The French economy seen through the lens of an empirical Stock-Flow model

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- The dataset includes national and financial accounts, and follows the basic stock-flow principles in the spirit of Tobin (1982), as well as Godley and Lavoie (2007)
- The model distinguishes 5 **institutional sectors** and explicit dynamics for over 250 equations up to this point

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- This is one of the objectives of the Stock-Flow Consistent approach

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- SFC modeling goes beyond the analysis of GDP and its components, and allows us to take into account the interactions among sectors in the real and financial spheres
- We distinguish:
  - S.11 Non-financial firms
  - S.12 Financial institutions
  - S.13 Government
  - S.14 Households + S15 NPISH
  - S.2 Rest of the world

Symbolic GDP accounting

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- The distinction between volumes, prices and values is explicit throughout the simulations
- In our model, these identities actually look a bit different

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  volume of demand

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- Superscripts F, B, G, H, R are for each institutional sector, subscripts r, p are for received or paid (except P, which stands for products)
- $I_1^F + I_1^B + I_1^G + I_1^H$ is the volume of GFCF, and I_{12}^F is the volume of the change in inventories

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Identities such as *Saving* – *Investment* = *Exports* – *Imports* must be satisfied (therefore, accounting simplifications are not abundant)

Financial transactions

SNA 2008

- F.1 Monetary gold and SDRs
- F.2 Currency and deposits
- F.3 Debt securities
- F.4 Loans
- F.5 Equity and investment fund shares
- F.6 Insurance, pension and standardized guarantee schemes
- F.7 Financial derivatives and employee stock options
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SNA 1993

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- F.4 Loans
- F.5 Shares and other equity
- F.6 Insurance technical reserves
- F.7 Other accounts receivable/payable

Billions of current euros and % of GDP (2010)

Variable *Nomenclature*	**Firms** *F*	**Banks** *B*	**Government** *G*	**Households** *H*	**RoW** *R*	**Totals**
Production *Prod*	2420.9 121.4%	212.8 10.7%	436.9 21.9%	468.5 23.5%		**3539.1** **177.5%**
Inter. cons. *IC*	-1409.9 -70.7%	-122.7 -6.1%	-102.5 -5.1%	-104.5 -5.2%		**-1739.6** **-87.2%**
Value Added $p_{VA}\,VA$	**1011** **50.7%**	**90.3** **4.5%**	**334.5** **16.8%**	**364** **18.3%**		**1799.8** **90.3%**
Remuneration *W*	-504.3 -25.3%	-34.8 -1.7%	-175.4 -8.8%	777.3 - 53.4 39% - 2.7%	-9.1 -0.5%	**0.3** **0.02%**
L. Contributions *LC*	-157.3 -7.9%	-14 -0.7%	-84.4 -4.2%	275.4 - 16.6 13.8% - 0.8%	-3.1 -0.2%	**0**
Labor taxes T_L	-49.2 -2.5%	-5.9 -0.3%	82.1 - 9.2 4.1% - 0.5%	-17.3 -0.9%		**0.5** **0.03%**
Subsidies *Sub*	18.5 0.9%	0.4 0.02%	-18.6 -0.9%	7.5 0.4%	-7.5 -0.4%	**0.3** **0.02%**
G.O.S. Π	**318.6** **16%**	**35.7** **1.8%**	**(68.9)** **(3.5%)**	**(283.8)** **(14.2%)**		**(707)** **(35.5%)**

Billions of current euros and % of GDP (2010)

Variable *Nom.*	**Firms** *F*	**Banks** *B*	**Government** *G*	**Households** *H*	**RoW** *R*
Net taxes on pr. T_P			197 9.9%		1.9 0.1%
Interests *Int*	40.1 - 68 2% - 3.4%	198.8 - 137.1 10% - 6.9%	2.2 - 47.7 0.1% - 2.4%	25.1 - 20.8 1.3% - 1%	75.4 - 68.2 3.8% - 3.4%
Dividends *Div*	156 - 214 7.8% - 10.7%	43.8 - 28.8 2.2% - 1.4%	9.4 0.5%	50 2.5%	29.1 - 45.6 1.5% - 2.3%
RFDI* *RFDI*	9.8 0.5%	-59.4 -3%	4.4 0.2%	57.6 2.9%	-12.2 -0.6%
Income taxes *T*	-32.3 -1.6%	-11.1 -0.6%	220.7 11.1%	-173.4 -8.7%	-3.6 -0.2%
Soc. contributions *SC*	10.8 0.5%	29.6 1.5%	361.7 18.1%	-406.9 -20.4%	4.4 0.2%
Soc. benefits *SB*	-10.8 -0.5%	-29.5 -1.5%	-382.9 -19.2%	419 21%	4.3 0.2%
Transfers *Tr*	-20.4 -1%	-1.9 -0.1%	-51.1 -2.6%	40.2 2%	33.1 1.7%
Disp. Inc. Y_d	**190** **9.5%**	**40.2** **2%**	**442.5** **22.2%**	**1327.3** **66.6%**	

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Variable *Nomenclature*	**Firms** *F*	**Banks** *B*	**Government** *G*	**Households** *H*	**RoW** *R*	**Totals**
Consumption $p_C C$			-476.2 -23.9%	-1121.8 -56.3%		**-1598** **-80.2%**
Saving *S*	**190** **9.5%**	**40.2** **2%**	**-33.7** **-1.7%**	**205.5** **10.3%**		**402** **20.2%**
Cap. Transf. Tr_K	16.7 0.8%	1.2 0.1%	-16.9 -0.8%	-0.7 -0.04%		**0.3** **0.01%**
GFCF $p_I I$	-222.2 -11.1%	-13.2 -0.7%	-85.1 -4.3%	-120.6 -6%		**-441.1** **-22.1%**
Ch. inventories $p_{I12} I_{12}$	5 0.2%					**5** **0.2%**
Imp - Exp $p_M M - p_X X$					555.5 - 518.8 27.8% - 26%	**36.7** / **(-)33.8** **1.8%** / **(-)1.7%**
FC/FN *FCN*	**-10.7** **-0.5%**	**28.3** **1.4%**	**-135.6** **-6.8%**	**84** **4.2%**	**33.9** **1.7%**	**-0.1** **-0.01%**
Disp. Inc. Y^d	**190** **9.5%**	**40.2** **2%**	**442.5** **22.2%**	**1327.3** **66.6%**		**2000** **100.3%**
In kind transfers Tr_S			-307.5 -15.4%	307.6 15.4%		0.1 **0%**
Adj. Disp. Inc. Y^d_{adj}	**190** **9.5%**	**40.2** **2%**	**134.8** **6.8%**	**1634.9** **82%**		**1999.9** **100.3%**

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- The latter include the patrimonial changes related to discoveries, inventions, disappearances, transformations, transfers and other unforeseen events (**other changes in volume** account) as well as price movements (**revaluation** account)
- Although not all operations pertaining to wealth items are recorded in the capital account or the financial account, all flows in these two accounts are components of changes in wealth

Non-financial assets

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$$K = \frac{p_{K-1} K_{-1}}{p_K} + I - \delta K_{-1} + K_{-1} - \frac{p_{K-1} K_{-1}}{p_K} + \frac{OCV_K}{p_K}$$

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$$E = \frac{p_{E-1} E_{-1}}{p_E} + \Delta^* E + E_{-1} - \frac{p_{E-1} E_{-1}}{p_E} + \frac{OCV_E}{p_E}$$

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From this growth rate, we can easily get a price index of the item of interest

Stocks, bn of current euros and % of GDP (2010)

Item	*F*	*B*	*G*	*H*	*R*	*Total*
*NFA*1∗	2019.7 101.3%	112.6 5.6%	1113.5 55.8%	3429.5 172%		= 6675.4 =334.8%
*NFA*12	325.3 16.3%					=325.3 =16.3 %
*NFA*2	1590.1 79.7%	123.2 6.2%	788.5 39.5%	3582.4 179.6%		=6084.2 =305.1%
*F*1		86.6 4.3%			-86.6 -4.3%	=0
*F*2	307.4 15.4%	2703.1 - 4720.7 135.6% - 236.8%	122.4 - 77.6 6.1% - 3.9%	1127.3 56.5%	1556.5 - 1018.4 78.1% - 51.1%	=0
*F*3	-316.9 -15.9%	2965 - 1472 148.7% - 73.8%	-1421.6 -71.3%	88.1 4.4%	1828.2 - 1670.9 91.7% - 83.8%	=0
*F*4	1598.4 - 2424 80.2% - 121.6%	2163.4 108.5%	-159.2 -8%	-1025.1 -51.4%	468.8 - 622.3 23.5% - 31.2%	=0
*F*5	2594.6 - 3818.5 130.1% - 191.5%	2065.8 - 2057.6 103.6% - 103.2%	442.2 22.2%	1043.8 52.3%	1045 - 1315.3 52.4% - 65.9%	=0
*F*6	51.5 2.6%	-1544.8 -77.5%	5.9 0.3%	1465.9 73.5%	21.4 1.1%	=0
*F*7		639.3 - 641.9 32% - 32.2%			419.4 - 416.9 21% - 20.9%	=-0.2
*F*8	112.4 5.6%	-30.8 -1.5%	-0.6 -0.03%	15.1 0.7%	-95.8 -4.8%	=0.2
Total	2039.9 102.3%	391.2 19.6%	813.5 40.8%	9727.2 487.8%	113.2 5.7%	=13085 656.2%

Flows, bn of current euros and % of GDP (2010)

