Projektbericht

Research Report

Update: Extension of the Empirical Stock-Flow Consistent (SFC) Model for Austria

Implementation of Endogenous Portfolio Choice and Simple Markup Pricing

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Final Report

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Abstract

This study presents the current status in the development of a novel empirical stock-flow consistent (SFC) model for Austria. SFC models are macroeconomic accounting models that feature several aggregated heterogeneous agents (sectors) and different classes of financial assets and liabilities. Stocks of assets/liabilities and financial flows of and between the sectors are depicted in a consistent and rigid accounting structure based on the logic of national annual sectoral accounts (flow of funds). The modelling approach allows complex interactions between agents as well as between the real and financial economy. Here, the SFC approach is used to construct an empirical model for the Austrian national economy that features endogenous economic dynamics. The dynamics do not necessarily converge to a steady state, but are based on trends derived from national accounting data. The moset recent extension in the current stage of development, is the implementation of (1) an endogenous portfolio choice for financial assets based on estimations from national accounting data and (2) a simple markup pricing mechanism derived from national accounting identities. A medium-term target of this work in progress is to develop a tool which is fit for medium to long-term forecasting, scenario-based policy evaluation/simulation, which can be the basis for policy advice.

Zusammenfassung

In dieser Studie wird der derzeitige Entwicklungsstand eines neuartigen empirischen bestands- und flussgrößenkonsistenten (Stock-flow Consistent - SFC) Modells vorgestellt. SFC Modelle sind makroökonomische Modelle, die sich durch eine makroökonomisch konsistente Buchhaltung, aggregierte heterogene Agenten (Sektoren) sowie verschiedene Klassen von finanziellen Forderungen und Verbindlichkeiten auszeichnen. Bestände von Forderungen/Verbindlichkeiten und finanzielle Flüsse der bzw. zwischen den Sektoren werden in einer konsistenten und rigiden buchhalterischen Struktur gemäß der Logik der volkswirtschaftlichen Gesamtrechnung (jährliche Sektorkontenrechnung) dargestellt. Dieser Modellierungsansatz erlaubt komplexe Interaktion sowohl zwischen Agenten als auch zwischen Real- und Finanzwirtschaft. An dieser Stelle wird der SFC Ansatz für die Konstruktion eines empirischen Modells der österreichischen Ökonomie herangezogen. In der derzeitigen Ausbaustufe des sich in Arbeit befindlichen Modells wurde eine endogene Portfoliowahl für finanzielle Vermögenswerte basierend auf empirischen Schätzungen aus Daten der VGR, sowie ein simpler realwirtschaftlicher Preismechanismus zusätzlich hinzugefügt. Ein mittelfristiges Ziel dieses noch in Bearbeitung befindlichen Modells ist die Bereitstellung eines Werkzeugs für mittel- bis langfristige Prognose sowie für Szenario-basierte Politikmaßnahmenevaluation, das nach seiner Fertigstellung als Basis für Politikberatung dienen soll.

Contents

Nomenclature

BANK Commercial Banking Sector and MMFs

BAU Business as Usual

BS Balance Sheet

BSM Balance Sheet Matrix

CB Central Bank

CPI Consumer Price Index

DS Debt Securities

dum Label in graphs due to technical reasons, please ignore

FC Financial Corporations

FOC Other Changes in Volume Account

FTR Financial Transactions

GDP Gross Domestic Product

Govt Government

HH Households

ICPF Insurance Corporations and Pension Funds

IFU Non-MMF Investment Funds

MMF Money Market Funds

NASA National Annual Sectoral Accounts

NFC Non-financial Corporations

NFTR Non-financial Transactions

NLNB Net Lending/Net Borrowing

NPISHs Non-profit Institutions Serving Households

NW Net Worth

OFI Other Financial Institutions

OS Operating Surplus

RECV Received

REV Revaluation Account

SDRs Special Drawing Rights

SFC Stock-flow Consistent

TFM Transaction Flow Matrix

VA Value Added

VAT Value Added Tax

1 Introduction

This project report documents a work-in-progress version of what is termed in the literature as a "fully empirical" stock-flow consistent (SFC) model, calibrated to the Austrian economy (see Caverzasi and Godin (2014), and Nikiforos and Zezza (2017) for SFC-model reviews). In fully empirical SFC models, not only are the model parameters estimated from empirical data, they are also used to predict variations of endogenous model variables in a scenario analysis. We follow this approach and derive a business as usual (BAU) scenario from national accounting data.

This model is the first of its kind for Austria, and among few empirical SFC models internationally. Specifically, Caverzasi and Godin (2014) restrict research in this area to two groups that work with this kind of fully empirical SFC models: one set of authors at the Levy institute, who constructed fully empirical models for the U.S. (Papadimitriou et al., 2011) and Greek economies (Papadimitriou et al., 2013). The other group can be found at the University of Limerick, see Kinsella and Tiou-Tagba Aliti (2012), where an empirical model of the Irish economy is still work in progress.

One of the main strengths of SFC models in general is their explicit depiction of heterogeneous aggregated agents interacting in a financial economy featuring several asset classes and their different rates of return. These interactions usually involve portfolio choice of agents between these assets, endogenous creation of money in the financial system, and a system of endogenous nominal flows constituting economic relations in a consistent accounting framework. These flows are related both to behavioural decisions of agents within a period, but also to their holdings of assets and liabilities and the implied flows of revenues and payments.

Empirical SFC models in specific have the decisive property that they can incorporate dynamics of the economy based on empirical evidence, and not necessarily presuppose a steady state growth path. Especially, our model is designed to project trends that we take from sectoral national accounting data into the future for the BAU scenario. In this framework, we can incorporate policy simulations leading to a new development of the economy. The economic effect of the policy measure is obtained by comparison of this new development due to the policy measure to the BAU scenario.

This model, while yet preliminary in nature, is an extended and improved version of the empirical SFC model for Austria put forth in Miess and Schmelzer (2016). We have concentrated on the following issues:

1. The inclusion of asset prices and an endogenous portfolio choice of financial assets for all sectors (including a leverage decision) based on estimations from national accounting data.
2. A simple markup pricing mechanism derived from national accounting identities.

The inclusion of endogenous portfolio choice for several asset classes was primarily motivated by the fact that by implementing a more detailed financial structure in our model from the first stages of model building onwards, we can cater to the specific strength of SFC models in the comprehensive depiction of the financial system. We included asset prices per sector and asset classes, as displayed in ESA2010 data, and implemented a sectoral leverage decision, and portfolio choice. The size each sector wants her balance sheet to be depends on macroeconomic data (gdp, price deflator, net lending/borrowing, etc.), while the shares according to which a sector wants to invest her funds into the different asset classes depend on expected return rates of all assets.

Furthermore, a real pricing mechanism was implemented that – yet preliminary without a more detailed model of real economic production – serves as a possibility to include a comprehensive link between firm pricing behaviour and distribution of national income between the factors capital and labour (functional income distribution) in the model.

While we are aware that many of the behavioural equations, as well as the projections of the multitude of parameters and (exogenous or endogenous) variables still deserve a closer look and comprehensive empirical work, we believe that the basic logic of this model can offer a convincing case for the possibilities this framework is able to open up for future applications. Especially, the effects of different policy measures on growth and distribution - but also on budgets, developments of indebtedness, and sectoral financial imbalances - can be effectively evaluated with empirical SFC models.

Fiscal and monetary policy can be evaluated separately, but also jointly and in mutual interaction. By using standardised national accounting data from Eurostat - based on the framework put forth in Eurostat (2013) - and implementing the construction of our underlying datasets in computer code, we can potentially replicate this framework for several countries of the European Union (given sufficient time and resources).

The structure of this report is as follows: Firstly, the reader is introduced into the underlying data framework in section 2. Firstly, we set out how we constructed the stock-flow consistent matrices for the model in section 2.1. This involves the compilation of a transaction flow matrix (TFM), section 2.1.1, a balance sheet matrix (BSM), section 2.1.2, as well as a flow-of-funds and a revaluation account, section 2.1.3. We describe some important aspects of the data structure and how the data are compiled, and relate to the main aggregations and disaggregations of flows, assets, and liabilities we undertook. Then we illustrate how we achieved consistency in these data sets individually, and elaborate how they interlink in the SFC framework. Some trends in balance sheet data are shown in section 2.1.4

Secondly, we describe the structure of our model in section 3. The model is composed of two major blocks, the first of which regards non-financial transaction (NFTR) flows, section 3.1, the second relates to financial transaction (FTR) flows, section 3.3. Each of these blocks features endogenous behavioural decisions of agents, exogenous variables forecast according to trends in the data, 'implied' stock-flow relations, and primary outcomes due to the interaction of these different flows. NFTR depict economic flows within an accounting period between agents resulting from various economic activities, while FTR show the accumulation of financial assets/and liabilities, and the transition of balance sheets from one year to the next. One major focus of the model extension set forth in this report is to achieve a link between the NFTR and FTR block of the model. Selected past developments as well as projections of both parameters and variables in the model are shown in this section. Section 4 shows the results of the business as usual scenario, and illustrates the endogenous dynamics - still preliminary in nature - implemented in this model.

Lastly, section 5 concludes and offers an outlook on further extensions, possible work and improvements of the modelling framework.

As the model described and applied below is still a preliminary work in progress, this project report is intended to show the basic logic of the modelling framework, forming a base for discussion.

2 Data

2.1 Matrices

2.1.1 Transaction Flow Matrix (TFM)

Table 1 shows the large non-financial transaction flow matrix directly from NASA data.

The first step in constructing this matrix was to achieve flow consistency between sectors in order to attribute a flow as expenditure/receipt for each sector, i.e. paid and received funds have to add to zero for each line. The complication that arises here is that for variables stemming from the production account, i.e. final consumption expenditure (P3), net value added (B1N), gross investment (P51G), change in inventories (P52), acquisition/disposal of valuables (P53), exports (P6), and imports (P7) below, there is no counterpart receiving the flow specified in NASA data. We constructed the matrix below to obtain net lending/net borrowing as specified in the non-financial accounts, to aim for consistency with the financial side of the data (flow of funds and differences between balance sheets), since net lending/net borrowing equals the net acquisition of financial assets/liabilities of a sector.

Table 1: The Large Non-financial Transaction Flow Matrix for Austria (2012, in million Euro)

Flow		NFC (S11)		FC (S12)		Gov't (S13)		HHs,NPISHs (S14_S15)		RoW (S2)	
Name	**Number**	**RECV**	**PAID**	**RECV**	**PAID**	**RECV**	**PAID**	**RECV**	**PAID**	**RECV**	**PAID**
Wages	D11	0	78,901	0	6,200	0	27,520	124,267	11,420	1,754	1,981
Social cont.	D12	0	15,868	0	1,877	0	6,283	26,096	2,274	380	174
VAT on products	D211	0	0	0	0	24,563	0	0	24,563	0	0
Imp tax on products	D212	0	344	0	0	0	0	0	0	344	0
Tax on products (other)	D214	0	10,895	0	0	10,858	0	0	0	37	0
Other tax on production	D29	0	6,722	0	1,154	10,534	1,470	0	1,188	0	0
Subsidies on products	D31	640	0	0	0	0	558	0	0	0	82
Other subs production	D39	3,134	0	143	0	0	4,181	2,052	0	0	1,149
Net interest payments	D41	2,212	5,295	23,438	20,356	1,709	8,624	5,095	1,968	16,731	12,942
Distr. income corp.	D42	16,779	25,397	1,657	7,476	1,603	0	18,696	0	8,852	14,714
Reinvested earnings fdi	D43	-867	1,334	2,621	3,592	0	0	61	0	4,926	1,816
Other inv. inc. To Insur. holders	D441	286	0	4	2,824	0	0	2,534	0	0	0
to pension holders	D442	0	287	0	643	0	0	931	0	0	0
to IF shareholders	D443	157	0	1,853	2,497	123	0	853	0	269	757
Rents	D45	0	211	0	0	211	0	0	0	0	0
Wage income tax	D51A C04, C08, D51E	0	0	0	0	26,032	37	0	26,024	150	121
Tax on Mixed Income HH	D51 C01, C02, C03, C05	0	0	0	0	4,621	0	0	4,621	0	
Capital Income Tax HH	D51A C06,C07; D59A	0	0	0	0	1,917	0	0	1,917	0	0
Firm Income Taxes	D51B		5,688	0	955	6,643	0	0	0	0	0
Other current taxes	D59 - D59A	0	13	0	0	1,841	0	0	1,828	0	0
Employers actual sc	D611	544	0	2,637	0	21,158	0	0	24,132	174	380
Employers imputed sc	D612	0	0	0	0	1,964	0	0	1,964	0	0
HH actual sc	D613	0	0	0	0	24,210	0	0	24,210	301	301
HH sc supplements	D614	287	0	643	0	0	0	0	931	0	0
Social transfers in cash	D62	0	847	0	1,602	0	59,728	62,096	0	768	689
Non life ins. Premiums	D71	0	1,882	6,482	55	0	0	0	4,262	32	314
Non life ins. Claims	D72	1,902	0	31	6,617	0	0	4,316	0	376	8
Current internaltional cooperation	D74	0	0	0	0	326	391	0	0	391	326
Misc. Current trfs	D75	16	482	109	330	2,479	5,244	5,582	2,676	1,009	463
EU own resources	D76	0	0	0	0	0	2,654	0	0	2,654	0
Pension enttlmts adjustments	D8	0	-16	0	1,564	0	0	1,549	0	0	0
Capital taxes	D91	0	0	0	0	32	0	0	32	0	0
Investment grants	D92	647	0	138	0	0	1,336	530	0	1	-20
Other capital trfs	D99	364	507	1,555	18	663	2,412	173	47	262	34
Net consumption + NET VA	P3, B1N	98,244	0	12,044	0	43,827	62,661	54,041	145,495	0	0
Gross investment	P51G	71,866	43,631	0	1,969	0	9,190	0	17,076	0	0
Depreciation	P51C	33,903	33,903	1,908	1,908	8,353	8,353	11,547	11,547	0	0
Change Inventories	P52	2,492	2,349	0	0	0	5	0	138	0	0
Acquis./disp. of valuables	P53	1,756	41	0	14	0	1	0	1,700	0	0
Exports	P6	170,599	0	0	0	0	0	0	0	0	170,599
Imports	P7	0	162,374	0	0	0	0	0	0	162,374	0
NLNB	recv - paid	8,006	8,006	-6,388	-6,388	-6,981	-6,981	10,406	10,406	-5,045	-5,045

We reached this flow consistency by mixing the distributive transactions accounts with the production account. The crucial line is net consumption (P3) + net value added (B1N), where net final consumption in the household and government sectors is attributed to net value added (VA) generated by the non-financial corporations sector (NFC), financial corporations (FC), as well as the government and household sector itself. Value added tax (VAT) on products was subtracted from gross household consumption, and assigned as a payment flow from the household to the government sector based on information obtained from Austrian Input-Output (I/O) tables, which are available until the year 2012.[1]

Net value added generated in the household sector is composed of NPISHs as well as output produced by self-employed. For the NFC sector, net value added can be obtained by subtracting paid from received funds by the NFC sector in the production account below. This is the entry that achieves consistency in this matrix, since the net VA for the NFC sector as obtained from our matrix closely matches net VA from accounting data. Furthermore, revenues resulting from exports were assigned to the NFC sector, as well as expenditures due to imports. Other taxes on products (D214) were also assigned to the firm sector according to figures in the Austrian I/O tables.

The operating surplus (which is needed later on for model applications and only implicitly given in the matrix above) for each sector is calculated by net VA - expenditure on labour (D1) - other taxes on production (D29) + subsidies on production (D3).

From this large matrix, in order to achieve a parsimonious structure manageable for model construction, we aggregated several of the accounts above to obtain the matrix denoted in table 2. While we have aggregated several flows, we split the financial corporations sector into sub-units as classified in the balance sheet data, where the aggregation of the financial corporations sector is finer, see section 2.1.2.

Taxes To achieve a more detailed exposition of taxes, we used information from Statistik Austria on taxes and social contributions by the government.[2] Specifically, the total income tax D51 was divided into taxes on wage - wage tax (Lohnsteuer, D51A C08) and other taxes accruing to labour income (employees' contribution to chambers D51 A C04, other taxes on income D51 E) - and taxes on capital income paid by the household, made up of the tax on capital yields (D51A C06, Kapitalertragssteuer) tax on interest (Kapitalertragssteuer auf Zinsen, D51A C07), and current taxes on capital (D59A, Vermögenssteuern). Since taxes paid by self-employed are not taxes on wages as such but on the operating surplus of own production in the household sector, we introduced a tax on mixed income, made up of income tax (veranlagte Einkommenssteuer, D51A C01), EU withholding tax (EU Quellensteuer, D51A C02), tax on industry and trade (Gewerbesteuer, D51A C03), and contributions to chambers by self-employed (D51A C05).

Additionally, we introduced a tax on firm income (D51 B - taxes on the income or profits of corporations, most of all 'Körperschaftssteuer'), and a value added tax on household consumption (D211).

Disaggregation of Financial Corporations (FC) Sector We have used the level of aggregation available from balance sheet data to split up FCs, see Eurostat (2013)[pp. 37 - 44]. In

[1] See `http://www.statistik.at/web_en/statistics/Economy/national_accounts/input_output_statistics/index.html` for more information on I/O tables. The availability of I/O data until the year 2012 is the reason why we chose to construct the TFM first for this year from the data, before implementing the TFM structure in computer code for all years 1995 - 2015.

[2] See `http://www.statistik.at/web_de/statistiken/wirtschaft/oeffentliche_finanzen_und_steuern/oeffentliche_finanzen/steuereinnahmen/index.html` (German) or `http://www.statistik.at/web_en/statistics/Economy/Public_finance_taxes/public_finance/tax_revenue/index.html` (English).

our model, special focus is placed on the financial sector since the explicit depiction of different financial assets emitted by various financial sub-sectors is one of primary strengths of SFC models. We want to cater to this strength by including these sub-sectors already in our basic modelling structure from begin with. Therefore, these institutions are described in higher detail below than the other sectors for a better understanding of what is comprised in the FC sector.

CB: Central Bank - the Austrian National Bank.

BANK: Deposit-taking corporations except the central bank (S122) and Money Market Funds (MMF, S123)

- S122. commercial, savings, credit, post, mortgage, etc. banks, i.e. all FCs principally engaged in financial intermediation and whose business is to receive deposits and/or close substitutes for deposits (but not only from other banks), and to grant loans and to make investment in securities for their own account.
- S123. MMFs are units that are principally engaged in financial intermediation and whose business is to issue investment fund shares or units as close substitutes for deposits, and to make investments on financial markets (MMF shares, short-term debt securities, and/or deposits) for their own account. This sector includes all collective investment schemes whose shares or units are close substitutes for deposits.

IFU: Non-MMF Investment Funds (S124) all collective investment schemes (except MMFs) engaged in financial intermediation who issue investment fund shares and that are not close substitutes for deposits and who, on their own account, make investments primarily in financial assets (not short-term) and in non-financial assets (primary real estate). These are institutions such as open- or closed-ended IFU, real estate IFU, IFU investing in other funds ('funds of funds'), hedge funds, etc.

OFI: Other Financial Institutions except ICPF (S125), Financial Auxiliaries (S126), captive financial institutions and money lenders (127)

- S125. all FCs engaged in financial intermediation by incurring liabilities other than currency, deposits or investment fund shares and that are not in relation to insurance or pension fund schemes. These are entities such as financial vehicle corporations (FVC) engaged in securitisation, security and derivative dealers, FC engaged in lending, or specialised financial corporations.
- S126. FC engaged in activities closely related to financial intermediation, but who are not financial intermediaries themselves. This includes insurance, loan or securities brokers; flotation corporations that manage the issue of securities; corporations that provide guarantees for different financial instruments; corporations arranging derivative and hedging instruments such as swaps, options and futures; corporations providing infrastructure for financial markets, central supervisory authorities of financial intermediaries if they are separate institutional units, etc.
- S127. FC that are neither engaged in financial intermediation nor in providing financial auxiliary services, and where most of their assets are not transacted on open markets. This comprises units as legal entities such as trusts, estates or agencies or "brass plate" ("name-in-only") companies, holding companies that hold equity but do not administer or manage other units; FVCs raising funds in open markets that shall be used by their parent corporation, etc.

Table 2: The Transaction Flow Matrix for the SFC model for Austria (year 2012, in million Euro)

Sector	NFC	NFC	CB	CB	BANK	BANK	IFU	IFU	OFI	OFI	ICPF	ICPF	Govt	Govt	HH	HH	row	row
Flow	RECV	PAID	RECV	PAID	RECV	PAID	RECV	PAID	RECV	PAID	RECV	PAID	RECV	PAID	RECV	PAID	RECV	PAID
Wages		-94,225				-3,495		-556		-897		-492		-33,803	147,162	-13,694		
Consumption	98,244				7,738		1,231		1,986		1,088		43,827	-62,661	54,041	-145,495		
SubTrans	3,288					-697		-111		-179		-98		-8,285	3,832		2,250	
Interest	2,212	-5,295	1,848	-1,876	17,699	-17,101	1,853	-29	783	-1,176	1,256	-173	1,709	-8,624	5,095	-1,968	16,731	-12,942
F_{DIV}	15,912	-26,731	19	-560	1,124	-3,216	278	0	2,646	-6,703	211	-589	1,603		18,758		13,778	-16,530
$ICPF_{DIV}$	286	-287		-57		-148					4	-3,262			3,464			
IFU_{DIV}	157		106		122		657	-2,497	160		807		123		852		269	-757
SocTrans														-59,728	59,728			
Investment	76,114	-46,021				-1,274		-203		-327		-179		-9,196		-18,914		
Exports	170,599																	-170,599
Imports		-162,374															162,374	
T_{va}													24,563			-24,563		
T_o		-18,185				-741		-118		-190		-104	23,444	-1,470		-3,016	381	
T_w													65,630			-65,630		
$T_{inc,se}$													7,294			-7,294		
T_{cap}													1,916			-1,916		
T_{firm}		-5,688				-614		-98		-158		-86	6,643					
Res		-7,113	1,272		118			-1,367	5,583		2,383			-242		-459		-176
NLNB	894		751			-486		-959	1,528		766			-7,257	9,984			-5,221

ICPF: Insurance Corporations (S128) and Pension Funds (S129)

- S128. all FCs engaged in financial intermediation as a consequence of the pooling of risk, mainly in the form of direct insurance or reinsurace. This includes all life and non-life insurance as well as reinsurance services by insurance corporations, but excludes social insurance services as provided by law/regulation and/or managed by the general government.
- S129. all FCs engaged in financial intermediation as a consequence of the pooling of social risk and needs of the insured persons (social insurance). They provide income in retirement and often include benefits for death or disability. Again, social insurance provided by the government sector is excluded.

Aggregation and Disaggregation of Flows To fit our model structure, we have constructed the following aggregate flows, subsuming several types of flows under one category. On the other hand, since we split up FC sector into sub-units, we had to take care of the issue that for non-financial transactions data, FC are only denoted as an aggregate. Flows thus had to be disaggregated concerning the institutional dimension to obtain flows to and from sub-units of the FC sector when applicable.

Aggregation according to type of flow: The following flows were aggregated with respect to NASA data.

- **Wages:** All wage income for the households including employers' social contributions (D11 + D12) was denoted as one aggregate flow of wages, i.e. households receive gross wages from NFC, FC, government and from their own sector (self employed and NPISH), and then pay an aggregate wage tax T_w, see below.
- **Consumption:** is the line comprising net consumption and own value added generated in the FC, government and household sector. The remainder of consumption not covered by own production of a sector is attributed to the NFC sector, creating consistency in the matrix as described above.
- **SubTrans** comprises subsidies on products (D3), all other current transfers (D7), adjustments for pension entitlements (D8), investments grants (D92) and other capital transfers (D99). It is treated in the model as an exogenous variable, the trend of which is taken from the data.
- F_{DIV} is an aggregate of distributed income of corporations (D42) and reinvested earnings on foreign direct investment (D43).
- $ICPF_{DIV}$ is property income due to holders of insurance papers (D441) and to holders of pension funds (D442).
- **Investment** is an aggregate of gross investment including depreciation (P51G), change in inventories (P52), as well as acquisition and disposition of valuables (P53). All investment is assumed to be carried out by the NFC sector, thus gross investment by all sectors is accounted in the received (RECV) entry of NFC, i.e. its current account, as an inflow of funds. Expenditure on NFC investment and depreciation are given in the paid column of NFC, i.e. the capital account of NFC, as an outflow of funds (financing of investment). Depreciation of investment by other sectors is contained in their gross investment, and does not need to be accounted for separately.

Taxes After disaggregating certain taxes from NASA data for the large matrix above, we aggregated other taxes to obtain the most important taxes in Austria in a form that can be implemented in our model. The tax rates, which are calculated directly from data for each year of the past, are given for the year 2012.

- **VAT tax (T_{va}):** This is the value added tax on products (D211), endogenously related household consumption in our model by a fixed rate. The average tax rate we calculate from NASA data here is about 16.9 %.
- **Other taxes (T_o):** This is an aggregate of all taxes on products other than VAT, all taxes on production, and a residual of other taxes that cannot be clearly attributed to a variable in our model. It comprises the import tax on products (D212), other taxes on products (D214), rents paid by firms to the government (D45), and other current taxes (D59). The largest part of this tax is paid by the NFC sector to the government, a smaller one by the household sector related to its own production. The endogenous tax base is the level of production by each sector, i.e. net VA produced by each sector (plus exports for the NFC sector). This tax rate is specific for each sector, and ranges from about 10.2 % for the NFC sector to ca. 5.2 % for households.
- **Wage tax (T_w):** As mentioned before, this is the total tax rate paid on wages including wage tax (Lohnsteuer and other taxes accruing to labour income, i.e. D51A C04, C08; D51E), and all social contributions by employers and employees (D12, D611 and D613). The tax rate applied to wage payments to households is about 44.6 %.
- **Tax on income of self-employed ($T_{inc,se}$):** This is a tax on the operating surplus/mixed income of the household sector, relating to income from the economic activities by self-employed. The corresponding tax rate is about 32.8 %.
- **Capital tax (T_{cap}):** Capital tax is paid on interest and dividend income by the household sector. The tax rate here as calculated from data is about 6.8 % (to be discussed).
- **Firm income tax (T_{firm}):** This is a tax on the operating surplus (profit, income) of the producing sectors (NFC, and all sub-sectors of the FC sector). The tax rate varies more for each year than for other taxes, since operating surlus (OS) by a producing sector is a rather volatile variable. The tax rate thus ranges between slightly above 20 % for the NFC sector, as well as between 15 % and 40 % for the FC sub-sectors (to be discussed)

All other flows have remained the same as in NASA data as regarding the type of flow:

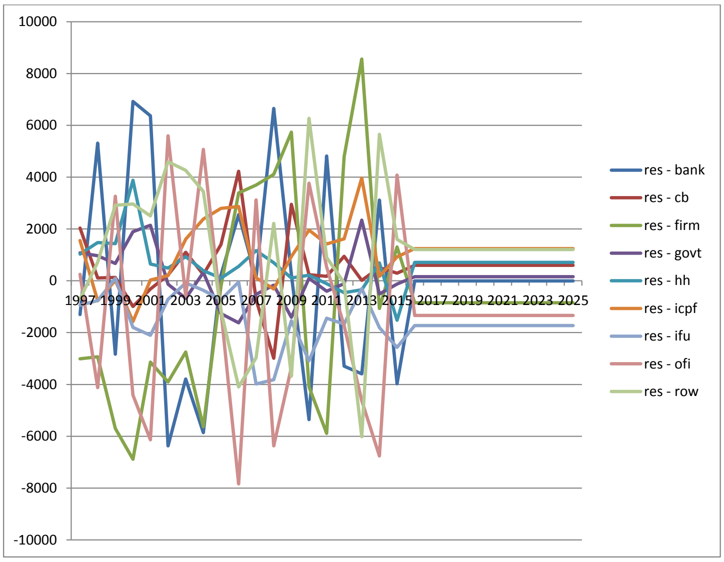
- **Interest** payments by sector are net interest payments (D41), related to the stock of the respective asset/liability held by a sector.
- IFU_{DIV} is investment income (D443) to IFU shareholders, related to the stock of IFU shares held by a sector.
- **SocTrans** constitute social transfers from the government to the household sector (D62), and are treated as exogenous.
- **Exports (P6), Imports (P7)** are directly taken from NASA data, attributed to NFC, and forecasted as exogenous variables.

Disaggregation of flows to FC sub-sectors Here, we used two different approaches described below.

1. **According to length of balance sheet:** Here, we took the length of the balance sheet as a proxy for the activities of this sector, determining a corresponding amount of flows implied by these FC sub-sectors to carry out these activities (to be discussed). The share of the balance sheet length of the respective sub-unit of the FC sector in the total balance sheet length of the FC sector was used to split the total flow of the FC sector among the respective sub-units. This procedure applies to consumption, wages, investment, exports, imports, social and other transfers (SocTrans, SubTrans), as well as other taxes (T_o) and the firm income tax (T_{firm}).

2. **According to stock of a financial asset/liability held:** In this case, we address a stock-flow relation proper (interest or dividend payment) relating to the size of the stock of a financial asset/liability held. The procedure here was to calculate the interest/dividend rate paid on a stock of assets for the FC sector as a whole. Keeping this interest/dividend rate fixed, we calculated the flow of interest payments to a sub-unit of the FC sector by applying the interest rate to each asset class on the stock of assets held by each FC sub-unit. This method applies to interest payments on loans (interest), as well as distributed income of corporations (F_{DIV}), dividends on insurance and pension fund shares ($ICPF_{DIV}$), as well as dividends on investment fund shares (IFU_{DIV})

Figure 1: Difference of Net Lending/Net Borrowing of Sectors between Non-Financial Transactions (NFTR) and Financial Transactgions (FTR) (in Mio. EURO)



Residual (Res) Generally, NLNB differ between the financial and the non-financial accounts. After contacting experts from Austrian National Bank, we decided to take NLNB from the financial account as link between the TFM and the balance sheet matrix (BSM), in order to safeguard consistency with financial account and since the financial accounts seem to rely more on data than assumptions as compared to the non-financial accounts. For constructing the large TFM given in table 1, however, we used NLNB from non-financial accounts as the target variable, as this amount of NLNB exactly is the result of all non-financial flows as calculated by the Statistik Austria, and we had to stick to the logic of the data here.

Since there is a "structure" in the difference between the accounts, we introduced a residual in the TFM, and a variable in the model, that takes account of this structure. For the future periods, we keep this residual variable fixed on the average of the time periods in the past, to avoid distortions of the model dynamics emanating from this data inconsistency. The values of the residual, which is a non trivial figure, are shown in figure 1 above. Here, we show the difference between NLNB for the financial and non-financial accounts , i.e $NLNB_{financial\ account} - NLNB_{non-financial\ account}$, for the years 1995 - 2015 from the data and the forecast, i.e. the average over the past periods. While the household sector and the government are agreed on by the institutions gathering these data, the differences for the sectors RoW, NFC and FC seem quite pronounced and follow no clear pattern except for the basic logic that the sum of NLNB over all sectors has to be zero (to be discussed).

In the course of this project, we talked to ÖNB officials, who said that there are efforts to further collaboration between the institutions providing this data, and that the datasets will be homogenous in the future. At the moment, there is no better way we could handle this problem, despite the size of the residual.

2.1.2 Balance Sheet Matrix

Table 3 shows the aggregated balance sheet matrix for the SFC model. While we have kept the finest disaggregation of institutional units with a focus on sub-units of the FC sector, we decided to aggregate financial assets/liabilities to simplify the model structure. The major financial assets/liabilities depicted in our model are given below. For further reference on the types of financial assets, see Eurostat (2013)[Chapter 5, pages 125 - 157]

F1: Monetary gold, SDRs - Monetary gold is gold bullion under effective control of monetary authorities (central bank) and which is held in reserve assets. SDRs are reserve assets created by the International Monetary Fund (IMF) which are allocated to members to supplement existing reserves. Thus, this asset is issued solely by the central bank agent, with the Rest of World (RoW) holding the major counter position as a liability.

F2: Currency and deposits - Currency (F21) is notes and coin issued or authorised by monetary authorities, both national and foreign currencies held by national residents.

Deposits in general are standardised, non-negotiable contracts with the public at large, offered by deposit-taking corporations (in some cases by the central government), allowing placement and later withdrawal of the principal by the creditor. Usually, the debtor gives back the full amount of the principal to the creditor.

More specific, transferable deposits (F22) are exchangeable for currency at par, and directly used for payment without penalty or restriction. This includes payment facilities such as cheque, draft, giro order, direct debit/credit, but also inter-bank positions between FC, deposits held at the central bank by other monetary institutions, or foreign currency deposits under swap arrangements.

Other deposits (F29) are all deposits other than transferable deposits. They cannot be used to make payments except on maturity or after an agreed period, and they are not exchangeable for currency without a significant restriction or penalty. This includes time deposits not immediately available for withdrawal (subject to fixed term or redeemable at notice of withdrawal); savings deposits, books and non-negotiable certificates; deposits resulting from a saving scheme or contract; deposits issues by savings and loans associations, building societies, credit unions etc.

redeemable at relatively short notice but not transferable; or short-term repurchase agreements (repos) which are a liability of monetary financial institutions.

In our balance sheet data and thus also the model, deposits are issued as a liability by banks, the central bank, the RoW and the government (the latter to a small extent). The vast majority is issued by banks (more than 592 bln. Euro) as a liability, less by the RoW (ca. 152 bln. Euro) and the central bank (ca. 88 bln. Euro). They are held by all other agents in the economy as an asset, being the primary means of payment. It is interesting to observe that banks hold more deposits (more than 274 bln. Euro) than households, who keep the majority of their wealth in the form of deposits (about 233 bln. Euro) - indicating the large size of inter-bank positions in the Austrian economy. The net position of Austria to the RoW is small and negative (net debtor).

Debt Securities (F3) are negotiable financial instruments serving as evidence of debt. They have the following characteristics: 1. an issue date 2. an issue price 3. a redemption or maturity date contractually scheduled for repayment 4. a redemption price or face value (the amount to be paid at maturity by the debtor) 5. a remaining or residual maturity until the date of redemption 6. a coupon rate the issuer pays to holders (fixed or variable) 7. coupon dates on which the issuer pays the coupons 8. they are denominated in national or foreign currency 9. they are subject to credit ratings assessing the credit worthiness of individual debt security issues.

In the data, they are classified by maturity: short-term debt securities (F31, less than a year of maturity) and long-term debt securities (F32, more than a year of maturity). The other classification by type of interest rate payment (fixed, variable, or mixed) is not available from NASA data. The most important fixed interest rate debt securities (DS) are those issued at discount or premium to their value, including treasury bills, commercial paper, promissory notes, bill acceptances, bill endorsements, and certificates of deposits. Other forms of DS include deep-discounted bonds having small interest payments but issued at a considerable discount to par value; zero-coupon bonds (single payment, no coupon payments); perpetual, callable or puttable DS; or convertible bonds with the embedded option to be converted into equity of the issuer. Variable interest rate DS can be indexed to a general price index such as the CPI, an interest rate or an asset price. Mixed DS have both a fixed and a variable coupon payment and are classified as variable interest rate DS.

In the BSM given in table 3, the largest amount of DS is issued by the general government (ca. 267 bln. Euro) as the primary financing means of government debt. This is closely followed by banks, who have outstanding liabilities of about 225 bln. Euros in DS. One can see that Austria is a substantial net debtor to the RoW with a net debt of a little less than 160 bln. Euros. Corporate financing by commercial paper in the NFC sector seems to play a rather limited role with a liability position of about 39 bln. Euro in debt securities compared to more than 312 bln. Euro liabilities in loans and other accounts.

Loans (F4), Other accounts receivable/payable (F8) Loans (F4) are created when creditors lend funds to debtors. They are characterised by the following features: 1. They are either fixed by the FC granting the loan or agreed by lender and borrower 2. the initiative of the loan normally lies with the borrower 3. it is an unconditional debt to the creditor to be repaid at maturity and which is interest-bearing. Again, they are classified by maturity (short-term, F41, and long-term, F42). The difference between loans and DS is that loans are non-negotiable financial instruments, while DS are negotiable. Furthermore, loans are usually evidenced by a single document, while DS issues consist of a large number of identical documents, each evidencing a round sum.

Other accounts receivable/payable (F8, 'other accounts' in short) are financial assets and liabilities created as counterparts to transactions where there is a timing difference between the transaction and the corresponding payment. This mostly involves trade credit (F81), which are financial claims arising from the direct extension of credit from suppliers of goods and services to their customers, as well as advances for work yet in progress. Another sub-category (F89) here are financial claims arising from timing differences between distributive transactions or financial transactions on secondary markets, regarding e.g. wages and salaries, taxes and social contributions, dividends, rent, purchase and sale of securities. We include these forms of credit with loans due to their similar properties as loans from one sector of the economy to the other (to be discussed), and are henceforth jointly referred to as loans.

The major holder of loans as an asset in the Austrian data, naturally, are banks with more than 440 bln. or loans outstanding in the year 2012 (of which not more than 4.2 bln. are other accounts). Major recipient of loans is the corporate sector with liabilities of more than 312 bln. Euro (258 bln. of which are loans proper, 54 bln. are other accounts). However, maybe surprisingly, the corporate sector is also a large creditor with more than 140 bln. in loans as asset (about 100 bln. of which are loans proper, the rest other accounts). It is also interesting to observe the interrelations between the Bank and OFI sector in Austria, with more than 50 bln. in bank loans taken out by OFIs (7 bln. of which are other accounts).

Insurance, pension and standardised guarantee schemes (F6) These are claims that insurance policy holders or pension fund share owners have against the insurance corporations or pension funds in various forms. Hence, the ICPF sector is the main issuer of these liabilities with more than 107 bln. Euro, the vast majority of which are held by the household sector as an asset with a positive position of more than 114 bln. Euros (including some ICPF share issued by the RoW).

Investment fund shares or units (F522) These represent a claim on a portion of the value of an investment fund (other than a MMF). These types of shares are solely issued by investment funds (national and by RoW), and were kept separate because the size of this sector is significant with more than 147 bln. in national and almonst 40 bln. in foreign shares outstanding. On the asset side, this financial instrument is largely held by the ICPF sector (more than 47 bln.), households (more than 41 bln.), and within the IFU sector (more than 38 bln.).

