) (V_{PF})

The profits of the pension funds are distributed to the households in the form of lower obligatory contributions.³⁵ Following the same reasoning as with banking, net worth of pension funds is in principle zero. However, since equity appears as an asset on the balance sheet, valuation gains and losses may occur. Hence we also introduce net worth of pension funds V_{PF} and does hold:

$$\Delta V_{PF} = (\Delta p_e) \cdot E_{PF} \quad (A7)$$

The financial sector

In order to keep the model manageable from a computational point of view, we combine the banking sector and the pension fund in the financial sector and assume the liabilities to be constant. The combined balance sheet is presented in Table A4 which is also new compared to the analysis in MMS (2015). All items on the balance sheet have already been discussed above and the only difference with the fully combined balance sheet is that liabilities of the pension fund L_{PF} have been subsumed under the net worth V_{FS} of the financial sector. As a consequence we find, since $\Delta L_{PF} = 0$:

$$\Delta V_{FS} = (\Delta p_e) \cdot E_{PF} - (\Delta p_e) \cdot E_{ba} \quad (A8)$$

The new element in Table A4 compared to MMS (2015) is the presence of both treasury bills and equity (invested abroad) on the balance sheet of the financial sector. The latter constitutes an important part of net external wealth of the Netherlands.

³⁵ The profits are given by $(1 - \text{tax rate}) \cdot \text{income from lending}$.

Table A4

Balance sheet of the financial sector

ASSETS		LIABILITIES
Cash (H_b)		Deposits (M)
Treasury Bills (B_{PF})		Advances Central Bank (A)
Equity ($p_e E_{PF}$)		Bonds (B_{ba})
Long lending	• mortgages (MO)	Equity ($p_e E_{ba}$)
	• firms (L)	Total (net worth) (V_{FS})

A2 Households, firms and government

The housing market

In order to include housing and mortgages in the model, we assume that when banks and households decide on a loan for buying a house, the affordability of the household determines the maximum loan the bank is willing to provide, as modeled in Madsen (2012). As we argue in MMS (2015) this implies that the growth rate of the house price p_h follows from:

$$\Delta \ln p_{ht} = \psi_t + \alpha \Delta \ln Y_t^h + (1 - \alpha) \Delta \ln Y_t^e - \Delta \ln [i_{MO}(1 - \tau_h \tau_{MO}) + f_{MO}] - \Delta \ln HS_t \quad (A9)$$

where Y_t^h is disposable income (not net of mortgage payments) and Y_t^e is expected income for next year. The one but last term refers to the user cost of (housing) capital and includes the interest rate on mortgages i_{MO} , corrected for the fraction that is deductible for income tax, and the mortgage repayment rate f_{MO} . The fraction that is deductible from income tax is given by the income tax rate τ_h times the fraction of mortgage interest payments that is deductible τ_{MO} . The final term in the above equation refers to the number of houses on the market, HS . We assume housing supply HS to be given, due to the highly regulated housing market in the Netherlands. The crucial parameter in the equation, however, is the affordability ψ , which is the total amount of housing costs that the household is able to spend (as perceived by banks), relative to its disposable income. The housing bubble was caused by an increase of ψ and in reaction to overstretching their balances banks have decreased ψ .

The household sector

The household sector is modelled similar to MMS (2015). With respect to mortgages MO we assume, in line with the affordability assumption above, that demand for mortgages is a fixed proportion φ of the housing value, while supply of mortgages is accommodating. Hence:

$$\Delta MO = \varphi \cdot p_h \cdot \Delta HS + \varphi \cdot \Delta p_h \cdot HS - \text{mor}c \cdot MO_{-1} \quad (A10)$$

where *mor*c is the share of mortgage repayments.

Once the share of assets to be spent on housing is determined we assume that, in line with ZDS, the demand for money H_h is proportional to nominal consumption $p.C$ and the remaining demand for assets, B_h and $p_e.E_h$, follows from a Tobin-type portfolio model. Then bank deposits M are determined as a residual of household wealth V_h . This implies that wealth net of housing minus mortgages and net of claims on pension funds:³⁶

$$VN = V_h - (p_h.HS - MO) - L_{PF} = H_h + M + B_h + p_e.E_h \quad (A11)$$

is distributed over financial assets as follows:

$$H_h = v_1.p.C \quad (A12)$$

$$p_e.E_h / (VN^e - H_h) = \lambda_{00} - \lambda_{01}.r_M^e + \lambda_{02}.r_E^e - \lambda_{03}.Yhd^e/V^e - \lambda_{04}.r_B^e \quad (A13)$$

$$B_h / (VN^e - H_h) = \lambda_{10} - \lambda_{11}.r_M^e - \lambda_{12}.r_E^e - \lambda_{13}.Yhd^e/V^e + \lambda_{14}.r_B^e \quad (A14)$$

$$M = VN - H_h - B_h - p_e.E_h \quad (A15)$$

The variables r_M^e and r_B^e are the expected real interest rates for deposits and bonds, respectively, and r_E^e is the expected return on equity defined in eq. (A.37). The expected values of variables are based on an adaptive expectations mechanism:

$$X^e = X_{-1} + \xi.(X_{-1}^e - X_{-1}) \quad (A16)$$

The above items constitute the balance sheet of the households, presented in Table A5. One should realise that when presenting the balance sheet this way, claims to pension funds L_{PF} are included in the household wealth V_h .

Table A5 Balance sheet of the household sector

ASSETS		LIABILITIES	
High powered money	$+ H_h$	Mortgages	$+ MO$
Bank deposits	$+ M$		
Bills	$+ B_h$		
Equities	$+ p_e.E_h$		
Homes	$+ p_h.HS$		
		Total (net worth)	$+ V_h$

Household income consists of wages WB and dividends FD paid by firms, bonuses FB paid by banks and interest income:

$$Y_h = WB + FD + FB + i_{M,-1}.M_{-1} + i_{B,-1}.B_{h,-1} \quad (A17)$$

Taxes are net of mortgage interest payments – this feature plays an important role in explaining the high incidence of mortgages in the Netherlands:

³⁶ The subtraction of claims on pension funds is new compared to MMS (2015).

$$Td = \tau_h \cdot (Y_h - \tau_{MO} \cdot i_{MO,-1} \cdot MO_{-1}) \quad (A18)$$

where τ_h is the tax rate on income and τ_{MO} is the tax reduction on interest payments.

