The Dutch balance sheet recession: a stock-flow consistent approach

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Abstract

In aftermath of the great recession the Netherlands suffers from low GDP growth, which was occasionally negative. An important reason is low consumption growth and a very low consumer confidence. This low confidence is aggravated by the insight that the funded pension system with defined benefits in the Netherlands becomes untenable in the light of the low interest rate and the continuous ageing of the population. Also investment remains remarkably low, in spite of an increased share of retained profits in GDP. Finally, the balance-of-payments surplus is very high. In relation to these problems the Netherlands is suffering from a banking crisis, combined with a housing/mortgage crisis and accompanied by a marked decline in household savings. As a consequence the Dutch situation shows many features of a balance sheet recession.

In this paper we argue that traditional macro-economic models cannot analyse this phenomenon since they lack a proper model of the financial sector and underestimate the potential for interactions between the monetary and the real sphere. We present the stock-flow consistent approach developed by Godley and Lavoie as a valuable alternative to traditional and new Keynesian macroeconomic models and we use this approach to analyse the balance sheet recession for the Netherlands. We also use this model to evaluate some policy proposals to improve economic growth and reduce inequality.

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1 Introduction

The Dutch economy is characterised by negative government savings, positive household savings, and large positive firm savings accompanied by a large balance of trade surplus. The household savings are mainly positive because of compulsory savings for funded pensions. Due to increased house prices voluntary household savings have been negative – the reason is that anticipating even further increases in house prices consumption soared, financed by mortgages. The latter led to huge mortgage burdens for households and overstretched bank balances. On the other hand pension wealth, managed by pension funds, has also increased strongly.

The financial sector in the Netherlands is large according to international standards. The banking system has grown strongly, mainly trough expanding mortgages. However, the traditional source of financing of mortgages through deposits was not sufficient (the so-called deposit financing gap) and has caused banks to resort to funding abroad, which is much more expensive. The resulting debt restructuring problems for banks have been investigated, together with the end of the housing boom, in Meijers, Muysken and Sleijpen (2014), from hereon denoted by MMS. In this paper we extend the analysis of MMS to include the three pillar pension system. Pension funds, which form the second pillar, are a large part of the financial sector. These funds mainly invest abroad and are facing solvency problems because of the low interest rate. This balance problem forces the funds to adjust pension contributions and benefits, which affects income and consumption.

We argue in MMS that the main stream approach of New-Keynesian models is not well suited to analyse balance restructuring since it lacks a consistent overview of balances in the economy. Moreover this approach usually does not feature a financial sector and tends to ignore the rich interactions between the monetary and the real sphere. The stock-flow consistent approach developed by Godley and Lavoie (2007a) provides a valuable alternative. This point is also elaborated in Muysken (2014), who also points out the importance of behavioural rules in the stock-flow consistent approach. In MMS we therefore developed a stock-flow consistent model for the Netherlands, extending the model of Zezza and Dos Santos (2006) and Zezza (2008) to include a foreign sector and a more elaborate bank sector. In this paper we further extend that model to include pension funds in the financial sector and to analyse the impact of compulsory pension savings on consumption of the young, together with the impact of benefits on consumption of the old. The distinction between young and old consumers also allows us to examine the consequences of an ageing population.

The paper is structured as follows. In Section 2 we present relevant stylised facts of the Dutch economy, including the three pillar pension system. Our model should be able to reproduce these stylised facts. The model itself is presented in Section 3, where we partly reproduce the model description used in MMS and emphasise the new features related to the pension system. We then calibrate the model in Section 4 and present some simulation results. We show how the decrease in the interest rate has forced the pension funds to increase its contributions and decrease its benefits in order to restore solvency. In combination with the restructuring by banks of their balances, this has affected consumption and economic growth negatively. We also show how the government budget deficit rule of 3% may impede recovery. The most important findings are summarised in Section 5.

2. Stylized facts for the Dutch economy

2.1 Introduction

In MMS we identified four stylized facts of the Dutch economy over the past decades, which we briefly mention here:

1. Economic growth is strongly dependent on export growth – exports are almost 90 per cent of GDP – and the Netherlands traditionally has a large current account surplus – it was 9 per cent of GDP in 2013.
2. There has been a structural decline in household savings relative to disposable income since the early 1990's, from 16 per cent in 1990 to below 6 per cent in 2012. This is related to the large increase in house prices – the average house price more than doubled in the decade between 1995 and 2005 and it reached a peak in late 2008, after which house prices started to decline. Related to that mortgages increased form 50 per cent of disposable household income in 1990 to almost 250 per cent in 2010.
3. The large banking sector, which traditionally has a large foreign exposure, has become excessively vulnerable, partly due to its huge mortgage exposure. The acceleration in mortgage debt since the early 1990s could no longer be financed by deposits (the deposit funding gap) and since the mid-1990s debt securitization became an increasingly important source of financing. This resulted in an enhanced vulnerability of the banking system to the vagaries of the international financial markets.
4. The Netherlands, like most other European countries, has a relatively high share of government expenditures: The 'collective expenditures', including transfers for social security, are about 50 per cent of GDP, whereas the 'pure' government expenditures, which are counted as value added in the national accounts, are about 30 per cent of GDP. Government debt in 2013 was about 70 per cent of GDP.

We were able to reproduce these stylised facts in MMS. The present analysis aims to explore the impact of pension funds on the Dutch economy and its balance sheet problems.

Table 1 Composition of the financial sector in the Euro Area and Germany and France in 2012 (multiples of GDP)

	MFI's	Pension & Insurance	Others[1]	Total
Euro Area	3.44	0.82	0.97	5.23
Germany	3.09	0.81	0.52	4.42
France	3.97	1.04	0.63	5.64
The Netherlands	4.15	2.45	1.82	8.43

Source: ECB Statistics

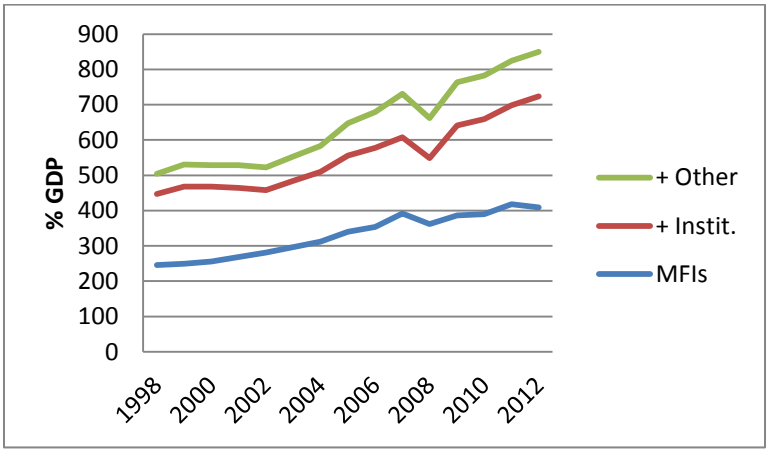
To illustrate the importance of pension funds, we present in Table 1 the composition of the Dutch financial sector in an international perspective. In line with its large financial sector, the ratio of total financial assets to GDP is high in the Netherlands: 8.4 times GDP as compared to the Euro Area in average in 2012 of 5.2 times GDP (compared to Germany 4.4 and France 5.6). The banking sector

[1] These are "Investment funds" and "Financial vehicle corporations".