Equity except investment fund share units (F5 w/o F522), Financial derivatives (F7) Equity (F51) is a financial asset that is a claim on the residual value of a corporation, after all other claims have been met, usually evidenced by the ownership of shares and stocks (which have the same meaning in the following). Listed shares (F511) are quoted on a stock exchange, meaning that current market prices are usually readily available. Unlisted shares (F512) are not listed on an exchange, and comprise various forms of participatory shares in unlisted companies, giving their owners different rights in the share of profits, ownership, and dissolution of the company.

Financial derivatives (F7) are financial instruments linked to a specified other financial instrument, indicator or commodity, through which special financial risks can be traded on financial markets. Their size is rather small for the Austrian economy (total gross holdings by FC of not more than 12 bln. Euro), thus they were subsumed under equity (to be discussed).

The major issuer of equity are Austrian NFC with more than 285 bln. Euro, closely followed by the RoW (272 bln. Euro). The OFI sector also has a sizeable liability position in this asset class with more almost 184 bln. in outstanding shares. The RoW is the largest holder of Austrian equity with almost 233 bln. Euro. The OFI sector has the second largest asset position here, potentially indicating large holdings of foreign stocks. Here, it is also interesting to observe the large amount of equity held within the NFC sector as asset (about 186 bln. Euro), possibly pointing to cross-holdings within the NFC sector. Households are other major holders with ca. 108 bln. Euro.

Table 3: The Balance Sheet Matrix (BSM) for Austria, 2012 (in million Euro)

No.	Name	NFC ass	NFC liab	CB ass	CB liab	BANK ass	BANK liab	IFU ass	IFU liab	OFI ass	OFI liab	ICPF ass	ICPF liab	Govt ass	Govt liab	HH ass	HH liab	row ass	row liab
F1	Monetary gold, SDRs			13,302	-2,024														-11,278
F2	Currency and Deposits	58,031		61,673	-88,096	274,382	-592,032	8,083		10,530		4,264		19,518	-3,325	232,686		166,159	-151,873
F3	Debt Securities	10,211	-38,825	25,720		132,404	-225,304	80,788		5,507	-5,698	47,163	-2,510	31,220	-267,462	48,114		351,489	-192,817
F6	Insurance, Pension, guarantee schemes	5,624	-9,552		-1,870		-4,853					6,997	-107,095			114,674		2,230	-6,155
F4F8	Loans, other accounts	141,847	-312,419	1,222	-1,802	442,124	-2,134	15	-1,399	21,514	-50,674	8,813	-5,771	76,091	-76,124	11,840	-166,186	99,789	-186,746
F522	Investment Fund Shares	9,296		6,260		7,192		38,618	-147,355	9,422		47,443		8,148		41,529		18,562	-39,115
F5F7	Other Equity, Derivatives	185,710	-285,166	1,326	-15,341	79,043	-88,121	19,539	-6	186,079	-183,678	14,819	-16,126	68,668	-34,799	108,161	-15	232,875	-272,967
	Net Worth (NW)		-235,244		371		22,701		-1,717		-6,999		-2,004		-178,064		390,802		10,154

Table 4: The Flow of Funds (Financial Transactions) Matrix for Austria, 2012 (in million Euro)

No.	Name	NFC ass	NFC liab	CB ass	CB liab	BANK ass	BANK liab	IFU ass	IFU liab	OFI ass	OFI liab	ICPF ass	ICPF liab	Govt ass	Govt liab	HH ass	HH liab	row ass	row liab
F1	Monetary gold, special drawing rights			18															-18
F2	Currency and Deposits	-4,091		-10,071	8,786	27,072	-23,498	1,336		610		25		1,992	-2,518	-4,399		9,397	-4,642
F3	Debt Securities	92	2,989	1,301		19,449	-25,312	-1,314		198	800	-113	-72	181	9,194	-130		6,094	-13,356
F6	Insurance, Pension, guarantee schemes	-275	-108		46		115					-922	3,159			-2,741		-172	896
F4F8	Loans, other accounts	-5,904	5,215	-26	54	1,885	-16	-1	28	-294	2,913	67	-271	-3,891	2,034	-1,162	507	-4,217	3,078
F522	Investment Fund Shares	-81		-610		1,295		-385	1,159	-1,065		-2,382		210		-967		-408	3,235
F5F7	Other Equity, Derivatives	-854	2,123	-48	-201	1,063	-1,567	-738	874	-13,011	8,320	-23	-236	869	-813	-1,090	-3	-5,552	10,886
	negative change in NW		-893		-752		486		959		-1,528		-766		7,257		-9,984		5,221

Table 5: The Revaluation and Other Changes in Volume Accounts (aggregated) for Austria 2012 (in million Euro)

No.	Name	NFC ass	NFC liab	CB ass	CB liab	BANK ass	BANK liab	IFU ass	IFU liab	OFI ass	OFI liab	ICPF ass	ICPF liab	Govt ass	Govt liab	HH ass	HH liab	row ass	row liab
F1	Monetary gold, special drawing rights			361	37														-398
F2	Currency and Deposits	-137		1	201	-465	409	9		77		1		34		-246		-382	499
F3	Debt Securities	92	-1,235	1,496		5,263	-5,712	5,276		199	-385	3,745	-52	1,632	-14,714	1,294		15,301	-12,200
F6	Insurance, Pension, guarantee schemes	-40			22		-42					-535	-832			1,433		0	-7
F4F8	Loans, other accounts	5,907	-14,124	0	0	1,207	717		1	-170	263	572	-300	12,768	-9,125	-5	656	884	747
F522	Investment Fund Shares	532		480		218		3,020	-9,982	589		3,583		416		2,013		1,430	-2,299
F5F7	Other Equity, Derivatives	2,669	-14,209	18	-837	464	-5,151	1,177	918	11,572	-7,494	-155	-1,989	15,591	-14,012	5,585	-10	14,331	-8,468
	Change NW due to holding gains/losses		-20,544		1,778		-3,093		419		4,652		4,040		-7,410		10,719		9,440

2.1.3 The Flow of Funds Matrix and the Revaluation Account

The Flow of Funds Matrix given in table 4 shows the transactions in financial assets according to the asset classes above. As mentioned before, NLNB from this financial account should match NLNB from the non-financial accounts (the TFM) - which is trivially does, since we introduced a respective residual in the TFM. However, the signs are opposite since an increase in an asset position indicates a use of funds (a rise in assets is denoted with a '-' sign), an increase in liabilities a source of funds (an increase in liabilities is denoted with a '+' sign). Thus, e.g. the -9,984 mln. Euro indicate that the asset position of households has increased by this amount, showing a breakdown of the assets that have been used in the portfolio choice by households as a store of this surplus.

One has to remark, however, that from Eurostat data, a *from-whom-to-whom financial account* is not available. This means that we do not know to whom the flows of financial transactions go - we only observe the change in the asset positions of the respective agents. This is one possible point of extension for later model versions in the medium-term future, as such whom-to-whom accounts are available from the Austrian National Bank from the year 2006 onwards.[3]

As a short note on the data itself, one can see that the bank sector has the highest changes (flows) in financial assets. This might have been expected, in particular for deposits as primary means of payment, but also for debt securities, for which highly liquid markets exist. A similar argument can be made for the OFI sector, which seems the most active national sector in dealing with equity. Furthermore, one might observe the high activity of the Austrian National Bank, possibly related to unconventional monetary policy interventions on financial markets.

The Revaluation and Other Changes in Volume Accounts are shown as an aggregate in table 5. In our model we cannot distinguish between these two, especially since the other changes in volume account is erratic and cannot be explained endogenously within our model. As we are still working on the asset pricing mechanism in our model, nominal capital gains/losses are treated as exogenous in the model, see section **??**. In this matrix, the sign conventions are the same as in the TFM, i.e. a rise in an asset position (a holding gain) is denoted with a '+' sign, the rise of a liability position (a holding loss) with a '-' sign.

What seems to stand out from these data are the large holding losses for the NFC sector in the year 2012 of close to 21 bln. Euro, while households and the RoW seem to have profited from the financial situation in this year. It is clear that when firm equity (stock) prices rise, liabilities of the firm sector are increased. However, this is a nominal holding loss for NFC in name only, since it usually is in the interest of NFC to see their share prices rise, and since the issue of equity by NFC - which is denoted in the data as a liability primarily for reasons of accounting consistency - does not imply an a future repayment of principal for the NFC. Apart from this effect due to accounting conventions, it seems that magnitudes in the revaluation account (at least for the year 2012) are similar or even higher than those in the flow of funds matrix. This can be seen as empirical support for the focus on the pricing of financial assets that we intend to place for the further construction of our SFC model.

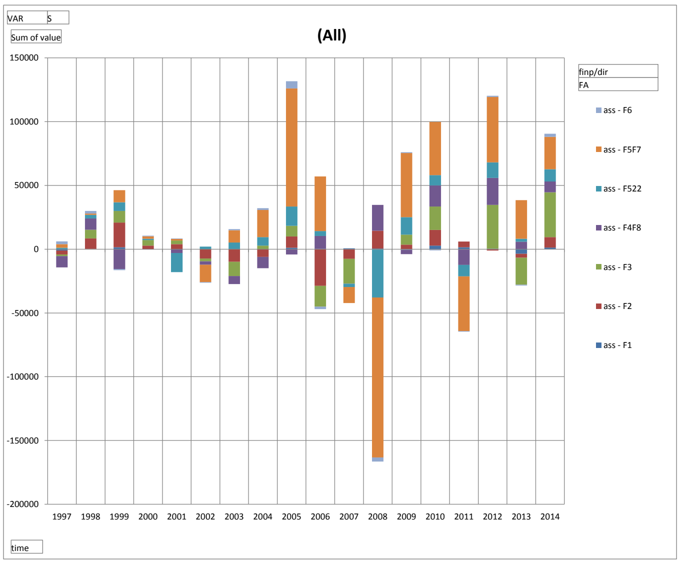
2.1.4 Balance Sheet and Revaluation Data 1995 -2015

Figures 3 - 4 offer an insight on the balance sheet composition of the Sectors of the Austrian economy in comparison in percent of GDP for the time period from 1995-2015.

[3]See `https://www.oenb.at/Statistik/Standardisierte-Tabellen/gesamtwirtschaftliche-finanzierungsrechnung/finanzierungsinstrumente.html` for further reference.

Several developments seem notable in figure 3. Firstly, one can observe the jump in financial assets held by FC (S12) during the period before the financial crisis 2007/2008, and a steady decline since. This picture is similar by the RoW, with the additional development of rising asset holdings by the RoW starting after 1995 to a level just below Austrian FC - potentially indicating increased integration of Austria in international financial markets. The rise before 2007/2008 in the FC sector is mainly driven by an increase of shares and equity (F5F7), see also figure **??** below regarding its portfolio choice. Generally, one can see the loss in asset value of all agents in the year 2008 after the crisis. The collapse of share prices is best visible in the household sector (S14_S15) in 2008, but is also clear for all other sectors. At the same time, asset holdings of the government increase in 2008, suggesting the take-up of financial assets of the government in reaction to the crisis. Lastly, the firm sector (S11) seemed to be the least affected by the crisis as regarding its asset holdings. Figure 2 - the revaluation account from 1995 until 2015 - shows the full extent of the devaluation in stock prices in 2008, and also indicates that securities devalued earlier (in 2007).

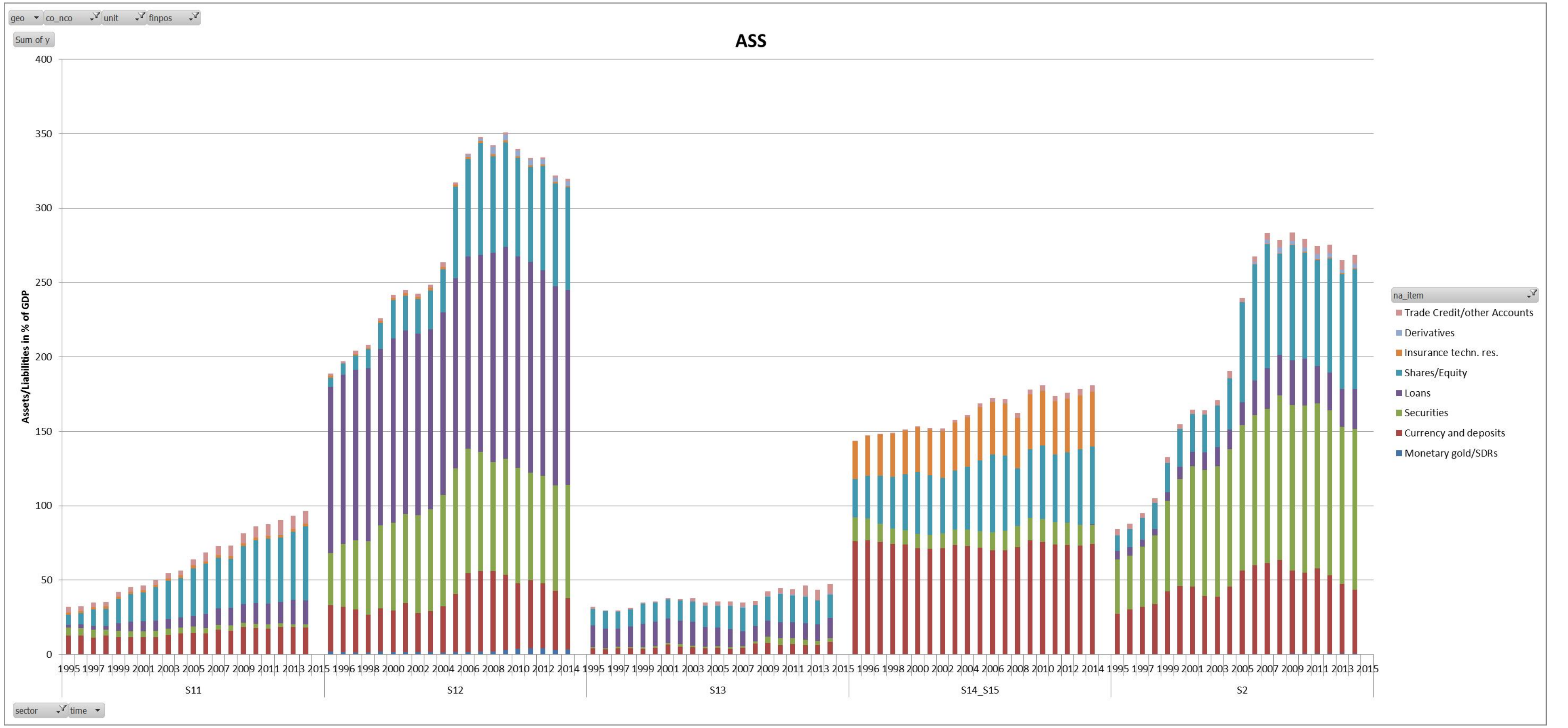
Figure 2: Revaluation of Assets for all Sectors in Aggregate until 2015 (in mln. Euro)



Legend - F6: Insur. techn. res., F5F7: Stocks, F522: IFU shares, F4F8: Loans, F3: Securities, F2: Deposits, F1: Mon. Gold and SDRs

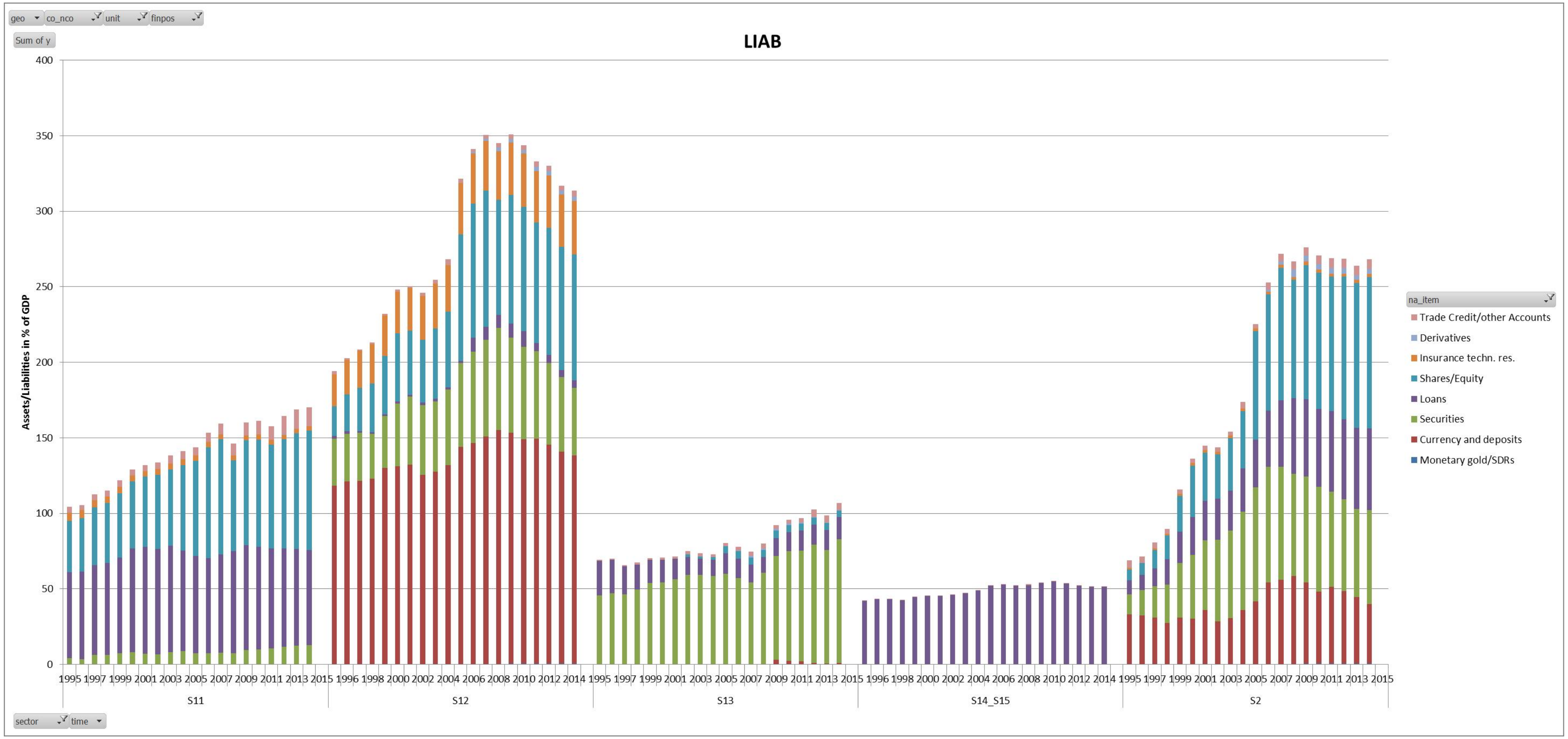
The development of financial liabilities in figure 4 closely mirrors the asset positions of sectors. Again, one can observe the fall in prices of equity, this time as a liability of the sectors themselves. Some deleveraging, i.e. a reduction of liabilities, can be distinguished for FC (S12) and the household sector (S14_S15). The rise in government debt after the crisis can be clearly observed. The shrinking of balance sheets shown in the data is best reflected in our model by the total change in balance sheets of agents, which is shown in figure 18 below.

Figure 3: Assets of Austrian Sectors in Comparison (in % of GDP)



Legend - S11: NFC, S12: FC, S13: GOVT, S14_S15: Households and NPISH, S2: RoW

Figure 4: Liabilities of of Austrian Sectors in Comparison (in % of GDP)



Legend - S11: NFC, S12: FC, S13: GOVT, S14_S15: Households and NPISH, S2: RoW

3 The Model

The model described in the following follows the basic logic of national accounting.

Firstly, non-financial transaction flows (current accounts) are set forth, including flows determined by behavioural equations for agents (e.g. consumption, investment), exogenous variables (e.g. exports, imports), and flows implied by stocks of the previous period (e.g. interest or divident payments). Outcome is primarily observed as change in GDP and NLNB.

Secondly, financial transactions (accumulation accounts) are depicted, including behavioural equations (portfolio choice), and variables exogenous in the model (revaluation of assets, amount of balance sheet extension). Outcome is observed by the actual holdings of different assets by agents, and their net worth at the end of the period, thus obtaining the closing balance sheet for this period (the opening balance sheet for next period).

The method to calibrate the model is as follows: firstly, we reformulate the equations taking the variables as fixed (taken from past NASA data 1995 - 2015) and the parameters as the unknowns. We then calculate parameter values and obtain trends for the parameters for these time series for the past, which are shown for the most important parameters below. We then use past trends to forecast the development of the parameters into the future. In most cases, we have used the simplest possible forecasting method for the parameter - taking the last value available in the data and keeping it fixed. This was due to 1. Time restrictions in the model construction stage due to the large amount of data work we had to manage, but also 2. since we do not want to distort the dynamics of the model too much by strong assumptions on the trends of the parameters. Since the trends in most parameters are very stable, it is possible to get a look at the dynamics of the behavioural assumptions in the model itself, not influenced too strongly by the trends in parameters.

After constructing the business as usual scenario, we obtain the effects of the policy measure by comparing the scenario simulation with the business as usual scenario. Currently, the forecasting horizon of the model runs until 2025.

Notation: below, parameters are denoted by lower case Greek letters, variables by capitalised Latin letters. Index t signifies time, index s economic sectors (institutional units), *direct* means the direction of payment: received (RECV) or paid. The index $finpos$ relates to the financial positions of a sector, i.e. whether the financial instrument is held as an asset (ass) or as a liability (liab). The subscript fa relates to the different classes of financial assets in the model.

3.1 Non-financial Transaction Flows

3.1.1 Behavioural Equations and Parameters

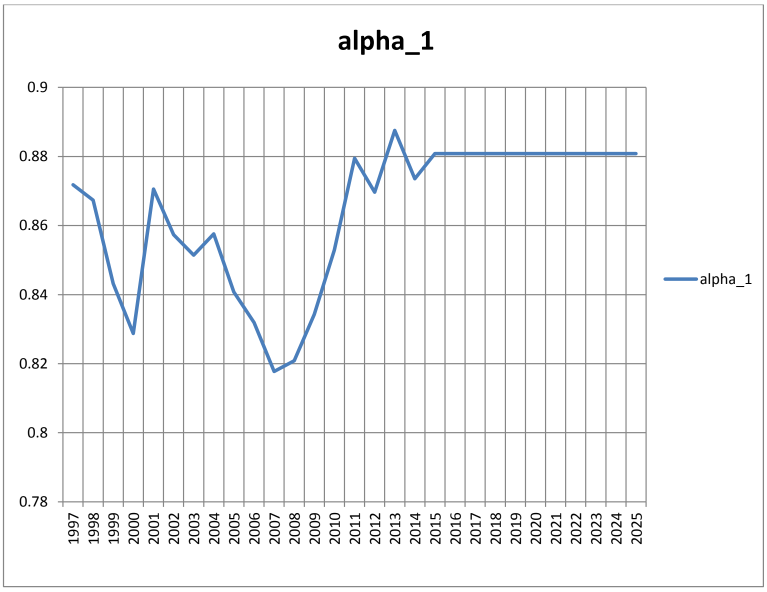
The core behavioural equations that decisively regulate the model behaviour are partly constructed in reference to the literature, mostly based on Godley and Lavoie (2007), or specified according to empirical evidence put forth in Schmelzer (2015). Most importantly, for our empirical SFC model, we obtain the parameter values directly from national accounting data. Since this is a very preliminary version of the model, the extrapolation procedures for parameter trends are work in progress, and are certainly open to discussion.

Household Consumption C_t is taken as a fixed fraction $\alpha_{1,t}$ of disposable household income INC_t as determined in equation 16 plus a fixed fraction $\alpha_{2,t}$ of household's last period's holdings of deposits DEP_{t-1} (their primary means of payment, and their storage of liquid means for consumption in our assumption):

$$C_t = \alpha_{1,t} \cdot INC_t + \alpha_{2,t} \cdot DEP_{t-1} \tag{1}$$

Figure 5 shows the values of α_1 for different time periods from data, given a constant value for $\alpha_{2,t}$ of 0.02[4]. As one can see, even though it varied in the past, the range remains within about 6 percentage points (pp). Since there is no clear trend observable, we assume this parameter to remain stable on the value of the year 2015.[5]

Figure 5: Parameter Choice - Consumption out of Disposable income with $\alpha_2 = 0.02$



Investment I_t is taken to be an exogenous parameter $\beta^0_{t,s}$, which depicts "animal spirits" plus a fixed fraction $\beta_{t,s}$ of last year's GDP, both specific for each sector:

$$I_{t,s} = \beta^0_{t,s} + \beta_{t,s} \cdot GDP_{t-1} \tag{2}$$

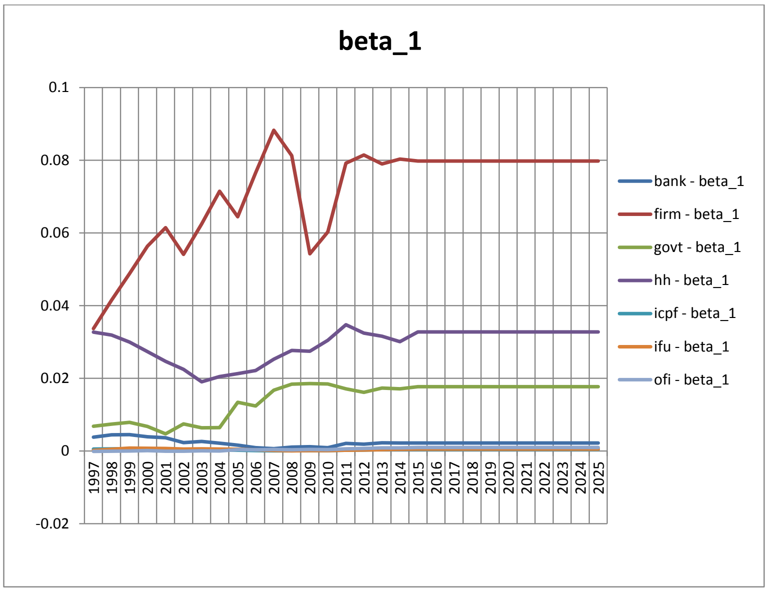
We are aware that this choice of investment function is rather crude at this stage of model building and we plan to improve this function according to the relevant literature. Here, we will primarily refer to existing forecasting models for Austria by IHS, see Hofer and Kunst (2005), and by WIFO, see Baumgartner et al. (2005), and the investment functions specified there.

As for the choice of the parameters in this equation, $\beta^0_{t,s}$ is taken to be the half of the average of past investment (1996-2015), and is kept fixed. The evolution of $\beta_{t,s}$ is calculated using past data and is shown in figure 6.

[4]The values for this marginal propensity to consume out of wealth usually vary between 0.02 and 0.05 in the empirical SFC literature.

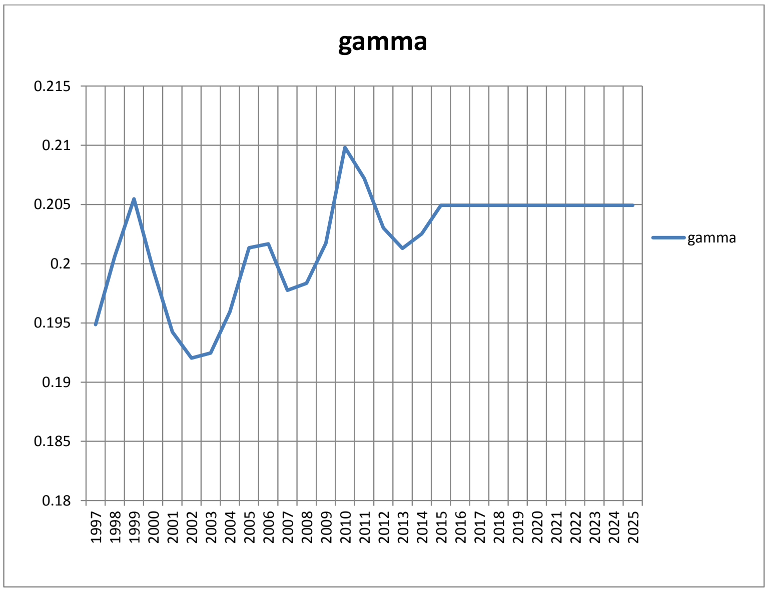
[5]Remark: the "dum" labelling of data series can be ignored by the reader in all of the figures below - this is an artefact due to the construction of the Microsoft Excel pivot table used for the generation of the figures.

Figure 6: Parameter Choice - Investment as Fraction of Last year's GDP



As was to be expected, investment as a fraction of GDP is highest for the NFC sector (labelled 'firm' above), and seems to be influenced by business cycles the most. The slump after the financial crisis 2007/2008, for example, is clearly visible. Again, the value for the year 2015 was taken as the trend for the period until 2025 (to be discussed).

Figure 7: Parameter Choice - Government Spending as Fraction of Last year's GDP



Government Spending G_t is simply related to last year's GDP by the time-dependent parameter γ_t (to be discussed):

$$G_t = \gamma_t \cdot GDP_{t-1} \tag{3}$$

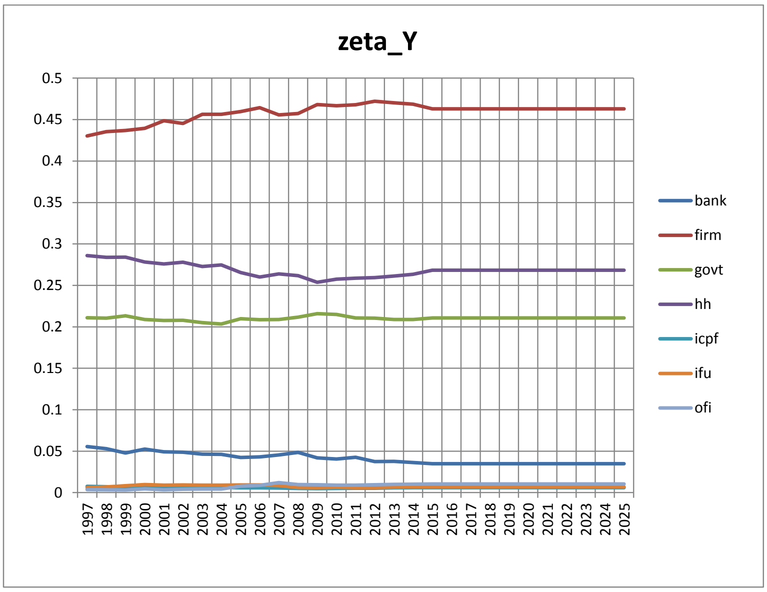
Values for γ through time can be observed from figure 7 below. Political events can be seen clearly: the reduction in government spending as a fraction of GDP after 2000 ("black-blue coalition government" and its "zero-deficit" politics), as well as the increase in government spending after the financial crisis 2007/2008, and renewed reduction after 2010 due to restrictive national and European government deficit regulations after the European "sovereign debt crises". Again, we take the trend after 2015 as fixed, since this seems to be a good average of past data and since we did not want the dynamic of our model to be driven too much by this influential parameter.

Sectoral Consumption Goods Production $Y_{t,s}$ other than investment is attributed to sectors according to a share $\zeta_{t,s}$ of household consumption and government spending that we take from the data. This is necessary since we had to allocate some consumption to own production (net VA produced within a sector) as a source of funds to achieve consistency in the TFM, see table 2, line 'consumption' in the received columns.

$$Y_{t,s} = \zeta_{t,s} \cdot (C_t + G_t) \tag{4}$$

Figure 8 shows the values for ζ in our time series. Clearly, this parameter appears to be quite stable, justifying our assumption of keeping it fixed at its value for the year 2015.

Figure 8: Parameter Choice - Share of Sectoral Consumption Goods Production



Wage Payments $W_{t,s}$ are related to the sectoral production by a wage input cost share $\omega_{t,s}$ specific for each sector. For the NFC (firm) sector, we also include investment and exports (correcting for imports), which also require labour as input in their production process:

$$W_{t,s} = \omega_{t,s} \cdot ULC_t \cdot \left[Y_{t,s} + (\sum_{\tilde{s}} I_{t,\tilde{s}} + EXP_t - IMP_t)|_{(\text{if s=firm})} \right] \cdot \frac{1}{p_t} \tag{5}$$

Furthermore, we include a simple markup pricing mechanism based on unit labour costs ULC_t, see section 3.2 below for details and respective figures on the values of the parameter $\omega_{t,s}$.

3.1.2 Taxes

Placing our focus on the Austrian tax system for the model extension, we introduced the following endogenous taxes. The tax rate is fixed and taken from data (value of the year 2015), while the tax flow is endogenous in the model subject to the tax base.

$$\begin{aligned}
T_{va,t} &= \tau_{va,t} \cdot C_t && (6)\\
T_{o,t,s} &= \tau_{o,t,s} \cdot [Y_{t,s} + (\sum_{\tilde{s}} INV_{t,\tilde{s}})|_{(\text{if s=firm})}] && (7)\\
T_{w,t} &= \tau_{w,t} \cdot \sum_{s} W_{t,s} && (8)\\
T_{incse,t} &= \tau_{incse,t} \cdot OS_{t,hh} && (9)\\
T_{cap,t} &= \tau_{cap,t} \cdot (Interest_{t,hh,recv} \\
&\quad + f_{DIV,t,hh,recv} \\
&\quad + icpf_{DIV,t,hh,recv} \\
&\quad + ifu_{DIV,t,hh,recv}) && (10)\\
T_{firm,s} &= \tau_{firm} \cdot OS_{t,s} && (11)
\end{aligned}$$

The VAT tax shown in equation (6) is related to household consumption with a fixed tax rate of 16.7 %. The other tax on production depicted in equation (7) is applied to the level of production of a respective sector, and varies between about 3.3 % (govt) and 10.5 % (NFC) for the different sectors. The wage tax as in equation (8) is levied on wage payments to households with a rate of 45.8 %. The tax on the income of self employed in (9) is tied to the operating surplus generated in the household sector with a rate of about 31.9 %. The capital tax as in equation (10) is levied on capital income of households: interest income, dividend income from (NFC) stocks, as well as from ICPF and IFU shares (to be discussed). The tax rate is rather small with about 9.5 %, and varies by some percentage points in the data over time due to the definition of the tax base we chose (to be discussed). The firm income tax as set forth in equation (11) is levied on the operating surplus by NFC and FC. The tax rate ranges from 14 % for FC sub-sectors to 22 % for NFC (to be discussed).

3.1.3 Exogenous Variables

Some variables are taken as exogenous trends from the data, and are not subject to the behavioural choice of any of the agents in the model. The most important of these are described in the following according to their past development and our choice of forecast.

Exports and Imports The trend for exports and imports we assume from the future is shown in figure 9. One can clearly see the rising trends were only interrupted by the economic recession in 2009. We extrapolate this trend for exports by assuming a 3.5 % growth rate p.a.

for future modelling periods, as predicted in the current official IHS forecast for the medium horizon[6]. Imports take a similar development; we assume a growth rate of 3 % to project their development into the future, also as given in the IHS forecast.

Figure 9: Exogenous Variables - Imports (in bln. Euro)

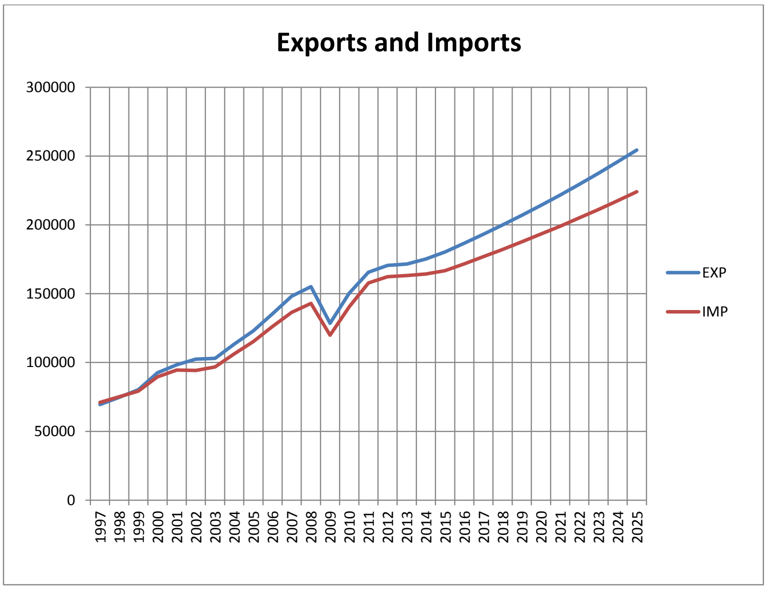
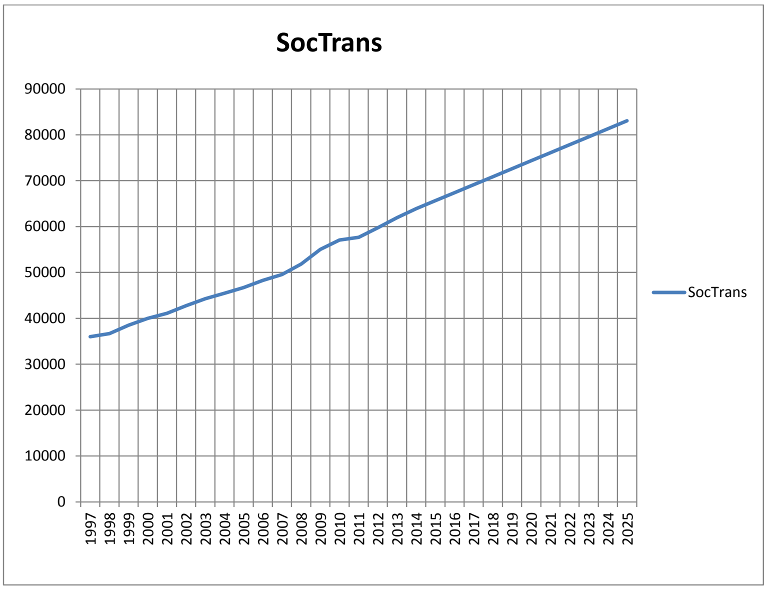


Figure 10: Exogenous Variables - Social Transfers (in bln. Euro)



[6]The values for export and import growth are taken from the IHS medium term forecast from July 2017, see `https://www.ihs.ac.at/fileadmin/public/2016_Files/Documents/20170719_Presseinfo_mittelfPrognoseJuli2017.pdf`

Social Transfers (Soctrans) are shown in figure 10. Even though they exhibit a rising trend until the year 2015, we assumed the, to remain on their level of 2015 to exclude any additional political measures in the BAU scenario raising these social transfers (to be discussed).