The disposable income of households is defined by deducting taxes paid by households Td , net contributions to the pension fund $contr_{PF}$ and interest payments on mortgages from household income Y_h :

$$Y_{hd} = Y_h - Td - contr_{PF} - i_{MO,-1} \cdot MO_{-1} \quad (A19)$$

We assume that households' real consumption depends on real disposable income, the opening stock of wealth V_h and on real capital gains. Capital gains can be obtained on the stock of equity, the only financial asset with a market price, and on housing. Moreover, we assume the stock of housing to have a different impact on consumption compared to financial wealth, due to its differences in liquidity. However, capital gains on housing are assumed to have the same impact as those on equity. As a consequence the consumption function is given by:

$$C = \alpha_1 \cdot y_{hd} + \alpha_2 \cdot v_{-1} + \alpha_3 \cdot (p_h \cdot HS - MO)/p + \alpha_4 \cdot (cge^e + cgh^e - [g_p^e/(1 - g_p^e)] \cdot v_{h,-1}) \quad (A20)$$

where small letters for variables indicate real values, f.i. $y_{hd} = Y_{hd}/p$.

Household savings are defined as the disposable income of households Y_{hd} minus consumption $p \cdot C$:

$$S_h = Y_{hd} - p \cdot C \quad (A21)$$

The capital gains are defined by:³⁷

$$CGE = \Delta p_e \cdot E_{h,-1} \quad \text{and} \quad CGH = \Delta p_h \cdot HS_{-1} \quad (A22)$$

The change in household wealth V_h then follows from:

$$\Delta V_h = S_h + CGE + CGH + \Delta L_{PF} \quad (A23)$$

where one should realise that since claims to pension funds L_{PF} are included in the household wealth, we should take these changes into account. However, as long as we take these claims as an exogenous constant we can ignore these.

Finally, the increase in housing should be included in the production of firms, which appears in the capital balance of the social accounting matrix - see Table 2 in the text.

Firm behaviour and wage and price formation

We combine elements of MMS (2015) and (2016) in modelling both firm behaviour and wage and price setting – in MMS (2016) we allow firms to investment of retained profits in foreign assets, which is also an important element in the present analysis.

³⁷ The term $- [g_p^e/(1 - g_p^e)] \cdot v_{-1}$ is valuation gain on wealth, with g_p^e as expected inflation.

As we elaborate below, the capital stock ($p.K$) is financed by firms using domestically accumulated retained earnings (E_f), equity issued to households ($p_e.E_h$), and loans at banks (L). Moreover, firms hold part of their retained earnings in foreign assets ($p_e.E_a$). This constitutes the balance sheet of firms presented in Table A6. The net worth of firms is $V_f = E_f + p_e.E_a$.

Table A6 Balance sheet of firms

ASSETS		LIABILITIES	
Capital	+p.K	Loans	+ L
Equity acquired	+ $p_e.E_a$	Equity issued	+ $p_e.E_h$
		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:

$$FP = p.Y - WB - T_i \quad (A24)$$

Price p , net of indirect taxes τ_i , is set as a mark-up m on unit labour cost.³⁸ Unit labour cost are defined as nominal wages w times the exogenous labour-output ratio a . Hence:

$$p.(1 - \tau_i) = [1 + m].w.a \quad (A25)$$

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

$$WB = w.N \quad (A26)$$

Nominal wages are exogenous.³⁹

When calculating total profits FT , we should include the returns on foreign assets $p_{ea}.E_a$, next to profits from production FP . The rate of return on foreign assets $r_{E,a}$ is an exogenous mark-up on domestic return r_E . Hence:

$$FT = FP + r_{E,a,-1} \cdot p_{ea,-1} \cdot E_{a,-1} \quad (A27)$$

A fixed proportion $(1 - \phi)$ 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:

$$FU = FT - r_{E,-1} \cdot p_{e,-1} \cdot E_{h,-1} - i_{L,-1} \cdot L_{-1} \quad (A28)$$

where i_L represents the rate of interest on loans L and r_E is the return on equity $p_e.E_h$ – the latter is endogenously determined.

³⁸ Hein assumes a positive impact of the rate of return on equity ρ on the mark-up, i.e. $m'(p) > 0$ – 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.

³⁹ 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.

The retained earnings FU also constitute firm's savings S_f . They are used to invest in both the capital stock and in foreign assets. Whereas in MMS (2016) we model the distribution of retained earnings according to a portfolio model, we use here an exogenous distribution. That is:

$$\Delta(p_{ea} \cdot E_a) = \text{inv}_a \cdot FU \quad (\text{A29})$$

And the remaining part of retained profits is used to finance investment.