(MFI's) in the Netherlands is relatively large – see also stylised fact 3 – and the other two sectors are very large in international comparison.[2] The group "others" is closely related to the banking sector – as is elaborated in Bezemer and Muysken (2014). The group "pension and insurance" is relative to GDP three times as large the Euro Area average, due to the presence of pension funds.

From Figure 1 one sees that total assets of Dutch financial institutions have grown strongly between 1998 and 2012: from 5 times GDP to more than 8 times GDP (which was about € 600 bln in 2012). The figure also shows the importance of the institutional financial institutions, in particular pension funds, in the Netherlands. The institutional sector increased from two times GDP in 1998 to three times GDP in 2013.[3]

Figure 1 Composition of Financial Institutions, 1998 -2012



Source: CBS Statline

As is elaborated in Bezemer and Muysken (2014), the institutional sector consists of pension funds, insurance companies and trust funds. It is dominated by pension funds (50 to 60 per cent of total assets of the sector) due to the presence of a funded pension system in the Netherlands followed by life-insurance companies (20 to 30 percent).

The present analysis aims to explore the impact of pension funds on the Dutch economy and its balance sheet problems. We elaborate the pension system in Section 2.2 and its impact on household balances in Section 2.3. The additional stylised facts the analysis should explain are summarised in Section 2.4.

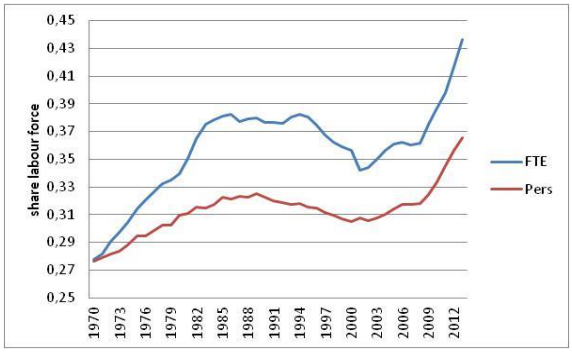
2.2 The Dutch three-pillar pension system

Old age provisions in the Netherlands are based on a three pillar system. Workers contribute to a pay-as-you-go system in the first pillar (called AOW) to provide for basic old age income of retired persons. The pensioners receive this basic income. The second pillar is a funded pension system, where wage earners (and employers) pay obligatory contributions into their pension fund. Until recently, this was a defined benefit system – i.e. the funds paid out to pensioners a fixed share of

[2] This is often overlooked in international comparisons. See for instance OECD (2104), which almost exclusively focuses on the vulnerability of the banking sector.
[3] This is partly due to a definition change in 2009, when trust funds ("institutionele beleggers") were included under institutions.

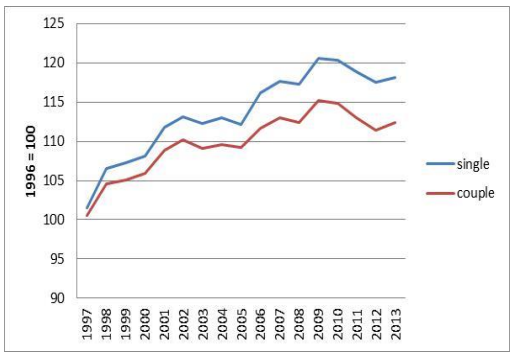
their (mean) wage (corrected for price or wage developments). Recently that share has been decreased. The third pillar is defined by individual savings.

Figure 2 Benefit recipients first pillar (AOW), 1970 – 2013



Source: CPB (2014)

Figure 3 Benefits first pillar (AOW), 1997 – 2013 purchasing power (1996 = 100)



Source: CPB (2014)

With respect to the first pillar we show in Figure 2 how the number of recipients has developed over time relative to the labour force. The lower line shows the share of the labour force in terms of the total population 15 – 64, the upper line shows the share of the labour force in terms of years actually worked (full-time equivalent).[4] Relevant for our analysis is the sharp increase in this ratio after 2000, in particular in the most recent years. This indicates how due to the ageing of population, accelerated by the post WWII baby boom in recent years, the claims on the basic old age income pensions have grown. Moreover, in particular the upper line illustrates the burden this implies for the working population which has to provide these pensions, due to the pay-as-you-go nature of the first pillar. Whereas in 1970 the old aged only constituted 28 per cent of the active labour force, this share has increased to 44 per cent as can be seen from Figure 2 – we sketch a similar development for pensions (pillar 2) in Figure 4 below. To keep the burden for the work force manageable, the basic old age income provisions over time have decreased. One sees from Figure 3 that in most years the purchasing power of benefits increased, 15 till 20 percent points over the period 1996 -2010. However, during that period real GDP increased by 35 percent points. This explains why total benefits as a share of GDP have been decreasing: from 6 per cent of GDP in 1997 – 2000 to below 5 per cent in 2008 and later. Moreover, in reaction to the recent surge in pensioners the decision has been made to gradually increase the entitlement age from 65 till 67 years.

The development of the numbers of persons contributing to and benefiting from the funded pension system (pillar 2) is shown in Figure 4. From the figure one sees how the number of pension recipients increases steadily over time, while the number of contributors, indicated by 'active', stagnates after 2000. As a consequence the ratio between recipients and contributors initially is steady around 0.4, but then increases till 0.53 in2012 – this development is quite similar to that depicted in Figure 2.

The development of benefits and contributions per person is presented in Figure 5. One observes how both increase steadily over time, although contributions increase faster. As a consequence the ratio of benefits and contributions per person increased from 25 per cent in 1997 to 60 per cent in 2012.

[4] The difference between both developments illustrates the increased incidence of part-time work in the Netherlands and the fluctuations in the number of inactive persons.