3.1.4 'Implied' Stock-Flow and Flow-Flow Relations

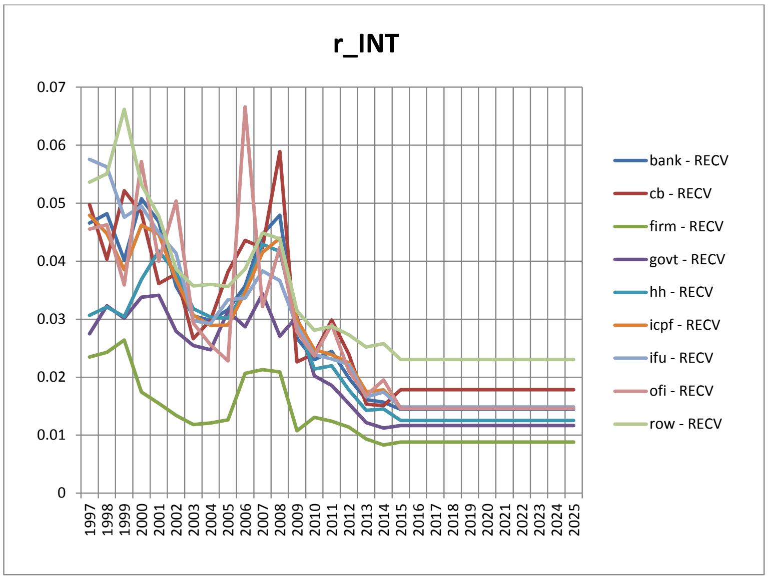
These are flows of payments that relate to stocks of different asset classes from last period, or are determined by flow decisions within a given period of the model. This involves mostly interest and dividend payments, but also income and operating surplus as a result of economic activities determined by the behavioural equations given in section 3.1.1.

Interest Flows $INT_{t,s,direct}$ are calculated applying an average interest rate $r_{int,t,s,direct}$ to last year's holding of the asset classes that carry interest - deposits (DEP, F2), debt securities (DS, F3), as well as loans and other accounts (LOAN; F4, F8). We had to apply this procedure since interest flows are only accounted for as an aggregate in the NFTR data, see table 1, line net interest payments (D41). However, the interest rate is specific for each sector s, time t, and we have different interest rates for the paid and received columns of the different sectors. Thus, we calculate an asset-class-specific average interest rate both for assets and liabilities for each sector separately.

$$INT_{t,s,direct} = r_{int,t,s,direct} \sum_{finpos} (DEP_{t-1,s,finpos} + DS_{t-1,s,finpos} + LOAN_{t-1,s,finpos}) \quad (12)$$

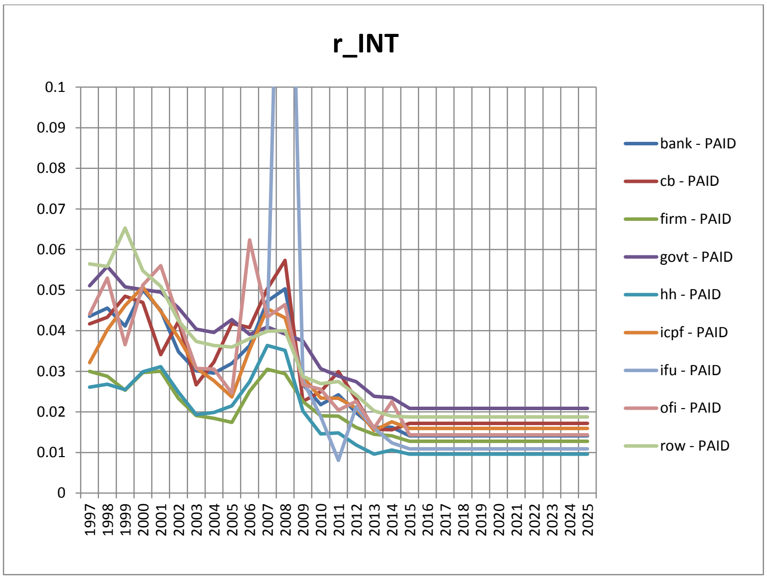
This is a first and rather crude approximation - there is ample space for improvement regarding this aspect of the modell, see also section 5. Interest rates as calculated from the data and projected into the future are shown in figures 11 and 12 below.

Figure 11: Interest Rates - Received for Asset Holdings



What strikes the eye regarding received interest rates in figure 11 are the high rates received by the OFI sector in the run-up to the financial crisis 2007/2008, which are then taken over by the central bank, probably due to its interventions on financial markets following the crisis. Generally, one can observe the rapid fall of all interest rates after 2007/2008 below 2% for all but one rate as a result of monetary policy and general conditions on financial markets after the crisis. We keep these interest rates at the low level of 2015, since again we do not want to assume an exogenous change in monetary policy or general framework conditions on financial markets (to be discussed).

Figure 12: Interest Rates - Paid for Liabilities



Interest rates paid on liabilities as depicted in figure 12 show a similar picture to the ones received, with differences for agents due to the composition of their balance sheets. The spike in the interest rates paid by the IFU sector above 20 % - which has been removed from this picture due to reasons of visibility - starts from a very low value of interest payments of 29 mln. Euro. Thus, any revaluation effects e.g. in DS stemming from the financial crisis which have very low absolute effects lead to high relative effects.

Dividend Rates are paid for holdings of firm equity[7] (STOCK), equation (13), ICPF ($SHARE_{icpf}$), equation (14), and IFU ($SHARE_{ifu}$) shares, equation (15). Again, the rates of return to these assets are specific for each sector s, time t, and the direction of payment.

$$F_{DIV,t,s,direct} = r_{f,t,s,direct} \sum_{finpos} STOCK_{t-1,s,finpos} \tag{13}$$

$$ICPF_{DIV,t,s,direct} = r_{icpf,t,s,direct} \sum_{finpos} SHARE_{icpf,t-1,s,finpos} \tag{14}$$

$$IFU_{DIV,t,s,direct} = r_{ifu,t,s,direct} \sum_{finpos} SHARE_{ifu,t-1,s,finpos} \tag{15}$$

[7] And derivatives, which are very small in total amount in the economy.

Since the focus of these dividends is on the received rate of interest, and cross-issuance of these liabilities is rather small (i.e. they are mostly emitted by one sector), the following figures 13, 14, and 15 show the interest rate received for these assets.

Figure 13: Dividend Rates - Firm Equity, received

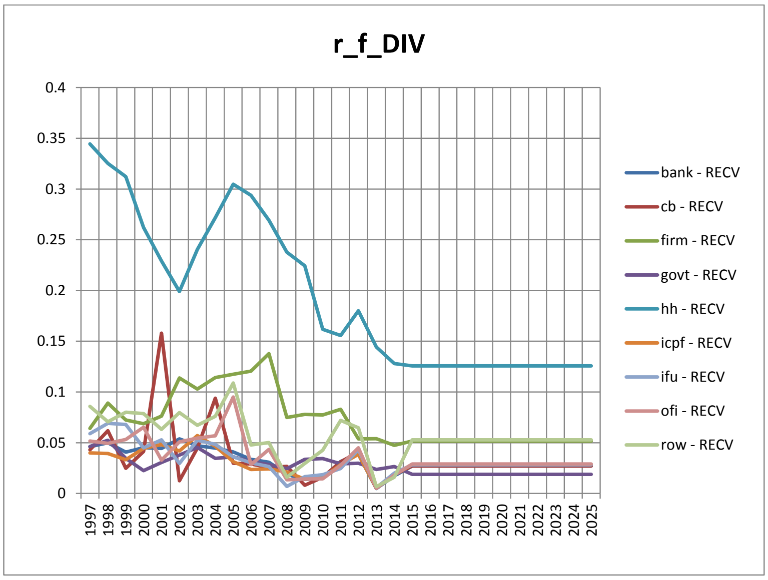
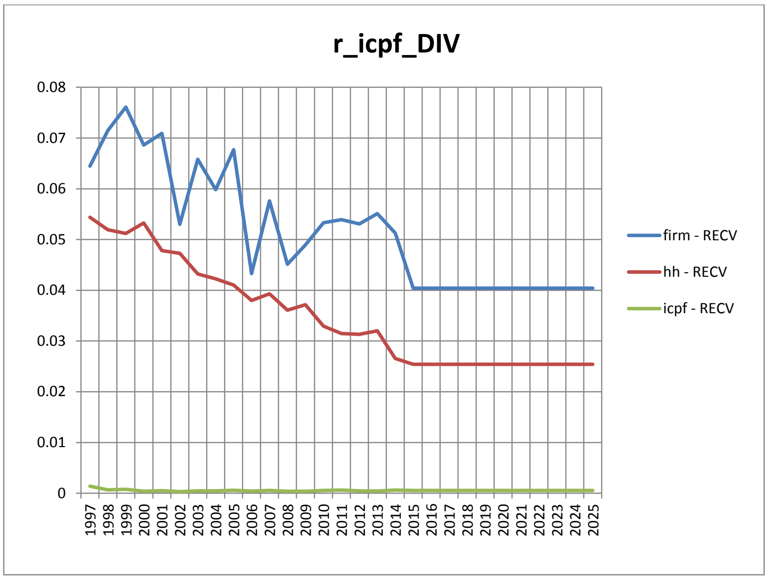
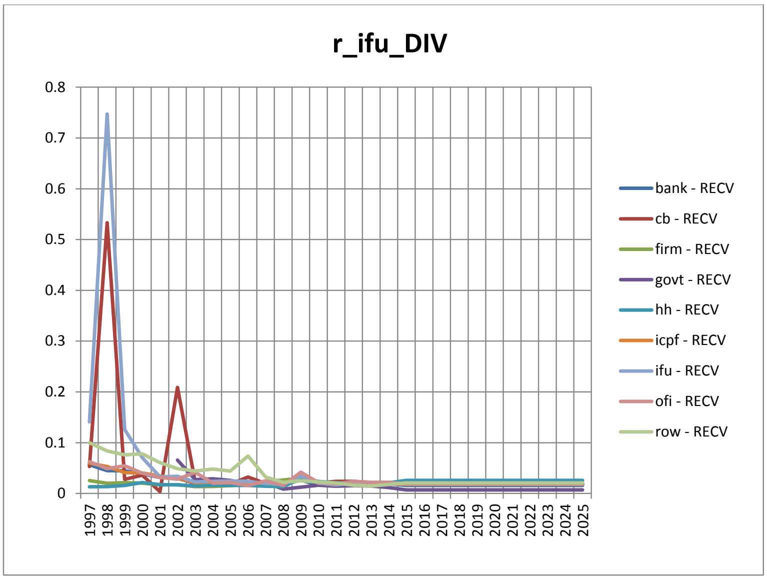


Figure 14: Dividend Rates - ICPF Shares, received



As regarding firm divident rates shown in figure 13, they seem to be quite high, especially before the financial crisis 2007/2008, but falling thereafter (to be discussed). The constant level after 2015 seems to be justified for all sectors, except maybe for the household sector, where a falling trend seems likely.

Figure 15: Dividend Rates - IFU Shares, received



Also, ICPF and IFU returns in figures 14 and 15 look reasonable. However, it seems surprising that ICPF shares have a higher return rate than IFU shares, even though one might expect that they are the safer asset. The spike in IFU returns before the financial crisis 2007/2008 seems intuitive, while the high spike in the year 2006 for the ROW seems to be a very particular phenomenon for which the authors have not found an explanation yet.

Household Income and Operating Surplus The remaining two equations in the 'implied' section of the model result from the intra-period flows in the model, by subtracting expenditures from revenues for a particular sector. Our definition of household income INC is shown in equation (16), the definition of operating surplus OS of different sectors in equation (17). What should be noted is that for household income, wage payments within the household sector as income to self employed and NPISH has to be deducted as an expenditure for the household sector to avoid double counting. For the OS of firms, it has to be noted that investment is a source of revenue for the NFC sector regarding total investment by all sectors including itself, and a source of expenditure only regarding its own investments.

$$
\begin{aligned}
INC_t &= \sum_s W_{t,s} - W_{t,hh} + Y_{t,hh} - I_{t,hh} - T_{w,t} - T_{va,t} - T_{o,t} - T_{incse,t} - T_{cap,t} \\
&\quad + INT_{t,hh,net} + F_{DIV,t,hh,net} + ICPF_{DIV,t,hh,net} + IFU_{DIV,t,hh,net} \\
&\quad + SubTrans_{t,hh,net} + SocTrans_{t,hh,net} + res_{t,hh,net} \qquad (16) \\
OS_{t,s} &= Y_{t,s} + \left[(\sum_{\tilde{s}} I_{t,\tilde{s}}) + EXP_t - IMP_t \right] |_{(\text{if s=firm})} - W_{t,s} - I_{t,s} - T_{o,t,s} \\
&\quad + SubTrans_{t,s,net} \qquad (17)
\end{aligned}
$$

3.2 UPDATE: A Simple Markup Pricing Mechanism

This section presents a pricing mechanism along the lines of Godley and Lavoie (2007)(GL 2007), Lavoie (2003) and comparable sources. According to a cost-plus pricing principle as generally endorsed by heterodox economics, see GL 2007, we assume that firms aim to secure profits equal to a certain proportion of their sales. Thus, we adopt a simple markup pricing mechanism where we set labour costs per real unit of output (unit labour costs) as the only cost factor in this economy. In our aggregate model, this corresponds to the assumption that all other costs of production not pertaining to labour (including costs for intermediate inputs) are incorporated in the markup. This implies that we assume vertically integrated industries similar to GL 2007, but in difference to GL 2007 we place all cost factors other than labour in the markup rate rather than unit costs of production. According to these provisions, firms place a fixed markup on unit labour costs in their pricing decision:

$$p_t = (1 + \varphi_t)ULC_t, \tag{18}$$

where p_t is the price level assumed to be uniform for all goods and industries. Thus, p_t simultaneously reflects the price for a single real unit of output produced and the general price level of the economy. Furthermore, ULC_t are unit labour costs, i.e. nominal compensation flowing to the factor labour per real unit of output produced, and φ_t is the markup rate on unit labour costs in period t.

The set-up of the pricing mechanism in our model is described in more detail below.

Equate unit labour costs and wage share in starting year of the model Unlike conventions in national accounting, but following the logic of our model, we define the wage share ws_t as the ratio of total nominal wage payments over total output:

$$ws_t = \frac{\sum_s W_{s,t}}{\sum_s (Y_{t,s} + I_{t,s}) + EXP_t - IMP_t}. \tag{19}$$

We value all prices in the model relative to the starting year of the model (1996), i.e. $p_t = 1$ for $t = 1996$. In this period, unit labour costs are equal to the wage share ws_t. The equality between unit labour costs and the wage share directly follows from our definition of the wage share and equation (18) above if we set $p_t = 1$. The line of argument is as follows: from each real unit of output, an amount of ULC_t Euro flows to the factor labour as remuneration. Given that total wages are a fraction of total nominal production as in equation (5), since total wage payments are the sum of unit labour costs per (real) unit produced, and since total production is the sum of individual units produced and sold (nominal), respectively, unit labour costs and the wage share have to be equal. Put formally:

$$\begin{aligned} ws_t &= \frac{\sum_s W_{s,t}}{\sum_s (Y_{t,s} + I_{t,s}) + EXP_t - IMP_t} = \frac{\sum_i ULC_t y_{i,t}}{\sum_i p_t y_{i,t}} = \frac{ULC_t}{p_t} \frac{\sum_i y_{i,t}}{\sum_i y_{i,t}} \\ &= ULC_t \quad \text{if} \quad p_t = 1. \end{aligned} \tag{20}$$

where $y_{i,t}$ depicts individual real units i of production (consumption, investment, and export goods measured in units of real output) at time t, which are not modelled explicitly, but are only shown here to state the relation between the wage share and unit labour costs. More generally, from equations (20) and (18), we can derive a relationship between the wage share, unit labour costs, the price level and the markup:

$$ws_t = \frac{ULC_t}{p_t} = \frac{1}{1 + \varphi_t}. \tag{21}$$

Calibrate unit labour costs and price level from data and define their laws of motion As described above, we equate unit labour costs to the wage share for the starting year of the model (1996). For the the calibration period (1997 - 2015), we use the growth rates of unit labour costs per hour worked according to OECD data to determine their development from their initial level in 1996.[8]

For the forecasting period (2016-2025), we use an exogenous projection based on trends obtained from the data:

$$ULC_t = (1 + \overline{ulc})ULC_{t-1} \quad \forall t \geq 2016, \tag{22}$$

where $\overline{ulc}$ is the average growth rate of unit labour costs in the calibration period (1997 - 2015). To obtain the price level p_t in our economy for the period 1997 - 2015, we use data on inflation (π_t)[9]. To determine the price level starting from its initial level of $p_t = 1$ for the initial period of the model (1996), we simply update it by yearly inflation:

$$p_t = (1 + \pi_t)p_{t-1} \quad \text{for} \quad 1997 \leq t \leq 2015. \tag{23}$$

For the forecasting period 2016 - 2025 – given the exogenous development of unit labour costs from equation (22) – we use the markup pricing equation (18) above and the law of motion for the markup defined below in equation (24) to infer the price level for period t.

The developments of unit labour costs and price level according to the data and our exogenous projections are shown in figure 16 below. Based on the average growth rate during the calibration period 1997-2015, unit labour costs increase steadily from their initial level of about 0.54 in the year 1997 to about 0.75 in the year 2025. The price level rises at a somewhat faster pace, increasing by about 50 % as compared to its initial level in 1996 until the year 2025.

Calibrate the markup and define its law of motion Since we know the development of unit labour costs ULC_t and the price level p_t from the data, we can calculate the markup rate according to equation (18) for the calibration period 1997-2015, see figure 16 for the values obtained.

Defining a simple law of motion for the markup during the forecasting period 2016-2025, we assume that firms adjust their markup rate φ_t according to its past deviation in period $t-1$ from the previous markup rate in $t-2$:

$$\varphi_t = \varphi_{t-1} + \zeta(\varphi_{t-1} - \varphi_{t-2}) \quad \forall t \geq 2016. \tag{24}$$

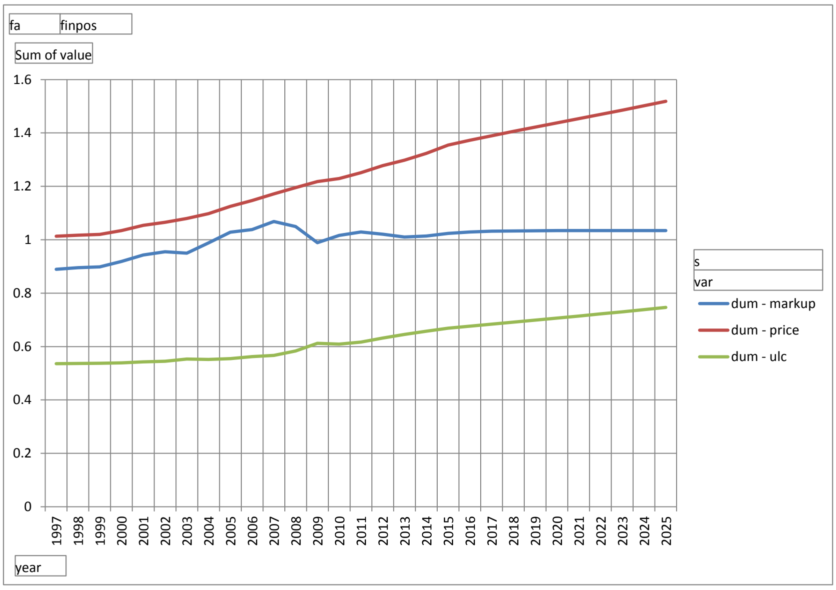
Here, ζ is an adjustment parameter that we set to 0.5 to obtain a stable development of the markup rate – similar to what we observe during the last periods of the calibration period since 2013.

Given the development of unit labour costs and the price level, figure 16 shows that the markup has increased steadily from an initial level of about 0.88 in 1997, with a dip around after the crisis years 2008/2009, and a very gradual increase from 2013 to a level of about 1.01 in 2015. Starting with our forecasting period in 2016, we assume the markup to remain approximately stable until the year 2025 according to our law of motion defined in equation (24).

[8] See OECD (2018), Unit labour costs (indicator). doi: `https://data.oecd.org/lprdty/unit-labour-costs.htm#indicator-chart` (Accessed on 29 January 2018).

[9] As a data source for prices, we use inflation as measured by the GDP deflator index obtained from the Austrian National Bank (OeNB) `https://www.oenb.at/Statistik/Standardisierte-Tabellen/Preise-Wettbewerbsfaehigkeit/deflatoren-der-volkswirtschaftlichen-gesamtrechnung.html`

Figure 16: Developments of Markup φ_t, Price p_t and Unit Labour Costs ULC_t

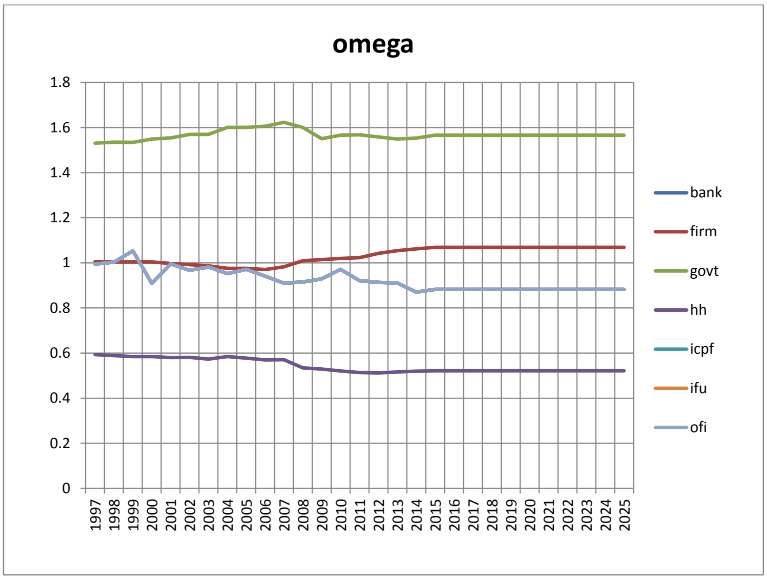


Modify the law of motion of sectoral wage payments Since we assume labour to be the only cost factor in our model economy, inflation enters the rest of the real economy via sectoral wage payments. Thus, it suffices to include unit labour costs in equation (5), stated again for convenience here as equation (25), to incorporate the entire inflation mechanism defined above within the structure of our model. Since unit labour costs are defined as the ratio of total labour compensation per hour worked (a nominal variable) to output per hour worked (labour productivity, real), we also have to deflate nominal production (given by the term in brackets) with the current price level to avoid double-counting of inflation. Therefore, we include unit labour costs ULC_t in equation (5), and deflate the nominal production by the different sectors of the economy with the current price level p_t:

$$W_{t,s} = \omega_{t,s} \cdot ULC_t \cdot \left[Y_{t,s} + \left(\sum_{\tilde{s}} I_{t,\tilde{s}} + EXP_t - IMP_t\right)\Big|_{(\text{if s=firm})} \right] \cdot \frac{1}{p_t} \tag{25}$$

Since unit labour costs are an aggregate economy-wide measure, but wage payments are recorded on a sectoral level in our model, we need a parameter that translates aggregate wage payments onto a sectoral level. Thus, we calibrate the sectoral wage input cost share $\omega_{t,s}$ for the period 1997-2015 so that – given the development of unit labour costs and prices – the sectoral wage bill $W_{t,s}$ for the initial period corresponds to what we obtain from the data. The development of this sectoral wage input cost share $\omega_{t,s}$ is documented in figure 17. Except for some relatively minor movements before and after the economic recession 2008/2009, the development of this parameter seems to be relatively stable without a clear trend. Thus, for our forecasting period 2016-2025, we assume $\omega_{t,s}$ to remain at the value of the year 2015. Since we had to disaggregate the FC sector according to several assumptions, the wage share is the same for all FC sub-sectors - all lines coincide here, i.e. OFI, BANK, ICPF and IFU share the same line that is coloured in grey.

Figure 17: Parameter Choice - Sectoral Wage Input Cost Share



Real variables accounting Finally, we can derive real economic variables from our nominal ones by accounting for the price level:

$$C_t^{real} = C_t/p_t \tag{26}$$
$$I_{t,s}^{real} = I_{t,s}/p_t \tag{27}$$
$$Y_{t,s}^{real} = Y_{t,s}/p_t \tag{28}$$
$$W_{t,s}^{real} = W_{t,s}/p_t \tag{29}$$
$$EXP_t^{real} = EXP_t/p_t \tag{30}$$
$$IMP_t^{real} = IMP_t/p_t \tag{31}$$
$$\tag{32}$$

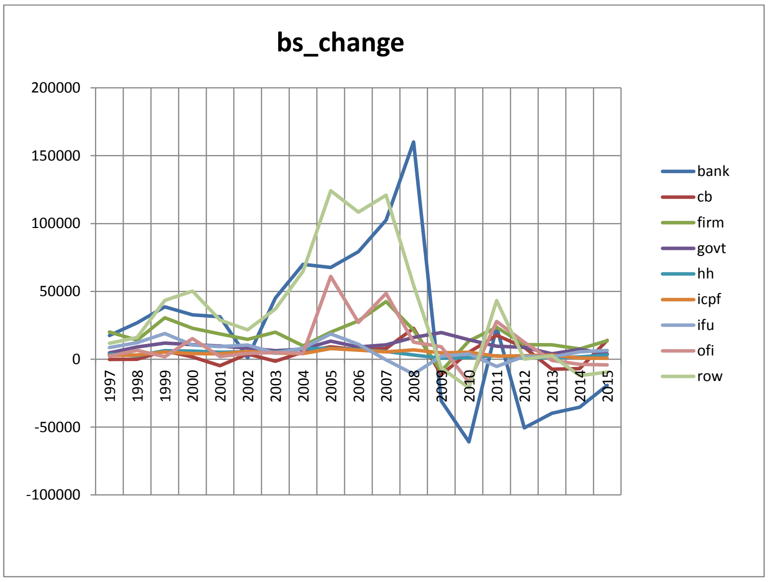
where we, for reasons of simplicity, assume the same inflation rate at home and abroad for imports.

3.3 UPDATE: Financial Transactions (FTR)

Changes in the balance sheets are divided into two kinds in the ESA 2010 data. Financial transactions (ftr, or flow of funds, fof, as denoted in SFC modelling convention), financial gains and losses (fgl), and other changes in financial assets (foc). In our model, we let the sectors choose how many assets and liabilities they would wish to hold in the next period, and then revaluate these amounts by the change in asset prices. Thus, we omit the other financial changes account for the model forecast, and model only intentional changes (corresponding to the ftr-account), and price changes (corresponding to the fgl-account).

Modelling the Flow of Funds behaviour of agents involves two components: First is leverage, i.e. the change in the size of the sectors balance sheet, and second is the composition of the balance sheet, or the portfolio choice, i.e. in which assets the sector wants to invest her funds. Figure 18 shows the sectors change in balance sheet length (total size of liabilites), and figure 19 shows the composition of the household's balance sheet over time.

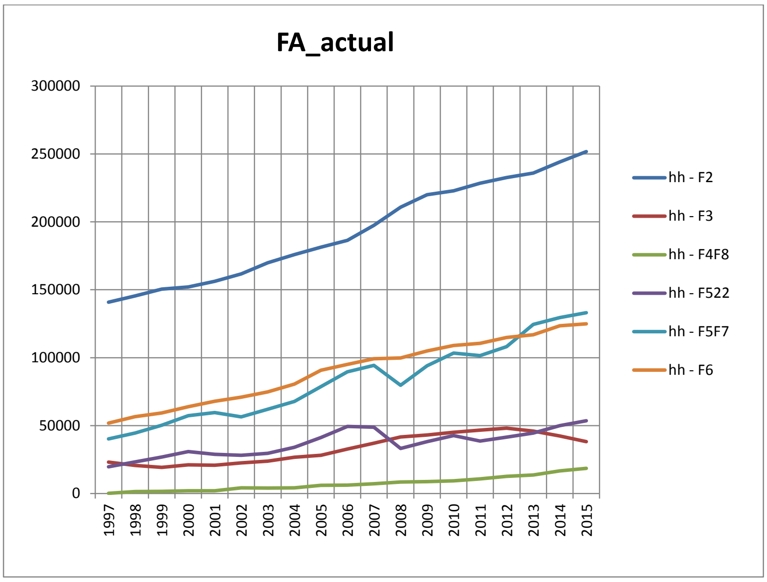
Figure 18: Extension/Shrinking of Balance Sheets (in mln. Euro)



3.3.1 Leverage

We explicitly account for leverage decisions of all the sectors. In a first stage, we determine the intended size of the balance sheet $A^{int}_{t,s,total\_FA}$ for each sector, i.e. the size each sector wishes its balance sheet to be after the time period $\overline{t}$, before revaluation due to asset price changes. The actual size of the balance sheet, i.e. the total value of all assets FA, held by the sector at the end of the period, $A^{act}_{t-1,s,total}$, is given as the intended amount, revaluated at the new prices of the assets, see below.

Figure 19: Financial assets of households (in mln. Euro)



In the leverage decision the sectors in the model first determine the total length they want the asset side of their balance sheet to be in the next period, $A^{int}_{t+1,s,total}$. This also determines the size of the liability side $L^{int}_{t+1,s,total}$, given net lending net borrowing in period t. We assume that the sectors decide this leverage decision according to a set of general macroeconomic variables, namely gross domestic product, inflation (price deflator), the aggregate weighted asset price index of the sector, net lending/net borrowing, and the refinancing cost of the sector.

Here we performed a linear regression analysis in order to obtain a suitable definition of leverage decision for each sector. For the regression we used quarterly data from the same source, ESA2010, in order to have more data points. The regression was carried out in changes of logs, and was specified in the following for each sector s:

$$\Delta\log A^{int}_{t,s,total} = \beta^0 + \beta^1 \Delta\log GDP_t + \beta^2 \Delta\log PD_t + \beta^3 \Delta\log P_{t-1,s} \quad (33)$$

$$+ \beta^4 NLNB^{shr}_{t,s} + \beta^5 \Delta\log r^{ref}_{t-1,s} \quad (34)$$

where:

$A^{int}_{t,s,total}$ ... balance sheet length (i.e. leverage)

GDP_t ... gross domestic product

$PD_{t,s}$ ... price deflator

$P_{t-1,s}$ ... aggregate weighted Asset Price index per sector

$NLNB^{shr}_{t-1,s}$ ... net lending/borrowing as share of lagged balance sheet length

$r^{ref}_{t-1,s}$ ... refinancing cost of sector

Data for gdp and the price deflator are taken directly from ESA2010 data, while the asset price index, net lending net borrowing and the rerfinancing rate are computed (in the data part of the model) from the balance sheet, flow of funds and transaction flow matrices, which depend on the ESA2010 accounts, see section 2.

Not all of the coefficients in the estimation were significant for each of the sectors. The specific results are given in the Appendix to this document.

In the model, since it works on a yearly basis, the coefficients could not be directly used in the same manner. Thus, we had to perform a transformation of the equations, in order to obtain reasonable forecasts on a yearly basis, stemming from the obtained coefficients from the quarterly estimations.

$$\begin{aligned} A^{int}_{t,s,total} = exp(\quad & \beta^0 \\ & + \beta^1[\log(GDP_t/4) - \log(GDP_{t-1}/4)] \\ & + \beta^2 \frac{NLNB_{t,s}/4}{A^{act}_{t-1,s,total} + (3/4) * A^{act}_{t-1,s,total} - A^{act}_{t-2,s,total}} \\ & + \beta^3[\log(P_{t-1,s}) - \log(P_{t-2,s} + (3/4) * [P_{t-1,s} - P_{t-2,s}])] \\ & + \beta^4[\log(r^{ref}_{t,s}) - \log(r^{ref}_{t-1,s} + (3/4) * [r^{ref}_{t,s} - r^{ref}_{t-1,s}])] \\ & + \beta^5[\log(PD_t) - \log(PD_{t-1} + (3/4) * [PD_t - PD_{t-1}])] \\ & + \log(A^{int}_{t-1,s,total}) \\ &) \end{aligned} \tag{35}$$

Here, essentially, the differences between yearly variables are transformed into what would be differences in quarters (divided by 4) for the yearly forecast.

The total intended change in liabilities $\Delta L^{int}_{t,s,total}$ is, by accounting rules, given as the residual of the intended change in the asset side of the balance sheet, and net lending/net borrowing, which is an endogenous outcome of the non-financial transactions block of the model:

$$\Delta L^{int}_{t,s,total} = A^{int}_{t,s,total} - A^{act}_{t-1,s,total} - NLNB_{t,s}. \tag{36}$$

Then, the total size of the of liabilities is clearly given as

$$L^{int}_{t,s,total} = L^{act}_{t-1,s,total} + \Delta L^{int}_{t,s,total}. \tag{37}$$

3.3.2 Asset Prices and the Revaluation Account

In the last section asset price indices played a crucial role. In this section we describe how we obtain sector- and asset-specific asset prices. The sector specific index above is then a simple average for each sector, weighted by the amount of assets held.

The financial gains/losses or revaluation account (fgl) of ESA2010 data depicts those changes to financial assets that stem from changes in assset prices. Annual data is available for Austria only for the time periods 2012-2016, however quarterly data is available for 2006Q2-2016Q4. Since the sum of quarterly revaluations equals the annual revaulations, we can use the information from 2007-2016.

We used the data to construct asset prices for the asset classes as depicted in our model. Since for each asset fa and sector s gains/losses (fgl) equal the change in the value of the stock (i.e. the asset size A) with respect to the change in the price,

$$fgl_{t,s,fa} = A_{t-1,s,fa}P_{t,s,fa} - A_{t-1,s,fa}P_{t-1,s,fa}, \tag{38}$$

we can calculate absolute asset price changes as

$$\Delta P_{t,s,fa} := P_{t,s,fa} - P_{t-1,s,fa} = \frac{fgl_{t,s,fa}}{A_{t-1,s,fa}}. \tag{39}$$

We normalize the price in the first available year (2007) to 1, and thus recursively obtain a set of asset prices for each sector and asset class for 2007-2015.

It should be noted that in theory it is often assumed that the price for an asset is the same for all the agents holding it. However in the case of this model, since our aim is to depict the ESA data structure as closely as possible, we end up with different prices for each agent. This is due to two reasons: First, an asset can be issued by more than one agent in our model, since there is no who-to-whom structure implemented at this stage. Second, the data (and thus our model) depicts aggregate agents and aggregate asset classes (portfolios) that depict the sum of many individual micro-agents holding different pieces of single assets out of the same class but with different price developments. It is thus possible (and given in the data) that on aggregate, one sector holds more profitable assets of an asset class than another sector, and has a different price development.

The asset price development for the future is not something our model aims to predict, since it is only a small open economy model, and asset prices will depend on international markets. Thus, we treat future asset prices as exogenous in the model, assuming that they stay constant in the BAU forecast at their 2015 level, for all assets and all sectors.

In order to obtain expected returns of assets, as used in the portfolio choice below, we also take into account the other changes in volume account for the past. When determining behavioural reactions to changes in size of assets, we think other change in volume also play a role. Thus we apply the same procedure as above also for this account, and obtain a variable P^{foc}, which can be viewed as a price equivalentfor the other changes in volume account. This variable is set to zero in the forecasting period. It is only used for the construction of the expected returns, that are used in the estimation.

The aim of the model is to predict the reaction of agents to asset price changes. Thus, the next section provides the theory of portfolio choice. The effects of e.g. an international asset price shock on the domestic economy can then be assessed with the model

3.3.3 Portfolio Choice

As mentioned before, the portfolio choice is a crucial element of the model. Agents choose their intended level of financial assets $A^{int}_{t,s,fa}$ and liabilities $L^{int}_{t,s,fa}$ according to the classic Tobinesque Portfolio Choice Theory. Each sector s has both a choice of the shares for her assets (the parameters are denoted by α^s), as well as her way of financing, i.e. the share of liabilities (parameter λ^s). Both portfolio choice parameters are specific for each asset class, and sector.

According to the Tobinesque theory, expected returns on the assets are the main variables that determine the shares according to which sectors want to invest their funds in the different assets. We estimate a linear regression model for each asset share with identical regressors and no restrictions on α:

$$\frac{A_{t,s,A1}}{A_{t,s,total}} = \alpha^s_{0,1} + \alpha^s_{1,1} R^e_{t,s,A1} - \alpha^s_{2,1} R^e_{t,s,A2} - \ldots - \alpha^s_{n,1} R^e_{t,s,An} + \epsilon_{t,A1} \tag{40}$$

$$\frac{A_{t,s,A2}}{A_{t,s,total}} = \alpha^s_{0,2} - \alpha^s_{1,2} R^e_{t,s,A1} + \alpha^s_{2,2} R^e_{t,s,A2} - \ldots - \alpha^s_{n,2} R^e_{t,s,An} + \epsilon_{t,A2} \tag{41}$$

$$\vdots$$

$$\frac{A_{t,s,An}}{A_{t,s,total}} = \alpha^s_{0,n} - \alpha^s_{1,n} R^e_{t,s,A1} - \alpha^s_{2,n} R^e_{t,s,A2} - \ldots + \alpha^s_{n,n} R^e_{t,s,An} + \epsilon_{t,An} \tag{42}$$

In theory, the signs of the coefficients should be positive in the diagonal, and negative off the diagonal. A rise of the return of another asset, say $A2$, should have a negative effect on the asset regressed, say $A1$, and the rise of the return of the same asset $A1$ should have a positive effect. However, at this stage, we let the data speak, and include all coefficients, whether the right sign, whether significant or not. The results of the estimations are shown in the appendix to this document.