Investment is determined by four variables. First the cash-flow rate, rfc , which is a source of self-financing of investment:

$$rfc = FU / (p \cdot K_{-1}) \quad (\text{A30})$$

The second determinant of investment is the interest payments on the leverage ratio, lev :

$$lev = L / (p \cdot K_{-1}) \quad (\text{A31})$$

The third determinant is Tobin's q :

$$q = (L + p_e E) / (p \cdot K_{-1}) \quad (\text{A32})$$

and the fourth determinant is the utilization rate, u , with normal utilization defined at u^* :

$$u = Y / (k \cdot K_{-1}) \quad (\text{A33})$$

As a consequence we find for the growth of the capital stock:

$$g_K = \gamma_0 + \gamma_1 \cdot rfc_{-1} - \gamma_2 \cdot r_{L-1} \cdot lev_{-1} + \gamma_3 \cdot q_{-1} + \gamma_4 \cdot (u_{-1} - u^*) \quad (\text{A34})$$

Gross investment is financed by domestically retained earnings $(1 - \text{inv}_a) \cdot FU$, equity issued to households ΔE_h and loans from banks ΔL . With respect to equity we assume that new equities are issued as a fixed proportion of the amount of external funds required to finance investment:

$$p_e \cdot \Delta E_h = \epsilon \cdot (p \cdot \Delta K - (1 - \text{inv}_a) \cdot FU) \quad (\text{A35})$$

Bank loans then are used to close the remaining financing gap:

$$\Delta L = p \cdot \Delta K - FU - p_e \cdot \Delta E_h \quad (\text{A36})$$

The equilibrium price of equity p_e follows from equating (A35) and (A13) and return on equity follows from:

$$r_E = (\phi \cdot FT - i_{L,-1} \cdot L_{-1}) / p_{e,-1} \cdot E_{h,-1} \quad (\text{A37})$$

Remember that retained earnings FU constitute firm's savings S_f , which contribute to the wealth of firms. Next valuation changes should be taken into account. Hence holds:

$$\Delta V_f = S_f + (\Delta p_e) \cdot E_{fa} - (\Delta p_e) \cdot E_h + (\Delta p) \cdot K \quad (\text{A38})$$

Government

Since we assume government expenditures G proportional to output, growth in government expenditures is equal to output growth:

$$g_G = g_{y,-1} \quad (A39)$$

Value added taxes, profit taxes and income taxes are proportional to the relevant tax base. The budget balance, together with profits from the Central Bank FC minus interest paid on government bonds $i_B \cdot B$, constitute government savings S_g :

$$S_g = Ti + Td + Tf + FC - p \cdot G - i_B \cdot B \quad (A40)$$

These savings, which usually are negative, are financed by supplying bills to the various sectors of the economy:

$$\Delta B = -S_g \quad (A41)$$

Accumulated government debt therefore equals $B = B_c + B_{PF} + B_h + B_a$, which is also the financial net worth of government.

A3. The foreign sector

The foreign sector is introduced in a simple way. 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:

$$TB = X - IM = X - i_m \cdot p \cdot Y \quad (A42)$$

Since foreigners hold bills issued by the government (B_a) and bonds (B_{ba}) and equity ($p_e \cdot E_{ba}$) issued by banks, 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 pension funds, $p_e \cdot E_{fa}$ and $p_e \cdot E_{PF}$, respectively, and by foreign reserves (R) held by the Central Bank. The balance sheet of the foreign sector is given in Table A7.

Table A7 Balance sheet of the foreign sector

ASSETS	LIABILITIES
Bills (B_a)	Equity ($p_e \cdot E_{fa}$)
Bonds (B_{ba})	Equity ($p_e \cdot E_{PF}$)
Equity ($p_e \cdot E_{ba}$)	Foreign Reserves (R)
	Total (net worth) (V_a)

Considering the liabilities of the foreign sector, equity held by pension funds $p_e.E_{PF}$ is exogenous, since the liabilities of pension funds are assumed to be exogenous in this version of the model – see eq. (A6a). On the other hand, foreign equity held by domestic firms $p_e.E_{fa}$ is determined by firms' savings as follows from eq. (A29). The formation of foreign reserves is discussed below in relation to foreign savings.

On the assets side one might consider a portfolio model to determine the distribution of net wealth over financial assets similar to the case of households (and of firms in MMS(2016)). However, that would imply an elaborate system of pricing of financial assets, whereas for the moment being we assume that the foreign sector absorbs the demand for funds by banks, compare equation (A4) and the discussion thereof. Implicitly we assume that asset prices will be set in such a way that banks can indeed acquire their demanded amounts of equity $p_e.E_{ba}$ and bonds B_{ba} , respectively. Nonetheless it seems reasonable to assume that total assets held in bonds by the foreign sector is considered relative to assets held in equity. Consequently, we assume that total assets held in bonds is a proportion of foreign net wealth:

$$B_a + B_{ba} = \nu_{a1} \cdot (B_a + B_{ba} + p_e \cdot (E_{ba} - E_{fa} - E_{PFa})) \quad (A43)$$

However, for simplicity we keep this proportion fixed and invariant to relative asset prices.

Given the discussion above of the other assets and liabilities, implicitly eq. (A43) determines the demand amount for domestic government bonds B_a held by the foreign sector. As we discuss in section 3.2 under QE operations by the domestic National Central Bank the amount for domestic government bonds B_a held by the foreign sector decreases. In section 4 we show how this will be compensated by an increase in domestic bank bonds B_{ba} held by the foreign sector.

The trade balance is part of foreign savings S_a , together with dividends paid to domestic firms and pension funds on their foreign investment, $\rho_a \cdot p_e \cdot E_{fa}$ and $\rho_a \cdot p_e \cdot E_{PF}$ respectively, as well as dividend received from banks $\rho_{ba} \cdot p_e \cdot E_{ba}$, and interest received on bonds issued by domestic banks and government, $i_{ba} \cdot B_{ba}$ and $i_a \cdot B_a$ respectively:

$$S_a = i_{a,-1} \cdot B_{a,-1} + i_{ba,-1} \cdot B_{ba,-1} + \rho_{a,-1} \cdot p_e \cdot E_{ba,-1} - TB - \rho_{a,-1} \cdot p_e \cdot E_{fa,-1} - \rho_{a,-1} \cdot p_e \cdot E_{PF,-1} \quad (A44)$$

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

$$\Delta R = \Delta B_a + \Delta B_{ba} + \Delta p_e \cdot E_{ba} - \Delta p_e \cdot E_{fa} - \Delta p_e \cdot E_{PF} - S_a \quad (A45)$$

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 appears from the stylised facts.