Figure 4 Number of contributors and recipients in the funded pension system[5]

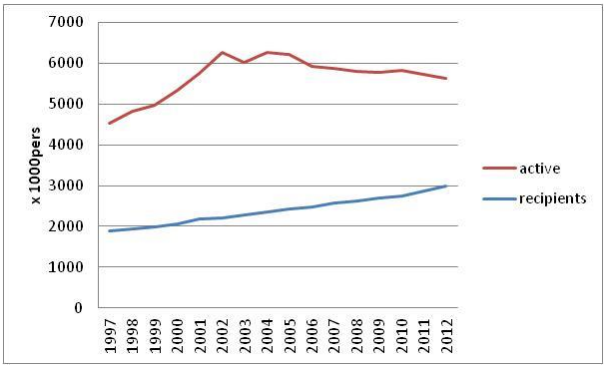
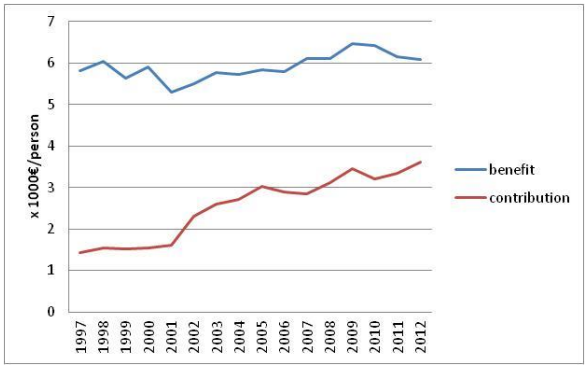


Figure 5 Benefits from and contributions to funded pensions[6]



Source: CBS, Statline Source: CBS, Statline

The financial situation of the second pillar has been discussed in Bezemer and Muysken (2014) – we reproduce part of that discussion below. The changing asset compositions of pension funds is shown in Figure 6. The liabilities are claims by pension or insurance holders.

Figure 6 Cumulated asset composition of pension funds, 1987 – 2012 [7]

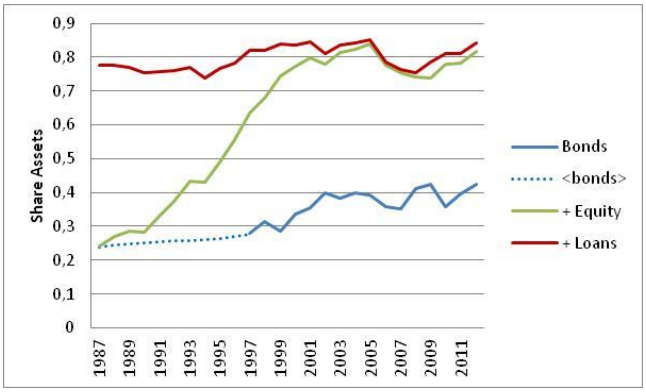
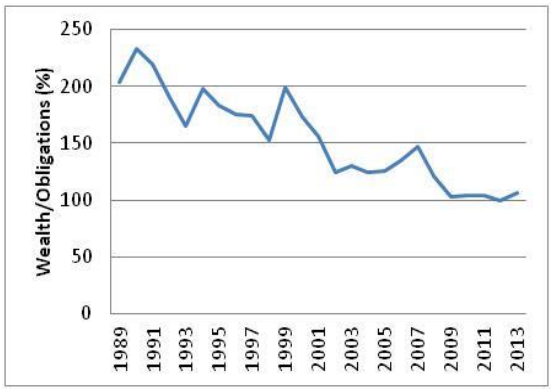


Figure 7 Coverage rate of pension funds, 1989 – 2013



Source: CBS, Statline Source Bosch (2011), DNB

In the 1980s, only a small part of pension fund assets was invested in (predominantly Dutch government) bonds. Most was invested in domestic loans. This was imposed by government regulations. After the 1980s deregulation this has changed dramatically. Over 80 % of total assets in 2013 and 2014 is invested in equity and bonds, mainly abroad. Pension funds hardly issue mortgages, in contrast to the 1980s. In life insurance a similar trend occurred – loans have also been replaced by

[5] This refers to all persons contributing to and benefiting from pension funds (which includes for instance pensions for orphans and widows). The number of old age pensioners increases from 60 to 70 percent of the total number of beneficiaries over the period 1997 – 2012.

[6] The benefits refer to old age pensions, the contributions refer to all pensions (and cover a larger number of persons). The data are corrected for the development of the nominal wage rate.

[7] The dotted line has been extrapolated for illustration, to show that initially only bonds were held, no equity. The remaining assets other than equity and bonds are mainly claims to debtors.

equity of which the risk is held by the insured persons themselves. In addition, life insurance companies invest in mortgages.

The data thus show that in both pensions and life-insurances there has been a development toward investment in more risky assets, of which the risk is partly born by the insured persons. For the pension funds this follows from the development of the coverage rate, which has been falling over time. In spite of having a defined benefit system, both pension funds and government underestimated the importance of building up proper reserves in good times. Presumably misled by the high coverage rate in the 1980's, pension funds were allowed to finance early retirement, to decrease pension payments and to finance firms directly (Bosch, 2011). This led to a dangerously low coverage rate in the early 2000's, below the target rate of 125 % - see Figure 7. After the financial crisis the coverage rate fell below the critical threshold of 105 %, which forced the pension funds to abandon the defined benefit system. The main reason for the sharp drop in the coverage rate after the financial crisis was the drop in the interest rate, which led to a sharp increase in discounted pension obligations due to the defined benefit system.[8]

This process was accompanied by a heated public debate, culminating in a "Pension Agreement" between the government, employers and labour unions in 2010. While the agreement solved short run problems (it decreased pensions and made them vary with the performance of the pension funds), the discussions also created uncertainty, which contributed to lower consumption and higher savings by households.

It is now debated in the Netherlands whether pension funds should invest more in the domestic economy. One proposal under discussion is the creation of a National Mortgage Bank (Nationale Hypotheekbank) partly funded by pension funds. While this may be in the interest of current borrowers, the policy is contested to the extent that it may clash with the need to generate returns on investment for future pensioners.

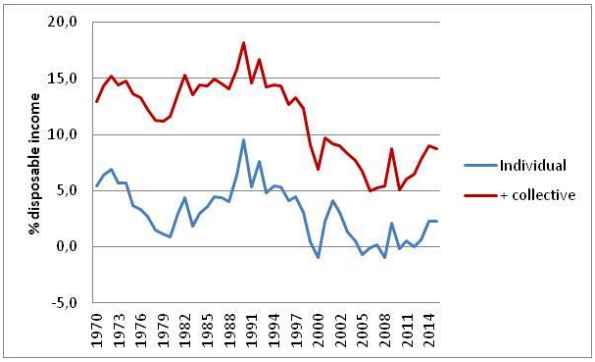
2.3 Funded pensions and savings behaviour of households[9]

As we discussed in the previous section, the second pillar is a funded pension system, where wage earners pay obligatory contributions into their pension fund. As a consequence one can distinguish between collective household savings used to finance the funded pension system, which are obligatory, and voluntary individual savings, which constitute the third pillar – see Figure 8. The collective savings (net of pension benefits) increased from 8 per cent of disposable income in 1970 till almost 12 per cent in 1983 and then decreased steadily till around 7 per cent in 2003, after which it fluctuated. The decrease after 1983 was due to lower pension contributions and facilitating early retirement, both motivated by the bad economic situation in the aftermath of the second oil crisis and the strong financial situation of the pension funds. In the early 2000's the ageing problem was recognised – see also Figure 2 above. Early retirement was abandoned and the defined benefit was redefined from a fraction of end wage to a fraction of mid-wage. In the aftermath of the financial

[8] Prior to the financial crisis a decrease in the interest rate also was responsible for some fall in the coverage rate, since that rate is calculated at market interest rates.
[9] This section follows Bezemer and Muysken (2014) closely.