Item	*F*	*B*	*G*	*H*	*R*	*Total*
*NFA*1∗	222.3 11.1%	13.2 0.7%	83 4.2%	118 5.9%		=436.4 =21.9%
*NFA*12	-3.4 -0.2%					=-3.4 =-0.2%
*F*1		0.05 0%			-0.05 0%	=0
*F*2	42.3 2.1%	45.6 - 64.5 2.4% - 3.3%	-1 - 19.2 -0.02% - 0.9%	35.4 1.8%	60.6 - 99.2 3% - 5%	=0
*F*3	-21.4 -1.1%	60.8 - 72.8 3.2% - 3.7%	-90.3 -4.6%	-7.5 -0.4%	90.5 + 40.7 4.6% + 2%	=0
*F*4	13.5 - 25.7 0.7% - 1.2%	97 4.8%	-17.4 -0.9%	-55.9 -2.8%	11.8 - 23.3 0.6% - 1.2%	=0
*F*5	74.9 - 106.8 3.8% - 5.4%	35.4 + 62.3 1.8% + 3.1%	-8.2 -0.4%	-5.4 -0.3%	7.7 - 59.9 0.4% - 3%	=0
*F*6	-0.2 -0.01%	-89.1 -4.5%	0.2 0.01%	87.6 4.4%	1.6 0.1%	=0
*F*7		717.8 - 728.5 36% - 36.5%			-2.2 + 13.2 -0.1% + 0.7%	=0
*F*8	9.9 0.5%	-35.7 -1.8%	1.7 0.06%	30.7 1.6%	-6.8 -0.3%	=0
Total	205 10.3%	41.7 2.1%	-49 -2.5%	200.9 10.1%	34.7 1.7%	=433.3 21.7%

Capital gains, bn of current euros and % of GDP (2010)

Item	*F*	*B*	*G*	*H*	*R*	*Total*
*NFA*1∗	38.9 1.9%	2 0.1%	29.8 1.5%	86.8 4.3%		= 157.5 =7.9%
*NFA*12	14.1 0.7%					=14.1 =0.7%
*NFA*2	138.5 6.9%	9.9 0.5%	79.4 4%	364.5 18.3%		=592.4 =29.7%
*F*1		23.3 1.2%			-23.3 -1.2%	=0
*F*2	1.1 0.06%	39.4 - 56.2 2% - 2.9%	-0.04 0%	-0.6 -0.03%	51.5 - 35.2 2.6% - 1.8%	=0
*F*3	-7.5 -0.4%	4.3 - 10.5 0.3% - 0.5%	-12 -0.6%	-0.2 -0.01%	44.6 - 18.6 2.3% - 1%	=0
*F*4	11 - 14.6 0.6% - 0.7%	14 0.7%	0 0%	0 0%	10.7 - 21.2 0.5% - 1.1%	=0
*F*5	52.1 - 206.4 2.5% - 10.2%	89.2 - 50.8 4.5% - 2.5%	15.5 0.8%	65.8 3.3%	70.3 - 35.8 3.3% -1.8%	=0
*F*6	0 0%	-13.2 -0.7%	0 0%	13.2 0.7%	0 0%	=0
*F*7		-688.7 + 699.8 -34.4% + 35%			6.2 - 19.9 0.4% - 1.1%	=0
Total	28.4 1.4%	62.4 3.2%	114.4 5.7%	529.6 26.5%	29.3 1.5%	=764.1 38.3%

The Volcker shock, a long term perspective

- Following the second oil shock, the Fed's determination to end inflation provoked a series of structural changes that had a deep impact in the French economy
- In order to counter the capital flight (stemming from $\uparrow i^{US}$), BdF raised the interest rate as well
- The capital structure of French non-financial firms shifted in favor of equity since then (in part driven by speculation in the stock market)
- The relative fall in the demand for firms' debt led French banks to look for other sources of credit demand (households and the rest of the world, mainly)

Wealth distribution across institutional sectors

- From the 1990s and up to the 2nd half of the 2010s, overall wealth went from less than 4 times GDP to more than 6.

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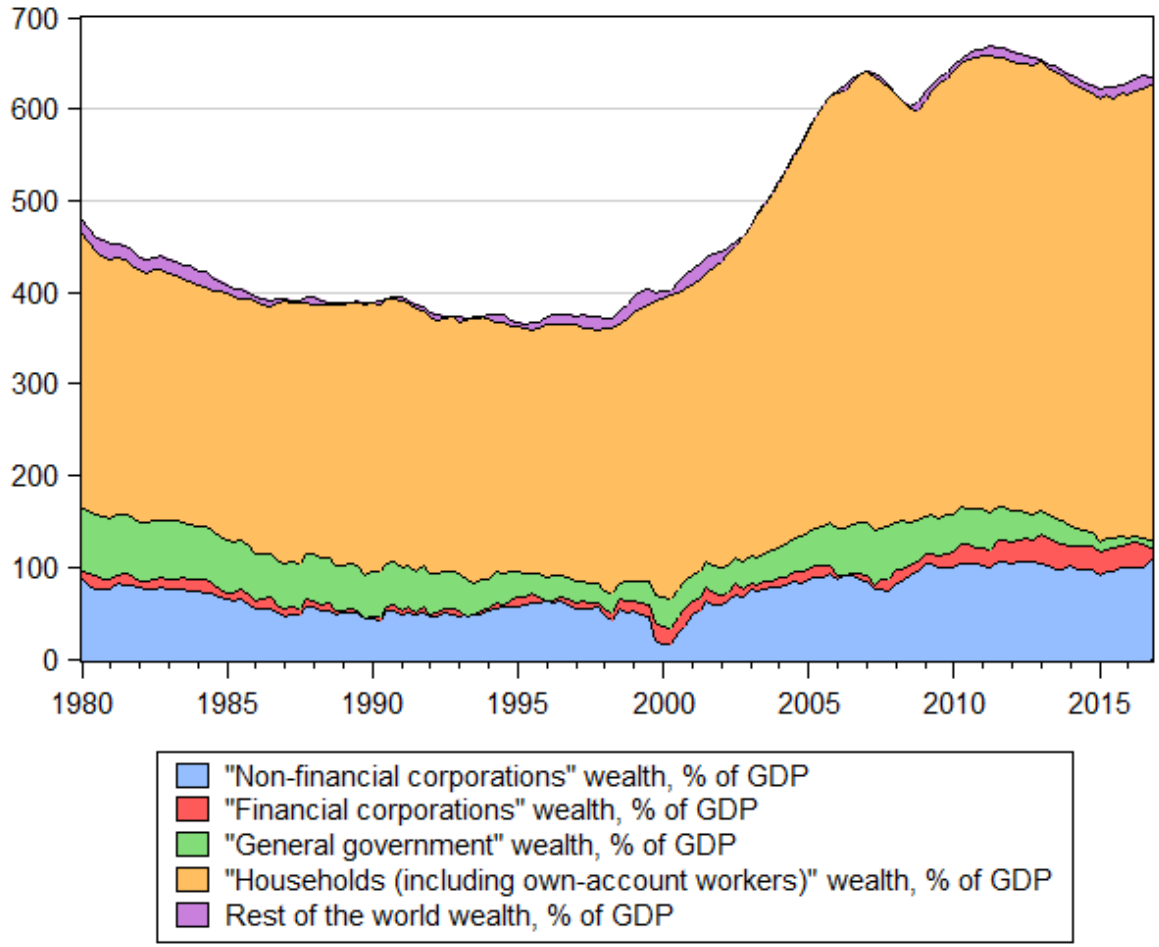
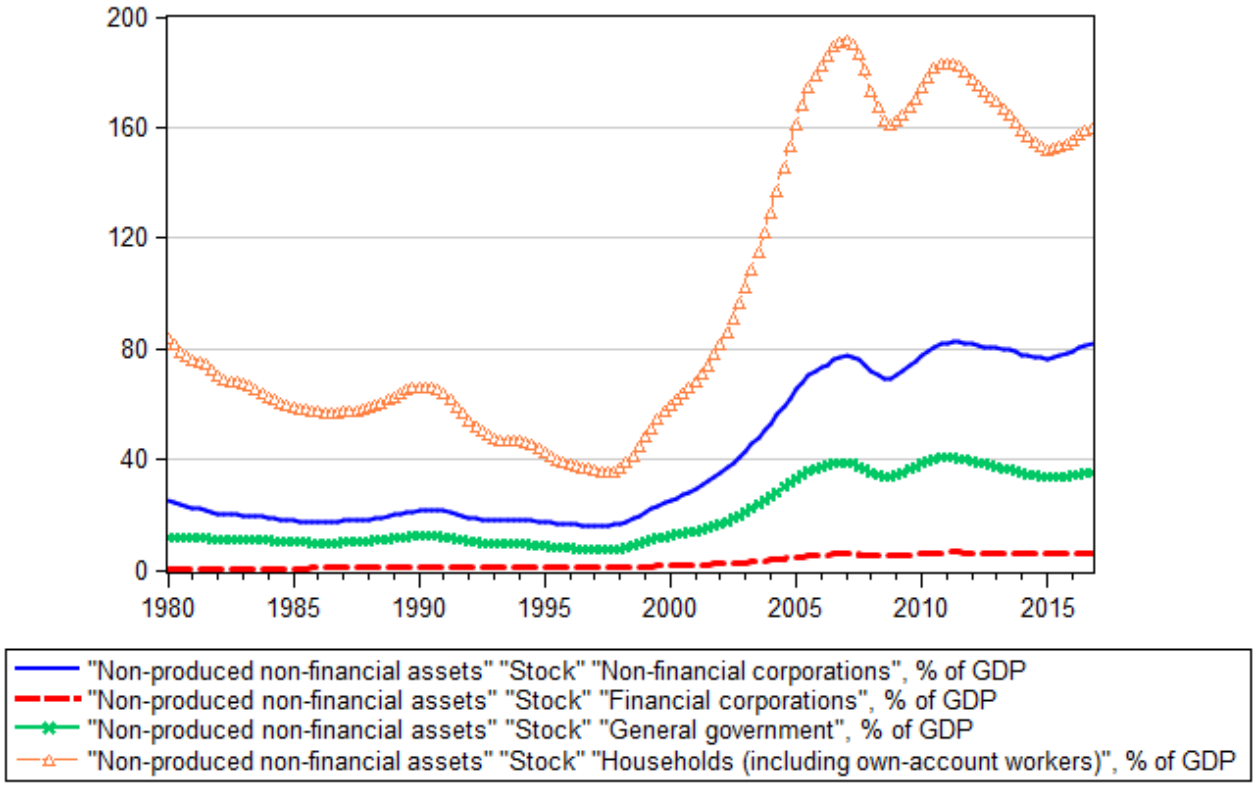
- All sectors benefited from a strong increase in the price of non-produced non-financial assets (1998-2006).
- GDP growth and inflation slowdown, coupled with strong price volatility of land and financial assets contributed greatly to this evolution.