In general we assume adaptive expectations in the model. The expectations about future developent of any variable X (specifically also asset prices P, the price equivalent of the öther changes in financial asset (foc)account P^{foc}, and interest rates r below) follow an Exponential Moving Average (EMA) process with weight $\eta = 0.4$:

$$E[X_t] \quad = \quad E[X_{t-1}] + \eta \left(X_{t-1} - E[X_{t-1}]\right) \tag{43}$$

The expected returns on the assets $R^e_{t,s,A1}$ in equations 40-42, however, are modelled as in Burgess et al. (2016), to be a combination of changes in asset prices, the other chan assets account (foc), and interest rates of the specific assets and sectors. The formula is given as

$$R^e_{t,s,Aa} \quad = \quad E[r_{t,s,a}] + \frac{E[P_{t,s,a}]}{P_{t-1,s,a}} - 1 + \frac{E[P^{foc}_{t,s,a}]}{P^{foc}_{t,s,a}} - 1. \tag{44}$$

For the liability side of the model, we employ the same theory. The linear model for each of the liabilities is given as

$$\frac{L_{t,s,L1}}{L_{t,s,total}} = \lambda^s_{0,1} - \lambda^s_{1,1} R^e_{t,s,L1} + \lambda^s_{2,1} R^e_{t,s,L2} + \ldots + \lambda^s_{n,1} R^e_{t,s,Ln} + \epsilon_{t,L1} \tag{45}$$

$$\frac{L_{t,s,L2}}{L_{t,s,total}} = \lambda^s_{0,2} + \lambda^s_{1,2} R^e_{t,s,L1} - \lambda^s_{2,2} R^e_{t,s,L2} + \ldots + \lambda^s_{n,2} R^e_{t,s,Ln} + \epsilon_{t,L2} \tag{46}$$

$$\vdots$$

$$\frac{L_{t,s,Ln}}{L_{t,s,total}} = \lambda^s_{0,n} + \lambda^s_{1,n} R^e_{t,s,L1} + \lambda^s_{2,n} R^e_{t,s,L2} + \ldots - \lambda^s_{n,n} R^e_{t,s,Ln} + \epsilon_{t,Ln}. \tag{47}$$

where $R^e_{t,s,Ll}$, the expected return rate of the liabilities the sector holds, is calculated similarly as above for the assets. Also here, the results are given in the appendix.

For assets and liabilities, the equations above, even though estimated using quarterly data, are used with the estimated coefficients in the model with yearly data. The argument here is that the expected returns are rates, and are thus comparable and actually very similar in size over years and quarters.

Remark: At this stage, a classic Tobinesque portfolio choice theory is implemented. However, this part of the model is momentarily work in progress, we are currently working on an implementation of a modified portfolio choice, where we do not only account for expected returns to determine financial investment shares, but also include autoregressive components, and more cross correlations between different asset classes. We also work on a strategy on modelling the investment decision not two stages, like now, where sectors choose first their leverage, and then the asset shares, but where they decide the size of investment directly per asset type. We plan to compare the performance of the different modelling strategies by means of out-of-sample forecasting.

3.3.4 Closure of the financial system:

After the determination of all the intended assets and liabilities for all sectors, actual assets and liabilities are determined by revaluation according to asset price changes,

$$A^{act}_{t-1,s,fa} = A^{int}_{t,s,fa} * P_{t,s,fa}. \tag{48}$$

The net worth per sector is the difference of the sum of all actual financial assets and liabilites held by each sector,

$$NW_{t,s} = \sum_{fa} \left\{ A^{act}_{t,s,fa} - L^{act}_{t,s,fa} \right\}. \tag{49}$$

Rest of the world Clearly, the sum of financial assets and liabilities in an economy, as determined above, always has to equal zero. However, the choice of assets and liabilities of the sectors does not automatically match each other over the whole economy.

Therefore, the Rest of the World sector (RoW) does not have a PC and is assumed to provide the additional/reduce the exceeding liabilities to satisfy accounting consistency. This is consistent with future prices being exogenous in the model. The rationale is that the price is dominated by world markets, not by decisions in Austria, and Austrian firms purchase assets and issue liabilities at constant world market prices. Thus there is no supply or demand constraints in financial asset in the domestic market.

4 UPDATE: Business As Usual (BAU) - NEW Results

The business as usual scenario is the simplest forecast the model can produce. All parameters and exogenous variables stay at their constant, or projected values as described in the previous sections. Specifically, asset prices stay constant, exports and imports, are assumed to grow at constant rates of 3.5% and 3 % p.a. respectively.

The result is a trajectory of the economy that depicts a future development if all things stay as they were until now. The results for the most important endogenous variables are shown below. Since the specification of many behavioural equations is still very crude (at this stage of model development), especially in the "real-ecomony" part of the model, these results should not yet be seen as a realistic forecast. However, they significantly reassure that the model is robust, since the results for all variables, flows and stocks, display a steady projection of the trend of the recent past.

4.1 BAU-Results: Non-Financial Transactions

GDP and Net Lending/Net Borrowing are the main outcomes from the non-financial transactions. GDP_t is completely demand-driven by (gross) consumption incl. VAT, government spending, investment, as well as the trade balance:

$$GDP_t = C_t + G_t + \sum_s I_{t,s} + EXP_t - IMP_t + T_{va,t} \tag{50}$$

Figure 20 shows the Business as Usual (BAU) forecast for the Austrian GDP. The model and the underlying dynamics we assumed for the parameters seem to replicate past dynamics fairly well. In the forecasting period 2016 - 2025, real and nominal GDP growth develops steadily.

Figure 20: Austrian GDP - Past Data and Model BAU Forecast (in mln. Euro)

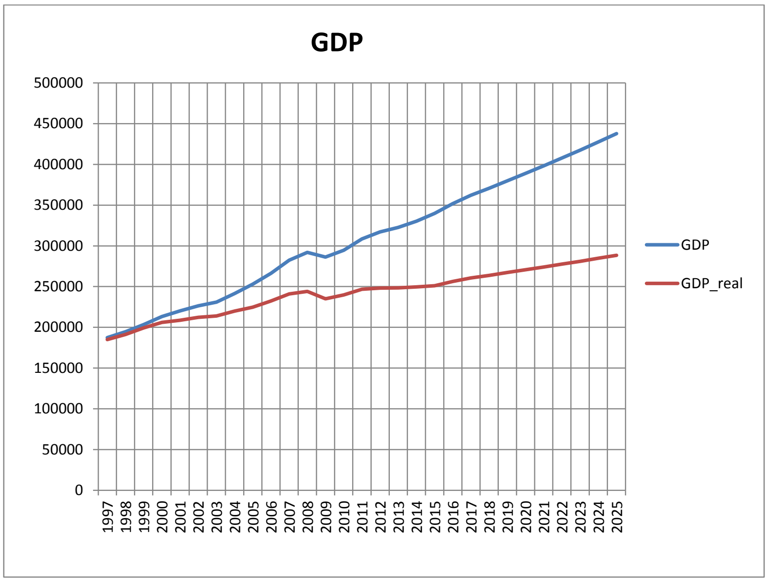


Figure 21 shows important macroeconomic flow-variables for the Business as Usual (BAU) forecast. Specifically private consumption C, public consumption G, household income INC, overall investment INV, overall operating surplus OS, households' wage income W, and overall output Y.

Figure 21: Macroeconomic Variables - Past Data and BAU Forecast (in mln. Euro)

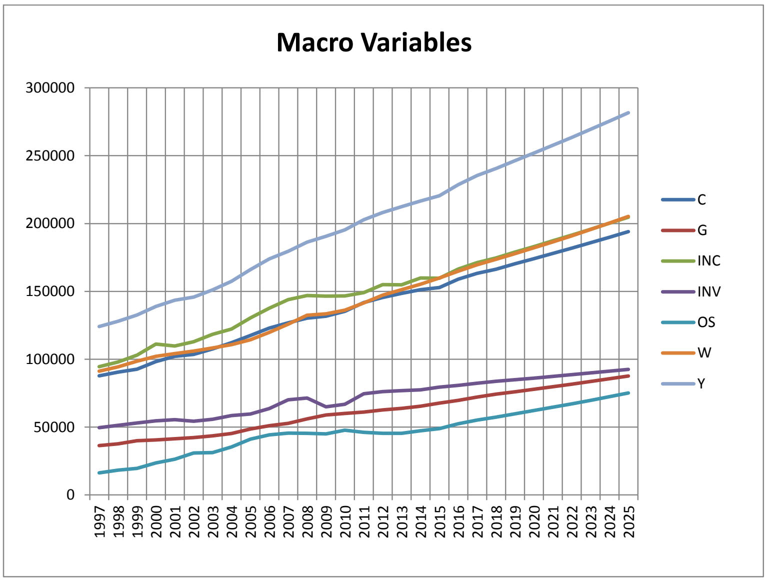
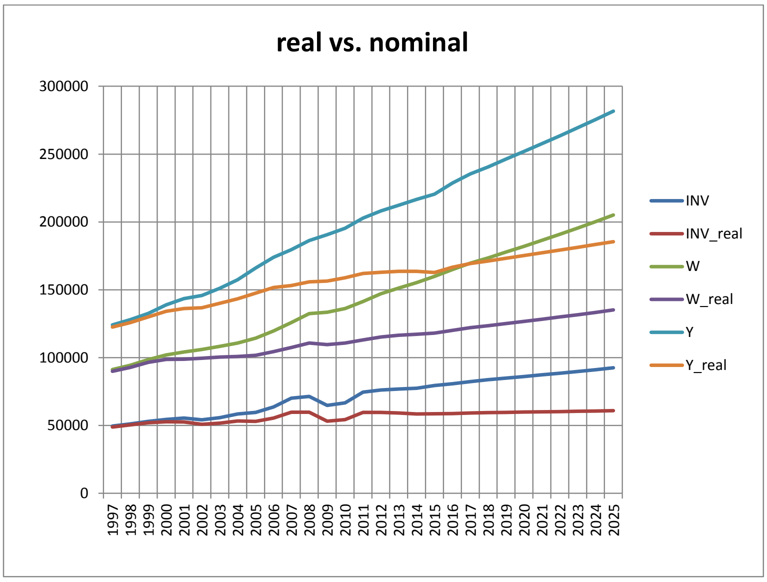


Figure 22: Real and nominal variables - Past Data and Model BAU Forecast (in mln. Euro)

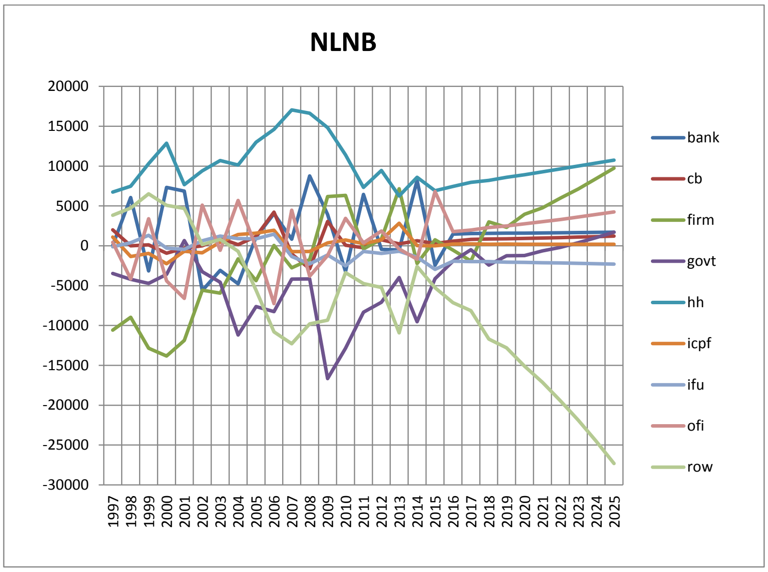


For all macroeconomic variables, past dynamics continue into the future fairly stable. The slight rise in consumption, operating surplus, output and income in the first forecasting period 2016 is due to the exogenously assumed uptake of the export surplus, see figure 9. The nearly equal development of income and wages is pure coincidence. Investment develops according to our calibrated investment function, and stays below the official IHS forecast. Wages stagnate because the price (inflation) enters the nominal wage equation in the denominator. Still, income rises sharply with output from 2016 onwards, via an increase in households' output (self employed) and in net financial household income, as well as the relatively lower rise in household investment expenditures, see equation 16.

Figure 22 shows the differences of selected real and nominal variables. Due to our early choice of base year for price inflation (1996, as mentioned above), the differences seem to be fairly large. Furthermore, real investment is declining while real wages increase substantially. Clearly, these developments only reflect the price inflation, as determined by our simple markup pricing mechanism.

Figure 23 shows NLNB for the different sectors. The data up to 2015 show very much a different picture than our model forecast. Most of all, the deficit of the RoW (light green line at the bottom) increases due to the exogenous developments of exports and imports that we assume as shown in figure 9. This export surplus has a positive growth effect for the domestic economy, and thus a positive effect on the domestic sectors firm, government, and households. The channels are increased production, increased income, and increased tax revenues. Since NLNB summed across sectors has to equal zero for reasons of accounting consistency, some developments after 2015 are implied by other projections in our model.

Figure 23: Net Lending/Net Borrowing by Sector - Past Data and BAU Forecast (in mln. Euro)

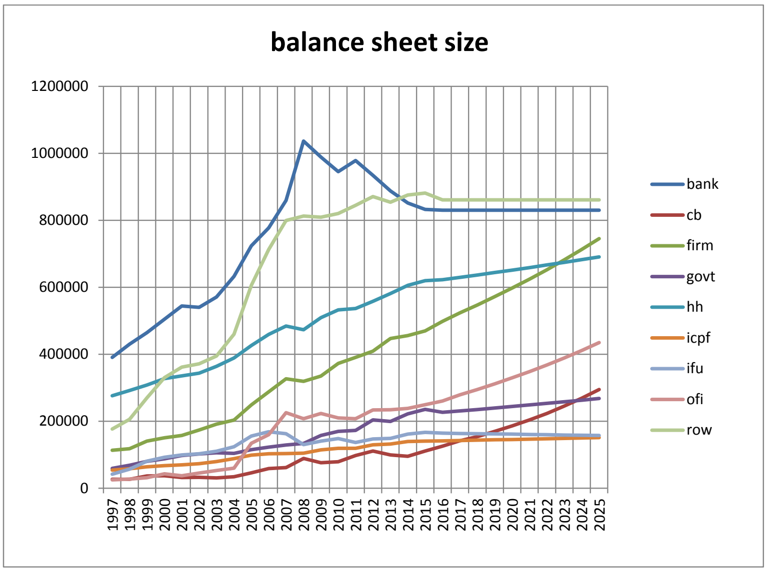


4.2 BAU-Results: Financial Transactions

Financial Assets After having determined the extension of all balance sheets, the revaluation and the portfolio choice, the actual holdings of financial assets by sectors is one of the two main outcomes of the financial transactions block of the model.

Figure 24 shows the total length of the balance sheets for each sector. These are endogenous outcomes of the leverage decisions, except for the rest of world and banks, where the estimations were insignificant, and the balance sheet length was kept constant for the future.

Figure 24: Development of total size of assets held by each sector - Data and BAU forecast (in mln. Euro)



One can see that the picture looks very different for the sectors, and that the growth of assets in the total economy slowed down considerably after 2007/2008, especially driven by deleveraging in the banking sector. However, the total stock of financial assets in the Austrian economy has never shrunk, but grew steadily, and at a higher rate than gdp.

Figure 25: Financial assets of households by asset class - Data and BAU forecast (in mln. Euro)

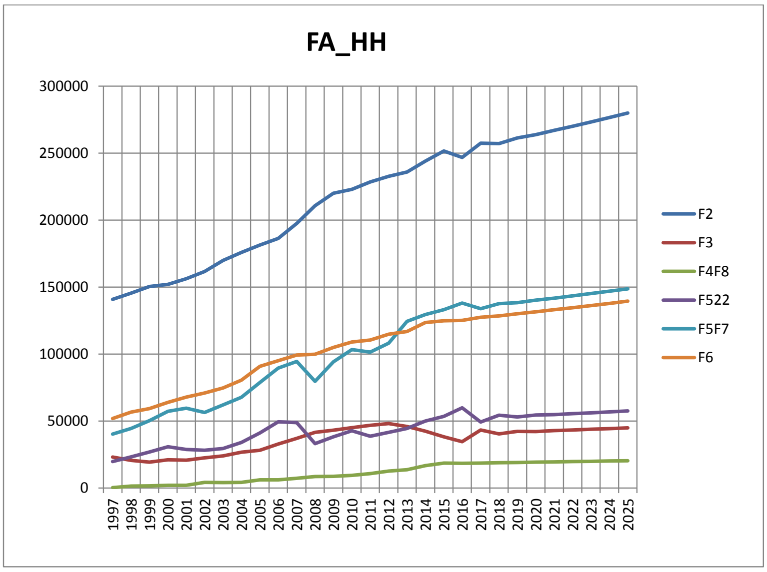


Figure 26: Financial assets of firms by asset class - Data and BAU forecast (in mln. Euro)

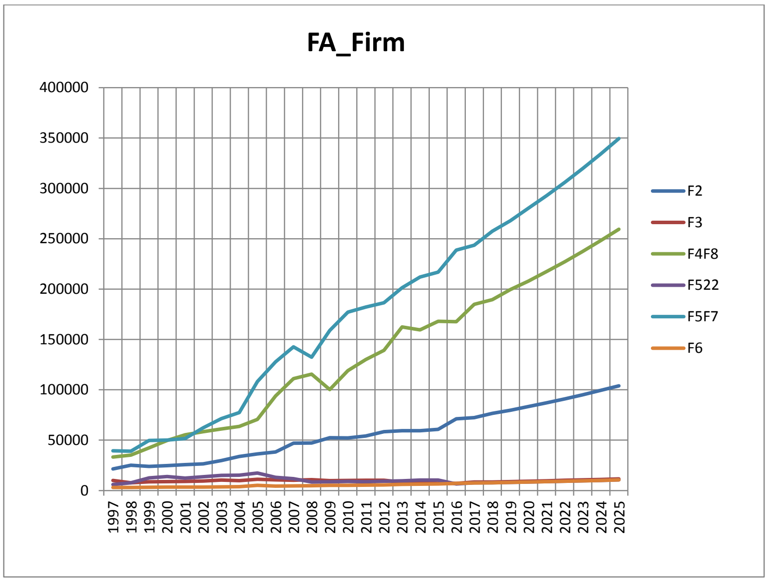
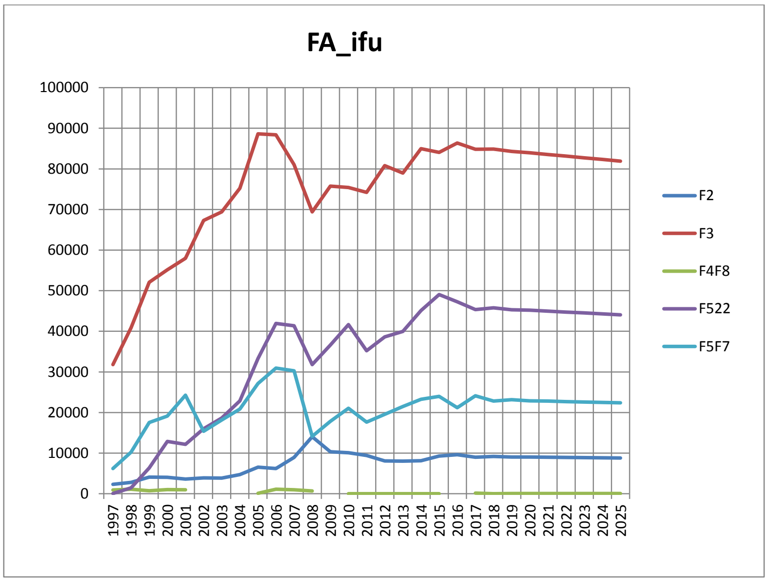


Figure 27: Financial assets of investment funds by asset class - Data and BAU forecast (in mln. Euro)

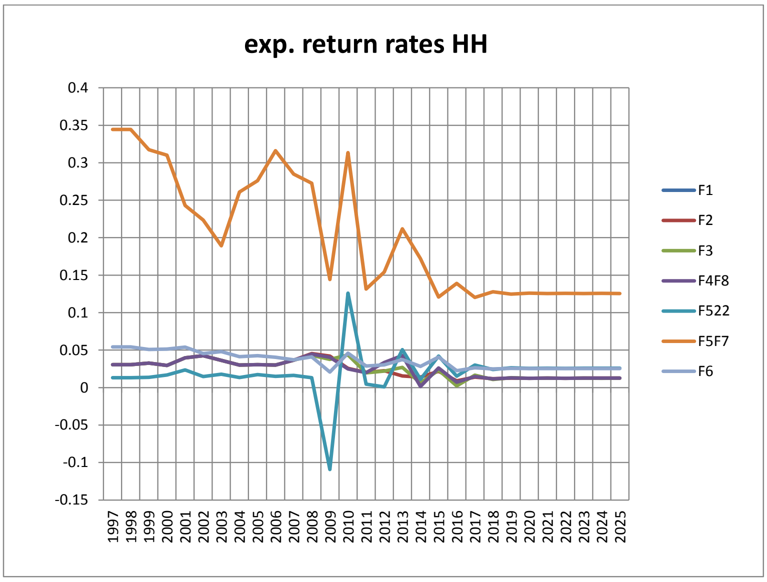


Figures 25- 27 show the combined results of the balance sheet extension and the portfolio choice, namely the size of assets by asset class, exemplary for the sectors households, firms, and investment funds. One can see that the shares between these assets stay relatively constant to each other over time. This is because of the constancy of prices and interest rates in the BAU. Therefore, the main determinant for investment decisions here is the leverage decision.

The pictures look similar for the other sectors and the liability sides, the detailed results for all sectors are given in the appendix, section 5.

Overall, the model shows a steady increase in financial assets that can be seen as a smooth continuation of the trend from 2008 - 2015. The slight bumps in the asset shares in 2016/17, that occur for nearly all sectors, are due to two reasons. Firstly, 2016 is the first period of the forecast, so it is the first period that agents in the model use the shares derived from the estimated equations, (35) and (40)-(47). Since the parameters are estimated using the time series data 2006-2016, one would expect that the result would not be a smooth transition from the last data point. Secondly, the expected returns, as constructed in the current model implementation, have an inherent cyclical nature, as can be seen in figure 28 below, and equation (44) above. The cyclical nature stems from the functional forms, and only fades out after a few time periods. This issue is currently adressed by trying different combinations of functional forms for general expectations formations (43), and the expected return rates on assets (44).

Figure 28: Expected return rates for different asset classes by household sector - Data and BAU forecast



New Worth is the determinant of a sector's financial wealth[10] and is shown in figure 29 below. Strictly speaking, there are two channels by which the net worth of a sector is influenced. The first is Net Lending/Net Borrowing, stemming only from the real side of the model, and the second is changes in asset prices[11], stemming only from the financial side. In practice, however, changes in prices will not influence the net worth very much, while on the other hand, a continuous negative/positive NLNB position, even if small, sums up to a constant fall/rise in the net worth. In the case of the BAU scenario results presented here, there is only the NLNB effect, since prices

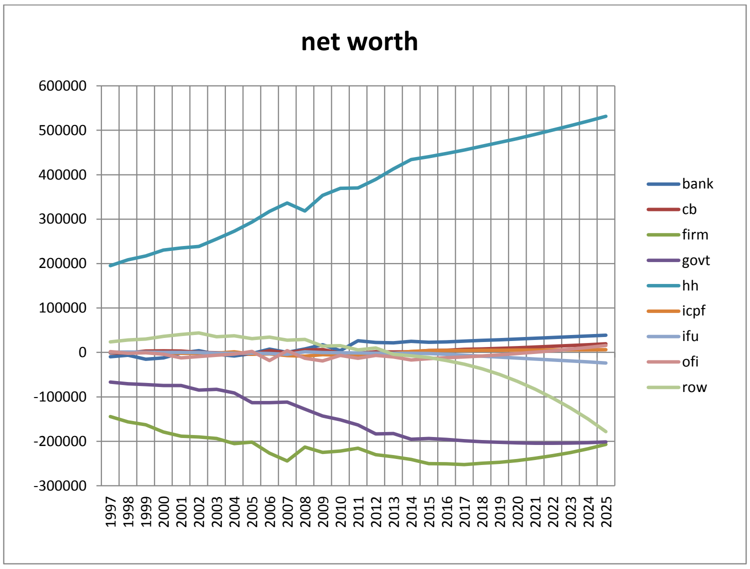
[10]No real capital is depicted here. This especially affects the net worth of firms, which is highly negative in this depiction, but also the net worth of the household sector. The inclusion of real capital is a point of further extension for the model.

[11]A positive net worth would be increased, if prices for assets would rise, and prices for liabilites would fall simultaneously, and vice versa.

were assumed to stay constant.

Households have by far the highest net worth, starting with a level of slightly more than 425 bln. Euro in 2015 up to almost 530 bln. Euro in 2025, due to the constantly positive NLNB position. Banks are second in net worth in the Austrian economy, but far below. Due to its trade deficit that increases with our exogenous projections of exports and imports from 2015 - 2025, the RoW accumulates a negative net worth which even reaches a value of -180 bln. Euro in 2025.This is very pronounced, but it beautifully shows the stock effect, that a flow effect can have: Half of one percent difference in the growth rates between exports and imports lead to this massively negative finance positon. The government can keep its negative net worth stable due to the rise in NLNB. Lastly firms (NFCs) can even reduce their negative net worth, which is due to their increasing NLNB position.

Figure 29: Net Worth by Sector (in mln. Euro)



5 Conclusion and Outlook

The purpose of this document is to give an overview of the empirical SFC model of the Austrian economy (which is still work in progress), and specifically of the new implementations in this project. These are 1. The implementation of a pricing mechanism for the real economy, and 2. the implementation of asset prices, and a portfolio choice of all sectors, including a leverage decision.

With this report we show the holistic view of the Austrian economy that this model takes, and take into account the richness of the underlying data structure (ESA2010 data). It was intended to introduce the reader to the principal logic as well as functioning of the model, and then to demonstrate its capabilities by constructing a new business as usual scenario. The basic logic of this model is to keep the behavioural part of the model as simple as possible, and to obtain most of the dynamics from the variables' development in the past. All parameters in the model include information about past data. Most parameters are obtained by calculating their yearly values in the past (1996-2015), with the help of the ESA data, and the reformulated model equations. These values are then projected into the future, in order to obtain parameter values for the model forecast.

The projections and mechanics of the model are still simple and preliminary. However, we think our business as usual scenario already gives a reasonable and stable forecast.

In comparison to the model presented in Miess and Schmelzer (2016), this model has undergone several improvements:

1. The introduction of asset prices, and an endogenous portfolio choice, including leverage, based on empirically estimated portfolio choice parameters
2. A simple markup pricing mechanism

The portfolio choice implemented in the model gives each sector the choice of how much to extend her balance sheet, and of the portfolio, according to which the sector wants to invest her funds. The main determinants of the portfolio are expected returns for all asset types per sector, which are a combination of exponential moving averages of interest returns and asset prices. The determinants in the leverage decisions are macroeconomic variables like gdp, a price deflator, net lending/borrowing, and an asset price index. The results for the leverage decision are quite different across sectors. We are currently working on another estimation strategy, that combines the leverage and portfolio decision, however this endeavor is far from finished.

As to our knowledge, this is the first empirical sfc model with such a detailed portfolio choice theory. Other SFC models depict only portfolios for some sectors (household and firm), and typically omit leverage decisions.

The markup pricing mechanism - though preliminary in nature - offers a first possibility to connect issues of the functional distribution of income between the factors labour and capital and the pricing behaviour of the real economy. At later stages, this price mechanism, if complemented by a simple model of real production, might serve to determine the flows of income accruing to different household types such as a worker and capitalist household.

For further work, this model offers a broad base for extension and further improvement, since it already incorporates the full extent of the underlying ESA data structure (the model can e.g. easily be calibrated to other countries of the European Union). Among these points of improvement and extension are the following:

1. Implementing scenarios such as asset price shocks, and their impact on the economy.
2. Endogenize the markup and unit labour costs. Introduce hours worked, and a wage rate. Introduce endogenous employment and unemployment, at best related to endogenous business cycles.
3. Behavioural equations in the real side of the model should be closer related to empirical evidence and economic theory.
4. Including personal income and wealth distribution using HFCS data.
5. Include physical capital such as real capital by firms and houses - take data e.g. from firm-level data sets.
6. Apply this framework to other countries of the Eurozone (single country models). Maybe link these single country models via non-financial and financial flows between different countries (long-term plan).
7. A who-to-whom structure regarding financial assets can be implemented in the model, allowing great detail in the financial sector for Austria. However, only few European countries record this type of data. At this stage we wanted to keep the model at the transferrable level.
8. Add in structure from I/O tables, i.e. a sectoral, detailed production sector with an integrated structure.

As can be inferred from the long list above, this framework has the potential for extensive future work and research, offering a prospect on scientific novelty in several aspects along the way. As regarding the political dimension, the broad view on the economy as an integrated system of flows and stocks presents a viable framework for policy evaluation and recommendations. Specifically linking measures and effects in the real economy with those in the financial economy (public debt/deficit, sectoral financial imbalances, etc.)

Endogenous dynamics derived from empirical data help to capture likely developments of recent and long-term economic trends and their effects on overall economic developments. Basing the assumptions on agents' behaviour in these models firmly on empirical evidence and economic theory can help in addressing potential criticism regarding the choice of these assumptions.

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Appendix

In the following we provide regression tables for each sector. The abbreviations F1-F5F7 denote the agent's assets as aggregated in the model. ER_ipo_F1-ER_ipo_F5F7 denote expected return rates; the return rates were computed for each sector for assets and liabilites seperately, even though they share the same abbreviations in the tables. For the calculations we used the specific interest returns, price gains and losses the sector experienced on the assets and liabilities it held, and the other financial changes account, thus the "ipo" element in the name, "i" for interest, "p" for price, and "o" for other changes.

Table 6: Firm: Change in log of total balance sheet length

	Dependent variable:			
	value			
	(1)	(2)	(3)	(4)
DEL_log_GDP	1.509***	1.376***	1.303***	1.351***
	(0.462)	(0.388)	(0.366)	(0.366)
DEL_log_PD	−0.725	−0.765	−0.858	
	(0.746)	(0.731)	(0.709)	
DEL_log_P_lag1	−0.116			
	(0.305)			
NLNB_shr	0.256***	0.260***	0.265***	0.271***
	(0.081)	(0.079)	(0.078)	(0.078)
DEL_log_r_ref	−0.025	−0.025		
	(0.042)	(0.041)		
Constant	0.014***	0.014***	0.015***	0.011***
	(0.005)	(0.004)	(0.004)	(0.003)
Observations	41	42	42	42
R^2	0.504	0.494	0.489	0.469
Adjusted R^2	0.433	0.439	0.449	0.442
Residual Std. Error	0.016	0.016	0.016	0.016
F Statistic	7.104***	9.033***	12.122***	17.243***

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 30: Firm: Regression results after backward elimination.
left: residuals vs. fitted values; right: fitted values (line) and data points (dots)

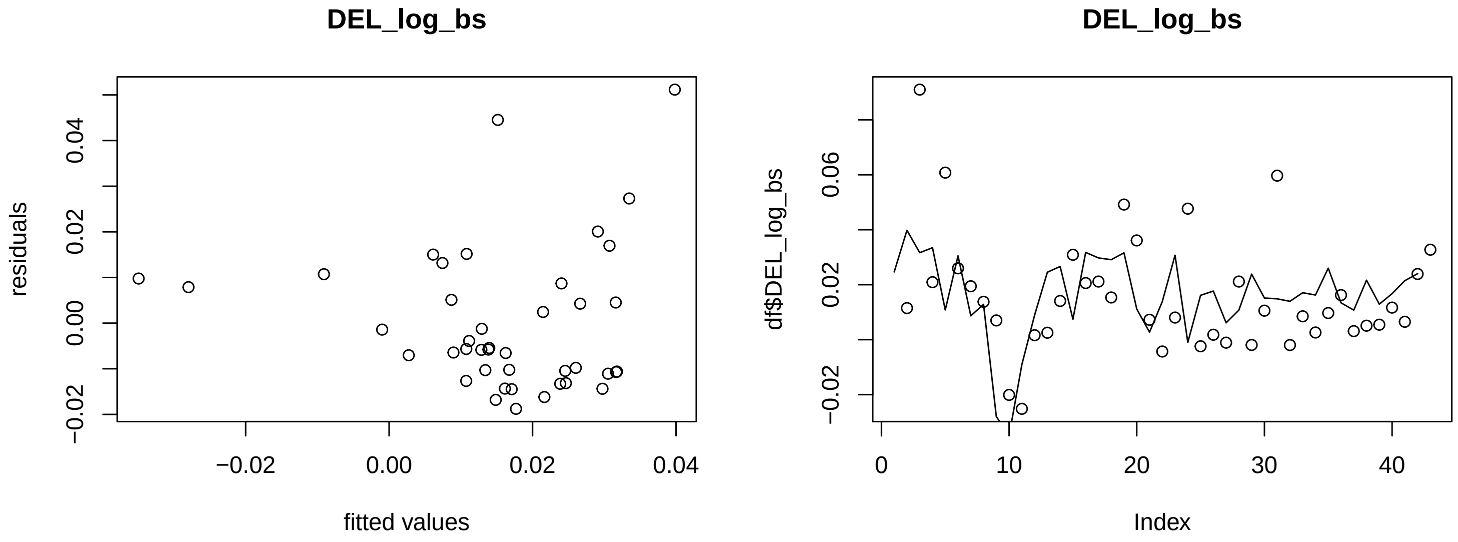


Table 7: Firm: Asset Shares depending on expected returns

	Dependent variable:					
	F2	F3	F4F8	F522	F5F7	F6
	(1)	(2)	(3)	(4)	(5)	(6)
ER_ipo_F2	−0.667***	−0.226	1.234**	−0.012	−0.298	−0.031
	(0.161)	(0.163)	(0.487)	(0.192)	(0.301)	(0.021)
ER_ipo_F3	0.057	−0.089	0.006	−0.160	0.204	−0.018
	(0.126)	(0.127)	(0.380)	(0.150)	(0.235)	(0.016)
ER_ipo_F4F8	0.068	−0.052	−0.319	−0.050	0.355**	−0.002
	(0.080)	(0.080)	(0.241)	(0.095)	(0.149)	(0.010)
ER_ipo_F522	−0.083	−0.013	0.192	−0.034	−0.069	0.007
	(0.059)	(0.060)	(0.178)	(0.070)	(0.110)	(0.008)
ER_ipo_F5F7	0.215***	0.102***	−0.083	0.017	−0.262***	0.010**
	(0.033)	(0.033)	(0.100)	(0.039)	(0.062)	(0.004)
ER_ipo_F6	−0.236	0.734***	−1.146**	1.147***	−0.534	0.036
	(0.184)	(0.186)	(0.556)	(0.219)	(0.344)	(0.024)
Constant	0.144***	−0.016*	0.387***	−0.031***	0.503***	0.012***
	(0.009)	(0.009)	(0.027)	(0.011)	(0.017)	(0.001)
Observations	43	43	43	43	43	43
R^2	0.669	0.574	0.331	0.524	0.629	0.364
Adjusted R^2	0.613	0.503	0.219	0.445	0.567	0.258
Residual Std. Error	0.005	0.005	0.016	0.006	0.010	0.001
F Statistic	12.111***	8.091***	2.966**	6.616***	10.162***	3.432***
Note:						*p<0.1; **p<0.05; ***p<0.01

Figure 31: firm: share of investment of asset (F1-F5F7) in total balance sheet length