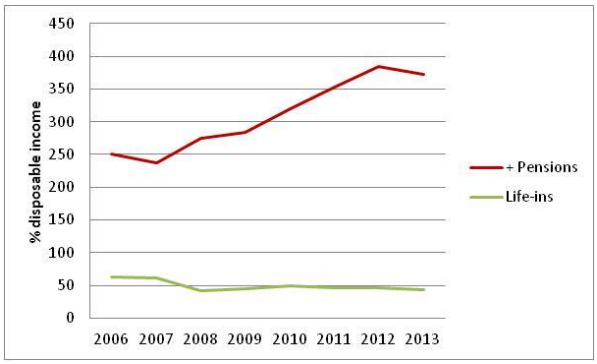
crisis, the fall in the interest rate increased the liabilities of the pension funds, which forced the pension funds to increase their assets. As a consequence the pension funds increased their contributions (and also lowered benefits). This led to an increase in collective savings.

Figure 8 Savings of Dutch households (cumulated), 1970 – 2014



Source: CPB (2014)

Figure 9 Pension and life-insurance wealth of Dutch households (cumulated)



Source: DNB

The behaviour of individual savings is quite different, as can be seen from Figure 8. The sharp fall in these savings after the oil crisis reflects the wish to maintain consumption at 1970s level. These savings then returned to their early 1970s level of 5 per cent, until the early 1990s. Then individual savings turned negative due to the housing boom around 2005, as we elaborate below, and started to increase again when the housing boom went bust.

DNB publishes data on financial wealth of households since 2006. On the one hand it is a narrow definition of household wealth since it only focuses on financial wealth, on the other hand it includes pension wealth and life insurances. The latter two are presented in Figure 9 as a percentage of disposable income. One observes that life insurances only play a minor role in old age provisions; pensions are almost four times as large already in 2006. Moreover, pension wealth has grown very strongly over 2008 – 2012, until almost 350 per cent of disposable income. The reasons are the lower interest rate which inflated the liabilities of the pension funds and a positive return on investments in the period 2009 – 2013.

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.[10] Another example is that in studies of the impact of wealth on consumption behaviour, usually pension wealth is not included – see for 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. The funds also lowered benefits – see Figure 4 above.

[10] See, for instance , WRR (2014, Ch. 4).

2.4 Additional stylised facts for the Netherlands

The developments sketched above constitute the fifth and sixth stylised facts we want to add to our description of the Dutch economy in four stylised facts as presented in MMS, and summarised in Section 2.1. The present model seeks to explain in particular these additional stylised facts.

5. The Netherlands has a three pillar pension system, consisting of a self-supporting pay-as-you go system with a relatively low benefit as the first pillar. This is supplemented by a compulsory funded pension system as the second pillar and voluntary savings as the third pillar. The funded pension system is administered by pension funds, which constitute a large part of the Dutch financial sector. The compulsory contributions led to collective savings which were a stable share of about 6 per cent of disposable income since the mid 1990s. Due to the low interest rate the pension funds have been forced recently to restructure their balances by raising pension contributions and lowering benefits.
6. Pension wealth of households is very large, but exerts no direct influence on consumption. Individual savings, which constitute the third pillar, have been zero or even negative in the last years because of the housing boom. Recently these savings started to increase slightly because of the end of the housing boom and uncertainty on the development of the pension system.

3. A stock-flow consistent model for the Dutch economy

As indicated in the introduction our analysis includes the pension system in the MMS stock-flow consistent model of the Dutch economy. The MMS model extends the model developed by Zezza and Dos Santos (2006) and further elaborated in Zezza (2008) to include a foreign sector and a more elaborate banking sector. In this section we present the model, partly reproducing the description provided in MMS.

We start with a model of the household sector (Section 3.1), showing how a housing boom can decrease voluntary savings whereas the presence of funded pensions leads to compulsory savings. Moreover, increased pension contributions and decreased benefits affect consumption negatively. We then model the pension fund (Section 3.2), which mainly invests abroad. The model shows how both ageing and a decrease in the interest rate can threaten the solvency of the pension fund, inducing it to increase contributions and lower benefits. The other sectors are taken (almost unchanged) from MMS. The banking sector (Section 3.3) issues loans and mortgages and faces a deposit financing gap. The foreign sector (Section 3.4) shows a current account surplus and adds to the reserves of the Central Bank. The firm sector (Section 3.5) invests and retains profits and government (Section 3.6) follows an anti-cyclical budget policy. The closure of the model is discussed at the end (Section 3.7). There also the balances presented for each sector are summarized in the balance sheet for the total economy, together with the social accounting matrix which summarizes all transactions – see Tables 8 and 9 below, respectively. The full model is presented in the Appendix.

Finally, nominal variables are in upper cases; real variables are in lower cases and indicated explicitly as such.

3.1 A household model with mortgages and pensions

In MMS we presented a household model with a housing market, which we briefly summarise below. In this section we extend the model to include pensions.

When including 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 this implies that the growth rate of the house price follows from:

$$\Delta \mathrm{lnP_t^h} = \psi_t + \alpha \Delta \mathrm{lnY_t^h} + (1-\alpha)\Delta \mathrm{lnY_t^e} - \Delta \mathrm{ln}[\mathrm{i_{MO}}(1-\tau_h \tau_{MO}) + \mathrm{f_{MO}}] - \Delta \mathrm{lnHS_t} \qquad (1)$$

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 willing and able to spend, 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.

With respect to mortgages 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:

$$\Delta MO = \varphi.ph.\Delta HS + \varphi.\ \Delta ph.HS - morc.MO_{-1} \qquad (2)$$

where *morc* is the share of mortgage repayments.

To introduce pensions in the model, we distinguish between the working age population, N^Y, and the retired population, N^O. Consistent with the Dutch three pillar system, workers contribute in the first pillar (called AOW) to a pay-as-you-go system to provide for their basic old age income, paying a premium p_{AOW} of their wages. The pensioners receive a benefit b_{AOW} as a fraction of the wage W. The determination of benefits and premiums is determined by the government – see Section 3.6 below.