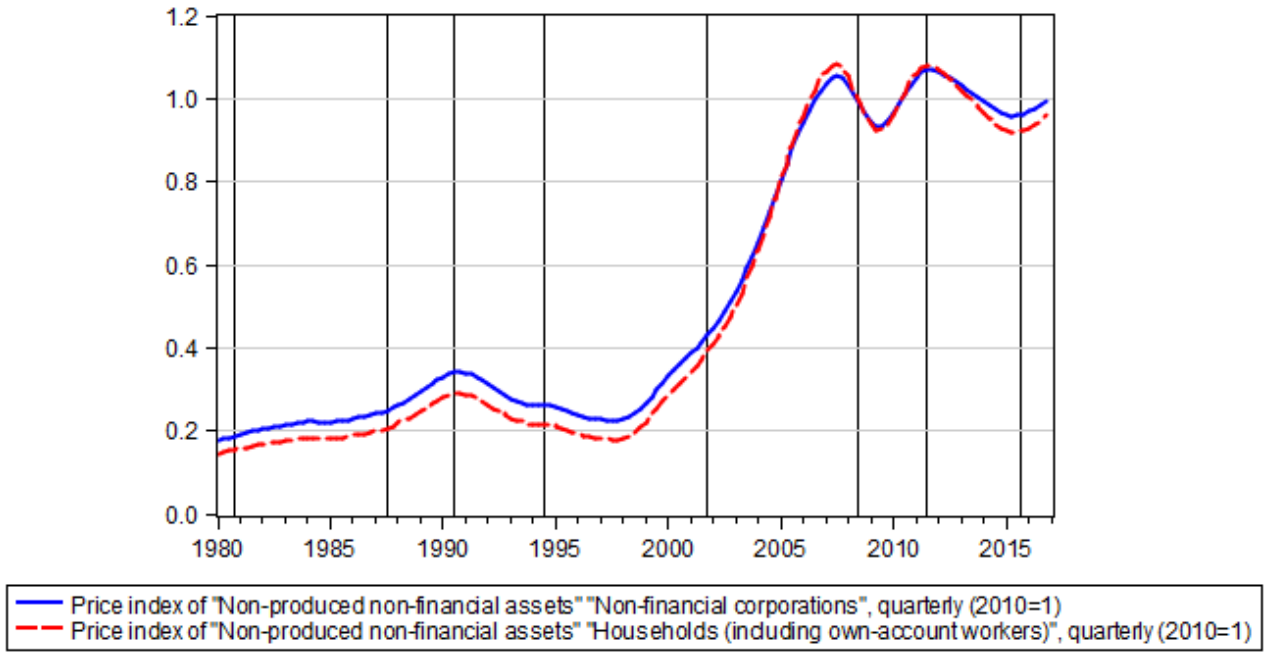
Wealth, % of GDP



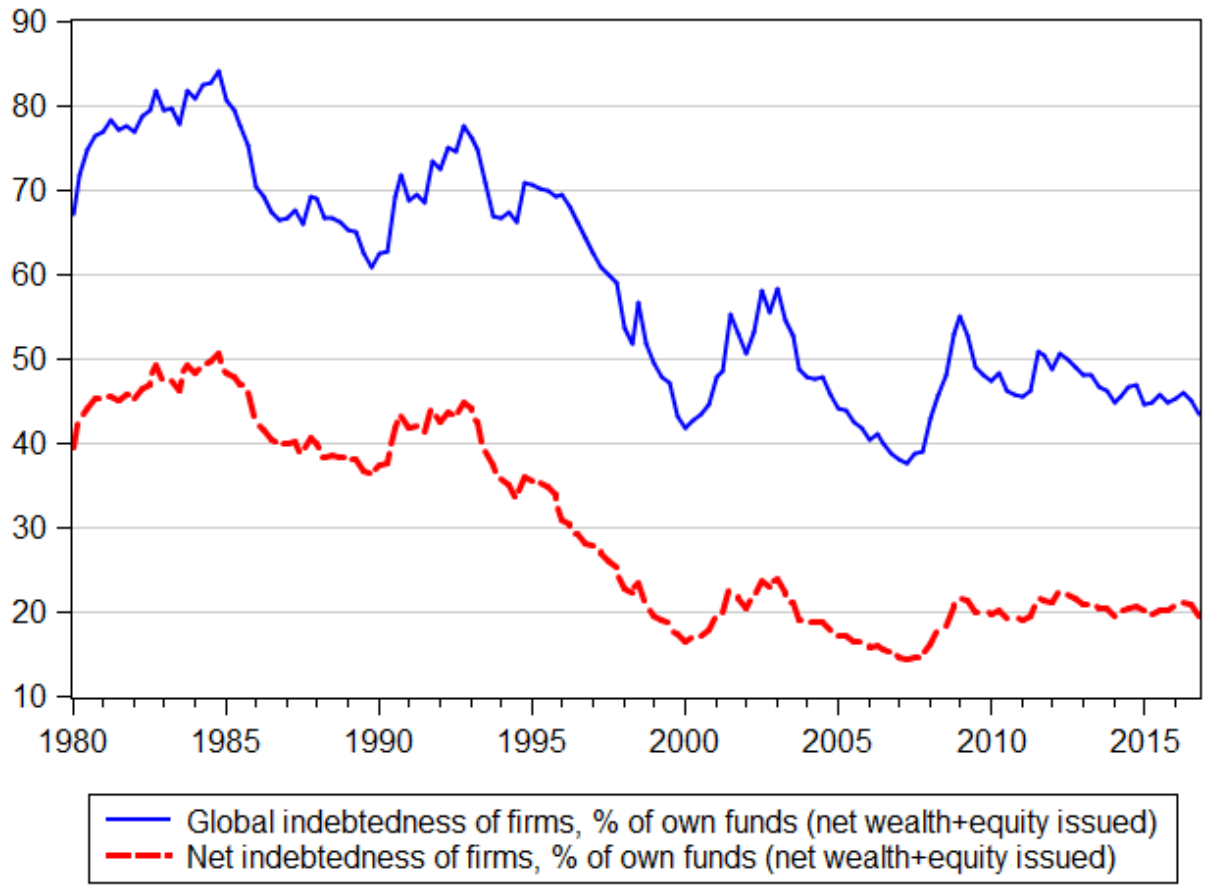
Non-produced non-financial assets by sector, % of GDP



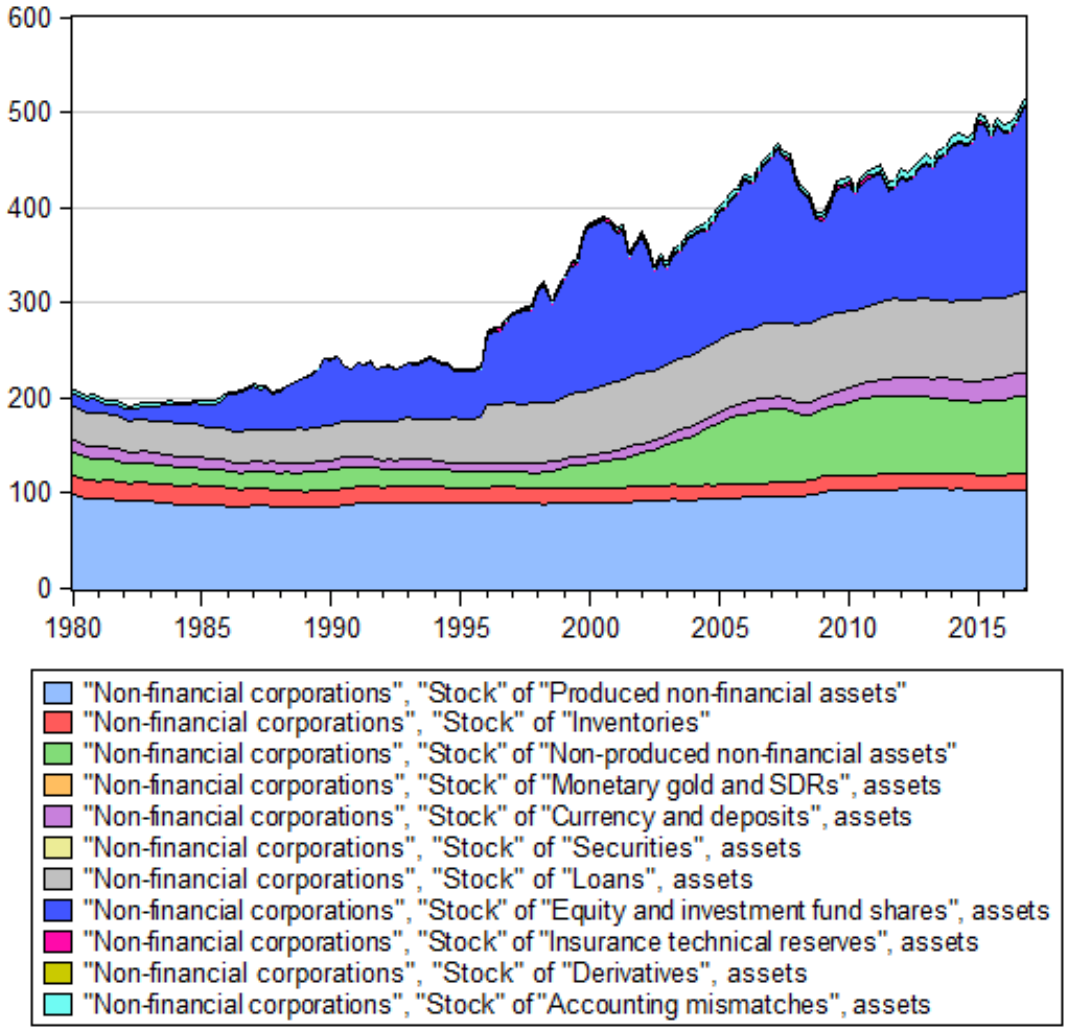
Price of non-produced non-financial assets, % of GDP