Finally, foreign savings S_a contribute to the net foreign wealth. Next valuation changes should be taken into account. Hence holds:

$$\Delta V_a = S_a + (\Delta p_e) \cdot E_{ba} - (\Delta p_e) \cdot E_{fa} \quad (A46)$$

Appendix B. Full model description and parameter values

Table 1. Full model description

***** GDP COMPONENTS	
$SK = CONSK + IK + IHK + GK + EXK - IMK$	Real final sales (Real GDP)
$S = SK * P$	Nominal sales (nominal gdp)
$CONS = CONSK * P$	Nominal household consumption
$I = IK * P$	Nominal investments
$IHK = IH / P$	Nominal investments houses
$G = GK * P$	Nominal government consumption
$GRS = @PCH(S)$	growth rate of nominal sales (nominal gdp)
$AV_GRS = @MOVAV(GRS(-1), IAVLAGS)$	Lagged average over the last x years
***** FOREIGN SECTOR	
$IM = P_IM * S$	Nominal Imports
$IMK = IM / P$	Real imports
$EX = (P_EX_ADJ=0) * EX_0 + (P_EX_ADJ=1) * (EX(-1) * (1 + AV_GRS))$	Nominal exports
$EXK = EX / P$	Real Exports
$TB = EX - IM$	Trade balance
$FFA = REA * PE(-1) * EFA(-1)$	Foreign dividends paid to domestic firms
$REA = RE + P_REA$	return on foreign equity
$REPFA = REA$	rate of return on foreign assets held by pension funds
$FPFA = REPFA * PE(-1) * EPFA(-1)$	return on foreign assets held by pension funds
$SA = -TB - RBA(-1) * BPFA(-1) + RB(-1) * BA(-1) + RBA(-1) * BBA(-1) + FBA - FPFA - FFA$	Savings foreign sector
$YA = TB + FFA + RBA(-1) * BPFA(-1) + FPFA + SA$	Total expenditures (=income) foreign sector
$DELTAR = DELTABA - DELTABPFA + DELTABBA + PE * DELTAEBA - PE * DELTAEFA - PE * DELTAEPFA - SA$	Change in reserves
$R = R(-1) + DELTAR$	Stock of reserves (held by country as asset on trade partners)
$RS = R / S$	Stock of reserves as percentage of GDP, just for information
$BA = (PE * (EBA - EFA - EPFA)) * VPAR_BA / (1 - VPAR_BA) - BBA$	Foreign held government bonds
$VA_CHK = BA - BPFA + BBA + PE * EBA - PE * EFA - PE * EPFA - R$	Wealth held by foreigners (wealth abroad)
$CGEFA = (PE - PE(-1)) * EFA(-1)$	capital gains firms abroad
$CGEPFA = (PE - PE(-1)) * EPFA(-1)$	capital gains pension funds on equity abroad
$VA = VA(-1) + SA + CGEBA - CGEFA - CGEPFA$	Wealth held by foreigners (wealth abroad)
$TBS = TB / S$	Just for information, trade balance as percentage of GDP
***** HOUSEHOLD SECTOR	
$YH = W + FD + RM(-1) * M(-1) + FB + RB(-1) * BH(-1)$	Taxable Disposable Nominal income
$YHT = YH - TD$	Disposable nominal income net of taxes
$Y = YHT - RMO(-1) * MO(-1)$	Disposable nominal income net of taxes, net of interest payments on mortgages
$YE = Y(-1) * (1 + GRSKE) * (1 + INFLE)$	expected nominal income
$TD = P_DTRATE * (YH - P_TAUMO * RMO(-1) * MO(-1))$	Taxes on income (part of interest payment on mortgages is deductible)
$YK = Y / P$	Disposable real income net of taxes
***** HOUSEHOLD SECTOR, WEALTH AND ITS COMPONENTS	
$VH_CHK = HH + M + BH + EH * PE + PH * HS - MO$	Nominal Household wealth
$VHK = VH / P$	Real Household Wealth