The second pillar is based on funded pensions according to which wage earners are obliged to contribute to their pension fund by paying a premium, p_{pf}, based on their wage. When retiring, the pensioners receive a pension benefit. We assume a defined benefit system, which implies that pensioners receive a benefit which is a fraction, b_{pf}, of their wage with pension benefits and accruals being increased based on price or wage developments. As a consequence the working age population contributes each year $p_{pf}.WB$, and the pensioners receive each year $b_{pf}.WB.N^O/N^Y$. The determination of benefits and premiums is determined by the pension fund – see Section 3.2 below.

The third pillar is defined by household savings. For simplicity we assume that financial wealth in the form of bills B_h, high-powered money H_h, equities $p_e.E_h$ and bank deposits M, is held by the young and the old proportional to their size; the same holds for housing property $ph.HS$ and mortgages MO.

The balance sheet of households then can be represented by Table 2. The liabilities of the pension funds, L_{pf}, also are assets held by the households - we elaborate these in Section 3.2 below .

Table 2 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	$+ph.HS$		
Pension claims	$+L_{pf}$		
		Total (net worth)	$+ V_h$

In line with Godley and Lavoie (2007a) we assume that demand for the financial assets H_h, B_h and E_h follows from a Tobin-type portfolio model. Bank deposits *M* then are determined as a residual of household wealth. This implies that financial wealth, net of housing property and mortgages and net of pension claims:

$$VN = V_h - (ph.HS - MO) - L_{pf} = H_h + M + B_h + p_e.E_h \quad (3)$$

is distributed over its assets components as follows:[11]

$$H_h = v_1.p.C \quad (4)$$

$$p_e.E_h /(VN^e - H_h) = \lambda_{00} - \lambda_{01}.r^e_M + \lambda_{02}.r^e_E - \lambda_{03}.Yhd^e/V^e - \lambda_{04}.r^e_B \quad (5)$$

$$B_h/(VN^e - H_h) = \lambda_{10} - \lambda_{11}.r^e_M - \lambda_{12}.r^e_E - \lambda_{13}.Yhd^e/V^e + \lambda_{14}.r^e_B \quad (6)$$

$$M = VN - H_h - B_h - p_e.E_h \quad (7)$$

The expected values of variables are based on an adaptive expectations mechanism:

$$X^e = X_{-1} + \xi.(X^e - X_{-1}) \quad (8)$$

With respect to the income of households we distinguish between income for young and for old. We assume that bank profits *FB* accrue to the young only, in the form of bonuses, as does the wage bill. As a consequence the income of the young is:

$$Yh^y = (1 - p_{AOW} - p_{pf}).WB + FB + [i_{M,-1}.M_{-1} + FD + i_{B,-1}.B_{h,-1}].N^y/(N^y + N^o) \quad (9)$$

and that of the old is:

$$Yh^o = (b_{AOW} + b_{pf}).WB.N^o/N^y + [i_{M,-1}.M_{-1} + FD + i_{B,-1}.B_{h,-1}].N^o/(N^y + N^o) \quad (10)$$

We may assume different propensities to consume for the young and the old, but for simplicity we assume these to be identical. That implies that we can look at total household income *Yh* as a determinant of consumption, which is given by:

$$Yh = (1 - p_{pf} + b_{pf}.\ N^o/N^y).WB + FD + i_{M,-1}.M_{-1} + FB + i_{B,-1}.B_{h,-1} \quad (11)$$

We define the disposable income of households *Yhd* by deducting taxes and interest payments on mortgages:

$$Yhd = Yh - Td - i_{MO,-1}.MO_{-1} \quad (12)$$

Td are taxes paid by households, corrected for tax reduction for interest on mortgages:

$$Td = \tau_h.(Yh - \tau_{MO}.i_{MO,-1}.MO_{-1}) \quad (13)$$

The tax reduction on interest payments plays an important role in explaining the high incidence of mortgages in the Netherlands.

[11] Restrictions on lamda are hardly relevant, except $\lambda_{00} + \lambda_{10} < 1$, because bank deposits act as a buffer to wrong expectations – see Zezza (2008) for an elaboration of this point.

For wealth effects, we assume that there is no wealth effect from pension claims in line with the Dutch modeling tradition (CPB, 2010). Moreover, financial wealth, net housing wealth and capital gains have different propensities to consume – see also CPB (2013). In that case real consumption follows from

$$c = \alpha_1.yhd + \alpha_2.vn_{-1} + \alpha_3.(ph.HS - MO)/p + \alpha_4.(cge^e + cgh^e - [g^e_p/(1 - g^e_p)].v_{-1}) \quad (14)$$

where small letters for variables indicate real values, f.i. yhd = Yhd/p and vn = VN/p. The capital gains are defined by:

$$CGE = \Delta p_e.E_{-1} \quad \text{and} \quad CGH = \Delta ph.HS_{-1} \quad (14)$$

Household savings are defined as disposable income of households minus consumption:

$$Sh = Yhd - C \quad (15)$$

The change in household wealth then follows from:

$$\Delta V = Sh + CGE + CGH + \Delta L_{pf} \quad (16)$$

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 9 below.

3.2 The pension fund

The Netherlands has a funded pension system according to which wage earners are obliged to contribute to their pension fund by paying a premium, p_{pf}, based on their wage.[12] When retiring, the pensioners receive a pension benefit. Till recently we used to have a traditional defined benefit system, which implied that pensioners receive a benefit which is a fraction, b_{pf}, of their (mean) wage with pension benefits and accruals being increased based on price or wage developments. However, this defined benefit system has been under discussion recently and the fraction has been decreased, as we explain below.

As mentioned in the previous section, we distinguish between the working age population, N^Y, and the retired population, N^O. The working age population contributes each year $p_{pf}.WB$, and the pensioners receive each year $b_{pf}.\ WB.\ N^O/\ N^Y$. In a funded pension system the contributions by the workers increase their claims on the pension fund. If the number of working years is T^Y, each young worker accumulates on average an amount $\sum_{t=0}^{T^y}(1+r^y)^t.p_{pf}W$ which is available to pay out for the pension at the beginning of his or her retirement;[13] r^y represents the real interest rate during the period of accumulating the pension. The liabilities of the pension fund with respect to this person then are on average $\sum_{t=0}^{T^o} b_{pf}W/(1+r^o)^t$ at the beginning of retirement; T^o is the average number of retirement years and r^0 represents the real interest rate which should be used to discount the future claims of the worker and retired person. However, the future is uncertain, for instance due to longevity T^o, which has increased beyond expectations, and the interest rate has decreased beyond

[12] We ignore here for simplicity that employers are in practice paying (a substantial) part of the premium.
[13] The use of the word "average" refers to the notion of risk-sharing between plan members.

expectations, which affects r^o. As a consequence the pension funds are required to hold a fraction f_{pf}^{min} of liabilities in excess of their assets.[14] That is, the liabilities are:[15]

$$L_{pf} = b_{pf} WB. \frac{N^o}{N^y} \sum_{t=0}^{T^o} \frac{1}{(1+r^o)^t} \tag{17}$$

The required assets then are $A_{pf}^{min} = (1 + f_{pf}^{min})\, L_{pf}$.