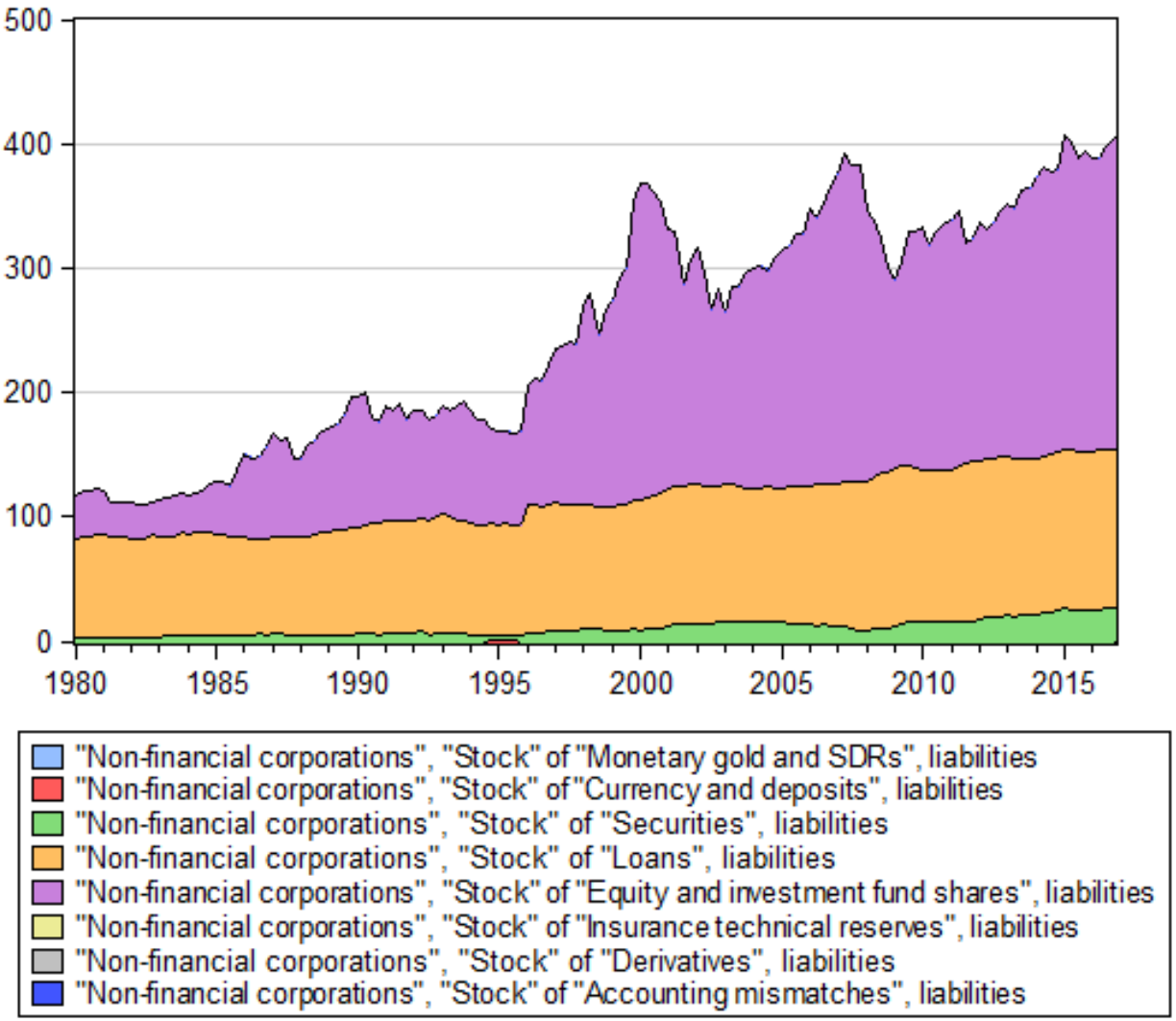
Indebtedness of non-financial firms



Stock of assets of non-financial firms, % of GDP



Stock of liabilities of non-financial firms, % of GDP



Behavioral equations

CH $$\Delta \ln(C^H) = 0.26\Delta \ln(C^H_{-2}) + 0.62\Delta \ln\left(\frac{Y^H_d}{p_C}\right) - 0.47\Delta \ln\left(\frac{Y^H_{d-2}}{p_{C-2}}\right) + 0.06\Delta \ln\left(\frac{WLTH^H}{p_C}\right) + 0.09\Delta \ln\left(\frac{WLTH^H_{-1}}{p_{C-1}}\right) - 0.2vc_{-1}$$

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IH $$\left(\frac{p^H_{K_1}\Delta K^H_1}{Y^H_d}\right) = 0.34\left(\frac{p^H_{K_1-1}\Delta K^H_{1-1}}{Y^H_{d-1}}\right) - 0.08r^F_{L_{-1}} * +0.02\left(\frac{\Delta p^H_{K2}}{p^H_{K2-1}}\right) + 0.01\left(\frac{\Delta p^H_{K2-1}}{p^H_{K2-2}}\right) - 0.005vc_{-1}$$

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IF $$\Delta\left(\frac{I^F_1}{K^F_{1-1}}\right) = 0.31\Delta r_K + 0.19\Delta r_{K-2} - 0.27\Delta r^F_L - 0.14\Delta r^F_{L-1} + 0.12\Delta r^F_{L-2} - 0.005\Delta r_E + 0.003\Delta r_{E-2} - 0.05\Delta\left(\frac{L^F_L}{p^F_{K1}K^F_1}\right) - 0.02vc_{-1}$$

Behavioral equations

CH $$\Delta \ln(C^H) = 0.26\Delta \ln(C^H_{-2}) + 0.62\Delta \ln\left(\frac{Y^H_d}{p_C}\right) - 0.47\Delta \ln\left(\frac{Y^H_{d-2}}{p_{C-2}}\right) + 0.06\Delta \ln\left(\frac{WLTH^H}{p_C}\right) + 0.09\Delta \ln\left(\frac{WLTH^H_{-1}}{p_{C-1}}\right) - 0.2vc_{-1}$$