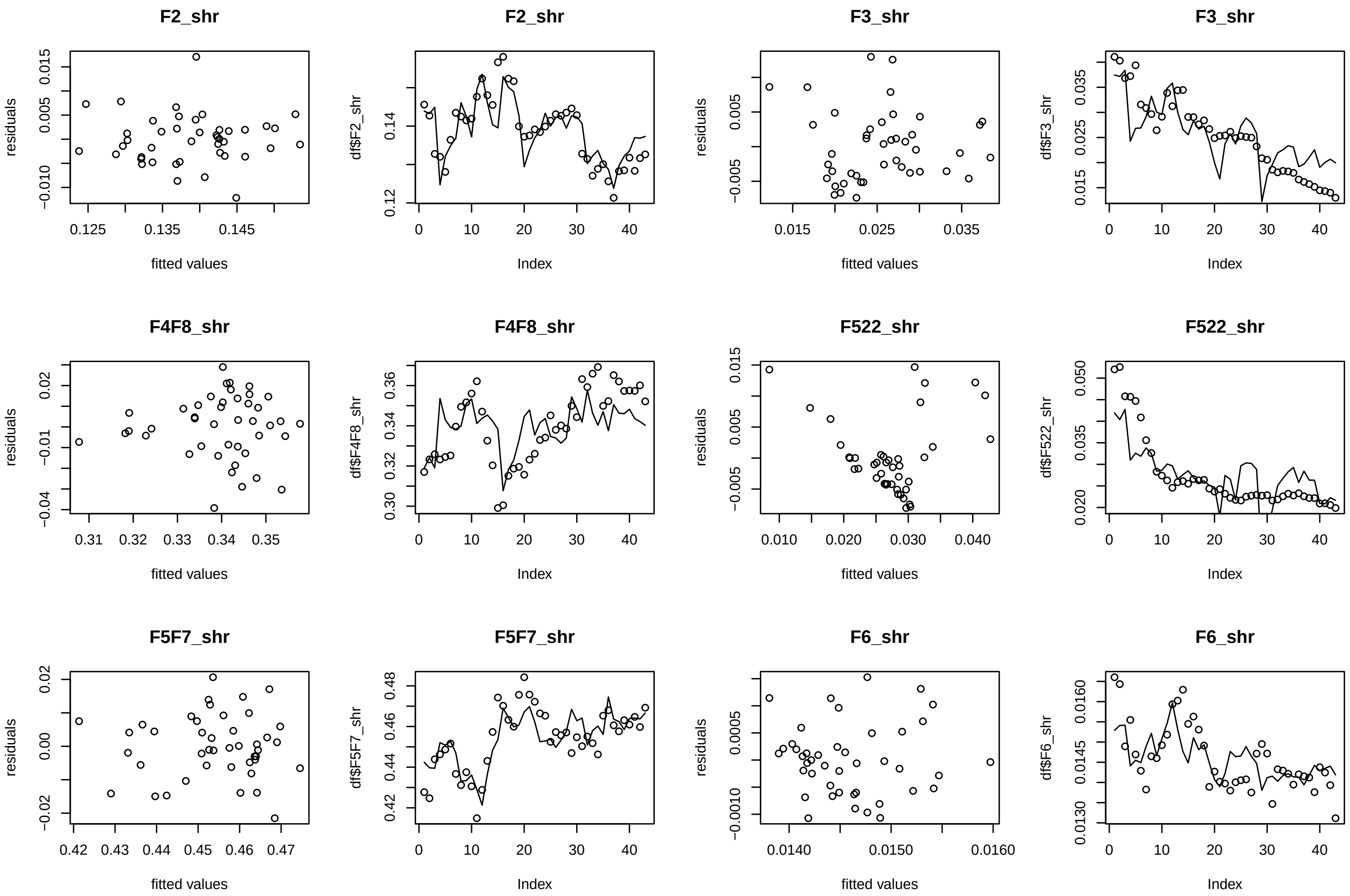


Table 8: Firm: Liability shares depending on expected returns

	Dependent variable:			
	F3	FF4F8	F5F7	F6
	(1)	(2)	(3)	(4)
ER_ipo_F3	−0.123	0.060	0.068	−0.004
	(0.083)	(0.188)	(0.240)	(0.014)
ER_ipo_F4F8	−0.032	−0.076	0.077	0.031
	(0.176)	(0.399)	(0.509)	(0.031)
ER_ipo_F5F7	−0.100***	0.162**	−0.089	0.027***
	(0.032)	(0.072)	(0.092)	(0.006)
ER_ipo_F6	−0.074	0.552*	−0.498	0.020
	(0.128)	(0.290)	(0.370)	(0.022)
Constant	0.071***	0.439***	0.478***	0.012***
	(0.005)	(0.010)	(0.013)	(0.001)
Observations	43	43	43	43
R^2	0.578	0.426	0.139	0.661
Adjusted R^2	0.533	0.366	0.048	0.625
Residual Std. Error	0.006	0.014	0.017	0.001
F Statistic	12.998***	7.055***	1.534	18.529***

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 32: firm: share of liabilities paer asset type (F1-F5F7) in total liabilities

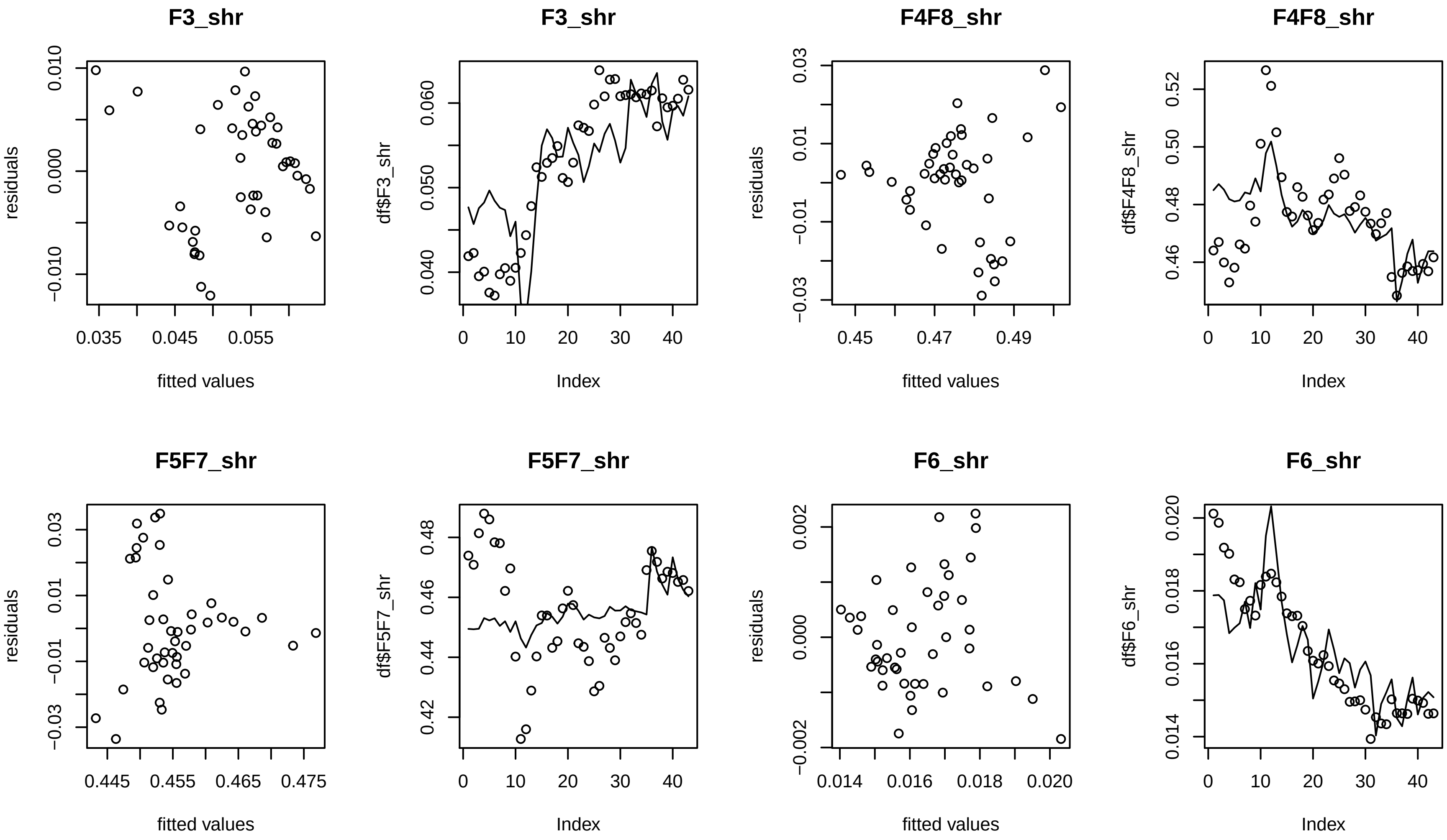


Figure 33: Firm: Financial assets by asset class - Data and BAU forecast (in mln. Euro)

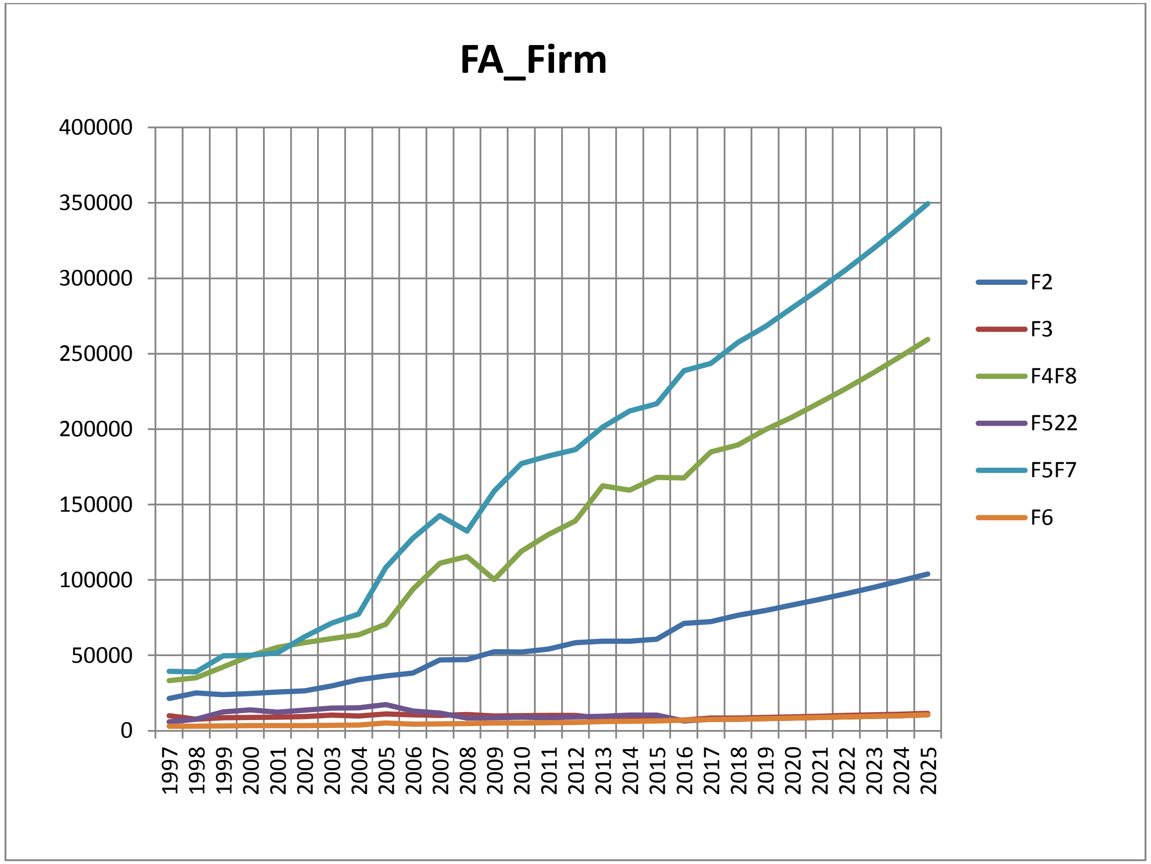


Figure 34: Firm: Financial liabilites by asset class - Data and BAU forecast (in mln. Euro)

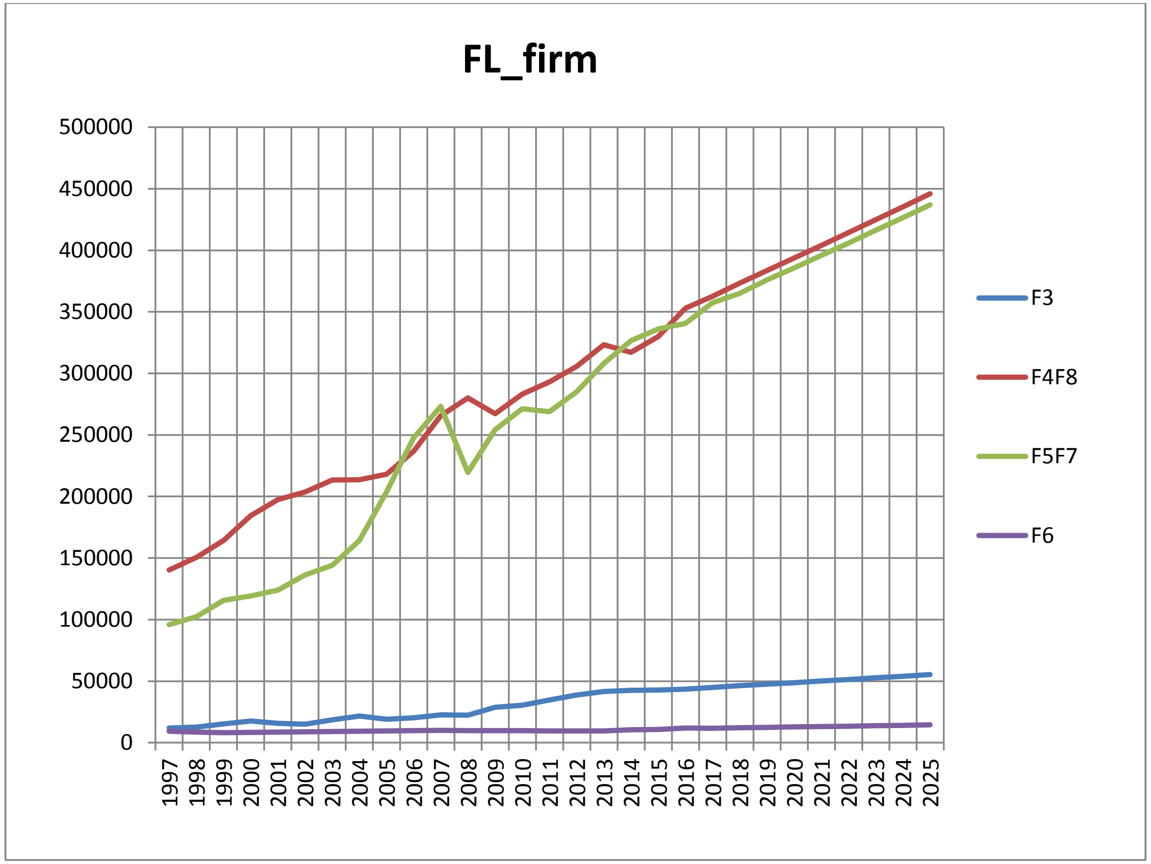


Table 9: CB: Change in log of total balance sheet length

	Dependent variable:				
	value				
	(1)	(2)	(3)	(4)	(5)
DEL_log_GDP	2.792*	2.746	3.139**	3.436**	3.890**
	(1.651)	(1.632)	(1.540)	(1.549)	(1.463)
DEL_log_PD	−4.634	−4.956	−4.389		
	(3.215)	(3.119)	(3.012)		
DEL_log_P_lag1	−3.277**	−3.125**	−3.074**	−3.050**	−3.008**
	(1.230)	(1.182)	(1.173)	(1.190)	(1.187)
NLNB_shr	0.320				
	(0.626)				
DEL_log_r_ref	0.047	0.050			
	(0.067)	(0.066)			
Constant	0.034*	0.035*	0.030*	0.010	
	(0.019)	(0.019)	(0.018)	(0.011)	
Observations	41	41	41	41	41
R^2	0.267	0.262	0.250	0.207	0.226
Adjusted R^2	0.162	0.180	0.189	0.165	0.186
Residual Std. Error	0.069	0.069	0.068	0.069	0.069
F Statistic	2.551**	3.189**	4.104**	4.949**	5.692***

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 35: CB: Regression results after backward elimination.
left: residuals vs. fitted values; right: fitted values (line) and data points (dots)

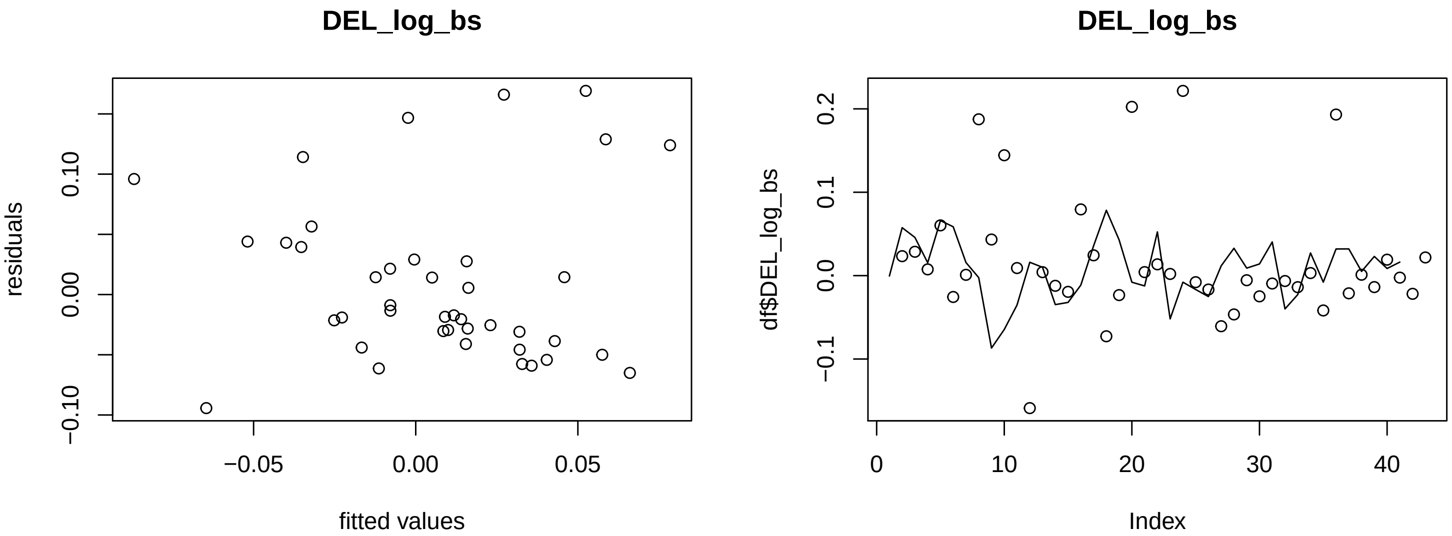


Table 10: CB: Asset Shares depending on expected returns

	Dependent variable:				
	F2	F3	F4F8	F522	F5F7
	(1)	(2)	(3)	(4)	(5)
ER_ipo_F2	0.296	−1.680	1.521***	−0.204	0.067
	(0.996)	(1.063)	(0.471)	(0.155)	(0.043)
ER_ipo_F3	2.425***	−2.520***	0.401	−0.376***	0.070**
	(0.669)	(0.715)	(0.317)	(0.104)	(0.029)
ER_ipo_F4F8	−0.160	0.010	0.491	−0.334*	−0.007
	(1.098)	(1.172)	(0.519)	(0.170)	(0.047)
ER_ipo_F522	−0.201	0.142	0.028	0.030	−0.0003
	(0.280)	(0.299)	(0.132)	(0.043)	(0.012)
ER_ipo_F5F7	−0.167	0.046	0.084	0.038**	−0.001
	(0.107)	(0.114)	(0.051)	(0.017)	(0.005)
Constant	0.504***	0.437***	−0.048***	0.095***	0.012***
	(0.037)	(0.040)	(0.018)	(0.006)	(0.002)
Observations	43	43	43	43	43
R^2	0.398	0.541	0.578	0.566	0.414
Adjusted R^2	0.317	0.479	0.521	0.507	0.335
Residual Std. Error	0.053	0.057	0.025	0.008	0.002
F Statistic	4.892***	8.712***	10.130***	9.643***	5.225***
Note:					*p<0.1; **p<0.05; ***p<0.01

Figure 36: CB: share of investment of asset (F1-F5F7) in total balance sheet length

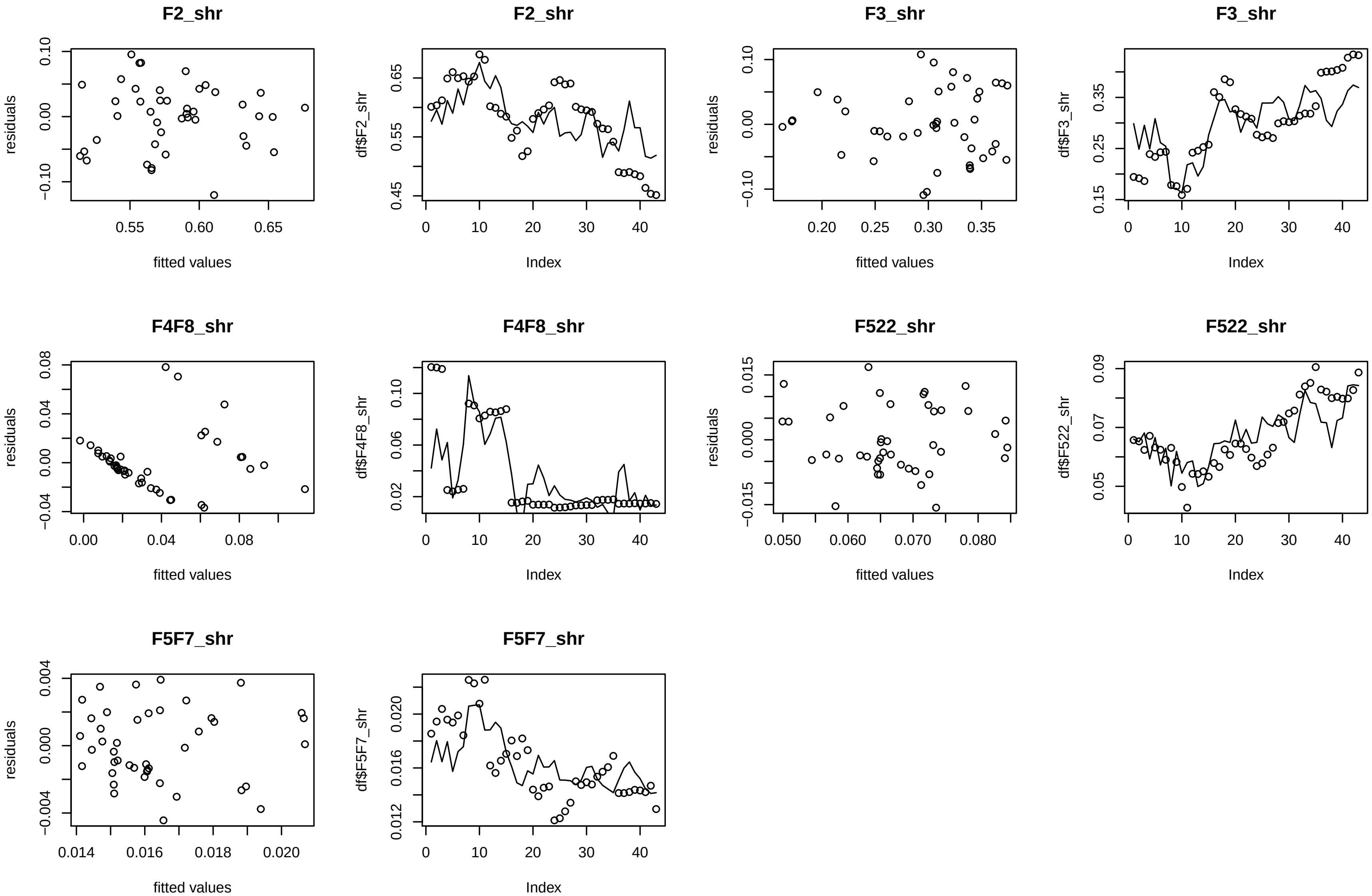


Table 11: CB: Liability shares depending on expected returns

	Dependent variable:			
	F2	F4F8	F5F7	F6
	(1)	(2)	(3)	(4)
ER_ipo_F2	0.723**	−0.041	−0.998***	0.316***
	(0.290)	(0.050)	(0.304)	(0.081)
ER_ipo_F4F8	0.002	−0.001***	−0.0002	−0.001
	(0.002)	(0.0004)	(0.002)	(0.001)
ER_ipo_F5F7	0.064	0.002	−0.057	−0.009
	(0.038)	(0.007)	(0.040)	(0.011)
ER_ipo_F6	0.077	−0.024	−0.038	−0.015
	(0.099)	(0.017)	(0.104)	(0.028)
Constant	0.806***	0.021***	0.161***	0.012***
	(0.010)	(0.002)	(0.010)	(0.003)
Observations	43	43	43	43
R^2	0.272	0.222	0.288	0.340
Adjusted R^2	0.196	0.141	0.213	0.271
Residual Std. Error	0.018	0.003	0.019	0.005
F Statistic	3.552**	2.718**	3.836**	4.904***

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 37: CB: share of liabilities paer asset type (F1-F5F7) in total liabilities

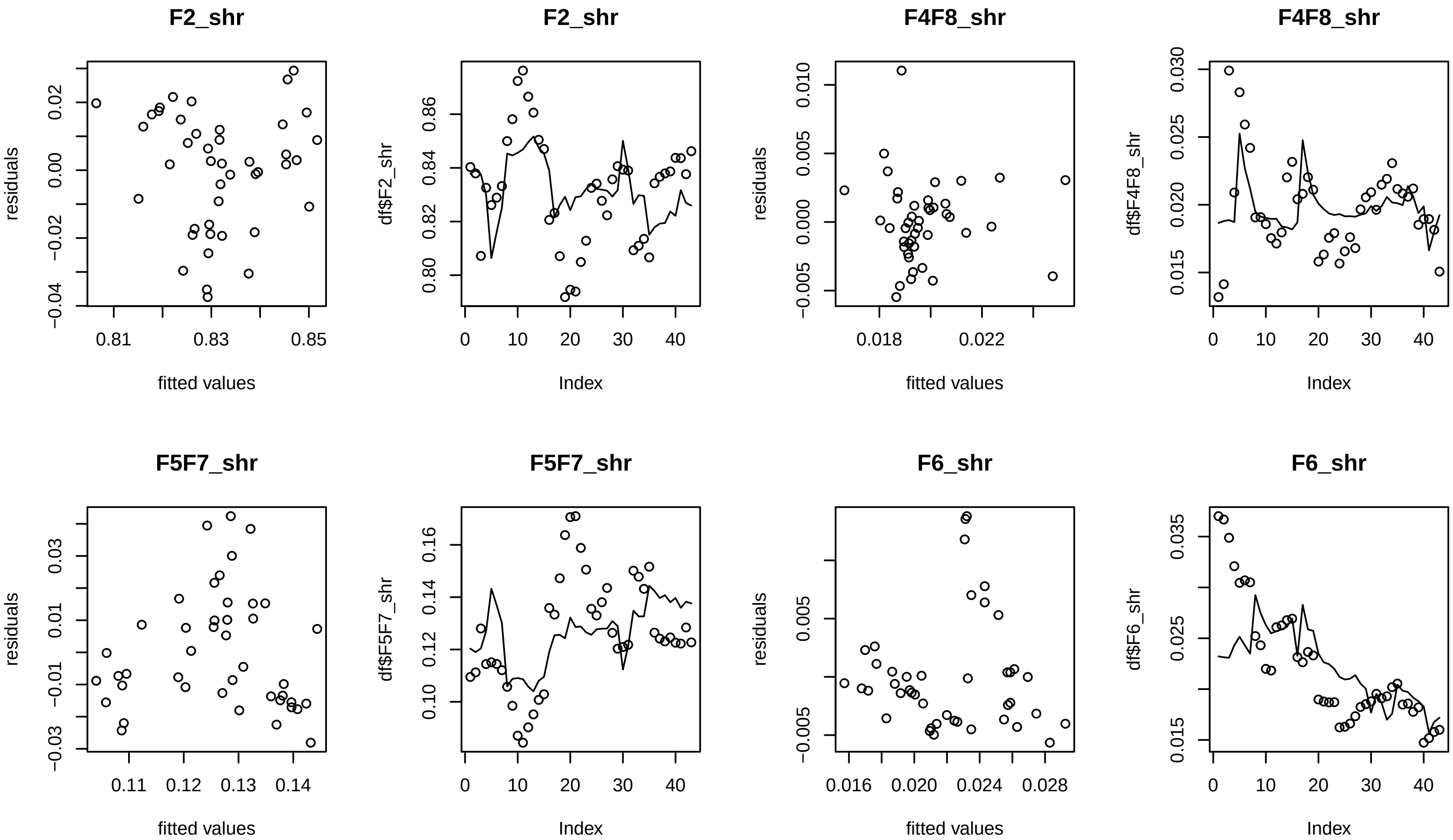


Figure 38: cb: Financial assets by asset class - Data and BAU forecast (in mln. Euro)

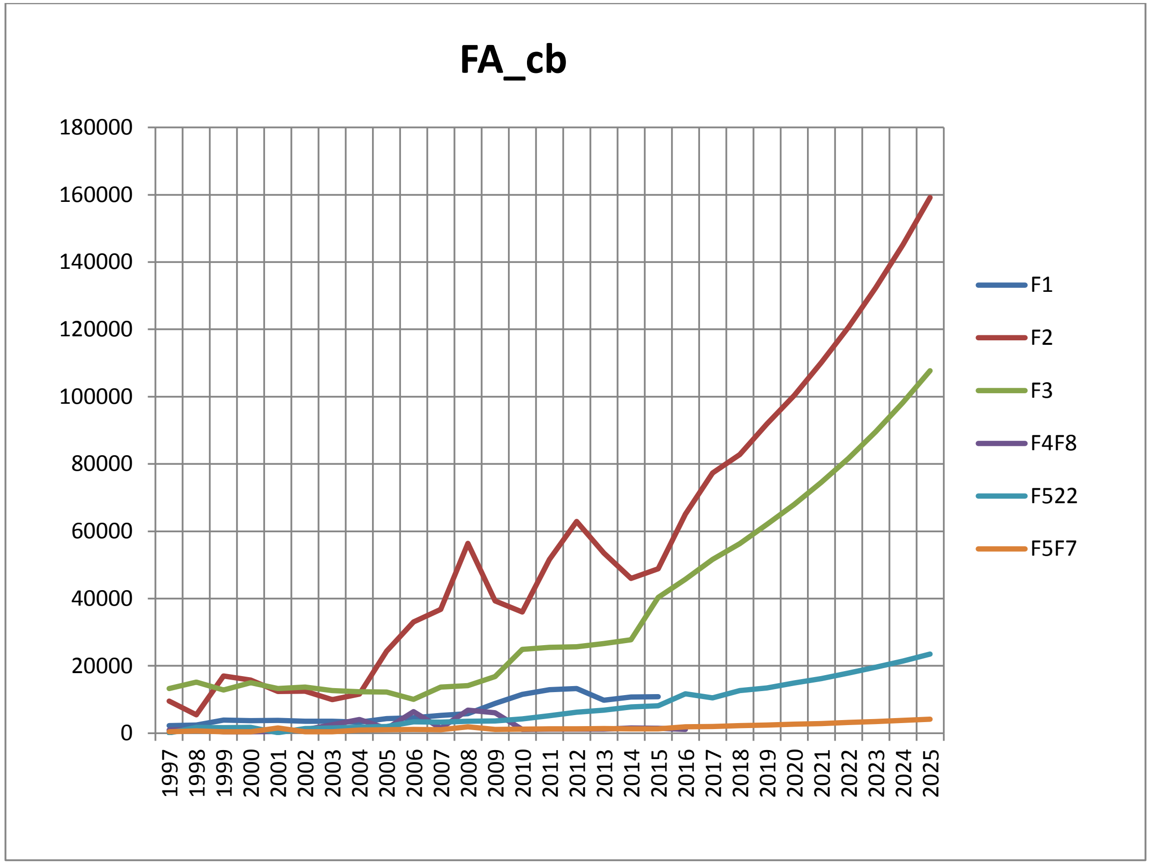


Figure 39: cb: Financial liabilites by asset class - Data and BAU forecast (in mln. Euro)

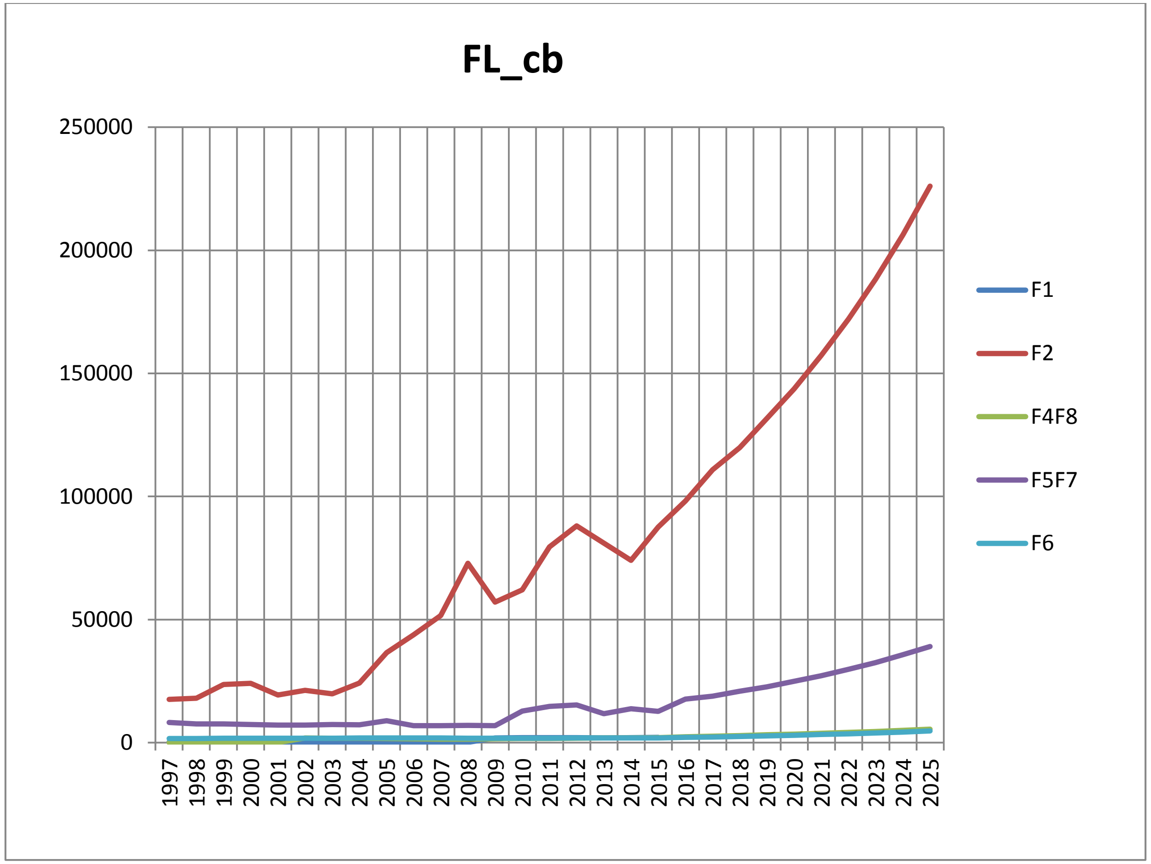


Table 12: Banks: Change in log of total balance sheet length

	Dependent variable:					
	value					
	(1)	(2)	(3)	(4)	(5)	(6)
DEL_log_GDP	−0.599	−0.595				
	(0.610)	(0.590)				
DEL_log_PD	−1.808	−1.803	−1.498	−1.613		
	(1.114)	(1.088)	(1.045)	(1.044)		
DEL_log_P_lag1	−0.671	−0.674	−0.788			
	(0.642)	(0.622)	(0.612)			
NLNB_shr	−0.010					
	(0.328)					
DEL_log_r_ref	0.067*	0.067*	0.051*	0.053*	0.043	0.038
	(0.034)	(0.033)	(0.029)	(0.030)	(0.029)	(0.029)
Constant	0.014**	0.014**	0.011*	0.011*	0.004	
	(0.007)	(0.007)	(0.006)	(0.006)	(0.004)	
Observations	41	41	41	42	42	42
R^2	0.171	0.171	0.147	0.105	0.050	0.040
Adjusted R^2	0.052	0.079	0.078	0.059	0.026	0.016
Residual Std. Error	0.023	0.023	0.023	0.023	0.024	0.024
F Statistic	1.442	1.854	2.131	2.280	2.098	1.699

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 40: bank: Regression results after backward elimination.
left: residuals vs. fitted values; right: fitted values (line) and data points (dots)
Unfortunately for the bank no regression was significant. In the model thus the banks balance sheet size is kept constant for the future.