$HH = P_{HH} * CONS$	Cash held by the public
$M = VH - HH - BH - EH * PE - PH * HS + MO$	Stock of bank deposits
$BH = VPAR1 * (VHE - HH)$	Stock of Treasury Bills held by households
$VPAR1 =$ $P_{LAM10} + P_{LAM11} * RRM + P_{LAM12} * RREE + P_{LAM13} * (YE / VHE) + P_{LAM14} * P_{RRB}$	Treasury Bills fraction in portfolio distribution
$REE = RE(-1) + P_{THETARE} * (REE(-1) - RE(-1))$	Expected nominal return on equities
$RREE = (1 + REE) / (1 + INFLE) - 1$	Expected real return on equities
$PE = (VPAR2 * (VHE - HH) - P_{SEQ} * (I + FUA - FU)) / EH(-1)$	Price of equities
$VPAR2 =$ $P_{LAM00} + P_{LAM01} * RRM + P_{LAM02} * RREE + P_{LAM03} * (YE / VHE) + P_{LAM04} * P_{RRB}$	Equity fraction in portfolio distribution
$DHS = X_{HS} - X_{HS}(-1)$	change in the stock of houses (number count)
$HS = HS(-1) + DHS$	stock of houses
$G_{PH} = P_{THETAPHA} * (YHT / YHT(-1) - 1) + (1 - P_{THETAPHA}) * (YE / YE(-1) - 1) -$ $((RMO * (1 - P_{DTRATE} * P_{TAUMO}) + P_{PHI_REP}) / (RMO(-1) * (1 - P_{DTRATE}(-1) * P_{TAUMO}(-1)) + P_{PHI_REP}(-1)) - 1) - P_{PHI_H} * (HS / HS(-1) - 1)$	growth rate of nominal house prices
$PH = PH(-1) * (1 + G_{PH})$	prices of housing
$IH = PH * DHS$	nominal investment in houses
$VHS = PH * HS$	total value of houses
$DMO = P_{PHI1} * PH * DHS + P_{PHI2} * (PH - PH(-1)) * HS - MORC$	Change in mortgages
$MO = MO(-1) + DMO$	Mortgages
$CGEH = (PE - PE(-1)) * EH(-1)$	Capital gains on equities
$CGHS = (PH - PH(-1)) * HS(-1)$	Capital gains on houses
$VH = VH(-1) + Y - CONS + CGEH + CGHS$	Nominal Household wealth
$VHE = VH(-1) + YE - CONS + CGEEH + CGEHS$	expected nominal wealth
***** HOUSEHOLD SECTOR, CONSUMPTION AND SAVINGS	
$CONSK = P_{A1} * YK + P_{A2} * VHK(-1) + P_{A3} * (VHS - MO) / P +$ $P_{A4} * (CGKEEH + CGKEHS) - P_{A4} * INFLE * VHK(-1) / (1 + INFLE)$	Real Consumption
$PEE = PE(-1) * (1 + PEGE)$	expected market price of equities
$PEGE = PE(-1) / PE(-2) - 1 + P_{THETAPE} * (PEGE(-1) - (PE(-1) / PE(-2) - 1))$	expected growth rate of equity prices
$CGEEH = (PEE - PE(-1)) * EH(-1)$	Expected nominal capital gains equities
$CGKEEH = (PEE - PE(-1)) * EH(-1) / (P(-1) * (1 + INFLE))$	Expected real capital gains on equities
$PHE = PH(-1) * (1 + PEGH)$	expected price of houses is equal to:
$PEGH = PH(-1) / PH(-2) - 1 + P_{THETAPH} * (PEGH(-1) - (PH(-1) / PH(-2) - 1))$	and the expected growth rate of houses is:
$CGEHS = (PHE - PH(-1)) * HS(-1)$	Expected nominal capital gains on houses
$CGKEHS = (PHE - PH(-1)) * HS(-1) / (P(-1) * (1 + INFLE))$	Expected real capital gains on houses:
$INFL = P / P(-1) - 1$	Rate of inflation
$INFLE = INFL(-1) + P_{THETAP} * (INFLE(-1) - INFL(-1))$	expected inflation
$SH = Y - CONS$	Nominal savings
***** FIRM SECTOR, PRODUCTION STRUCTURE	
$PRODG = P_{PRODG0} + P_{SHOCKPROD}$	Growth rate labour productivity
$PROD = PROD(-1) * (1 + PRODG)$	labour productivity
$N = SK / PROD$	Demand for labour
$SFC = P_{LAMBDA} * KK$	Full capacity Capital Stock
***** FIRM SECTOR, INVESTMENT AND CAPITAL ACCUMULATION	
$KK = (1 + GR) * KK(-1)$	Real capital stock
$K = KK * P$	Nominal capital stock
$GR = P_{GR0} + P_{GR1} * RFC(-1) - P_{GR2} * RRL(-1) * LEV(-1) + P_{GR3} * Q(-1) + P_{GR4} * (U(-1) - P_{UNORM})$	growth rate real capital stock
$RFC = FU / K(-1)$	cash flow ratio

$LEV = L/K(-1)$	leverage
$Q = (L+PE*EH)/K(-1)$	Tobins' q
$U = SK/SFC(-1)$	Rate of capacity utilisation
$IK = KK-KK(-1)$	Real investments
$KKSK = KK/SK$	Just for information, real capital output ratio
***** FIRM SECTOR, WAGES AND PRICES	
$INFLW = INFLE+PRODGE+INFLW0$	Growth rate real wages
$PRODGE = PRODG(-1) + P_THETAPR*(PRODGE(-1)-PRODG(-1))$	expected productivity growth
$P = (1+P_RO)*WAGE/(PROD*(1-P_TAU))$	price level
$WAGE = WAGE(-1)*(1+INFLW)$	Nominal wage rate
$W = WAGE*N$	Nominal wage sum
$DELTAW = W - W(-1)$	change in wage sum
$UN = LF-N$	Unemployment
$UR = UN/LF$	Unemployment Rate
***** FIRM SECTOR, PROFITS, LOANS AND EQUITY	
$FT_CHK = P_RO*W$	gross profits
$TI = P_TAU*S$	Indirect tax, sales tax
$FT = S - W - TI$	gross profits from production, different definition
$YF = FT + FFA$	gross profits
$TF = P_TFRATE*FT$	Taxes on profits
$FNET = YF-RL(-1)*L(-1)-TF$	Net profits
$FD = @RECODE(FNET<0,0,(1-P_RET)*FNET)$	Distributed profits, fraction of (gross profits - interest on loans - taxes)
$FU = FNET - FD$	Retained profits
$FUA = @RECODE(P_INVA * FU < -PE*EFA(-1), -PE*EFA(-1), P_INVA * FU)$	Change in Equity abroad held by firms, Stock of equity broad cannot be negative
$DELTAEFA = FUA/PE$	Change in Equity abroad held by firms
$EFA = EFA(-1) + DELTAEFA$	Equity abroad held by firms
$DELTAEH = P_SEQ*(I + FUA - FU)/PE$	Change in stock of Equities held by households
$EH = EH(-1) + DELTAEH$	stock of Equities held by households
$DELTAL = (1-P_SEQ) * (I + FUA - FU)$	Change in Stock of Loans
$L = L(-1) + DELTAL$	Stock of Loans
$VF = P*KK-L-PE*EH+PE*EFA$	Wealth of firms
***** GOVERNMENT SECTOR	
$GGK = GRSKE+GRG0$	Growth Real Government consumption
$GK = GK(-1)*(1+GGK)$	Real Government consumption
$GRSK = SK/SK(-1)-1$	Growth rate of real sales
$GRSKE = GRSK(-1) + P_THETAGR*(GRSKE(-1) - GRSK(-1))$	expected growth output
$GD = (G+RB(-1)*B(-1))-YG$	Government deficit
$SG = -GD$	Government savings
$B = B(-1) + GD$	Stock of government bonds
$YG = TI + TD + TF + FC$	government income (production)
$GDS = GD / S$	just for information government deficit as percentage of GDP
$BS = B / S$	just for information government bonds as percentage of GDP
$VG = -B$	just for information, Wealth Government
***** CENTRAL BANK	
$RC = (1+P_RRC)*(1+INFLE)-1$	Nominal interest rate on Central Bank