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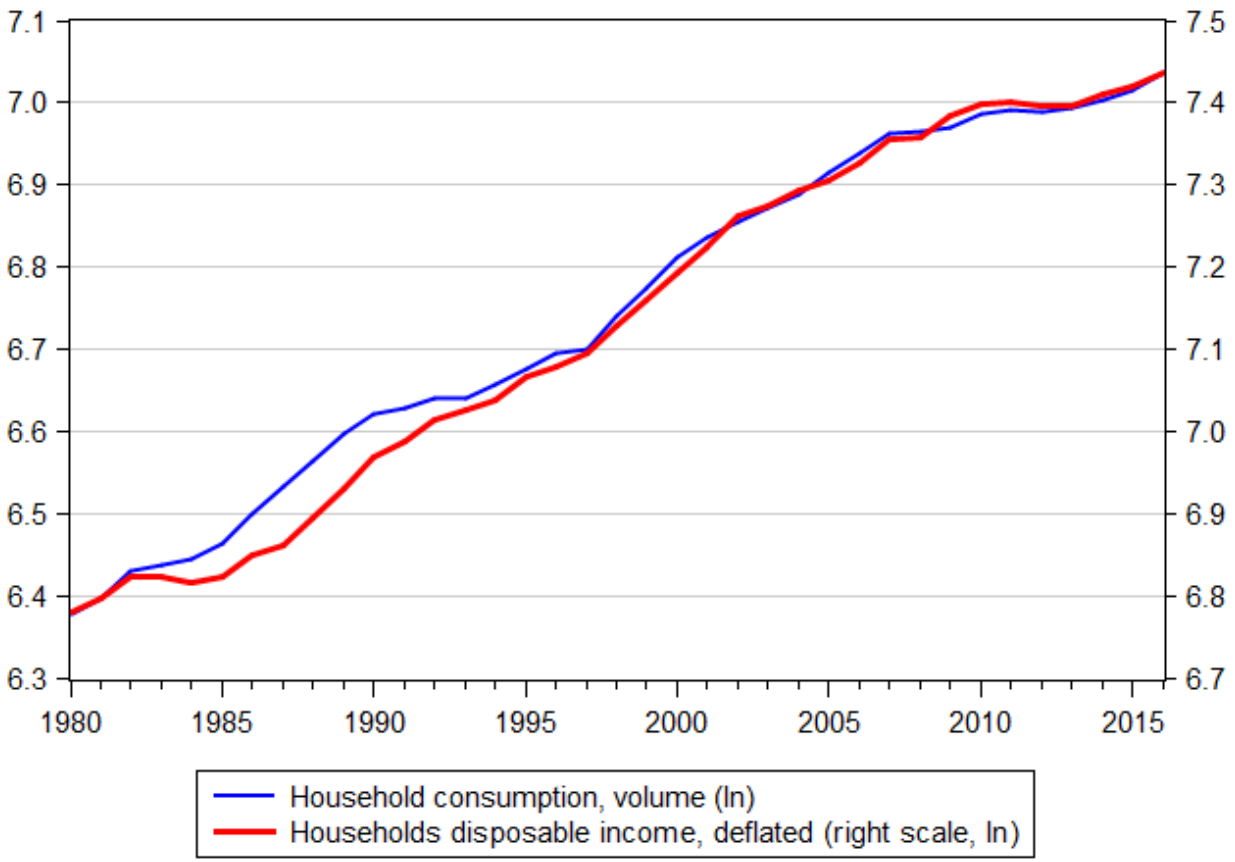
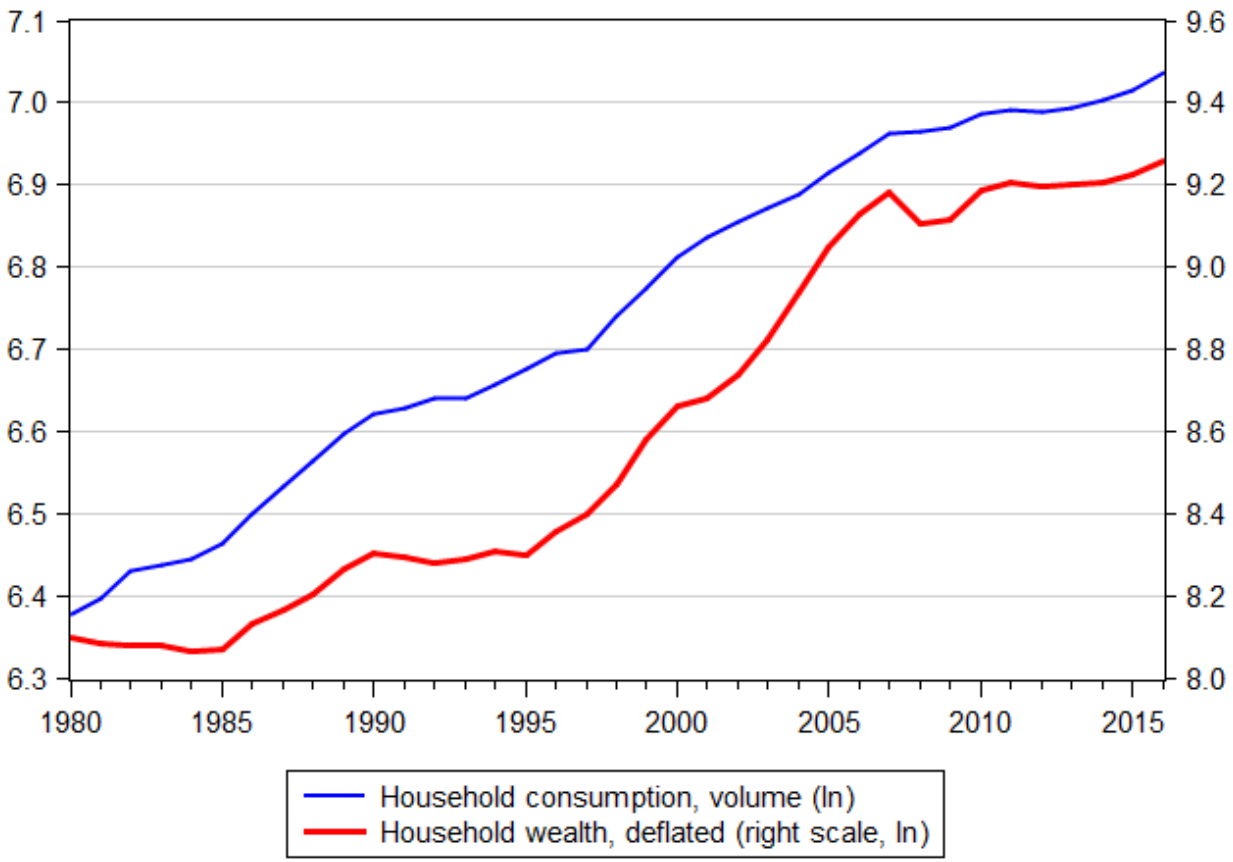
M $$\Delta \ln M = 1.44\Delta \ln Y^{ID} - 0.53\Delta \ln Y^{ID}_{-2} + 0.06\Delta\left(\frac{p_Y}{p_M}\right) - 0.13vc_{-1}$$