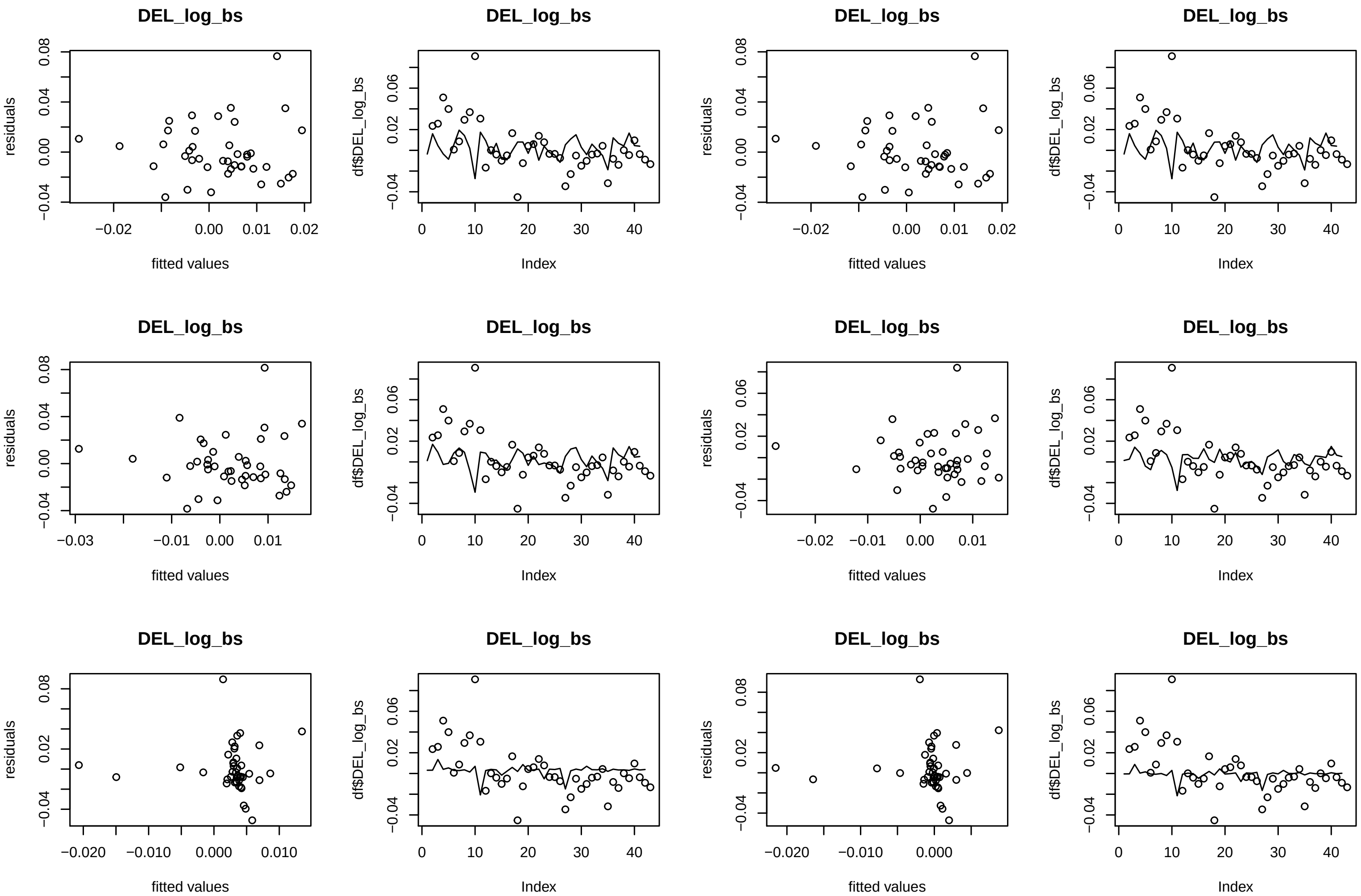


Table 13: Banks: Asset Shares depending on expected returns

	Dependent variable:				
	F2	F3	F4F8	F522	F5F7
	(1)	(2)	(3)	(4)	(5)
ER_ipo_F2	0.697^{*}	0.067	−0.584	-0.104^{*}	−0.076
	(0.403)	(0.143)	(0.425)	(0.061)	(0.087)
ER_ipo_F3	1.265^{**}	−0.183	-0.989^{*}	−0.027	−0.066
	(0.491)	(0.175)	(0.518)	(0.074)	(0.106)
ER_ipo_F4F8	1.229^{**}	0.453^{**}	-1.726^{***}	0.236^{***}	−0.192
	(0.548)	(0.195)	(0.577)	(0.082)	(0.118)
ER_ipo_F522	0.076	0.029	−0.099	0.014	−0.020
	(0.139)	(0.050)	(0.147)	(0.021)	(0.030)
ER_ipo_F5F7	0.006	0.066	−0.023	0.089^{***}	-0.140^{***}
	(0.152)	(0.054)	(0.160)	(0.023)	(0.033)
Constant	0.195^{***}	0.142^{***}	0.564^{***}	0.004	0.095^{***}
	(0.015)	(0.005)	(0.015)	(0.002)	(0.003)
Observations	43	43	43	43	43
R^2	0.658	0.272	0.634	0.574	0.720
Adjusted R^2	0.611	0.174	0.585	0.517	0.682
Residual Std. Error	0.021	0.008	0.022	0.003	0.005
F Statistic	14.211^{***}	2.764^{**}	12.836^{***}	9.987^{***}	19.011^{***}

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 41: Banks: share of investment of asset (F1-F5F7) in total balance sheet length

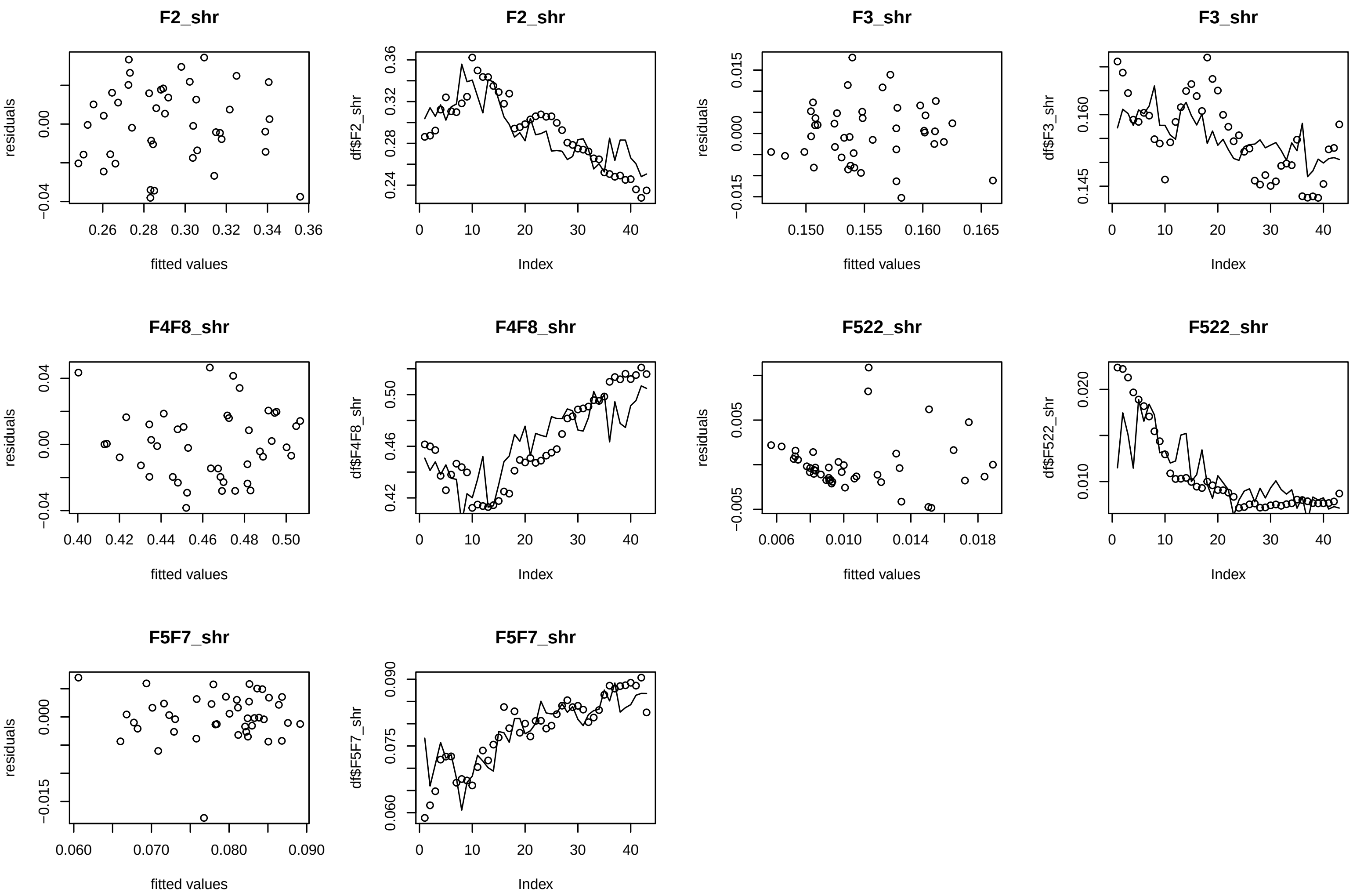


Table 14: Bank: Liability shares depending on expected returns

	Dependent variable:				
	F2	F4F8	F5F7	F6	F6_shr
	(1)	(2)	(3)	(4)	(5)
ER_ipo_F2	−1.700***	2.274***	0.190***	−0.672***	−0.093***
	(0.232)	(0.284)	(0.024)	(0.141)	(0.012)
ER_ipo_F3	0.727***	−0.876***	0.039*	0.068	0.041***
	(0.217)	(0.266)	(0.023)	(0.132)	(0.011)
ER_ipo_F4F8	−0.050***	0.064***	−0.002	−0.010	−0.002***
	(0.013)	(0.016)	(0.001)	(0.008)	(0.001)
ER_ipo_F522					
ER_ipo_F5F7	0.090*	0.024	0.006	−0.116***	−0.003
	(0.046)	(0.056)	(0.005)	(0.028)	(0.002)
ER_ipo_F6	0.165**	−0.218**	−0.0005	0.054	−0.0001
	(0.067)	(0.082)	(0.007)	(0.041)	(0.004)
Constant	0.673***	0.212***	−0.003***	0.112***	0.007***
	(0.008)	(0.010)	(0.001)	(0.005)	(0.0004)
Observations	43	43	43	43	43
R^2	0.681	0.723	0.781	0.661	0.718
Adjusted R^2	0.638	0.685	0.751	0.615	0.680
Residual Std. Error	0.012	0.014	0.001	0.007	0.001
F Statistic	15.810***	19.301***	26.364***	14.427***	18.885***

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 42: Bank: share of liabilities paer asset type (F1-F5F7) in total liabilities

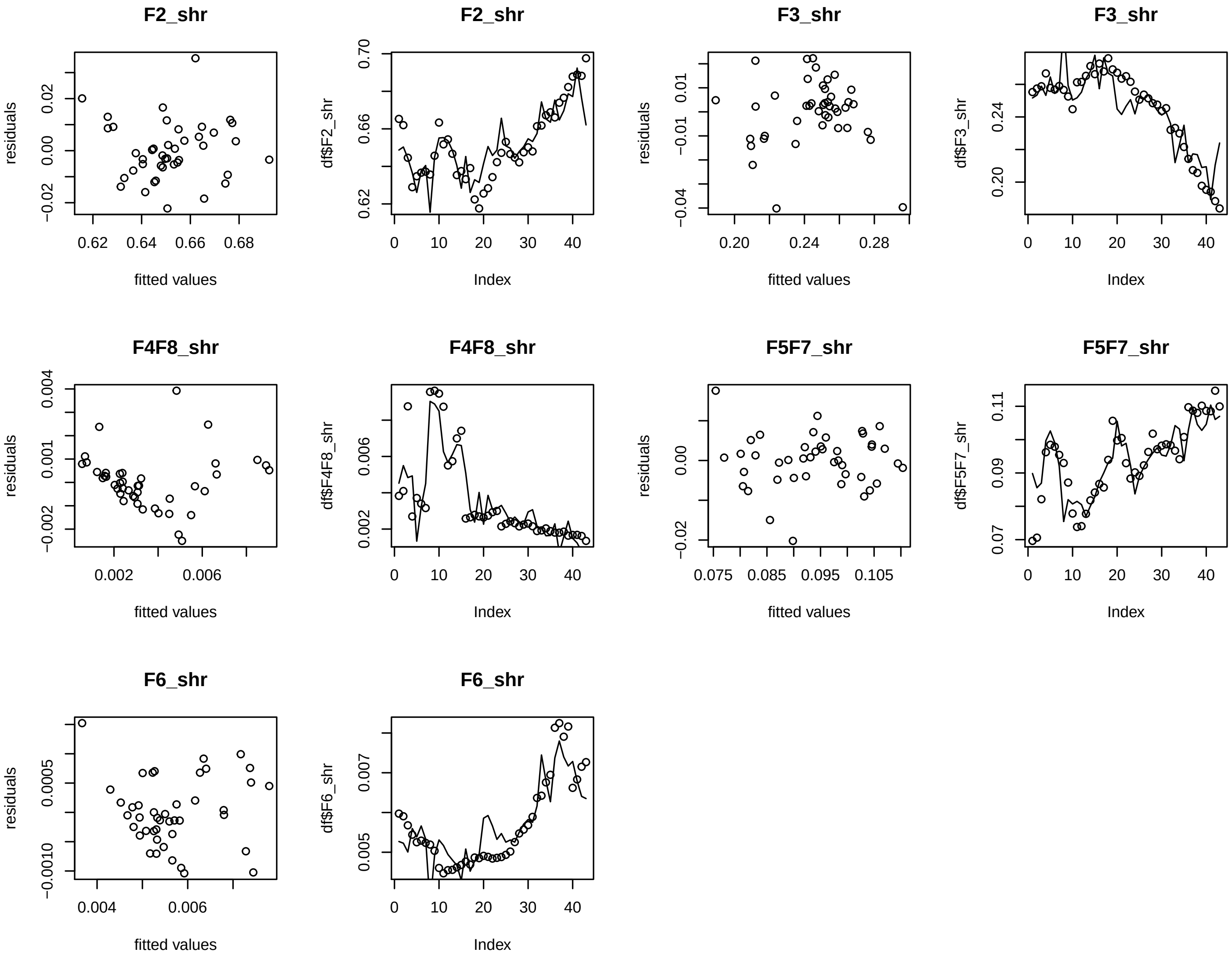


Figure 43: Bank: Financial assets by asset class - Data and BAU forecast (in mln. Euro)

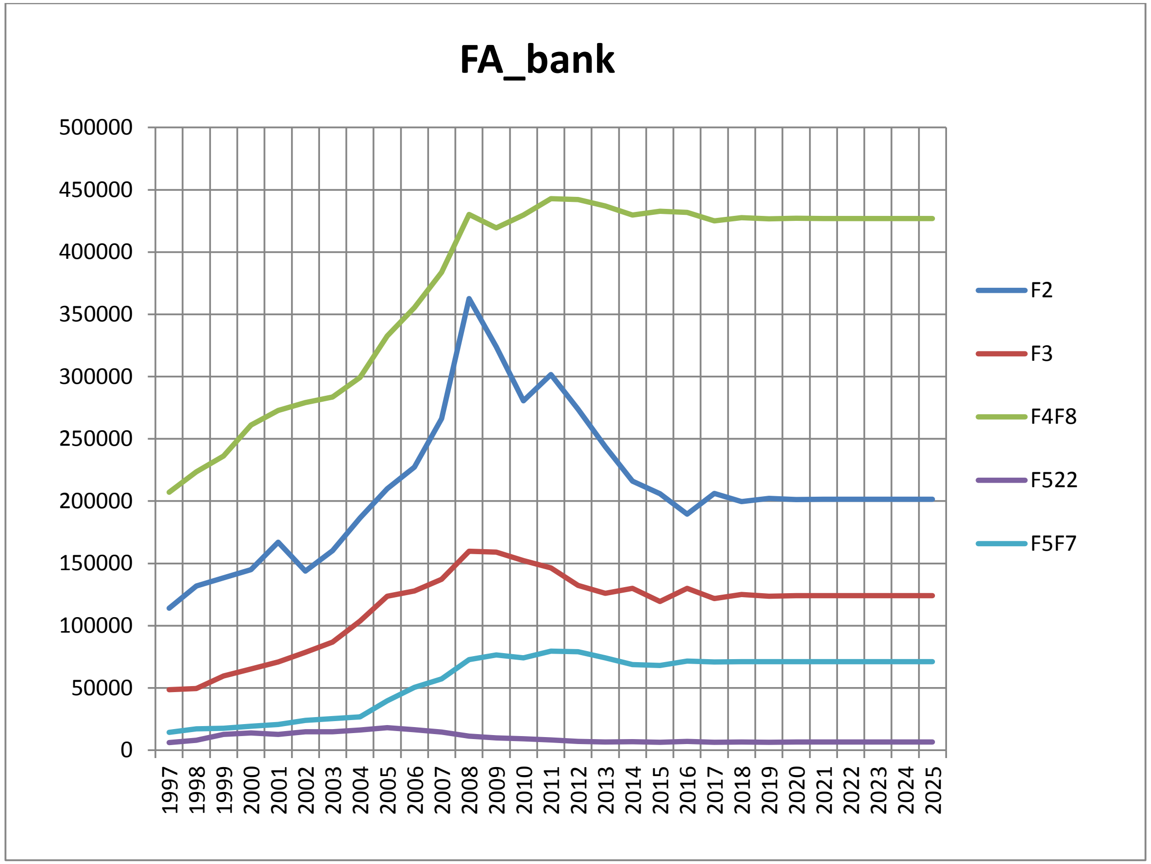


Figure 44: Bank: Financial liabilites by asset class - Data and BAU forecast (in mln. Euro)

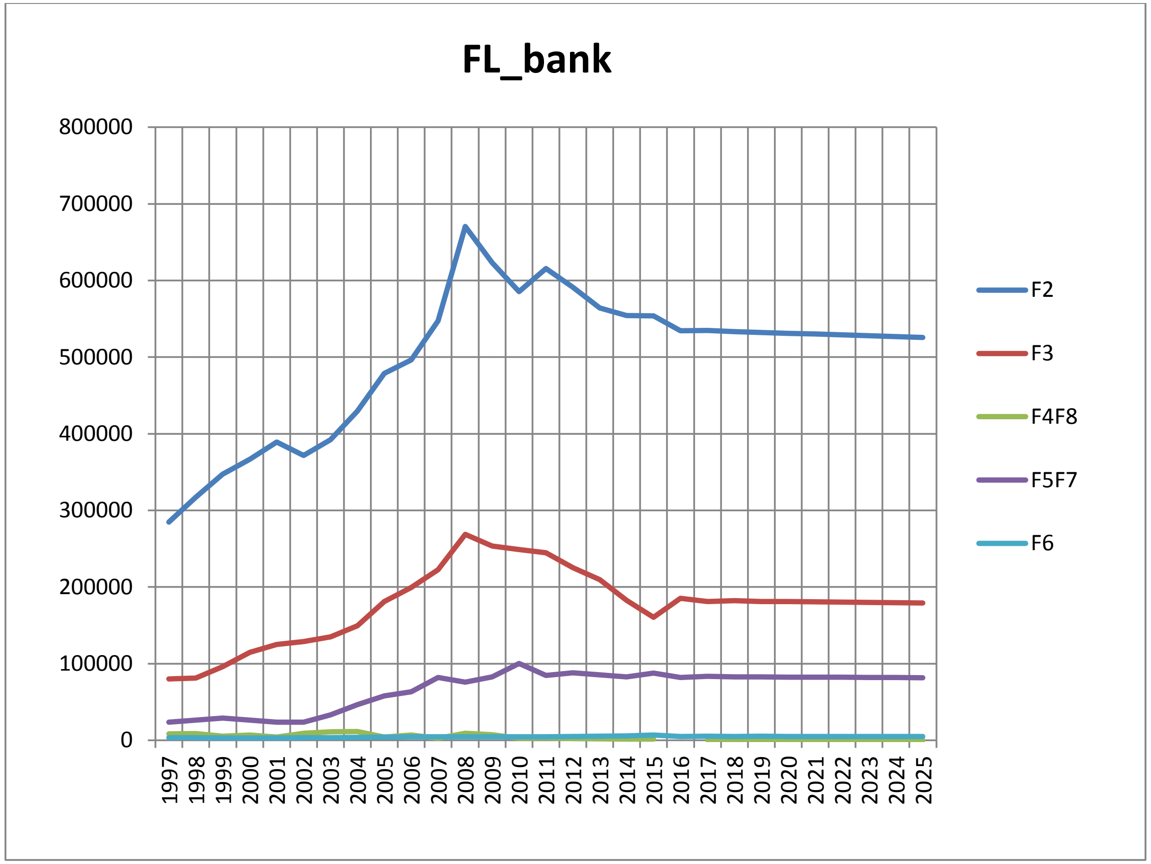


Table 15: IFU: Change in log of total balance sheet length

	Dependent variable:			
	value			
	(1)	(2)	(3)	(4)
DEL_log_GDP	−0.219	−0.169		
	(0.252)	(0.232)		
DEL_log_PD	−0.631	−0.432	−0.461	−0.507*
	(0.466)	(0.284)	(0.279)	(0.283)
DEL_log_P_lag1	0.245***	0.235***	0.215***	0.222***
	(0.072)	(0.069)	(0.063)	(0.064)
NLNB_shr	0.690***	0.694***	0.694***	0.710***
	(0.041)	(0.040)	(0.040)	(0.039)
DEL_log_r_ref	−0.022	−0.023	−0.022	
	(0.015)	(0.015)	(0.015)	
Constant	0.001			
	(0.003)			
Observations	41	41	41	41
R^2	0.920	0.919	0.918	0.913
Adjusted R^2	0.909	0.908	0.909	0.906
Residual Std. Error	0.010	0.010	0.010	0.010
F Statistic	80.563***	82.194***	103.935***	132.955***
Note:				*p<0.1; **p<0.05; ***p<0.01

Figure 45: IFU: Regression results after backward elimination.
left: residuals vs. fitted values; right: fitted values (line) and data points (dots)

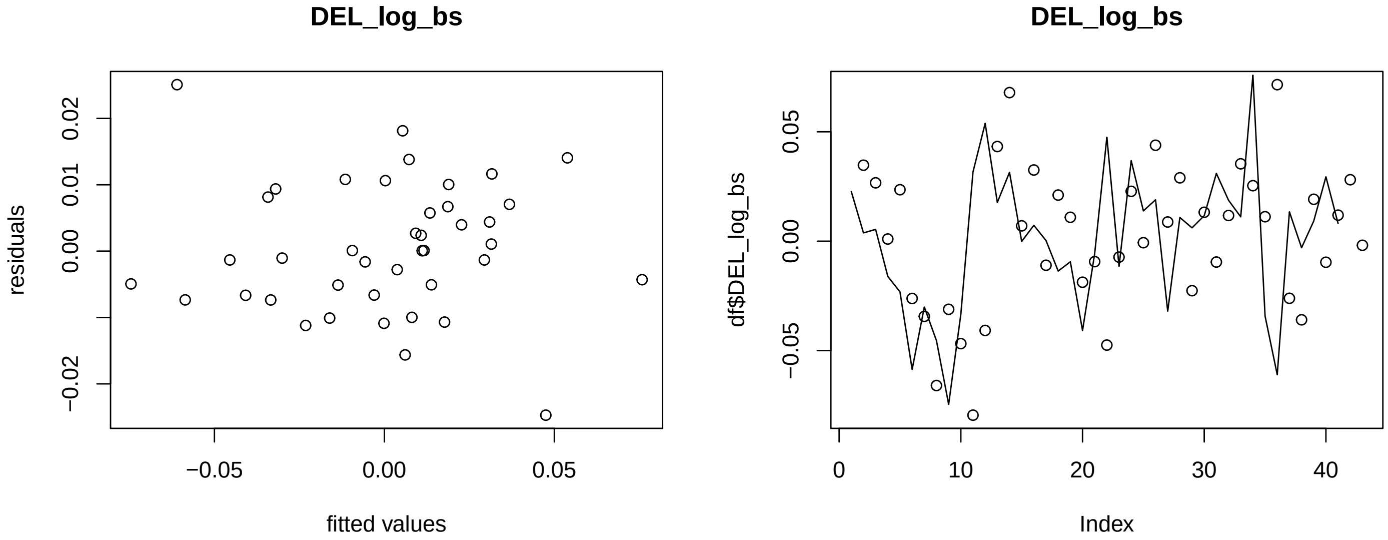


Table 16: IFU: Asset Shares depending on expected returns

	Dependent variable:				
	F2	F3	F4F8	F522	F5F7
	(1)	(2)	(3)	(4)	(5)
ER_ipo_F2	0.032	0.105	0.070	-0.246^{**}	0.070
	(0.087)	(0.118)	(0.068)	(0.110)	(0.115)
ER_ipo_F3	0.357^{**}	0.218	0.068	-0.945^{***}	0.293
	(0.169)	(0.229)	(0.049)	(0.213)	(0.223)
ER_ipo_F4F8	-0.096	-0.074	0.024	-0.108	0.251^{*}
	(0.105)	(0.143)	(0.020)	(0.133)	(0.139)
ER_ipo_F522	-0.627^{***}	-0.663^{**}	0.030	0.722^{**}	0.533^{*}
	(0.223)	(0.302)	(0.046)	(0.281)	(0.295)
ER_ipo_F5F7	0.311^{***}	0.333^{***}	-0.007	-0.311^{***}	-0.324^{***}
	(0.084)	(0.114)	(0.018)	(0.106)	(0.111)
Constant	0.055^{***}	0.520^{***}	-0.002^{*}	0.295^{***}	0.132^{***}
	(0.004)	(0.006)	(0.001)	(0.005)	(0.005)
Observations	43	43	36	43	43
R^2	0.503	0.285	0.619	0.555	0.537
Adjusted R^2	0.435	0.188	0.555	0.494	0.474
Residual Std. Error	0.011	0.015	0.002	0.014	0.015
F Statistic	7.479^{***}	2.943^{**}	9.731^{***}	9.213^{***}	8.582^{***}
Note:					$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Figure 46: IFU: share of investment of asset (F1-F5F7) in total balance sheet length

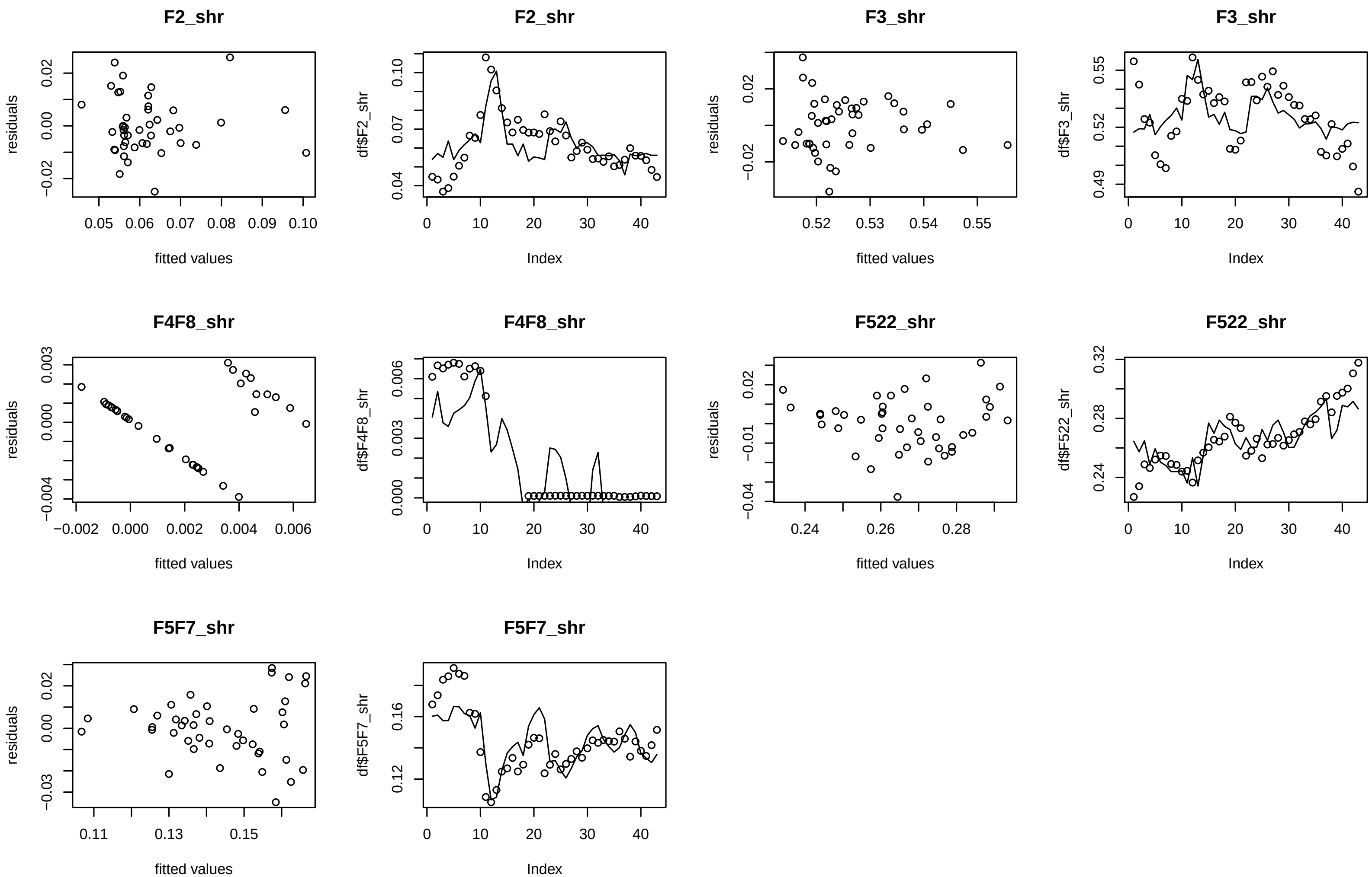


Table 17: IFU: Liabilities shares depending on expected returns

	Dependent variable:		
	F4F8	F522	F5F7
	(1)	(2)	(3)
ER_ipo_F4F8	−0.075***	0.074***	−0.0001
	(0.019)	(0.019)	(0.002)
ER_ipo_F522	−0.034	0.035	−0.002
	(0.068)	(0.066)	(0.007)
ER_ipo_F5F7	0.0001*	−0.0001	−0.00003***
	(0.0001)	(0.0001)	(0.00001)
Constant	0.016***	0.984***	0.0005*
	(0.002)	(0.002)	(0.0002)
Observations	43	43	40
R^2	0.361	0.348	0.459
Adjusted R^2	0.312	0.298	0.414
Residual Std. Error	0.009	0.009	0.001
F Statistic	7.341***	6.946***	10.198***

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 47: IFU: share of liabilities paer asset type (F1-F5F7) in total liabilities

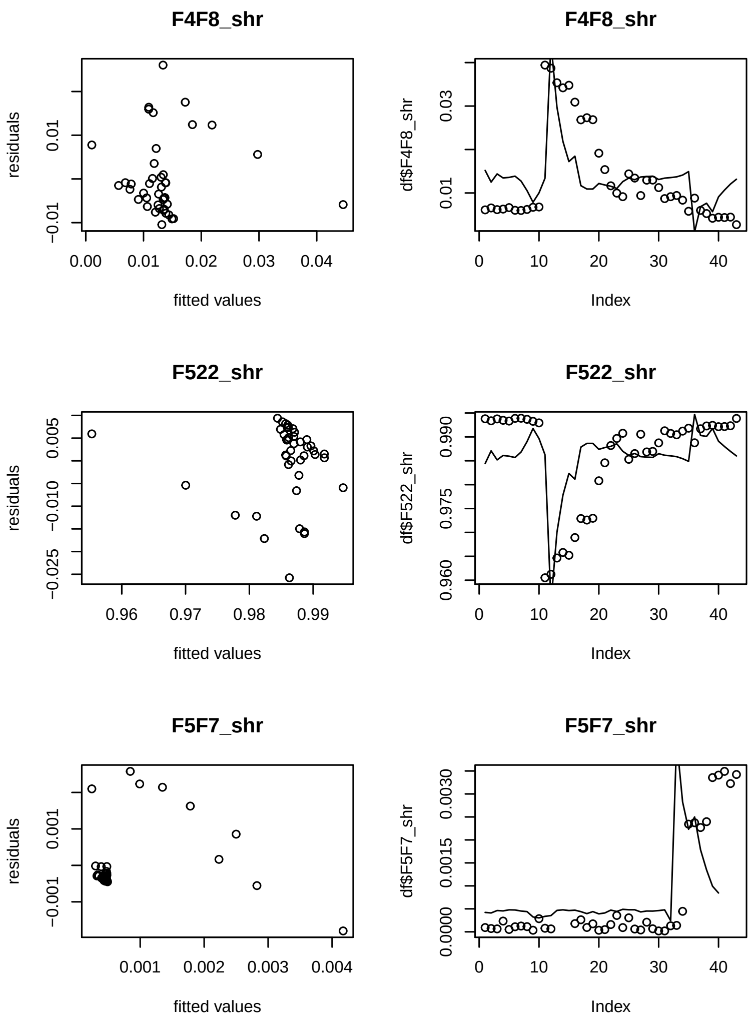


Figure 48: IFU: Financial assets by asset class - Data and BAU forecast (in mln. Euro)

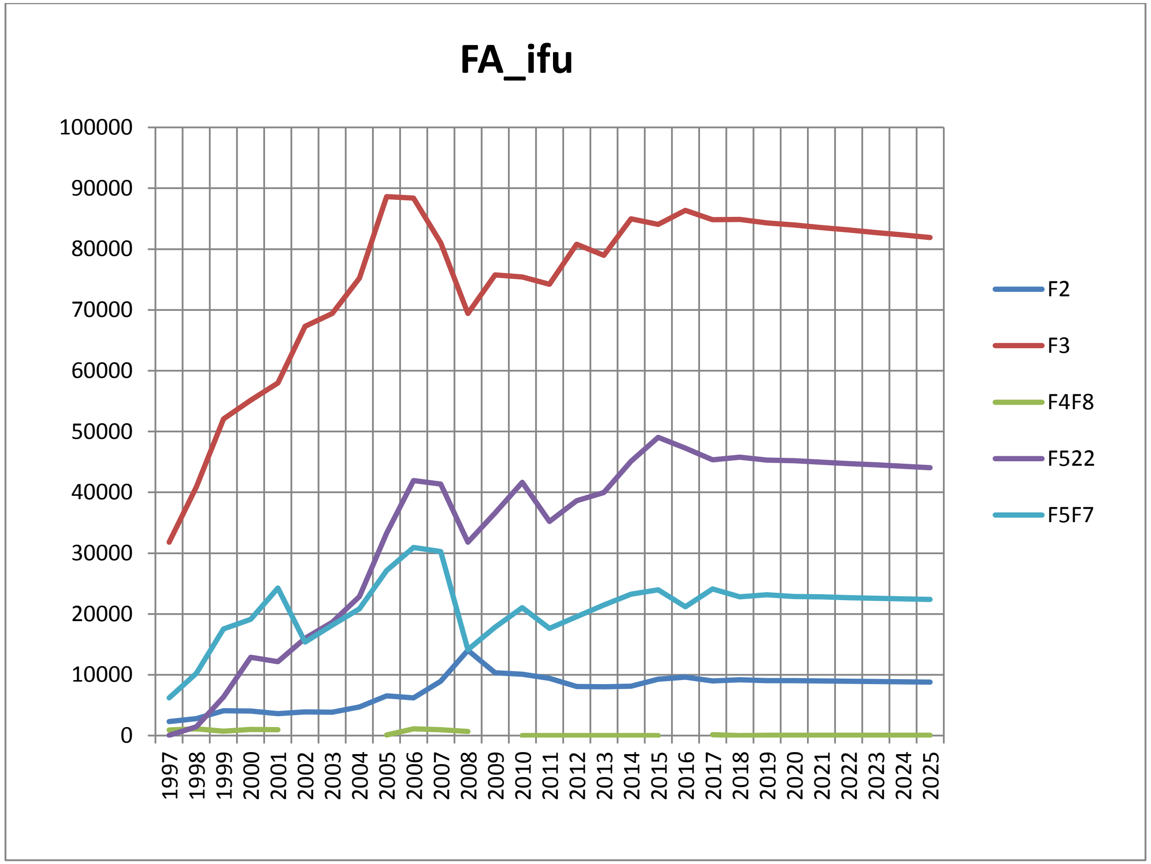


Figure 49: IFU: Financial liabilites by asset class - Data and BAU forecast (in mln. Euro)

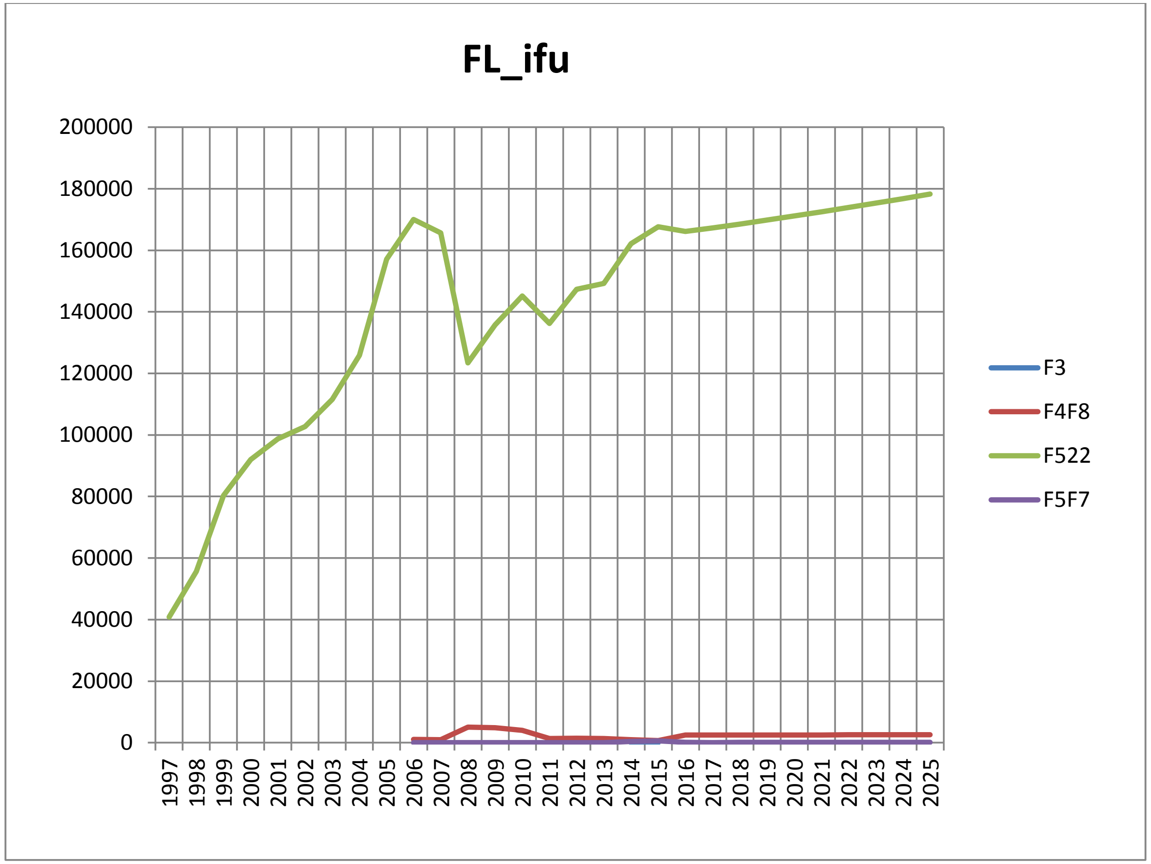


Table 18: Ofi: Change in log of total balance sheet length

	Dependent variable:				
	value				
	(1)	(2)	(3)	(4)	(5)
DEL_log_GDP	2.711*	2.632*	2.527*	2.135*	2.295*
	(1.504)	(1.422)	(1.259)	(1.192)	(1.164)
DEL_log_PD	3.703	3.652	3.101	1.202	
	(3.149)	(3.008)	(2.573)	(1.672)	
DEL_log_P_lag1	0.009				
	(0.445)				
NLNB_shr	0.477	0.453	0.421*	0.428*	0.481**
	(0.301)	(0.288)	(0.247)	(0.247)	(0.234)
DEL_log_r_ref	−0.006	−0.005			
	(0.024)	(0.023)			
Constant	−0.019	−0.019	−0.014		
	(0.018)	(0.018)	(0.015)		
Observations	36	37	42	42	42
R^2	0.201	0.196	0.189	0.189	0.178
Adjusted R^2	0.068	0.096	0.125	0.126	0.137
Residual Std. Error	0.063	0.062	0.057	0.057	0.057
F Statistic	1.513	1.953	2.961**	3.023**	4.329**

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 50: OFI: Regression results after backward elimination.
left: residuals vs. fitted values; right: fitted values (line) and data points (dots)