We assume that if the required assets are below their target level, the pension fund has to adjust its contribution rate upward by 3 percentage points and its benefit rate downwards by 3 percentage points, till the target level has been reached.[16] Also we assume that when the assets are relatively large, say a fraction f_{pf}^{max}, a downward adjustment of the contribution rate and an increase of pension benefits of the same magnitude are initiated.

In summary, each year the pension fund pays out $PF_b = b_{pf}.\ WB.\ N^O/\ N^Y$ and receives $PF_c = p_{pf}.\ WB$ from the workers; the fund also receives a return on its assets. Hence the income Y_{pf} of the pension funds equals

$$Y_{pf} = Pfc + i.B_{pf} + i_a.B_{pfa} \tag{18}$$

and its savings S_{pf} are given by:

$$S_{pf} = Y_{pf} - Pfb = (Pfc - Pfb) + i.B_{pf} + i_a.B_{pfa} \tag{19}$$

All savings are used for asset accumulation, or asset decumulation if negative. Hence:

$$\Delta B_{pf} = frb_{pf}.\ S_{pf} \qquad \text{and} \qquad \Delta B_{pfa} = (1 - frb_{pf}).\ S_{pf} \tag{20}$$

where frb_{pf} is the proportion of assets held in domestic bills. The latter refers to the notion that in the Dutch situation, the assets of the pension fund are mainly invested abroad. That is, 15 per cent of the assets are invested in Dutch government bills B_{pf}, and the remaining 85 per cent are invested foreign bonds B_{pfa}.[17]

As a consequence the balance sheet of the pension fund has the structure as presented in Table 3.

[14] In the Netherlands, for instance, solvency rules require pension funds to have on average a funding ratio (i.e. assets divided by liabilities) of at least 120%.

[15] This is a very rough approximation, since the claim of the existing old pensioners is about half of the liabilities indicated here (remember T^o is the average number of years of retirement). The other part of the liabilities consists of future claims built up by the young till now – for simplicity we assume that to equal the other half of the liabilities here. This short cut is taken because we want to focus on the impact of a decrease in the interest rate r^o and an increase in the ratio $N^O/\ N^Y$. The qualitative impact of these variables on L_{pf} will not change in an extended specification of equation (17).

[16] This is roughly what happened in the Netherlands when the liabilities of the pension funds increased due to the fall in the interest rate after the financial crisis.

[17] This does not reflect the current situation, since 40% of assets is invested in equity and other risky assets. In an elaborated version we will develop a portfolio model for the pension fund, where the division between foreign bonds and equity is endogenous and Dutch bills adjust to capture errors in expectations; compare the portfolio model used for households in Section 3.1.

Table 3 Balance sheet of the pension funds

ASSETS		**LIABILITIES**	
Bills	$+ B_{pf}$	Outstanding claims	$+ L_{pf}$
Bonds	$+ B_{pfa}$		
		Total (net worth)	$+ V_{pf}$

3.3 Banks and the deposit financing gap

We use the bank model developed in MMS to which we refer for a more elaborate description. Here we provide a brief summary. Banks finance their assets by borrowing from the financial sector, which we model by issuing equity ($pe.E_b$) and bonds abroad (B_{ba}).[18] Equity is such that the leverage ratio, which is tier 1 capital / risk-unweighted long lending, should exceed a certain threshold. As a consequence, tightening of capital requirements forces banks to either issue equity (which they usually are reluctant to do) or reduce their outstanding loans on the asset side. As mention in Section 3.1 all profits of the banking sector are distributed to the households as bonus payments in excess of normal wages.[19] However, in case of losses no profits are distributed to the households and equity is issued to compensate for these losses.

For issuing deposits banks need to meet the reserve requirement:

$$H_b = v_{res}.M \tag{21}$$

The demand for mortgages by households is fully accommodated by banks as mentioned in Section 3.1; the same holds for the demand for loans. The amount of equity is a fixed proportion of the total liabilities of the banking sector, v_{bas}, determined by the Basel requirements:

$$p_e.E_{ba} = v_{bas}.(M + A + B_{ba}) \tag{22}$$

Bonds are available from the foreign sector at a relatively high rate i_{ba}, in principle to an unlimited amount. We assume that there is a ratio between advances and deposits, v_{CB}, implicitly imposed by the Central Bank:

$$A = v_{bas}.M \tag{23}$$

The remaining gap is financed by borrowing B_{ba} from abroad.[20] The resulting balance sheet is presented in Table 4.

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

[19] The profits are given by [(1 – tax rate)*(income from lending – costs of borrowing) – dividends on equity]. We ignore retained profits which can contribute to internal funds, as a consequence net worth of banking is zero.

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

Table 4 Balance sheet of the banking sector

ASSETS		**LIABILITIES**	
Cash (H_b)		Deposits (M) Advances Central Bank (A)	
Long lending	• mortgages (MO) • firms (L)	Bonds (B_{ba})	
		Capital (tier 1)	Equity ($p_e.E_{ba}$)

With respect to the pricing decisions, we assume in line with the ZDS analysis that the interest rates on loans i_l and deposits i_m are set as a fixed mark-up on the rate on advances i_a 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 i_b. Endogenising these mark-ups consistent with the analysis of Godley and Lavoie (2007a, Ch. 10) is left for further research. With respect to equity, we assume that the price of equity p_e equals that determined for firms, hence that is also given for the banking sector. The same does hold for dividend payments: we impose on banks the dividend paid by firms.

As we elaborate in MMS the model allows us to identify the deposit financing gap as the discrepancy between M and $L + MO$. This gap is considered to be problematic since the larger the gap is, the more banks have to rely on expensive foreign capital to finance their loans. It is obvious from our modelling of bank behaviour that an increase in mortgages issued at a given amount of deposits will automatically lead to an increase in the deposit financing gap.

3.4 The foreign sector and the Central Bank

The foreign sector is introduced in a simple way, following Godley and Lavoie (2007b). Next to consumption, investment and government goods, firms also produce net-exports ($X – IM$). This does not affect their balance sheet, however, nor does it affect their flow of funds. We assume exports X to be exogenous and imports IM to be proportional to GDP. Initially Godley and Lavoie do not discuss terms of trade and exchange rate issues. Here, we follow their ignorance of these issues – partly motivated by the knowledge that a lot of trade by the Netherlands is within the euro area.