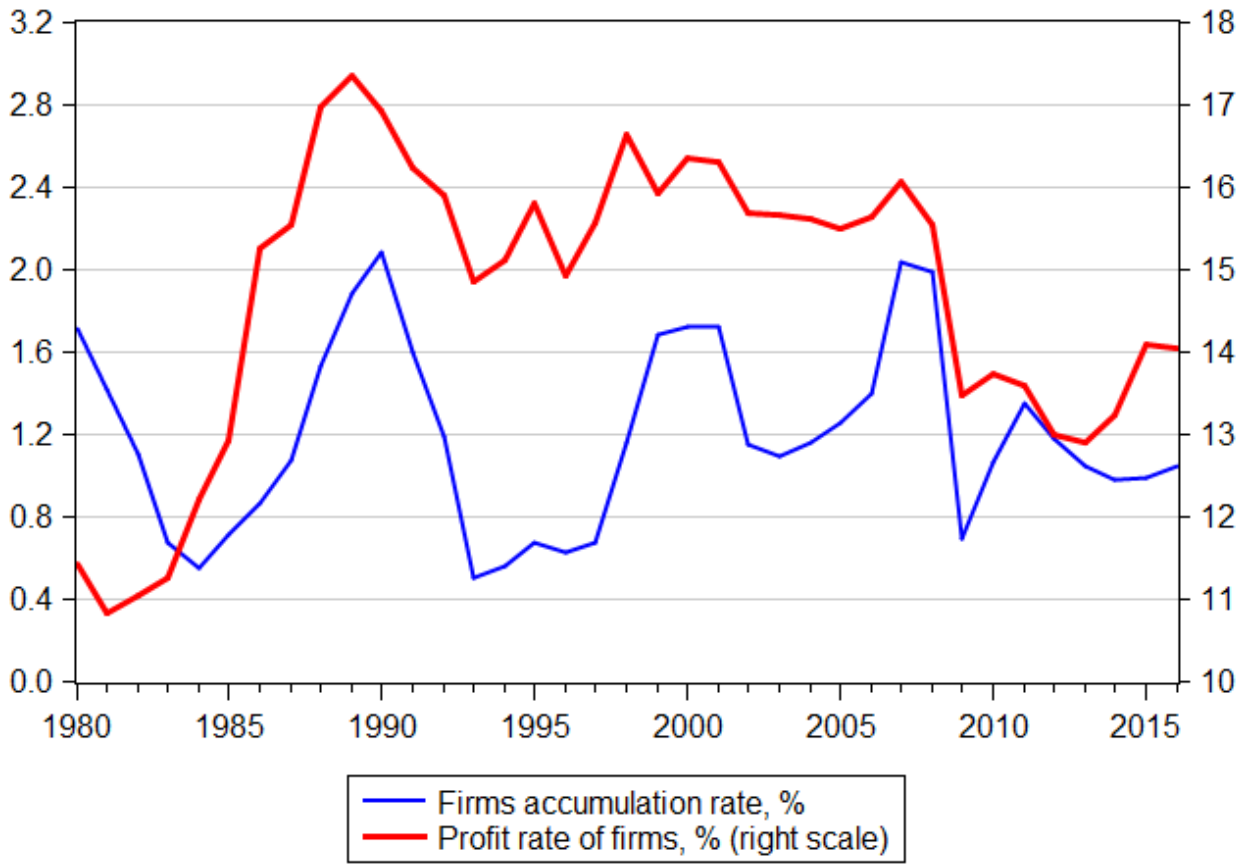
Consumption and disposable income



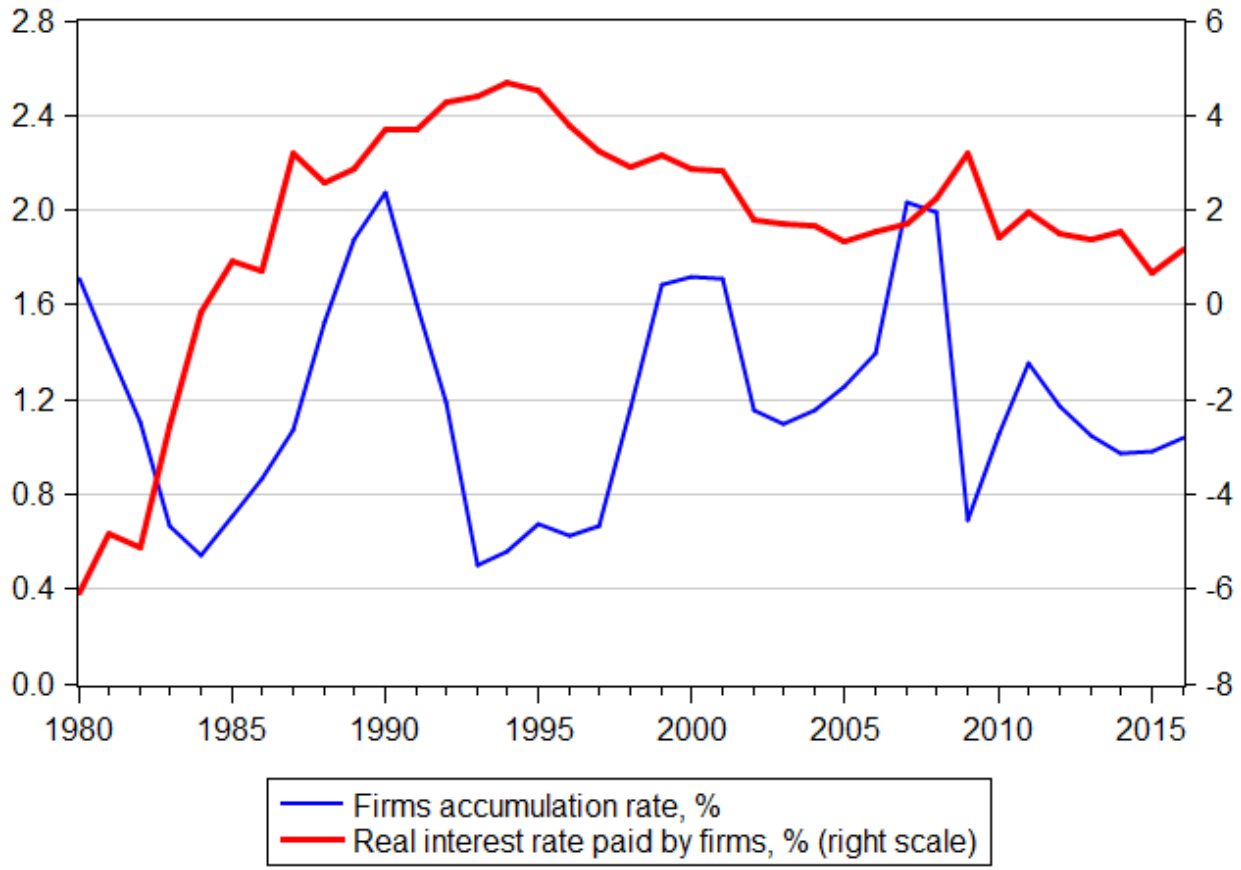
Consumption and wealth



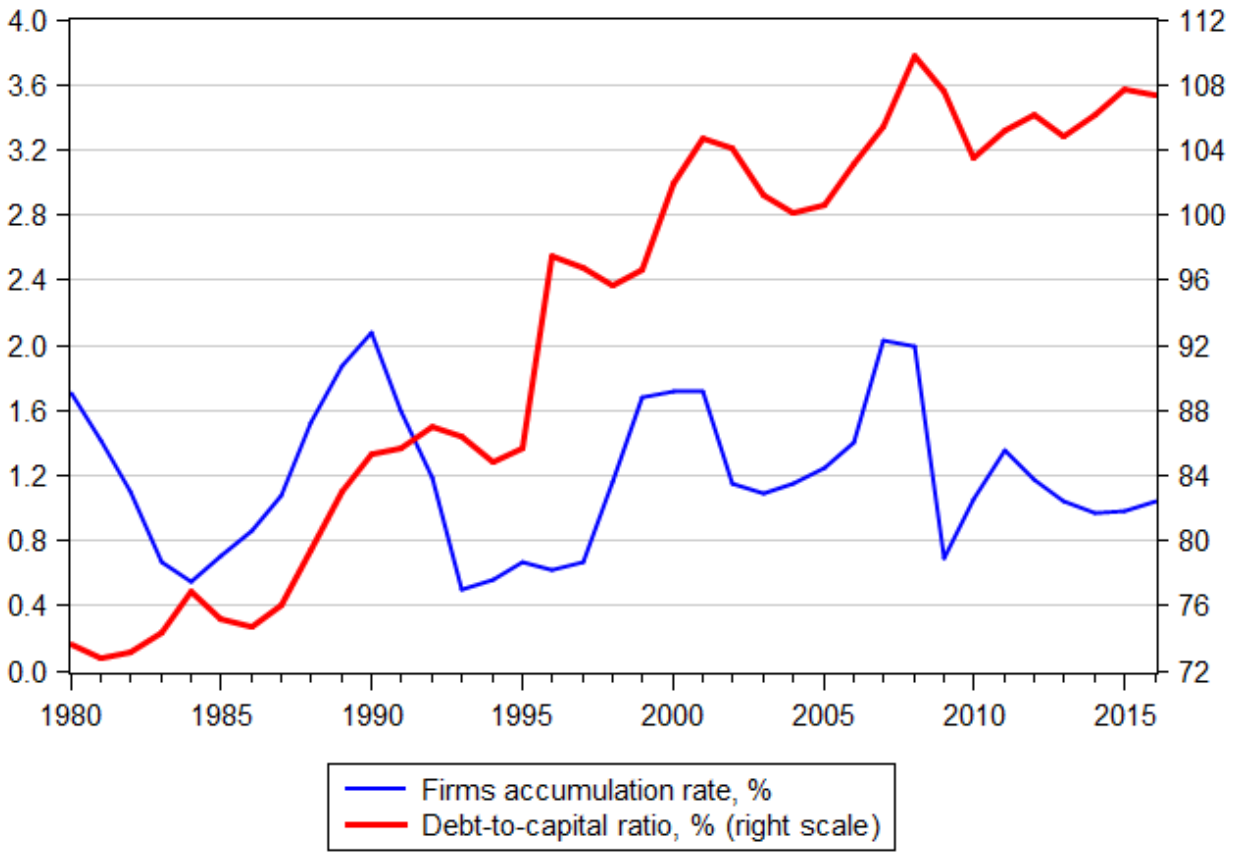
Investment and profit rate



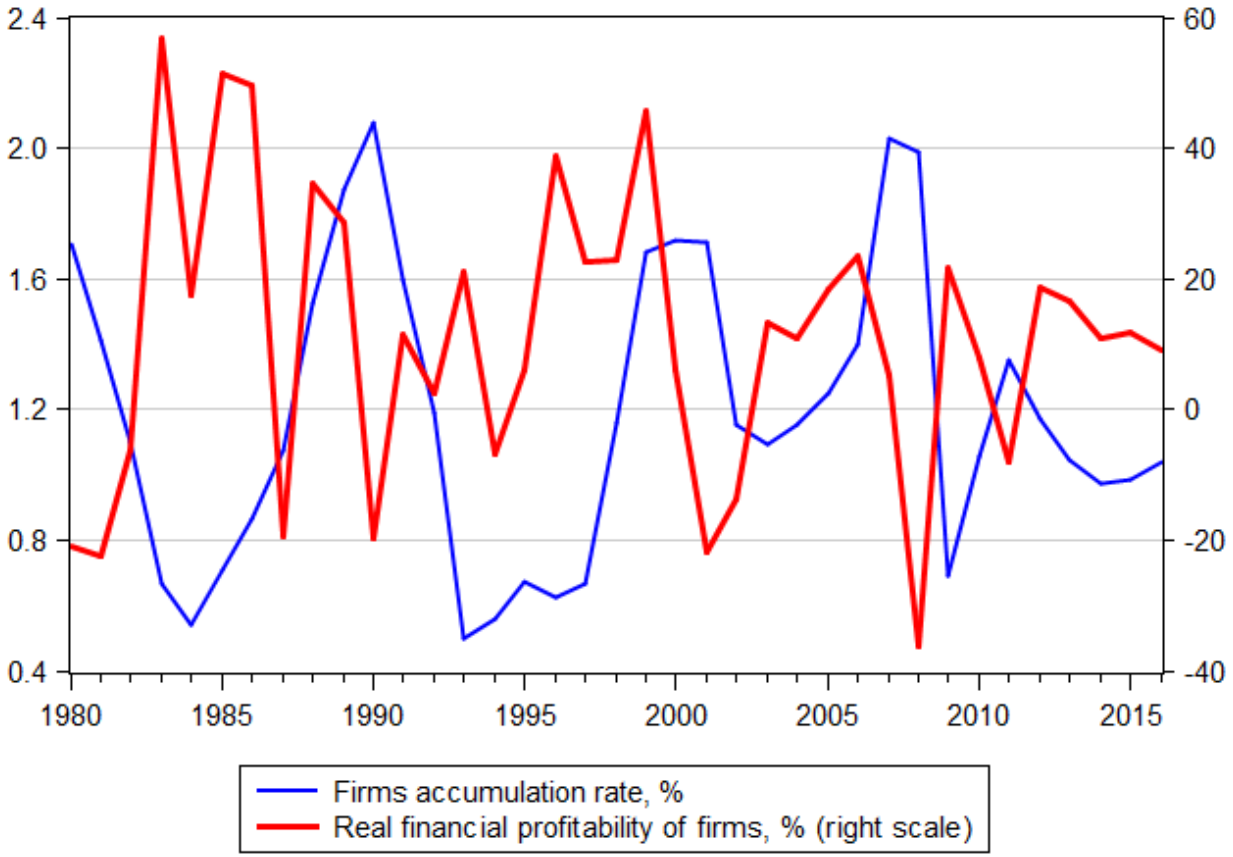
Investment and interest rate



Investment and debt ratio



Investment and financial profitability



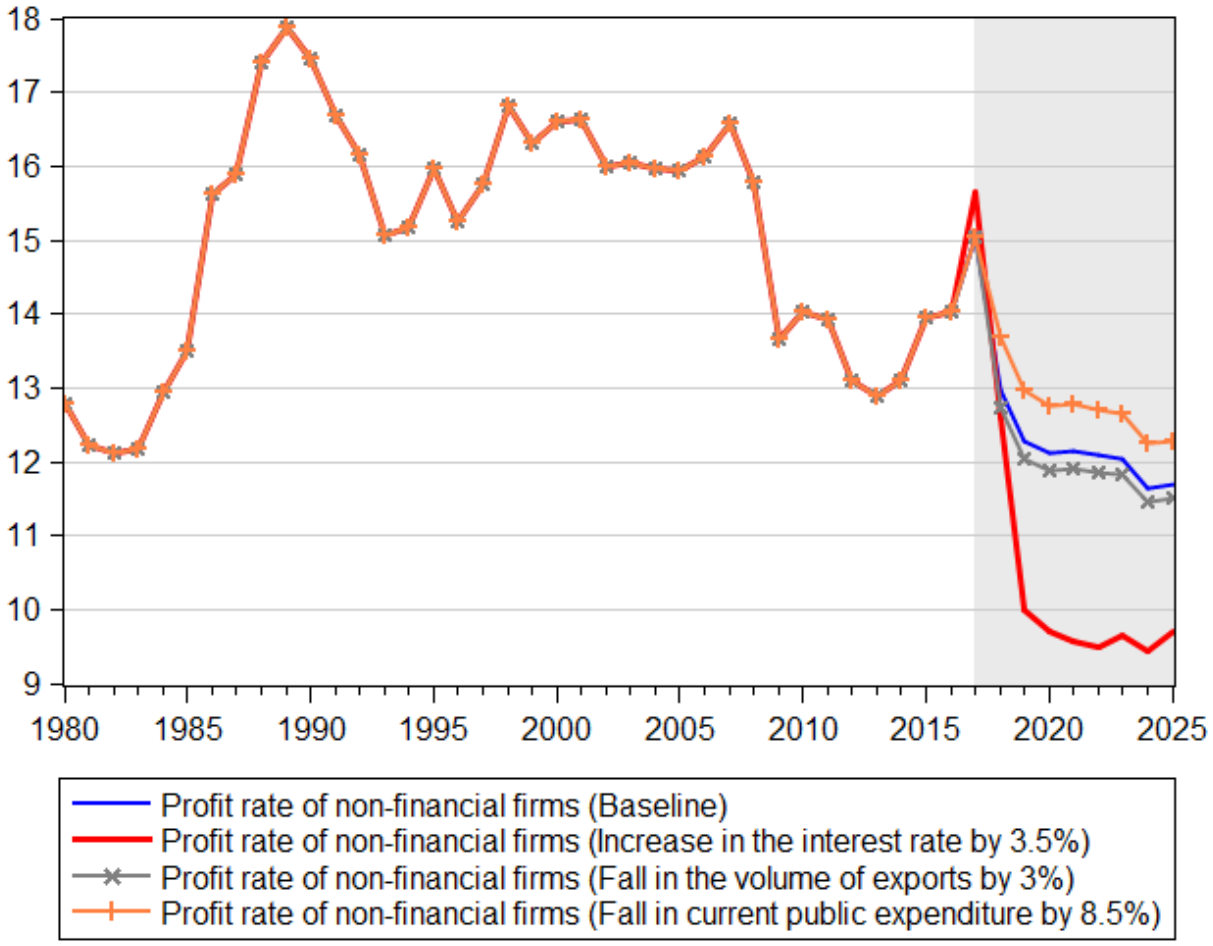
System solving

- Other types of equations were used in the system; identities, exogenous series and period-by-period calibrated parameters (mainly)
- The system was solved using Broyden's method, which approximates partial derivatives via an iterative method
- The parameters of the error correction models remain constant in the projection period