	advances
$RB = (1 + P_RRB) * (1 + INFLE) - 1$	Nominal interest on treasury bills
$H = HH + HB$	High powered money
$BC = B - BH - BPF - BA$	Treasury Bills held by central bank
$BC_CHK = H - LC - R$	New equation Government Bills by the central bank
$LC = P_ALPHA * M$	alternative, advances as fraction of deposits
$LC_CHK = HB - M + L + BPF + BPFA - BBA + PE * EPFA - EBA * PE + MO - VFS$	Stock of treasury bills by banks, plus loans, plus banks reserves minus stock of bank deposits
$FC = RC(-1) * LC(-1) + RB(-1) * BC(-1) - FBLOSS$	Central bank profits
***** BANKING SECTOR, INCLUDING PENSION FUNDS	
$RMO = RB + P_SPREAD_RMO$	interest on mortgages
$RBA = RB + P_SPREAD_RBA$	interest on bonds issued by bank to foreigners
$RL = RC + P_SPREAD_RL$	Nominal Interest on loans
$RM = RC + P_SPREAD_RM$	Nominal interest on deposits
$BLPR = M / LC$	Nominal interest on deposits is now a spread on interest on advances. The spread depends on the bank liquidity pressure ratio
$RRM = (1 + RM) / (1 + INFLE) - 1$	Real expected interest rate on deposits
$RRL = (1 + RL) / (1 + INFLE) - 1$	Real expected interest rate on loans
$RE = FD / (PE(-1) * EH(-1))$	Nominal interest rate (nominal returns) on equities
$HB = P_HB * M$	Bank reserves
$EBA = EBA(-1) + DELTA EBA$	Stock of equities from banks
$DELTA EPFA = 0.5 * DELTA W$	changes in equity abroad pension funds
$DELTA BPFA = 0.5 * DELTA W$	changes in bills abroad held by pension funds
$EPFA = EPFA(-1) + DELTA EPFA$	Stock of equities of pension funds
$BPFA = BPFA(-1) + DELTA BPFA$	Bills abroad held by pension funds
$BBA = BBA(-1) + DELTA BBA$	New equation Bills issued by banks are now foreign (Bills abroad)
$DELTA BBA = DELTA HB - DELTA M - DELTA LC + DELTA L + DELTA BPF + DELTA BPFA + DELTA MO - PE * DELTA EBA + PE * DELTA EPFA$	Changes in Bonds abroad held by banks
$BPF = X_BPF$	Treasury bills held by pension funds
$DELTA EBA = @RECODE(DELTA EBA1 > DELTA EBA2, DELTA EBA1, DELTA EBA2)$	Change in equities
$DELTA EBA1 = @RECODE(FBT < 0, -FBT / PE, 0)$	if bank profits are negative, buy equities to balance
$DELTA EBA2 = P_BASEL * (MO + L + BPF) / PE - EBA(-1)$	minimum stock of equities
$YFS = RMO(-1) * MO(-1) + RL(-1) * L(-1) + RB(-1) * BPF(-1) + FPFA + RBA(-1) * BPFA(-1)$	Total income of financial sector
$FBT = YFS - (RM(-1) * M(-1) + RC(-1) * LC(-1) + RBA(-1) * BBA(-1))$	Total Bank profits
$FBSA = RE * PE(-1) * EBA(-1)$	bank profits that is paid to equity owners as targeted dividends (but cannot be larger than total profits)
$FBA = @RECODE(FBT > FBSA, FBSA, @RECODE(FBT > 0, FBT, 0))$	bank profits paid as dividends to abroad. If larger than targeted dividends, only pay the latter, if negative, dividends to abroad are zero
$FB = @RECODE(FBT > FBSA, FBT - FBSA, 0)$	profits that remain in the country and are distributed to households. (if positive)
$FBLOSS = @RECODE(FBT < 0, -FBT, 0)$	Bank losses, if any
$MOY_RATIO = MO / Y$	Mortgages as percentage of disposable income
$CGEBA = (PE - PE(-1)) * EBA(-1)$	capital gains for banks
$SFS = -FB - RC(-1) * LC(-1) - RM(-1) * M(-1) + RL(-1) * L(-1) + RB(-1) * BPF(-1) +$	Savings of banks

$RBA(-1)*BPFA(-1) - RBA(-1)*BBA(-1)+RMO(-1)*MO(-1) - FBA + FPFA$	
$VFS = VFS(-1) + SFS - CGEBA + CGEPFA$	wealth accumulation of banks
$DFG = (MO + L) / M$	deposit financing gap
***** TOTAL WEALTH	
$VT = VH + VF + VFS + VG + VA$	Total Wealth
$VT_CHK = P*KK + PH*HS$	
$STOT = SH + FU + SFS + SG + SA$	total savings in the economy