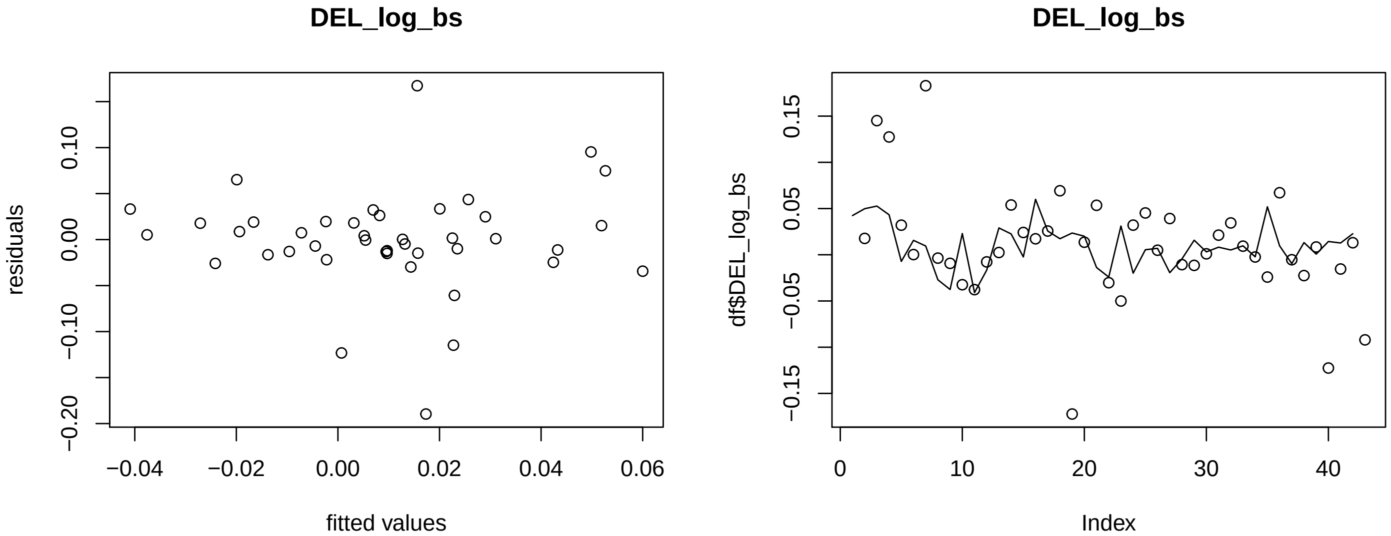


Table 19: Ofi: Asset Shares depending on expected returns

	Dependent variable:				
	F2	F3	F4F8	F522	F5F7
	(1)	(2)	(3)	(4)	(5)
ER_ipo_F2	−0.083	−0.014	0.015	0.011	0.071
	(0.064)	(0.020)	(0.064)	(0.033)	(0.112)
ER_ipo_F3	−0.020	0.089***	−0.308***	−0.166***	0.405***
	(0.045)	(0.014)	(0.044)	(0.023)	(0.078)
ER_ipo_F4F8	−0.023	0.003	−0.133	−0.078	0.231
	(0.092)	(0.028)	(0.092)	(0.047)	(0.161)
ER_ipo_F522	0.007	−0.022	0.048	0.039	−0.072
	(0.072)	(0.022)	(0.071)	(0.037)	(0.126)
ER_ipo_F5F7	0.048	0.054**	0.126	−0.025	−0.203
	(0.084)	(0.026)	(0.084)	(0.043)	(0.147)
Constant	0.057***	0.021***	0.094***	0.047***	0.781***
	(0.004)	(0.001)	(0.004)	(0.002)	(0.007)
Observations	43	43	43	43	43
R^2	0.054	0.695	0.675	0.723	0.546
Adjusted R^2	−0.074	0.654	0.631	0.686	0.484
Residual Std. Error	0.015	0.004	0.014	0.007	0.025
F Statistic	0.423	16.894***	15.362***	19.324***	8.887***

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 51: OFI: Share of investment of asset (F1-F5F7) in total balance sheet length

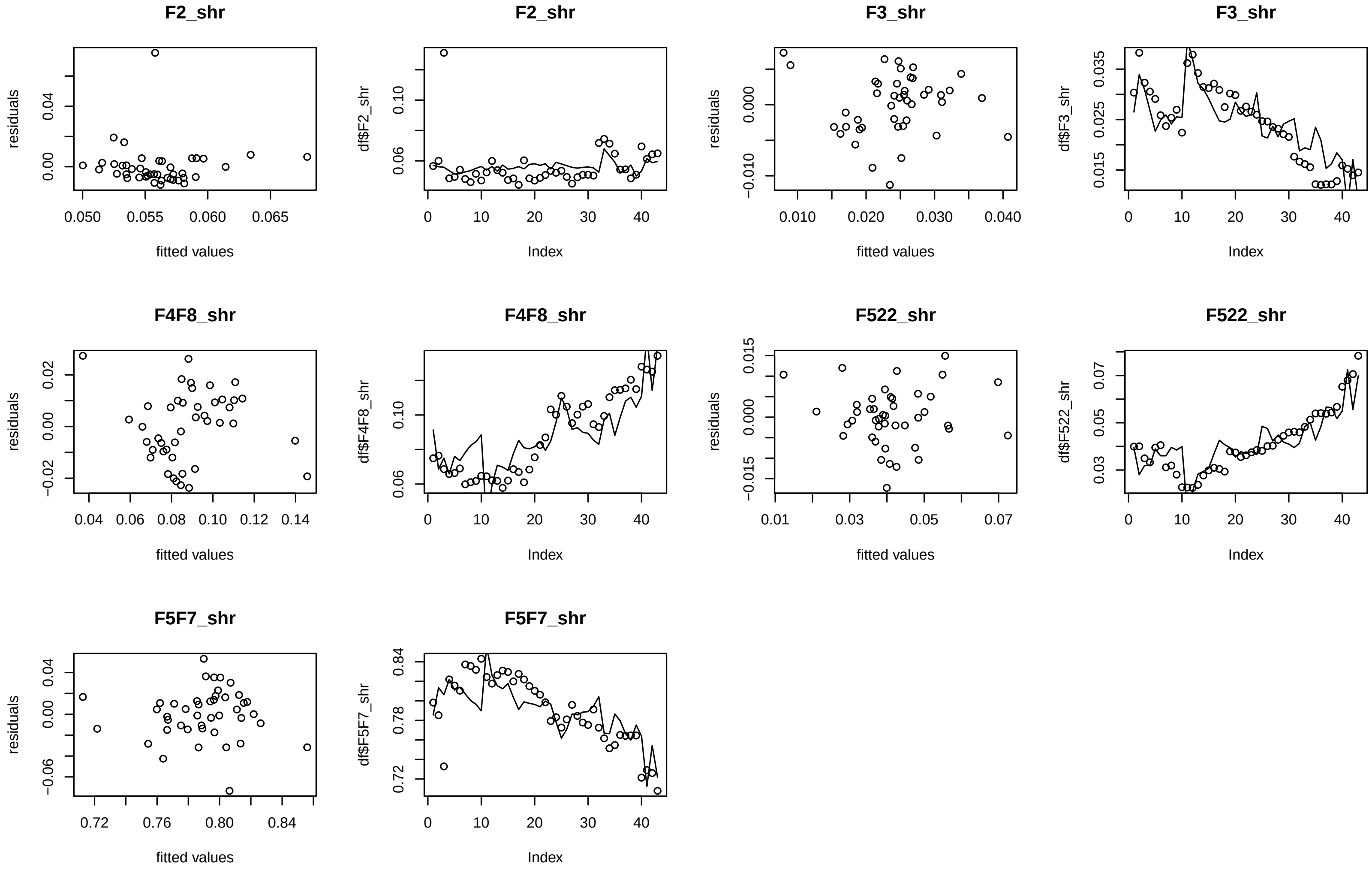


Table 20: OFI: Liabilities shares depending on expected returns

	Dependent variable:		
	F3	F4F8	F5F7
	(1)	(2)	(3)
ER_ipo_F3	−0.028	−0.002	0.031
	(0.021)	(0.025)	(0.025)
ER_ipo_F4F8	−0.016	−0.154	0.169*
	(0.080)	(0.097)	(0.095)
ER_ipo_F5F7	−0.312***	0.363***	−0.052
	(0.096)	(0.118)	(0.115)
Constant	0.029***	0.229***	0.741***
	(0.004)	(0.005)	(0.005)
Observations	43	43	43
R^2	0.299	0.198	0.133
Adjusted R^2	0.245	0.136	0.066
Residual Std. Error	0.016	0.020	0.019
F Statistic	5.541***	3.211**	1.992

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 52: OFI: share of liabilities paer asset type (F1-F5F7) in total liabilities

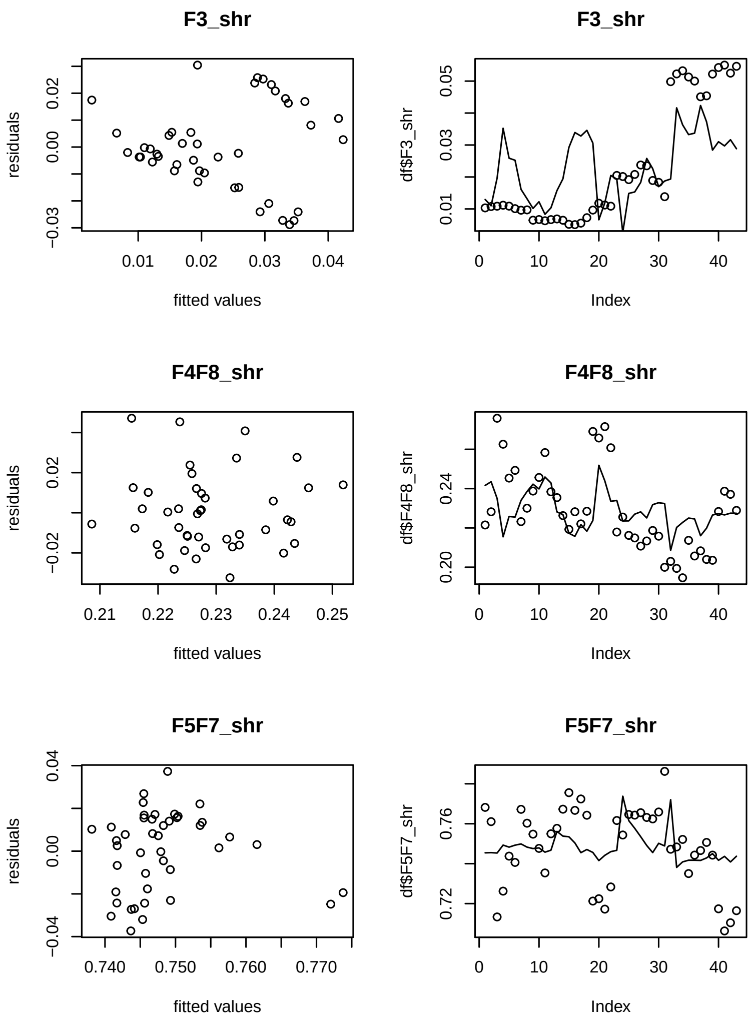


Figure 53: OFI: Financial assets by asset class - Data and BAU forecast (in mln. Euro)

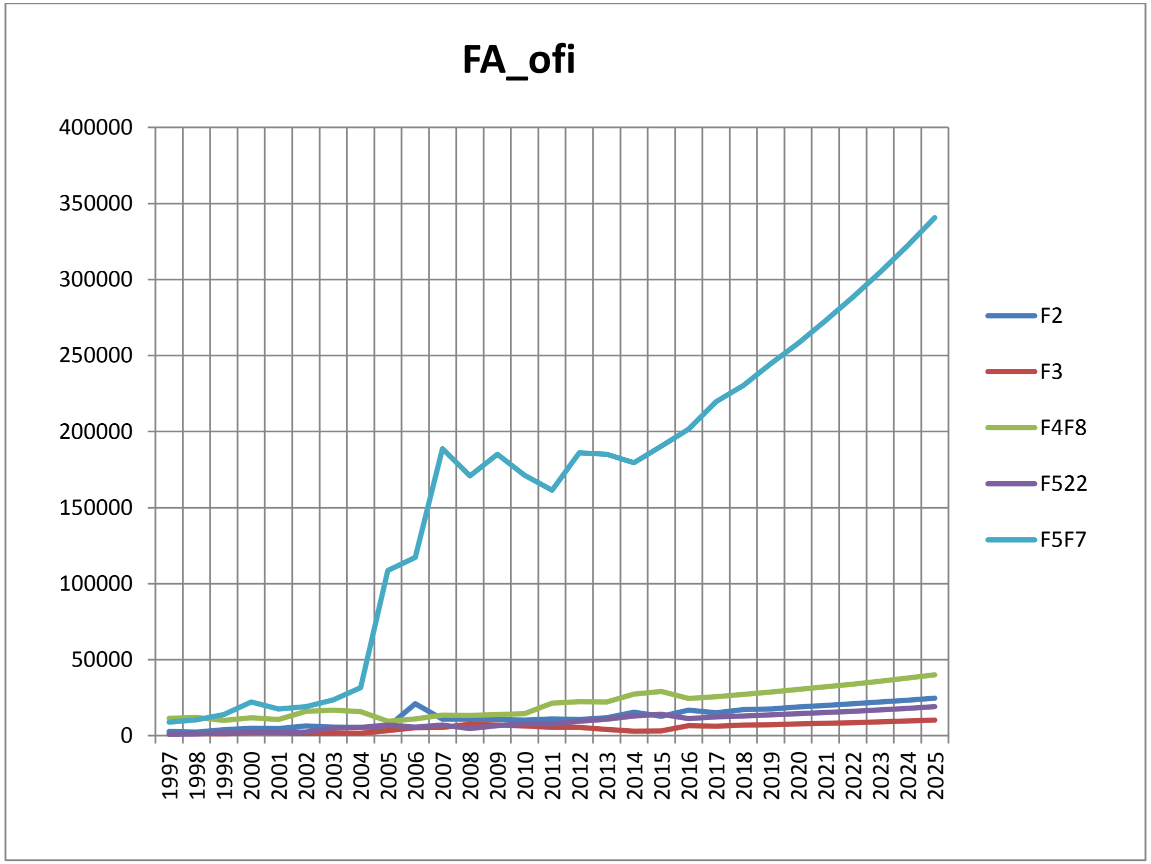


Figure 54: OFI: Financial liabilites by asset class - Data and BAU forecast (in mln. Euro)

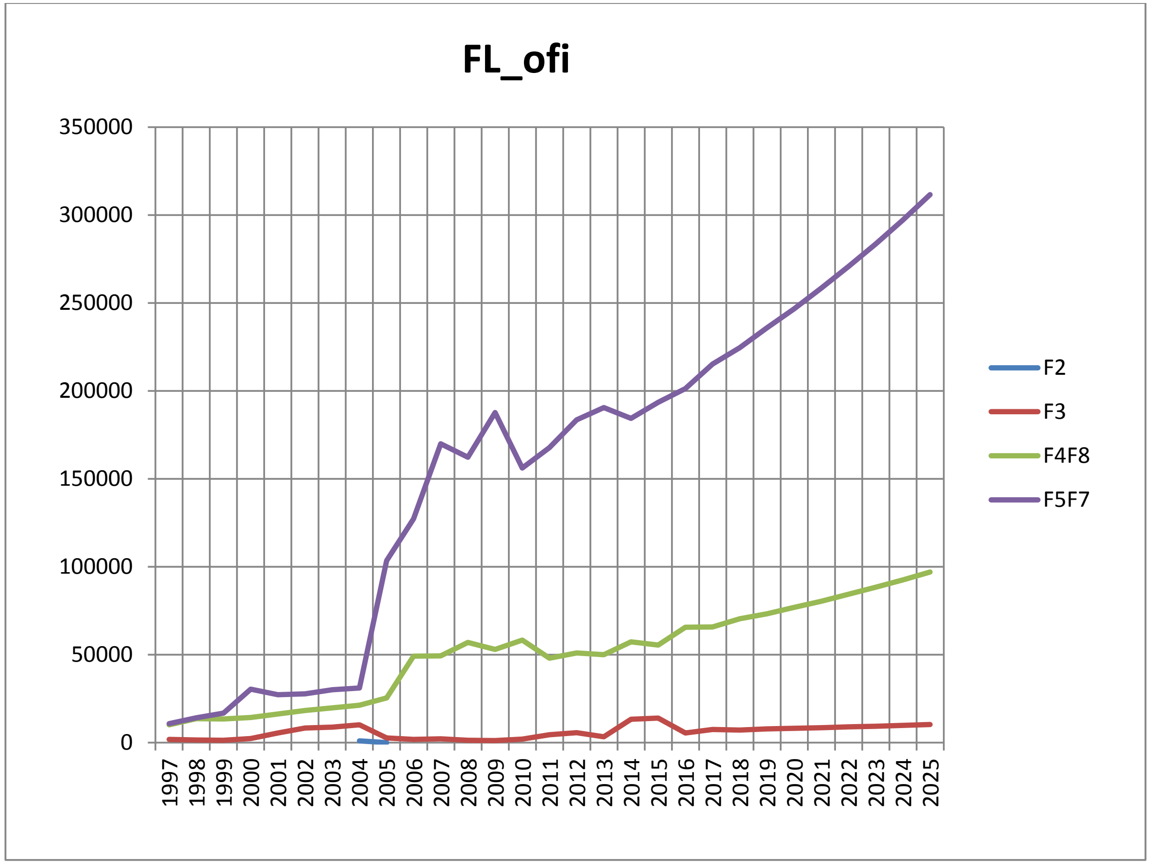


Table 21: ICPF: Change in log of total balance sheet length

	Dependent variable:			
	value			
	(1)	(2)	(3)	(4)
DEL_log_GDP	−0.296	−0.296	−0.279	
	(0.228)	(0.219)	(0.215)	
DEL_log_PD	−0.233	−0.246		
	(0.458)	(0.441)		
DEL_log_P_lag1	−0.060			
	(0.138)			
NLNB_shr	0.646***	0.646***	0.647***	0.635***
	(0.081)	(0.077)	(0.076)	(0.076)
DEL_log_r_ref	−0.045	−0.048	−0.052	−0.055*
	(0.034)	(0.033)	(0.032)	(0.032)
Constant	0.009***	0.009***	0.008***	0.007***
	(0.003)	(0.003)	(0.002)	(0.002)
Observations	41	42	42	42
R^2	0.679	0.684	0.681	0.667
Adjusted R^2	0.634	0.650	0.656	0.650
Residual Std. Error	0.010	0.010	0.010	0.010
F Statistic	14.830***	20.035***	27.100***	39.111***

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 55: ICPF: Regression results after backward elimination.
left: residuals vs. fitted values; right: fitted values (line) and data points (dots)

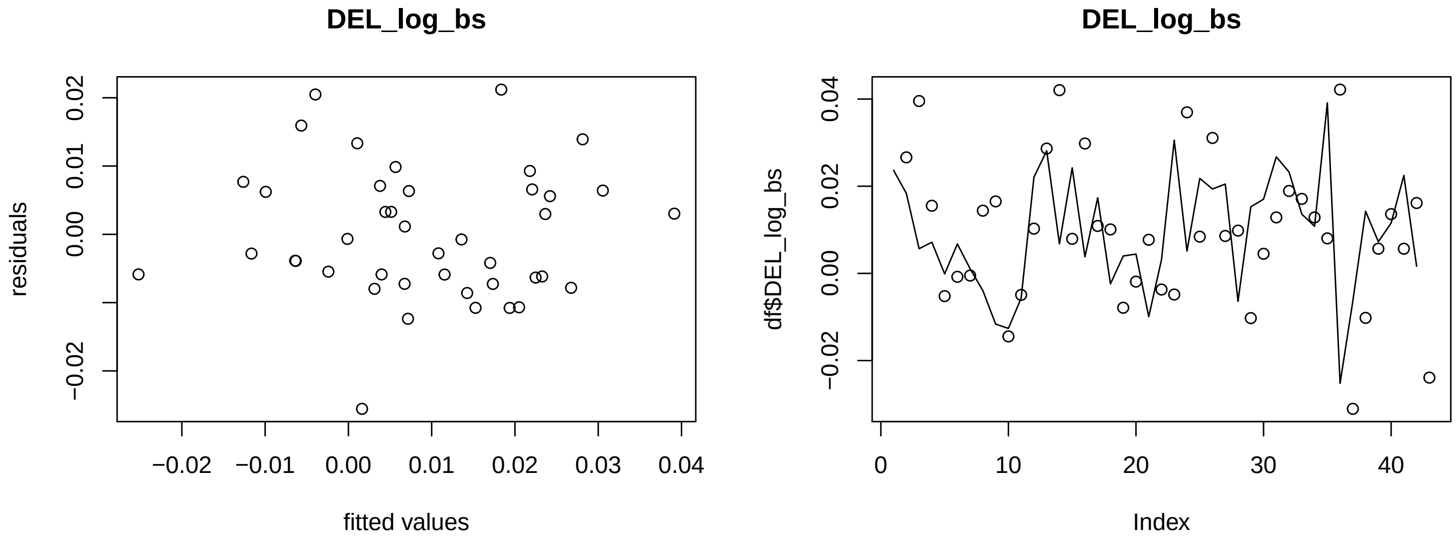


Table 22: ICPF: Asset Shares depending on expected returns

	Dependent variable:					
	F2	F3	F4F8	F522	F5F7	F6
	(1)	(2)	(3)	(4)	(5)	(6)
ER_ipo_F2	0.084	−0.066	0.307*	−1.979***	1.157***	0.498**
	(0.133)	(0.420)	(0.177)	(0.307)	(0.181)	(0.186)
ER_ipo_F3	−0.047	−1.090***	0.222**	0.468**	−0.079	0.526***
	(0.079)	(0.250)	(0.105)	(0.183)	(0.108)	(0.111)
ER_ipo_F4F8	0.018	−0.071	−0.054	0.190	−0.087	0.003
	(0.066)	(0.208)	(0.088)	(0.152)	(0.089)	(0.092)
ER_ipo_F522	0.165***	0.306*	0.029	−0.532***	0.107	−0.075
	(0.052)	(0.163)	(0.069)	(0.119)	(0.070)	(0.072)
ER_ipo_F5F7	−0.011	−0.013	0.025	−0.009	−0.015	0.022
	(0.023)	(0.071)	(0.030)	(0.052)	(0.031)	(0.032)
ER_ipo_F6	0.027	0.179	−0.083*	−0.086	0.129**	−0.165***
	(0.035)	(0.111)	(0.047)	(0.081)	(0.048)	(0.049)
Constant	0.031***	0.386***	0.055***	0.411***	0.084***	0.032***
	(0.004)	(0.012)	(0.005)	(0.009)	(0.005)	(0.005)
Observations	43	43	43	43	43	43
R^2	0.363	0.491	0.454	0.728	0.690	0.710
Adjusted R^2	0.257	0.407	0.362	0.683	0.638	0.662
Residual Std. Error	0.005	0.017	0.007	0.013	0.007	0.008
F Statistic	3.422***	5.796***	4.980***	16.070***	13.361***	14.704***
Note:						*p<0.1; **p<0.05; ***p<0.01

Figure 56: ICPF: share of investment of asset (F1-F5F7) in total balance sheet length

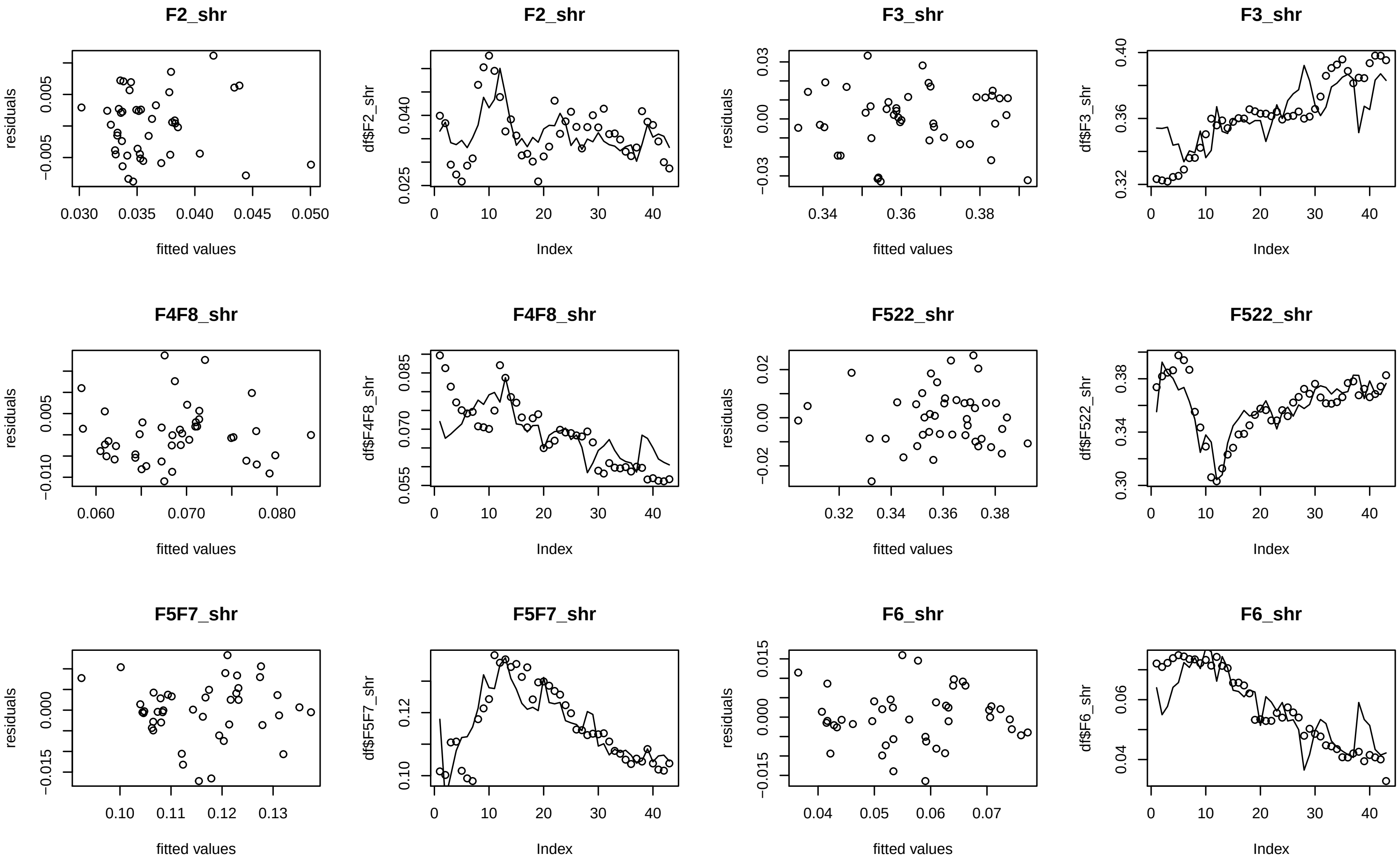


Table 23: ICPF: Liabilities shares depending on expected returns

	Dependent variable:			
	F3	F4F8	F5F7	F6
	(1)	(2)	(3)	(4)
ER_ipo_F3	0.107	0.044	−0.116	−0.035
	(0.068)	(0.115)	(0.126)	(0.136)
ER_ipo_F4F8	0.024	0.022	−0.016	−0.031
	(0.040)	(0.068)	(0.074)	(0.080)
ER_ipo_F5F7	0.021	−0.018	−0.152***	0.149***
	(0.016)	(0.026)	(0.029)	(0.031)
ER_ipo_F6	−0.640***	0.892***	0.773***	−1.024***
	(0.106)	(0.178)	(0.196)	(0.211)
Constant	0.040***	0.011**	0.098***	0.851***
	(0.003)	(0.004)	(0.005)	(0.005)
Observations	43	43	43	43
R^2	0.604	0.670	0.535	0.638
Adjusted R^2	0.563	0.635	0.486	0.600
Residual Std. Error	0.003	0.006	0.006	0.007
F Statistic	14.519***	19.277***	10.920***	16.739***

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 57: ICPF: share of liabilities paer asset type (F1-F5F7) in total liabilities

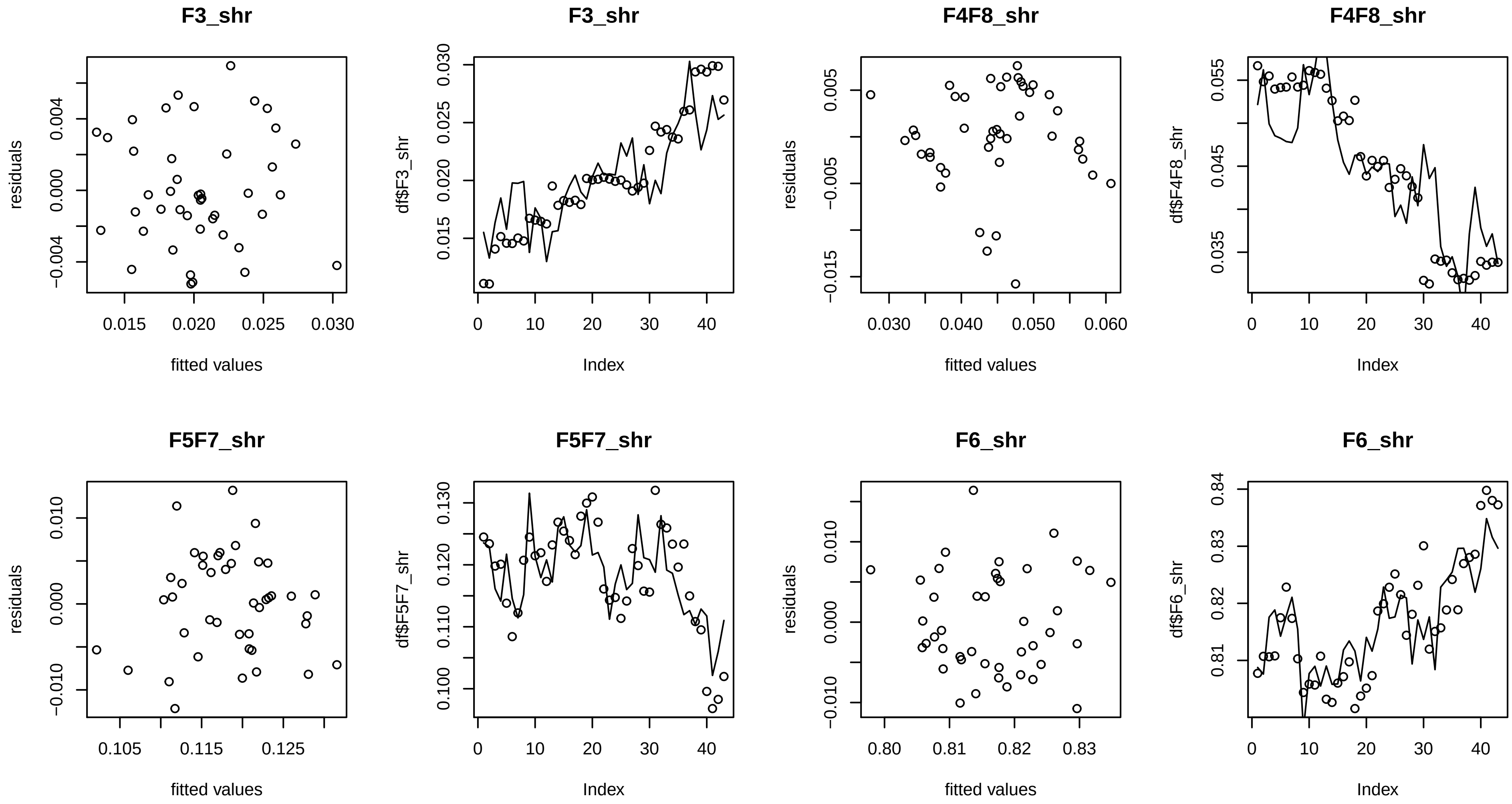


Figure 58: ICPF: Financial assets by asset class - Data and BAU forecast (in mln. Euro)

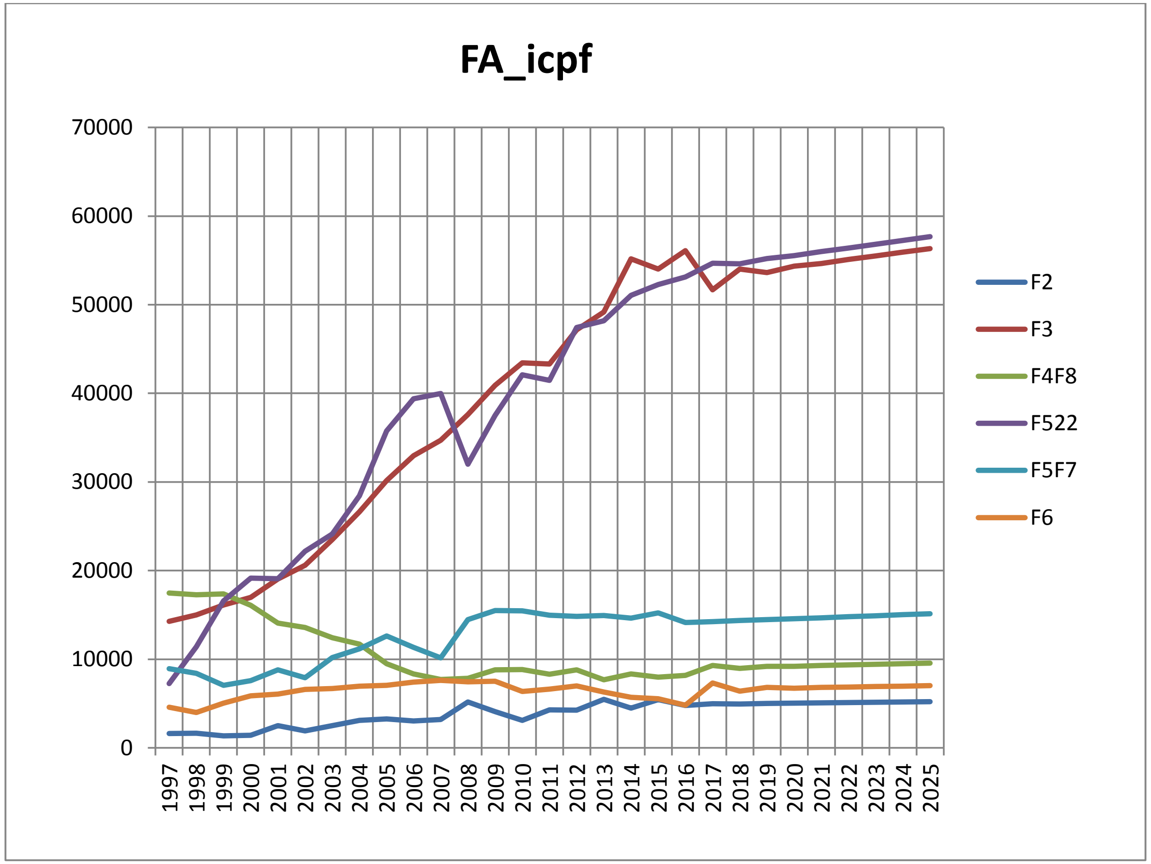


Figure 59: ICPF: Financial liabilites by asset class - Data and BAU forecast (in mln. Euro)

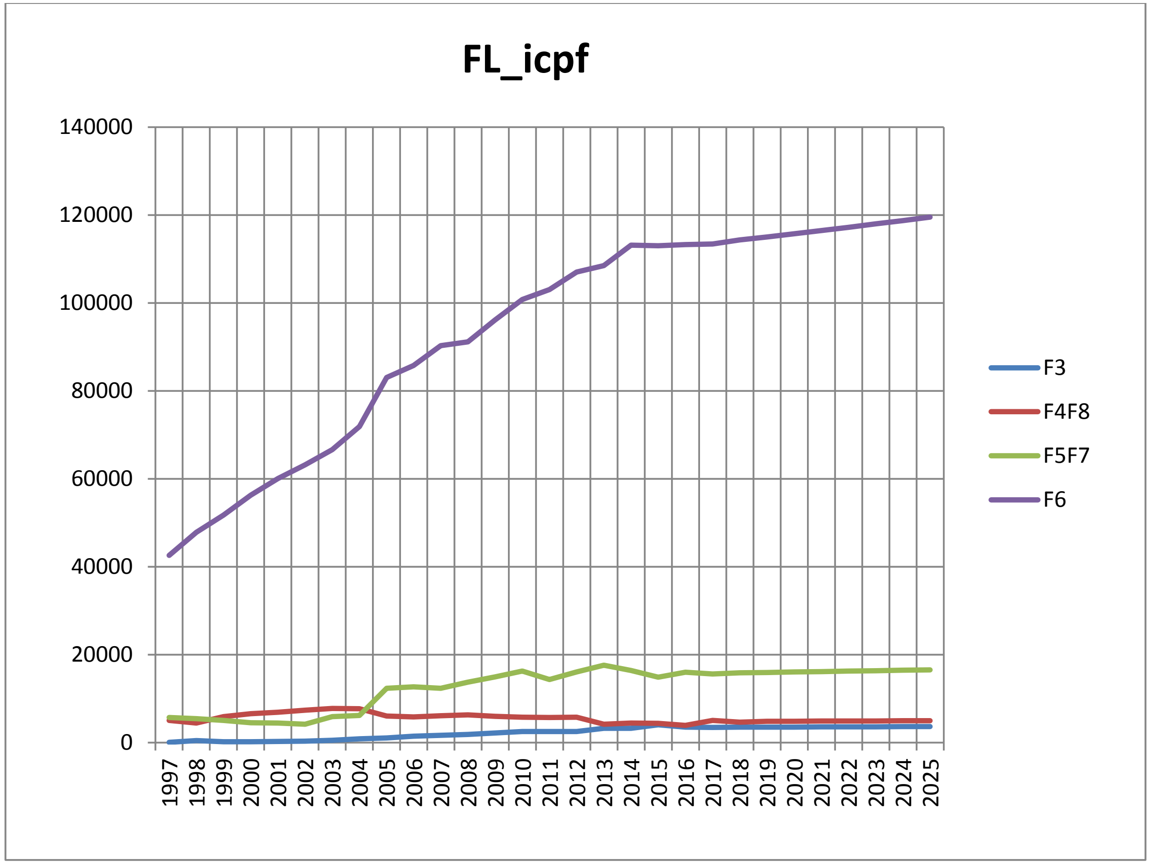


Table 24: Govt: Change in log of total balance sheet length

	Dependent variable:				
	value				
	(1)	(2)	(3)	(4)	(5)
DEL_log_GDP	0.838	0.832	1.095		
	(1.115)	(1.102)	(1.021)		
DEL_log_PD	2.237	2.053	3.167**	3.365**	3.800***
	(2.264)	(2.202)	(1.414)	(1.404)	(1.383)
DEL_log_P_lag1	−1.348***	−1.416***	−1.476***	−1.363***	−1.248***
	(0.469)	(0.439)	(0.426)	(0.414)	(0.410)
NLNB_shr	0.219	0.240	0.249	0.224	
	(0.175)	(0.167)	(0.165)	(0.163)	
DEL_log_r_ref	−0.061				
	(0.135)				
Constant	0.006	0.008			
	(0.013)	(0.012)			
Observations	41	41	41	41	41
R^2	0.238	0.234	0.304	0.282	0.247
Adjusted R^2	0.129	0.148	0.229	0.226	0.208
Residual Std. Error	0.047	0.047	0.047	0.047	0.047
F Statistic	2.186*	2.743**	4.041***	4.985***	6.396***