- Exogenous series are projected using the Holt-Winters method
- Parameters and interest rates keep the value of the last period throughout the projection period
- All interest rates (paid and received by all sectors, -1) are linked to the nominal 10-year treasury bond rate

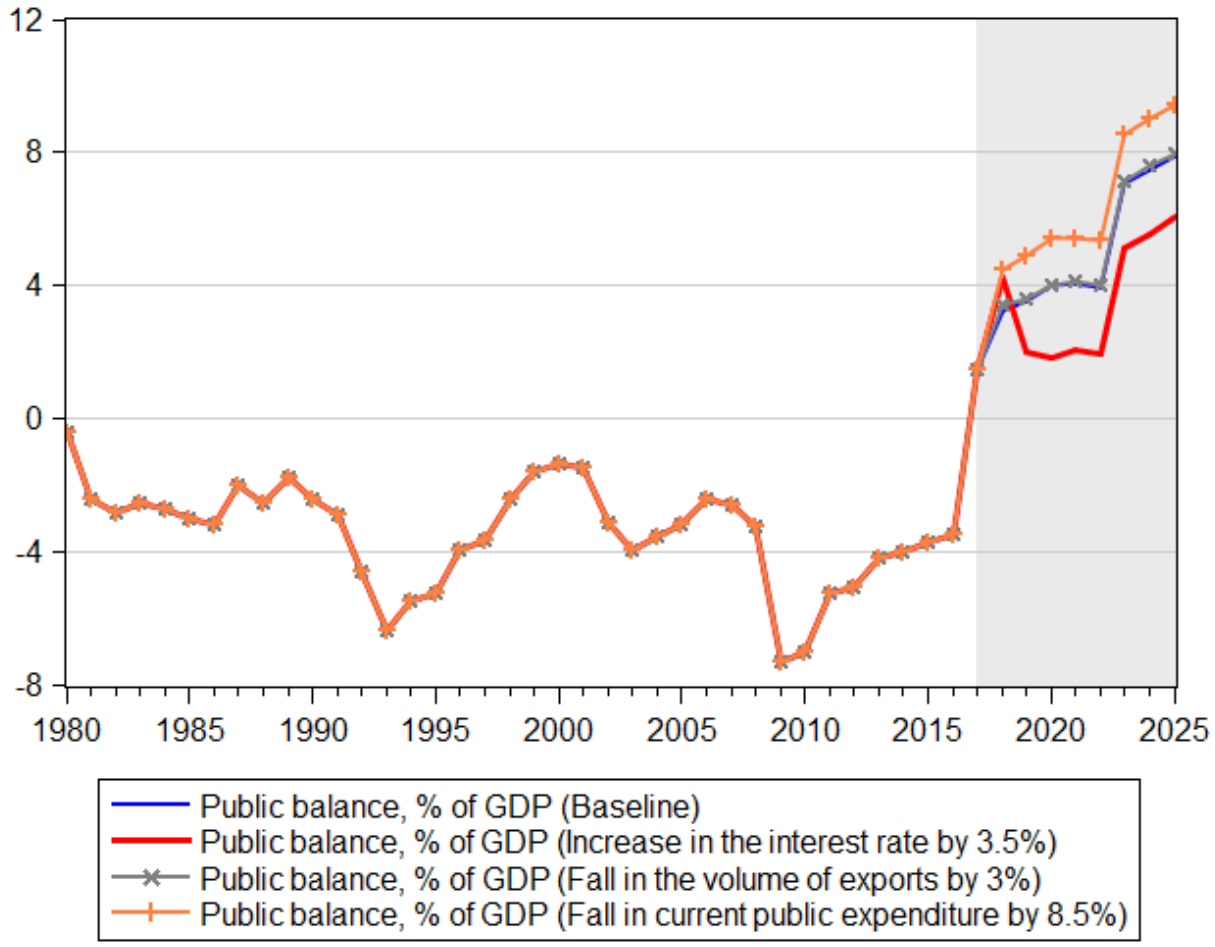
Scenarios

- Three shocks are applied to the model: $\uparrow i$, $\downarrow X$ and $\downarrow C^G$.
- These are compared to the baseline.
- Starting 2017:
  - The interest rate is set to 4% (3.5% higher than its current level)
  - The volume of exports increases by 3% (average g.r.)
  - The volume of current public expenditure is reduced by 8.5% (average g.r. $= 2.1\%$)