Since foreigners hold bonds issued by both banks (B_{ba}) and pension funds (B_{pf}), next to bank equity ($p_e.E_{ba}$), these appear as assets in the balance sheet of the foreign sector. The liabilities of the foreign sector consist of foreign reserves (R) held by the Central Bank. Changes in these foreign reserves occur because of net exports and financial transfers due to dividends payments out of bank equity and interest payments on bonds, as we discuss in section 3.7. The balance sheet of the foreign sector is given in Table 5 below.

Table 5 Balance sheet of the foreign sector

ASSETS	**LIABILITIES**
Bonds ($B_{ba} + B_{pf}$) Equity ($p_e.E_{ba}$)	Foreign Reserves (R) Total (net worth) (Va)

Foreign reserves are assets in the balance sheet of 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 modeling of the financial sector and the consistency of our analysis. We will use the 'neutral' term Central Bank in our analysis and refer to the ECB whenever appropriate.

Table 6 Balance sheet of the Central Bank

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

Next to holding foreign reserves, the Central Bank provides advances A to banks and holds bills issued by the government, B_c. The liabilities are high powered money H issued by the Central Bank, which is held by the public and banks. Since the revenues of the Central Bank, FC, are transferred to the government, the balance sheet of the Central Bank is closed without remaining net worth. As a consequence, the Central Bank balance sheet now looks as presented in Table 6.

The revenues of the Central Bank are given by:

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

The interest rate on advances, i_A, is set as a mark-up on inflation such that the real interest rate on advances is a constant.[21] The rate on government bills, i_B, is set by the Central Bank such that supply

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

of bills by the government is cleared.[22] Finally, the Central Bank provides as much high powered money as is demanded by banks and households.

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.

3.5 Firm behaviour and wage and price formation

Since nothing differs from our model in MMS we briefly summarise both wage and price setting and firm behaviour in this section. The model is kept deliberately simple since the focus is on the interaction with the financial sector. Price p, net of indirect taxes t_i, is set as a mark-up ρ on unit labour cost. The latter are defined as wages w relative to labour productivity π, where the latter is determined exogenously. Nominal wage growth, g_w, equals expected inflation, g^e_p, plus expected productivity growth, g^e_π, although the latter might not be fully accounted for.

Given labour productivity, demand for labour N follows from output, which equals aggregate demand. Part of profits FT that result after interest payments and profit taxes is kept as retained earnings, and the remaining part is paid out as dividend to households (provided it is positive).

Table 7 Balance sheet of firms

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

Investment of firms is an important ingredient of the model because of its impact on both aggregate demand and on productive capacity. Investment is determined by the cash-flow rate, the interest payments on the leverage ratio, Tobin's q and the utilization rate. The sources of financing investment are next to retained profits, loans and equity. New equities are issued as a fixed proportion of the amount of external funds required to finance investment and bank loans then are used to close the remaining financing gap.

The balance sheet of firms is presented in Table 7.

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

3.6 The government

Growth in government expenditures is modelled in line with ZDS to equal expected output growth

$$g_G = g_K \tag{25}$$

and taxes are proportional to the relevant bases. Hence we have:

$$Td = \tau_h.(Yh - \tau_{MO}.i_{M,-1}.M_{-1}) \tag{26}$$

$$Ti = t_i.p.Y \tag{27}$$

$$Tf = t_f.FT \tag{28}$$

for income, value added and profit taxes, respectively. As a consequence government savings, which constitute the budget balance, are given by:

$$Sg = Ti + Td + Tf + FC - p.G - i_B.B \tag{29}$$

The supply of bills by the government, which is cleared by the Central Bank as discussed in section 3.4, follows from:

$$\Delta B = - Sg \tag{30}$$

Finally, since the first pillar of the pension system is managed by government in such a way that it is self-financed, we find:

$$p_{AOW}.\ WB = b_{AOW}.\ WB.\ N^O/N^Y \tag{31}$$

Receipts are given by $Pc_{AOW} = p_{AOW}.\ WB$ and $Pb_{AOW} = b_{AOW}.\ WB.\ N^O/N^Y$ expenditures by . Equation (31) defines the ratio p_{AOW}/b_{AOW}, hence for a given benefit ratio b_{AOW} the required premium to finance the first pillar is $p_{AOW} = b_{AOW}.\ N^O/N^Y$.

3.7 The structure of the full model

The full model is summarized in Appendix 1. One aspect of the model is to present the consolidated balance sheet for the economy in Table 8. This balance sheet combines the balance sheets presented in Tables 2 – 7 above and closes some loose ends. In order to close the model we assume (as discussed above) that realized bank deposits by households (*M*) close the household balance sheet and that bonds issued by banks (B_{ba}) close the bank balance sheet. Finally the Central Bank accommodates treasury bills (B_c) to clear the market for these bills.

Another way of looking at the structure of the model is to construct the social accounting matrix – see Table 9. This matrix presents a consistent schedule of all flows between sectors.

Value added in the production sector is obtained by producing consumption goods, government goods, accumulation of capital and the housing stock and net-exports. The proceedings are paid to households as wages (*WB*), to firms as profits (*FT*) and to the government as indirect taxes (*Ti*). The

profits of the firms, net of interest payments on loans to banks ($i_L.L$) and taxes on profits (*Tf*), is either retained (*FU*) or distributed to households as dividends (*FD*).

Next to income from wages and dividends, households obtain interest on their deposits and government bills and get the remaining profits from banks. They use their income for consumption, income tax and interest payments on mortgages (using the reduced rate due to tax deductibility). The remaining part of their income is saved.

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

The foreign sector contributes foreign savings (*Sa*) to the capital account, which equals net capital inflow.

The social accounting matrix shows that

$$p \cdot \Delta K + ph.\Delta HS = S = Sh + FU + Spf + Sg + Sa \tag{32}$$

Hence holds:

$$p \cdot \Delta K + ph.\Delta HS = Sh + FU + Spf + Sg + i_B.B_{ba} + i_E.E_{ba} - i_a.B_{pfa} - TB \tag{33}$$

where $Sh + FU + Spf + Sg$ represents domestic savings and $i_B.B_{ba} + i_E.E_{ba} - i_a.B_{pfa} - TB$ represents net capital inflow. Thus capital and housing accumulation is financed by domestic savings and net capital inflow from abroad.