Table 2. Model Parameters

** CONSUMPTION FUNCTION	p_alpha = 0.2 central bank advances ratio
P_A1 = 0.8	p_im = 0.75 imports as fraction of sales
P_A2 = 0.025	** exports
P_A3 = 0.035	p_ex_adj = 1 endogenous adjustment of growth rate of exports (1 = yes, 0 = no)
P_A4 = 0.08	!avlags = 15
** INVESTMENT FUNCTION	p_grex = 0.01
P_GR0 = -0.05	av_grs = p_grex
P_GR1 = 2	** tax rates
P_GR2 = 1	p_dtrate = 0.18 Direct taxes
P_GR3 = 0.1	p_tau = 0.13 Indirect taxes
P_GR4 = 0.1	p_tfrate = 0.30 taxes on profits
P_LAMBDA = 1.3 FULL CAPACITY PRODUCTION, CAPITAL OUTPUT RATIO	** expectations
P_RET=0.10 RETAINED PROFITS	p_thetagr = 0.75
P_RO = 0.22 MARK-UP	p_thetap = 0.75
** 'HIGH POWERED MONEY	p_thetape = 0.75
P_HH = 0.25	p_thetapr = 0.75
P_HB = 0.25	p_thetare = 0.75
VPAR_BA = 0.2 FRACTION OF FOREIGN WEALTH ALLOCATED IN GOVERNMENT BILLS	p_thetaph = 0.75
P_SEQ = 0.32 SHARE OF INVESTMENT FINANCED BY ISSUING EQUITIES	p_thetapha = 1
** PORTFOLIO PARAMETERS	** Real interest rates
P_LAM00 = 0.24	p_rrc=0.01 Central bank advances
P_LAM01 = -0.30	p_rrb=0.02 Treasury bills
P_LAM02 = 0.25	** Banks spreads on central bank interest rate
P_LAM03 = -0.01	p_spread_rl = 0.01
P_LAM04 = -0.10	p_spread_rm = 0.00
P_LAM10 = 0.05	p_spread_rmo = 0.01
P_LAM11 = -0.45	p_spread_rba = 0.01
P_LAM12 = -0.25	p_basel = 0.08 Basel norm
P_LAM13 = -0.01	p_phi_h = 1 Housing price elasticity
P_LAM14 = 0.25	p_rea = 0.0 Return of foreign equity as mark up on return of domestic equity
P_PHI1 = 0.8 MORTGAGE RATIO ON NEW HOUSES	p_inva = 0.1 Fraction of retained profits that is invested in equity abroad
P_PHI2 = 0.8 MORTGAGE RATIO ON PRICE CHANGES ALL HOUSES	p_phi_rep = 0.033 Mortgage repayment rate
P_TAUMO = 0.6 FRACTION OF MORTGAGE INTEREST PAYMENTS THAT IS DEDUCTIBLE FROM TAXES	p_prodg0 = 0 Productivity growth of labour

The UNU-MERIT Working Paper Series

- 2016-01 *Mexican manufacturing and its integration into global value chains* by Juan Carlos Castillo and Adam Szirmai
- 2016-02 *New variables for vocational secondary schooling: Patterns around the world from 1950-2010* by Alison Cathles
- 2016-03 *Institutional factors and people's preferences in social protection* by Franziska Gassmann, Pierre Mohnen & Vincenzo Vinci
- 2016-04 *A semi-endogenous growth model for developing countries with public factors, imported capital goods, and limited export demand* by Jan Simon Hallonsten and Thomas Ziesemer
- 2016-05 *Critical raw material strategies in different world regions* by Eva Barteková and René Kemp
- 2016-06 *On the value of foreign PhDs in the developing world: Training versus selection effects* by Helena Barnard, Robin Cowan and Moritz Müller
- 2016-07 *Rejected Afghan asylum seekers in the Netherlands: Migration experiences, current situations and future aspirations*
- 2016-08 *Determinants of innovation in Croatian SMEs: Comparison of service and manufacturing firms* by Ljiljana Bozic and Pierre Mohnen
- 2016-09 *Aid, institutions and economic growth: Heterogeneous parameters and heterogeneous donors* by Hassen Abda Wakoy
- 2016-10 *On the optimum timing of the global carbon-transition under conditions of extreme weather-related damages: further green paradoxical results* by Adriaan van Zon
- 2016-11 *Inclusive labour market: A role for a job guarantee scheme* by Saskia Klosse and Joan Muysken
- 2016-12 *Management standard certification and firm productivity: micro-evidence from Africa* by Micheline Goedhuys and Pierre Mohnen
- 2016-13 *The role of technological trajectories in catching-up-based development: An application to energy efficiency technologies* by Sheng Zhong and Bart Verspagen
- 2016-14 *The dynamics of vehicle energy efficiency: Evidence from the Massachusetts Vehicle Census* by Sheng Zhong
- 2016-15 *Structural decompositions of energy consumption, energy intensity, emissions and emission intensity - A sectoral perspective: empirical evidence from WIOD over 1995 to 2009* by Sheng Zhong
- 2016-16 *Structural transformation in Brazil, Russia, India, China and South Africa (BRICS)* by Wim Naudé, Adam Szirmai and Nobuya Haraguchi
- 2016-17 *Technological Innovation Systems and the wider context: A framework for developing countries* by Hans-Erik Edsand
- 2016-18 *Migration, occupation and education: Evidence from Ghana* by Clotilde Mahé and Wim Naudé
- 2016-19 *The impact of ex-ante subsidies to researchers on researcher's productivity: Evidence from a developing country* by Diego Aboal and Ezequiel Tacsir
- 2016-20 *Multinational enterprises and economic development in host countries: What we know and what we don't know* by Rajneesh Narula and André Pineli
- 2016-21 *International standards certification, institutional voids and exports from developing country firms* by Micheline Goedhuys and Leo Sleuwaegen