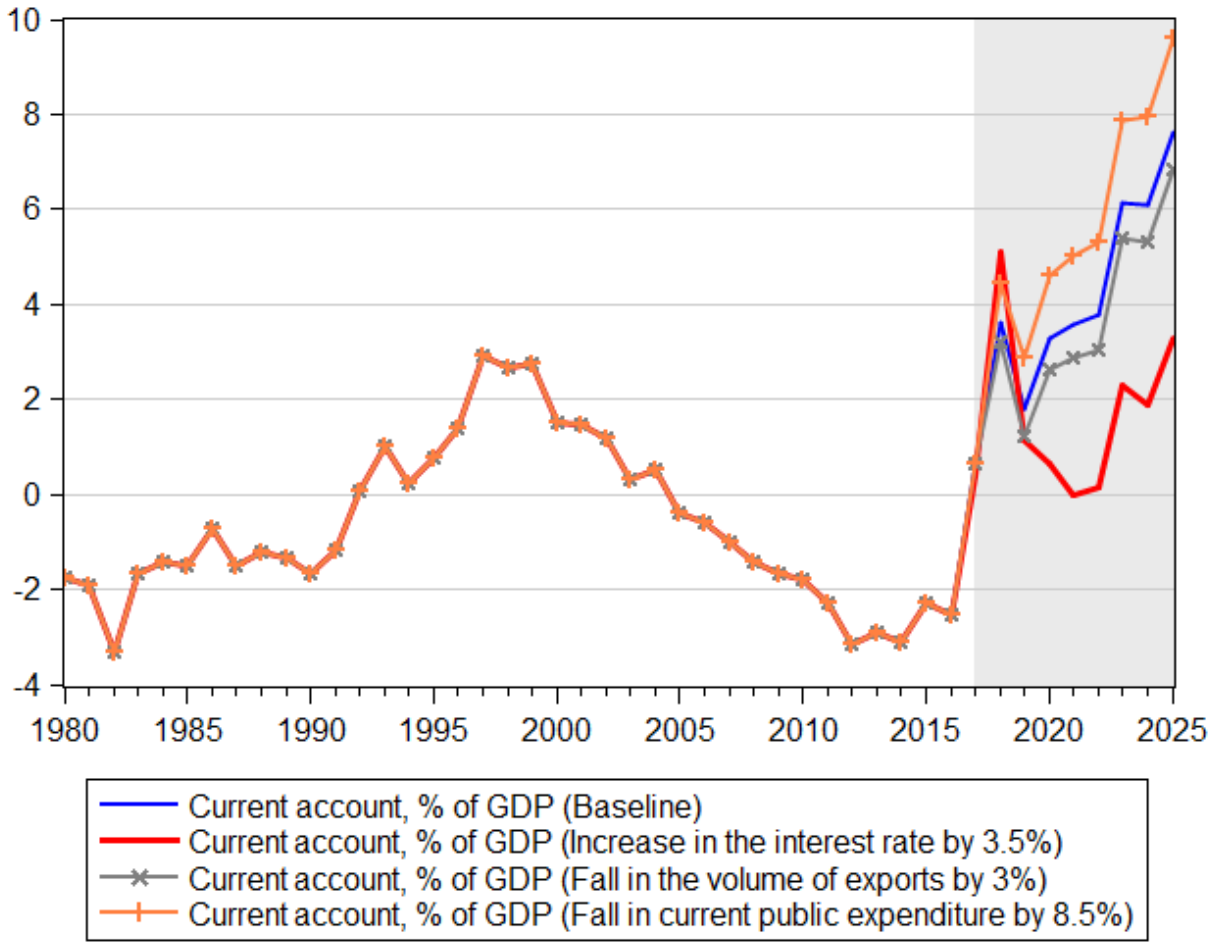
The results on the profit rate of firms



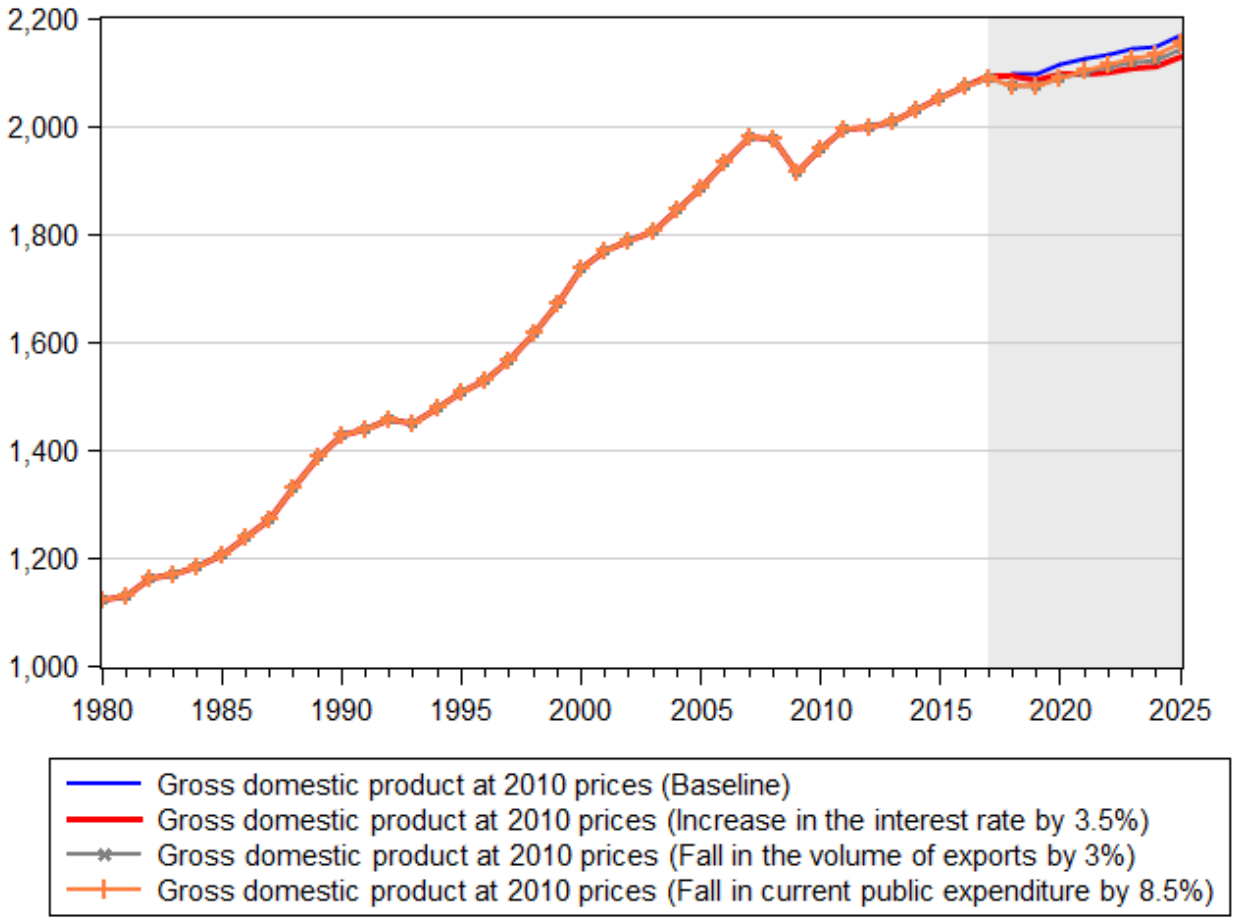
The results on the public balance



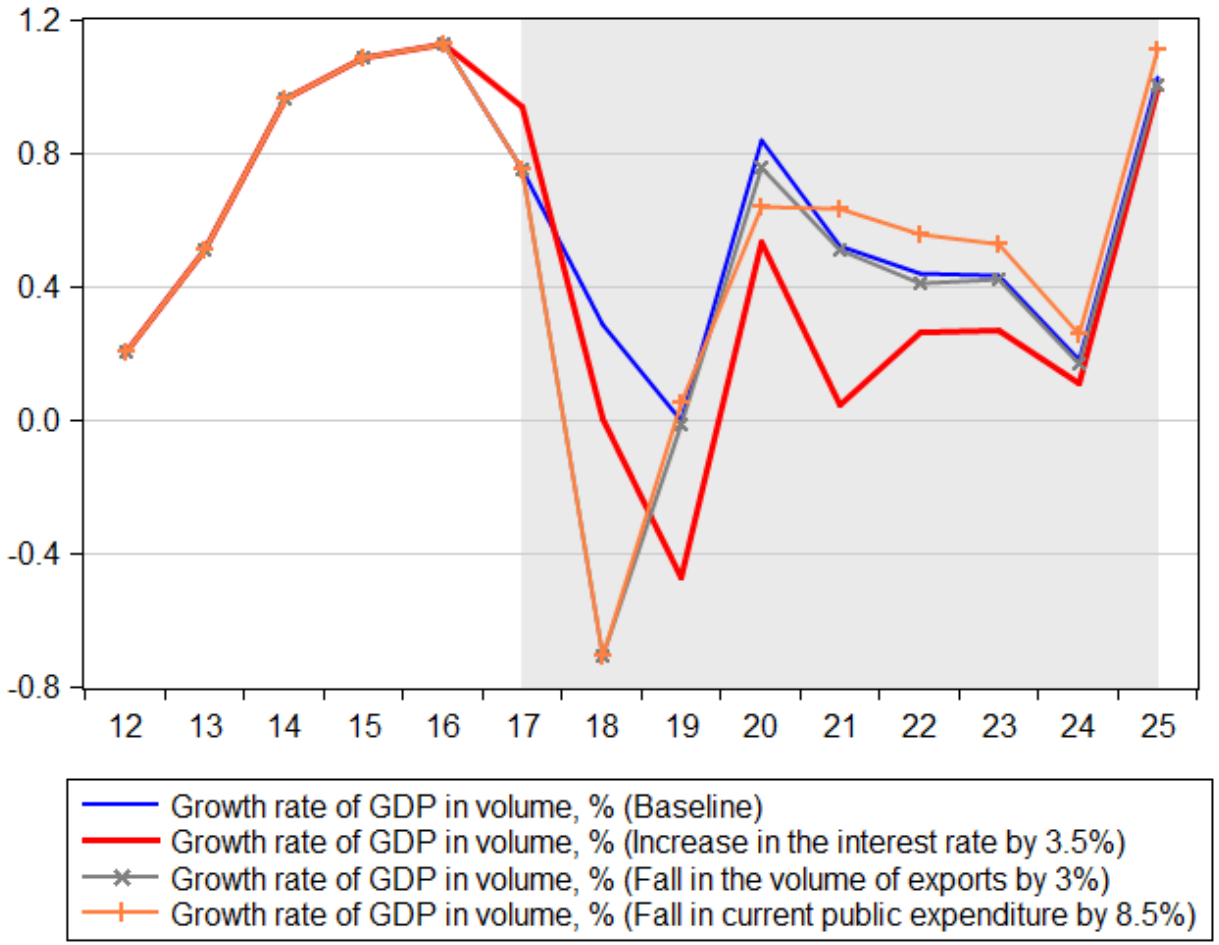
The results on the current account



The results on the volume of GDP



The results on the growth rate of GDP



Thank you for your attention