Finally, the change in foreign reserves is given by:

$$\Delta R = \Delta B_{ba} + \Delta B_{pfa} + \Delta(p_e.E_{ba}) - \Delta Va = \Delta B_{ba} + \Delta B_{pfa} + \Delta(p_e.E_{ba}) + TB + i_a.B_{pfa} - i_B.B_{ba} - i_E.E_{ba} \tag{34}$$

Table 8. Balance Sheets

	Households	**Firms**	**Banks**	**Central Bank**	**Pension Fund**	**Government**	**Foreign**	**Total**
High powered money	$+ H_h$		$+ Hb$	$- H$				0
Central Bank advances			$- A$	$+ A$				0
Bank deposits	$+ M$		$- M$					0
Loans		$- L$	$+ L$					0
Bills	$+ B_h$			$+ B_c$	$+ B_{pf}$	$- B$		0
Capital		$+ p{\cdot}K$						$+ p{\cdot}K$
Bonds			$- B_{ba}$		$+ B_{pfa}$		$+ B_{ba} - B_{pfa}$	0
Equities	$p_e E_h$	$- p_e E_h$	$- p_e.E_{ba}$				$+ p_e.E_{ba}$	0
Mortgages	$- MO$		$+ MO$					0
Houses	$+ ph.HS$							$+ ph.HS$
Pension Claims	$+ L_{pf}$				$- L_{pf}$			0
Foreign Reserves				$+R$			$-R$	0
Total (net worth)	$+ Vh$	$+ Vf$	0	0	$+ V_{pf}$	$- B$	$+Va$	$+Vt$

Table 9. Social Accounting Matrix

	Produc-tion	Households	Firms	Banks	Central Bank	Pension Fund	Government	Capital Account	Foreign	Total
Production		$+ p{\cdot}C$					$+ p{\cdot}G$	$p{\cdot}\Delta K$ $+ph.\Delta HS$	$+TB =$ $X - IM$	$+ p{\cdot}Y$
Households	$+ WB$		$+ FD$	$+ iM + Fb$		$+Pfb$	$+ iB_h +$ Pb_{AOW}			$+ Yh$
Firms	$+ FT$									$+ FT$
Banks		$+ i.MO$	$+ iL$							$+ Yb$
Central Bank				$+ iA$			$+ iB_c$			$+ Yc$
Pension Fund		$+Pfc$					$+ iB_{pf}$		$+ i_aB_{pfa}$	$+ Ypf$
Government	$+ Ti$	$+ Td+$ Pc_{AOW}	$+ Tf$		$+ Fc$					$+ Yg$
Capital Account		$+ Sh$	$+ FU$	0		$+ Spf$	$+ Sg$		$+ Sa$	$+ S$
Foreign				$+i_BB_{ba}+i_EE_{ba}$						$+Ya$
TOTAL	$+ p{\cdot}Y$	$+ Yh$	$+ FT$	$+ Yb$	$+ Yc$	$+ Ypf$	$+ Yg$	$+ p{\cdot}\Delta K$ $+ ph.\Delta HS$	$+Ya$	

4. Simulation results of the model

We are reasonably successful in calibrating the model, but still have to do more work before presenting the full results. A first result is presented below.

4.1 A reduction of the interest rate

We used the model to simulate the impact of a reduction in the interest rate from 3 to 2 per cent in year 75 (there is no inflation). As can be seen from Figure 10, GDP drops by 0.7 per cent and recovers slowly. Consistent with stylised facts 5 and 6 this is caused by a fall in consumption following increased benefits. The benefits increase because of the increase in the liabilities of the pension fund, as can be seen from Figure 11.

Figure 10 Impact on GDP

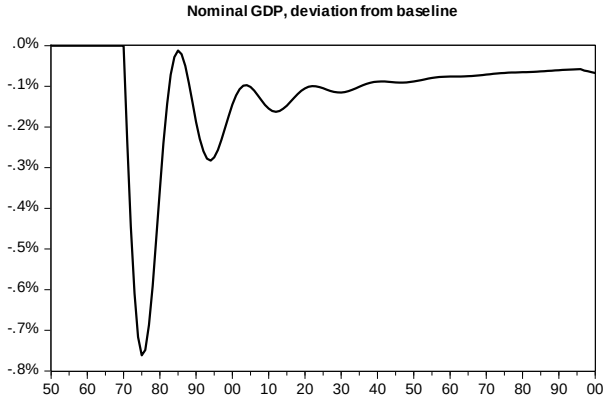
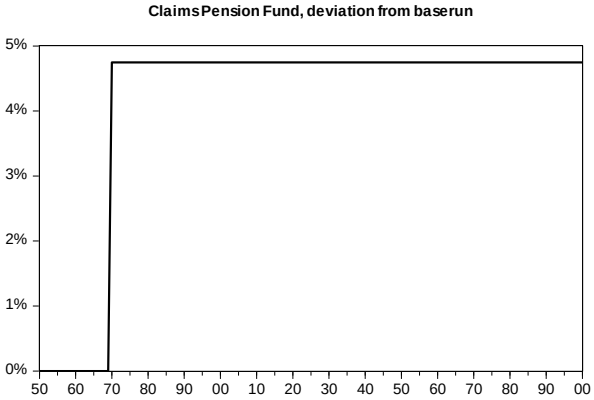


Figure 11 Impact on liabilities pension fund



<to be elaborated>

References

Bezemer D. and J. Muysken, "Dutch Financial Fragilities", forthcoming, 2014.

Bosch, F., *Performances en dekkingsgraden Nederlandse Pensioenfondsen 1990 – 2010,* Bureau Bosch, 2011.

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

CPB , "De Nederlandse Woningmarkt- Hypotheekrente, Huizenprijzen en Consumptie", *CPB Notitie*, 14-2-2013, Centraal Planbureau, Den Haag, 2013.

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.

Madsen, J., "A Behavioral Model of **House Prices",** Journal of Economic Behavior and Organization, April 2012, v. 82, iss. 1, pp. 21-38

Meijers H., J. Muysken and O. Sleijpen, *The deposit financing gap: Another Dutch disease*, UNU-MERIT Working Papers, Nr 2014-071, UNU-MERIT,Maastricht, 2014.

Muysken, J., 2014, Macroeconomics beyond General Equilibrium, in: Max Merbis en Lia van Wesenbeek (ed.), *Real and Integer: Thirty Essays on Economics, Development and Michiel Keyzer,* SOW-VU, Amsterdam, pp. 9 -29.

OECD, *OECD Economic Surveys: Netherlands 2013*, Paris: OECD Publishing, 2014.

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

WRR, *Hoe ongelijk is Nederland?*, Wetenschappelijke Raad voor het Regeringsbeleid, Den Haag, 2014.

Zezza, G. and Dos Santos, C.H. "Distribution and Growth in a Post-Keynesian Stock-Flow Consistent Model", In N. Salvadori (Ed.) *Economic Growth and Distribution: On the Nature and Causes of the Wealth of Nations.* Cheltenham, UK: Edward Elgar Publishing Limited, 2006.

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.