- 2016-22 *Public policy and mental health: What we can learn from the HIV movement* by David Scheerer, Zina Nimeh and Stefan Weinmann
- 2016-23 *A new indicator for innovation clusters* by George Christopoulos and Rene Wintjes
- 2016-24 *Including excluded groups: The slow racial transformation of the South African university system* by Helena Barnard, Robin Cowan, Alan Kirman and Moritz Müller
- 2016-25 *Fading hope and the rise in inequality in the United States* by Jo Ritzen and Klaus F. Zimmermann
- 2016-26 *Globalisation, technology and the labour market: A microeconomic analysis for Turkey* by Elena Meschi, Erol Taymaz and Marco Vivarelli
- 2016-27 *The affordability of the Sustainable Development Goals: A myth or reality?* By Patima Chongcharoentanawat, Kaleab Kebede Haile, Bart Kleine Deters, Tamara Antoinette Kool and Victor Osei Kwadwo
- 2016-28 *Mimetic behaviour and institutional persistence: a two-armed bandit experiment* by Stefania Innocenti and Robin Cowan
- 2016-29 *Determinants of citation impact: A comparative analysis of the Global South versus the Global North* by Hugo Confraria, Manuel Mira Godinho and Lili Wang
- 2016-30 *The effect of means-tested social transfers on labour supply: heads versus spouses - An empirical analysis of work disincentives in the Kyrgyz Republic* by Franziska Gassmann and Lorena Zardo Trindade
- 2016-31 *The determinants of industrialisation in developing countries, 1960-2005* by Francesca Guadagno
- 2016-32 *The effects of productivity and benefits on unemployment: Breaking the link* by Alessio J. G. Brown, Britta Kohlbrecher, Christian Merkl and Dennis J. Snower
- 2016-33 *Social welfare benefits and their impacts on labour market participation among men and women in Mongolia* by Franziska Gassmann, Daphne François and Lorena Zardo Trindade
- 2016-34 *The role of innovation and management practices in determining firm productivity in developing economies* by Wiebke Bartz, Pierre Mohnen and Helena Schweiger
- 2016-35 *Millennium Development Goals (MDGs): Did they change social reality?* by Janyl Moldaliev, Arip Muttaqien, Choolwe Muzyamba, Davina Osei, Eli Stoykova and Nga Le Thi Quynh
- 2016-36 *Child labour in China* by Can Tang, Liqiu Zhao, Zhong Zhao
- 2016-37 *Arsenic contamination of drinking water and mental health* by Shyamal Chowdhury, Annabelle Krause and Klaus F. Zimmermann
- 2016-38 *Home sweet home? Macroeconomic conditions in home countries and the well-being of migrants* by Alpaslan Akay, Olivier Bargain and Klaus F. Zimmermann
- 2016-39 *How do collaboration and investments in knowledge management affect process innovation in services?* by Mona Ashok, Rajneesh Narula and Andrea Martinez-Noya
- 2016-40 *Natural disasters and human mobility* by Linguère Mously Mbaye and Klaus F. Zimmermann
- 2016-41 *The chips are down: The influence of family on children's trust formation* by Corrado Giulietti, Enrico Rettore and Sara Tonini
- 2016-42 *Diaspora economics: New perspectives* by A.F. Constant and K.F. Zimmermann
- 2016-43 *Entrepreneurial heterogeneity and the design of entrepreneurship policies for economic growth and inclusive development* by Elisa Calza and Micheline Goedhuys

- 2016-44 *Gini coefficients of education for 146 countries, 1950-2010* by Thomas Ziesemer
- 2016-45 *The impact of rainwater harvesting on household labor supply* by Raquel Tsukada Lehmann and Christian Lehmann
- 2016-46 *The impact of piped water supply on household welfare* by Raquel Tsukada and Degol Hailu
- 2016-47 *The impact of household labor-saving technologies along the family life cycle* by Raquel Tsukada and Arnaud Dupuy
- 2016-48 *River deep, mountain high: Of long-run knowledge trajectories within and between innovation clusters* by Önder Nomaler and Bart Verspagen
- 2016-49 *Demographic dynamics and long-run development: Insights for the secular stagnation debate* by Matteo Cervellati, Uwe Sunde and Klaus F. Zimmermann
- 2016-50 *Reservation wages of first- and second-generation migrants* by Amelie F. Constant, Annabelle Krause, Ulf Rinne and Klaus F. Zimmermann
- 2016-51 *A 'healthy immigrant effect' or a 'sick immigrant effect'? Selection and policies matter* by Amelie F. Constant, Teresa García-Muñoz, Shoshana Neuman and Tzahi Neuman
- 2016-52 *The invisible hand of informal (educational) communication!? Social capital considerations on Twitter conversations among teachers* by Martin Rehm and Ad Notten
- 2016-53 *Fueling conflict? (De)escalation and bilateral aid* by Richard Bluhm, Martin Gassebner, Sarah Langlotz and Paul Schaudt
- 2016-54 *Trade liberalisation and child labour in China* by Liqiu Zhao, Fei Wang and Zhong Zhao
- 2016-55 *Three decades of publishing research in population economics* by Alessio J.G. Brown and Klaus F. Zimmermann
- 2016-56 *Corruption, innovation and firm growth: Firm-level evidence from Egypt and Tunisia* by Micheline Goedhuys, Pierre Mohnen and Tamer Taha
- 2016-57 *Poverty reduction strategies in Canada: A new way to tackle an old problem?* by Geranda Notten and Rachel Laforest
- 2016-58 *Innovation system in development: The case of Peru* by Pluvia Zuniga
- 2016-59 *Formal and informal appropriation mechanisms: the role of openness and innovativeness* by Ann-Kristin Zobel, Boris Lokshin and John Hagedoorn
- 2016-60 *On the fungibility of public and private transfers: A mental accounting approach* by Jennifer Waidler
- 2016-61 *Patents, exhibitions and markets for innovation in the early twentieth century: Evidence from Turin 1911 International Exhibition* by Giacomo Domini
- 2016-62 *Towards a new European refugee policy that works* by Amelie F. Constant and Klaus F. Zimmermann
- 2016-63 *The effect of improved storage innovations on food security and welfare in Ethiopia* by Wondimagegn Tesfaye and Nyasha Tirivayi
- 2016-64 *Tilting at windmills or whipping up a storm? Elites and ethno-nationalist conflict during democratisation* by Lutz F. Krebs
- 2016-65 *Contracting for technology transfer: patent licensing and know-how in Brazil* by Catalina Martinez and Pluvia Zuniga
- 2016-66 *Post-Enlargement Migration and the Great Recession in the E(M)U: Lessons and policy implications* by Martin Kahanec and Klaus F. Zimmermann

2016-67 *The impact of quantitative easing in the Netherlands: a stock-flow consistent approach* by Huub Meijers and Joan Muysken