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 60: Government: Regression results after backward elimination.
left: residuals vs. fitted values; right: fitted values (line) and data points (dots)

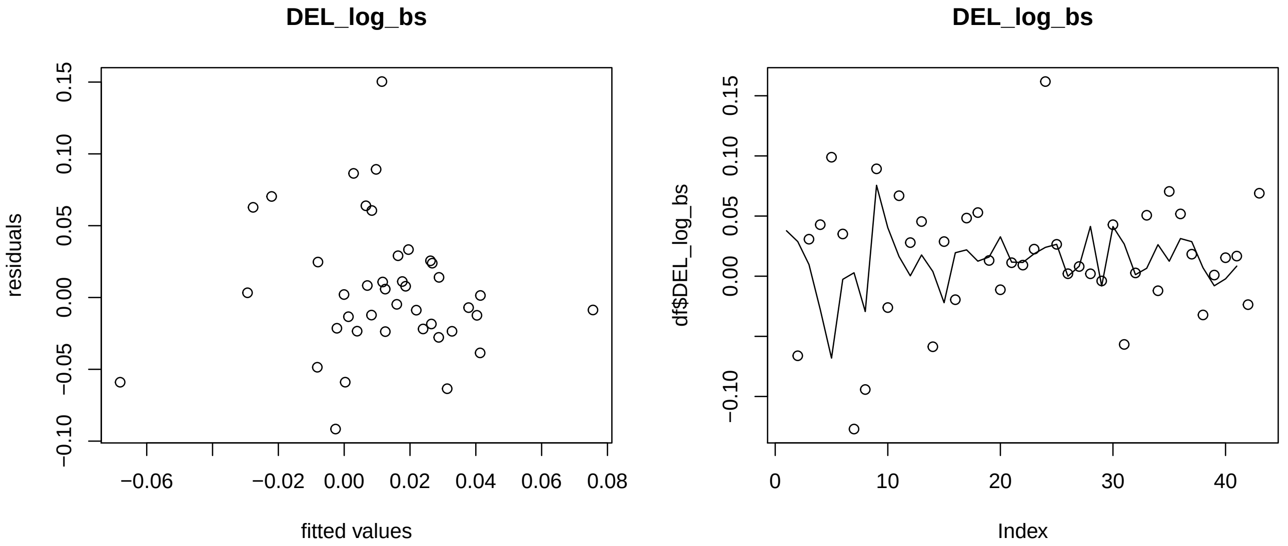


Table 25: Govt: Asset Shares depending on expected returns

	Dependent variable:				
	F2	F3	F4F8	F522	F5F7
	(1)	(2)	(3)	(4)	(5)
ER_ipo_F2	-0.490^{***}	0.455^{**}	0.046	0.069	-0.080
	(0.173)	(0.207)	(0.145)	(0.068)	(0.154)
ER_ipo_F3	0.050	0.239	-0.353	0.187	-0.123
	(0.382)	(0.455)	(0.319)	(0.149)	(0.339)
ER_ipo_F4F8	0.289	-0.194	-0.116	0.015	0.008
	(0.176)	(0.210)	(0.147)	(0.069)	(0.156)
ER_ipo_F522	-0.005	-0.023	-0.015	0.006	0.038^{*}
	(0.025)	(0.030)	(0.021)	(0.010)	(0.022)
ER_ipo_F5F7	0.085	0.039	0.026	0.010	-0.160^{**}
	(0.081)	(0.097)	(0.068)	(0.032)	(0.072)
Constant	0.116^{***}	0.129^{***}	0.382^{***}	0.045^{***}	0.328^{***}
	(0.006)	(0.007)	(0.005)	(0.002)	(0.005)
Observations	43	43	43	43	43
R^2	0.310	0.318	0.121	0.344	0.292
Adjusted R^2	0.216	0.226	0.002	0.255	0.197
Residual Std. Error	0.022	0.026	0.018	0.009	0.020
F Statistic	3.321^{**}	3.446^{**}	1.018	3.874^{***}	3.056^{**}

Note: $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Figure 61: Government: share of investment of asset (F1-F5F7) in total balance sheet length

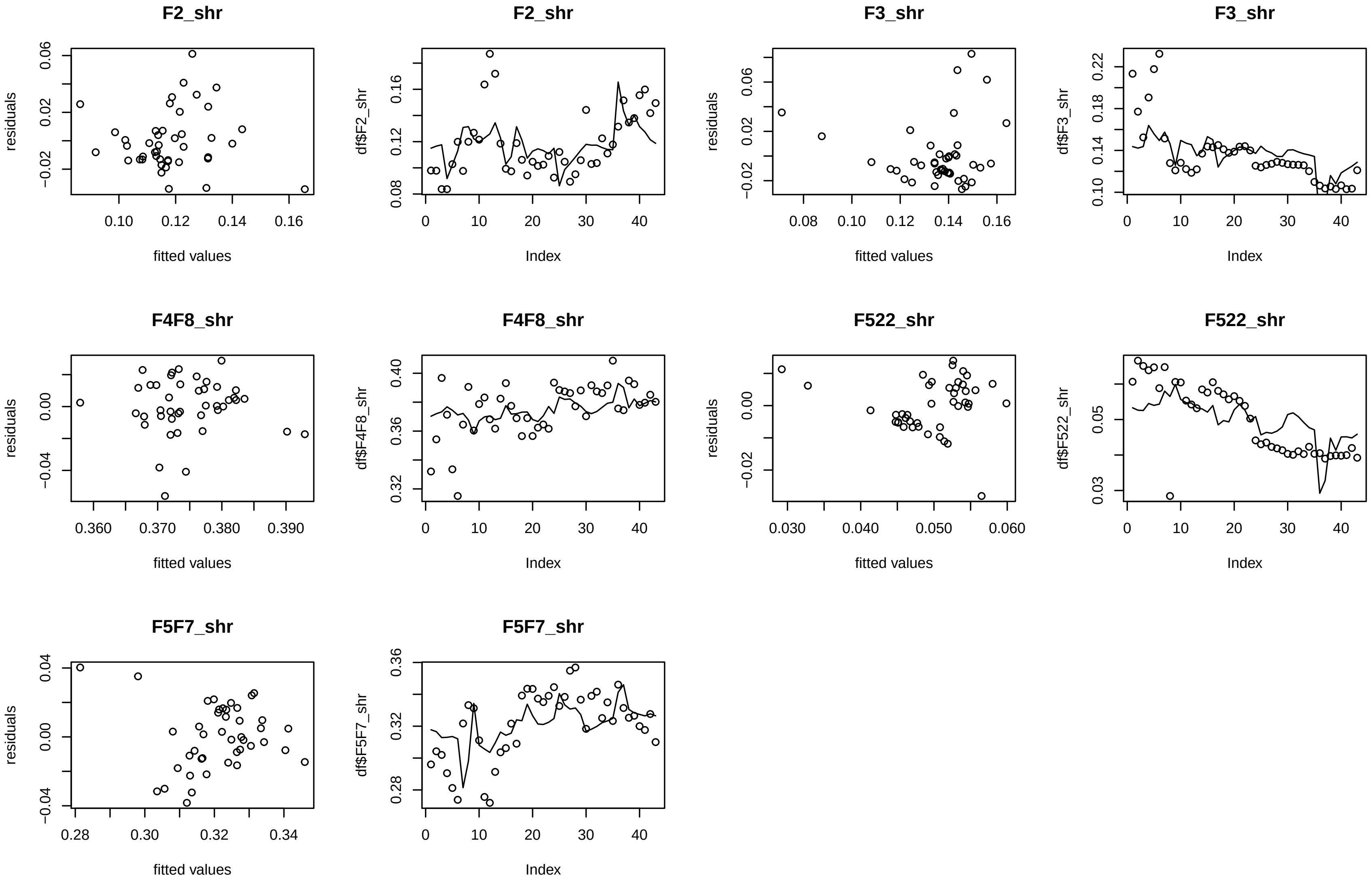


Table 26: Govt: liability shares depending on expected returns

	Dependent variable:				
	F2	F3	F4F8	F5F7	F6
	(1)	(2)	(3)	(4)	(5)
ER_ipo_F2	0.118***	−1.354***	0.467***	0.755***	0.013***
	(0.004)	(0.163)	(0.097)	(0.098)	(0.0001)
ER_ipo_F3	−0.004	0.030	−0.047	0.021	0.0001
	(0.003)	(0.115)	(0.068)	(0.069)	(0.0001)
ER_ipo_F4F8	0.005*	0.075	−0.011	−0.068	0.0001
	(0.002)	(0.096)	(0.057)	(0.058)	(0.0001)
ER_ipo_F522					
ER_ipo_F5F7	0.00000	−0.004***	0.002**	0.003***	−0.00000
	(0.00003)	(0.001)	(0.001)	(0.001)	(0.00000)
ER_ipo_F6	0.007	−0.801	0.733	0.061	−0.001
	(0.026)	(1.076)	(0.641)	(0.650)	(0.001)
Constant	0.00004	0.730***	0.199***	0.071***	−0.00001*
	(0.0001)	(0.006)	(0.004)	(0.004)	(0.00000)
Observations	43	43	43	43	43
R^2	0.979	0.781	0.555	0.755	0.999
Adjusted R^2	0.976	0.752	0.495	0.722	0.998
Residual Std. Error	0.0003	0.011	0.007	0.007	0.00001
F Statistic	344.107***	26.423***	9.220***	22.857***	5,565.523***

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 62: Government: share of liabilities paer asset type (F1-F5F7) in total liabilities

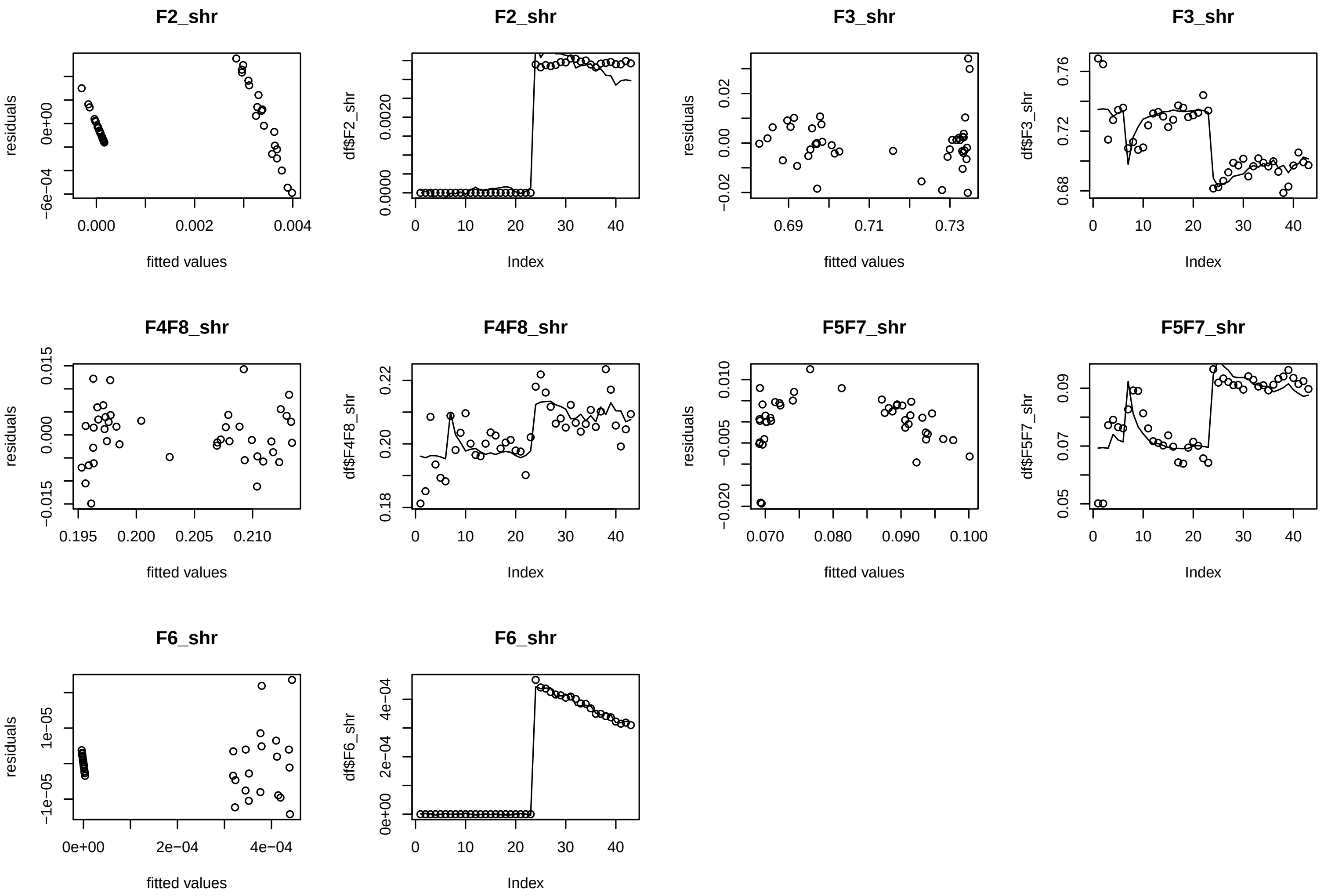


Figure 63: Govt: Financial assets by asset class - Data and BAU forecast (in mln. Euro)

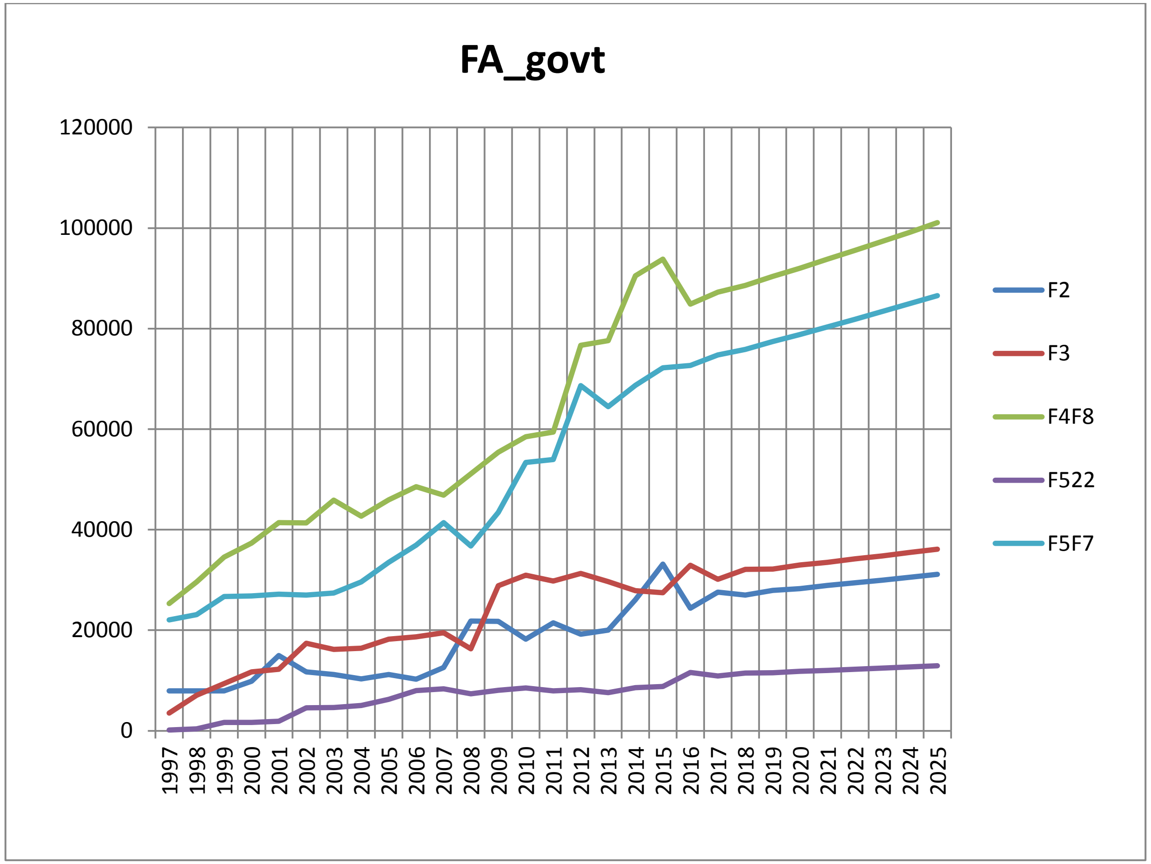


Figure 64: Govt: Financial liabilites by asset class - Data and BAU forecast (in mln. Euro)

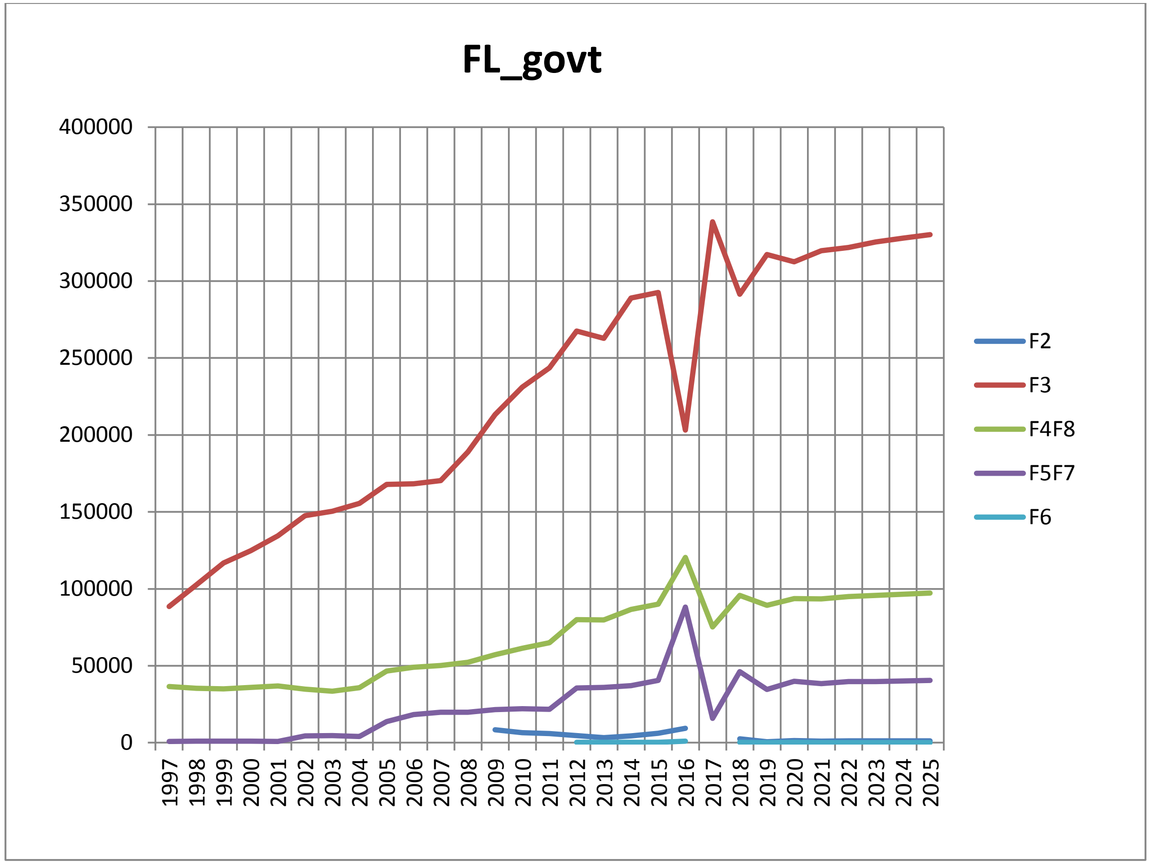


Table 27: Household: Change in log of total balance sheet length

	Dependent variable:				
	value				
	(1)	(2)	(3)	(4)	(5)
DEL_log_GDP	0.132	0.169	0.097		
	(0.218)	(0.195)	(0.168)		
DEL_log_PD	−0.362	−0.341	−0.400	−0.422	
	(0.355)	(0.345)	(0.334)	(0.329)	
DEL_log_P_lag1	0.060				
	(0.219)				
NLNB_shr	1.058***	1.083***	1.099***	1.112***	1.136***
	(0.186)	(0.175)	(0.172)	(0.170)	(0.170)
DEL_log_r_ref	−0.009	−0.009			
	(0.012)	(0.012)			
Constant	0.008***	0.008***	0.009***	0.009***	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Observations	41	42	42	42	42
R^2	0.552	0.558	0.551	0.547	0.528
Adjusted R^2	0.488	0.510	0.516	0.524	0.516
Residual Std. Error	0.008	0.008	0.008	0.007	0.008
F Statistic	8.616***	11.662***	15.543***	23.549***	44.736***
Note:					*p<0.1; **p<0.05; ***p<0.01

Figure 65: Household: Regression results after backward elimination.
left: residuals vs. fitted values; right: fitted values (line) and data points (dots)

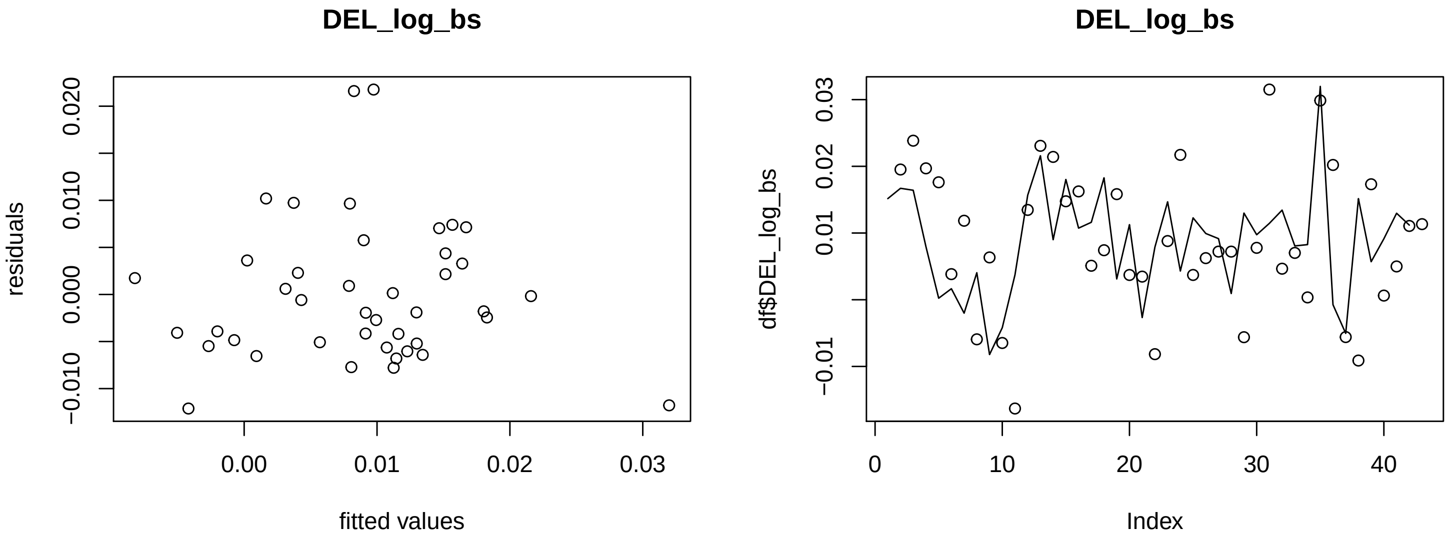


Table 28: Household's Asset Shares depending on expected returns

	Dependent variable:					
	F2	F3	F4F8	F522	F5F7	F6
	(1)	(2)	(3)	(4)	(5)	(6)
ER_ipo_F2	1.848***	2.024***	−0.146*	−2.442***	−1.579***	0.294**
	(0.297)	(0.272)	(0.074)	(0.307)	(0.234)	(0.108)
ER_ipo_F3	−0.201	0.098	−0.088*	0.187	−0.071	0.075
	(0.194)	(0.177)	(0.048)	(0.200)	(0.153)	(0.071)
ER_ipo_F4F8	0.232**	−0.026	0.031	−0.207**	−0.019	−0.010
	(0.088)	(0.081)	(0.022)	(0.091)	(0.070)	(0.032)
ER_ipo_F522	0.320***	0.131***	0.089***	−0.421***	−0.133***	0.015
	(0.051)	(0.047)	(0.013)	(0.053)	(0.040)	(0.019)
ER_ipo_F5F7	−0.111**	−0.142***	−0.050***	0.288***	0.003	0.011
	(0.041)	(0.038)	(0.010)	(0.043)	(0.033)	(0.015)
ER_ipo_F6	−0.567*	−0.608**	−0.169**	1.115***	0.455*	−0.226**
	(0.287)	(0.262)	(0.072)	(0.296)	(0.226)	(0.104)
Constant	0.402***	0.069***	0.040***	0.060***	0.228***	0.201***
	(0.005)	(0.004)	(0.001)	(0.005)	(0.004)	(0.002)
Observations	43	43	43	43	43	43
R^2	0.792	0.704	0.931	0.744	0.881	0.532
Adjusted R^2	0.757	0.655	0.920	0.701	0.861	0.454
Residual Std. Error	0.006	0.006	0.002	0.006	0.005	0.002
F Statistic	22.789***	14.262***	81.079***	17.433***	44.532***	6.825***
Note:				*p<0.1; **p<0.05; ***p<0.01		

Figure 66: Household: share of investment of asset (F1-F5F7) in total balance sheet length

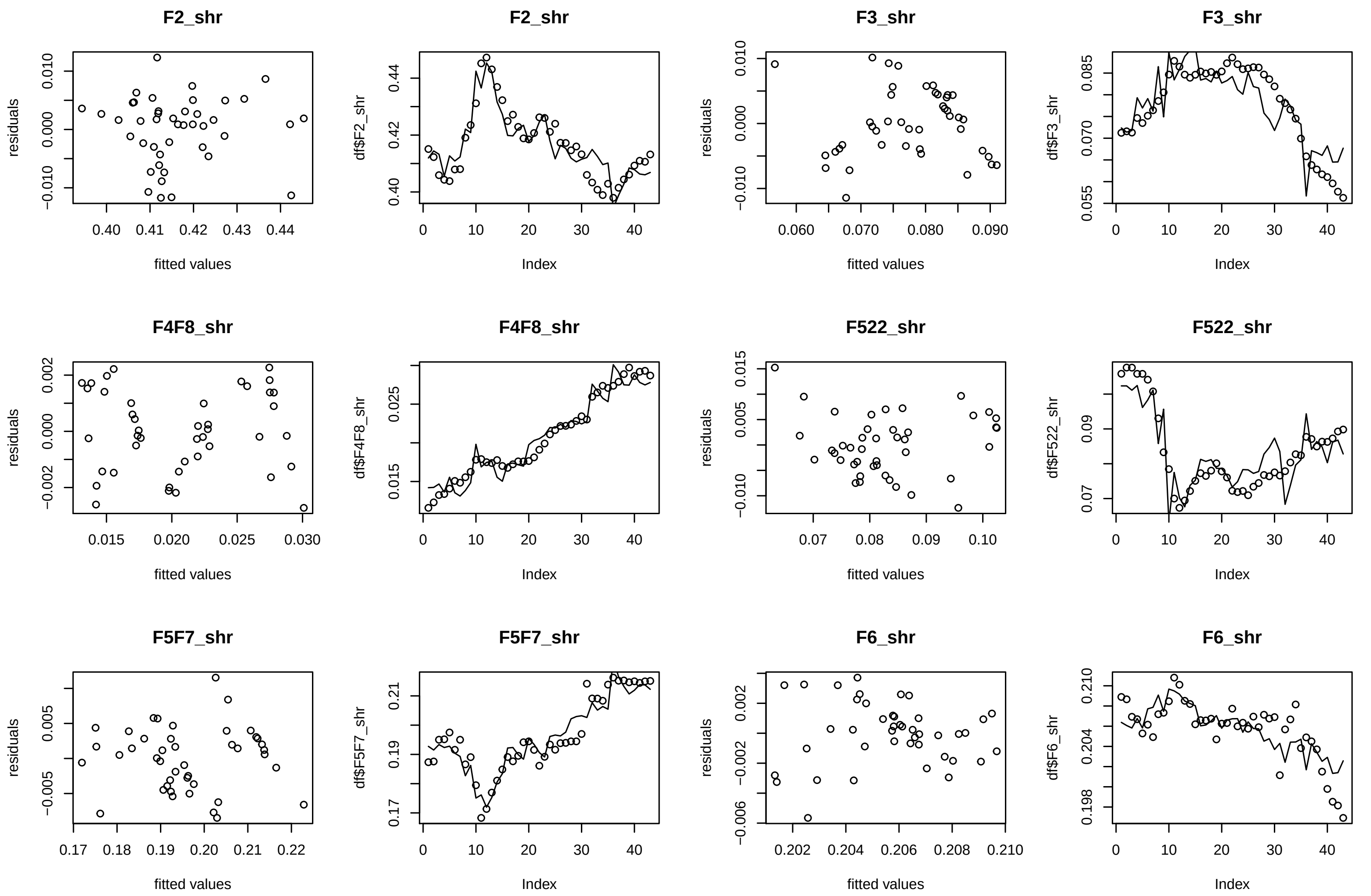


Table 29: Household: liabilities Shares depending on expected returns

	Dependent variable:	
	F4F8	F5F7
	(1)	(2)
ER_ipo_F4F8	0.004***	−0.004***
	(0.001)	(0.001)
ER_ipo_F5F7	0.00005	−0.00004
	(0.0001)	(0.0001)
Constant	1.000***	0.0001***
	(0.00001)	(0.00001)
Observations	43	43
R^2	0.526	0.569
Adjusted R^2	0.503	0.547
Residual Std. Error	0.00003	0.00003
F Statistic	22.215***	26.357***
Note:	*p<0.1; **p<0.05; ***p<0.01	

Figure 67: Household: share of liabilities paer asset type (F1-F5F7) in total liabilities

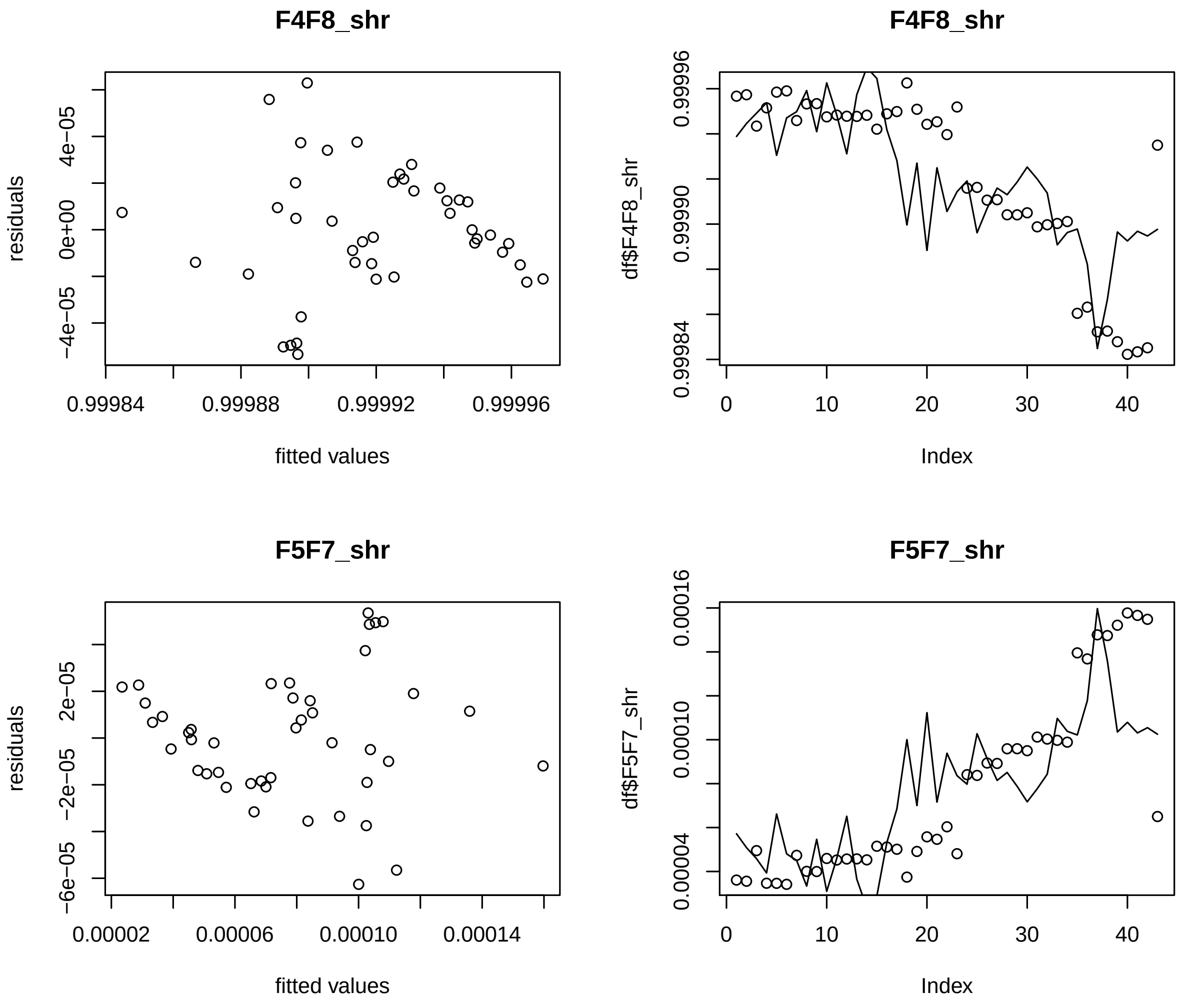


Figure 68: HH: Financial assets by asset class - Data and BAU forecast (in mln. Euro)

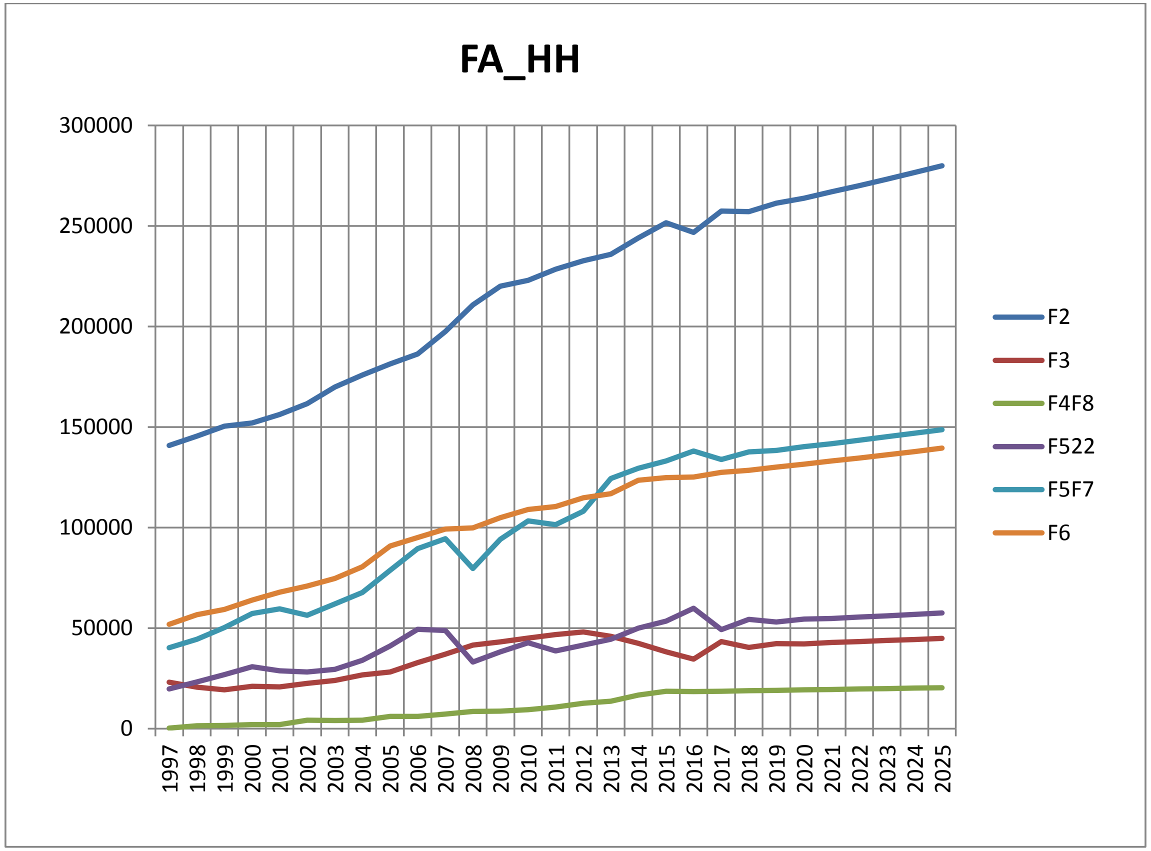
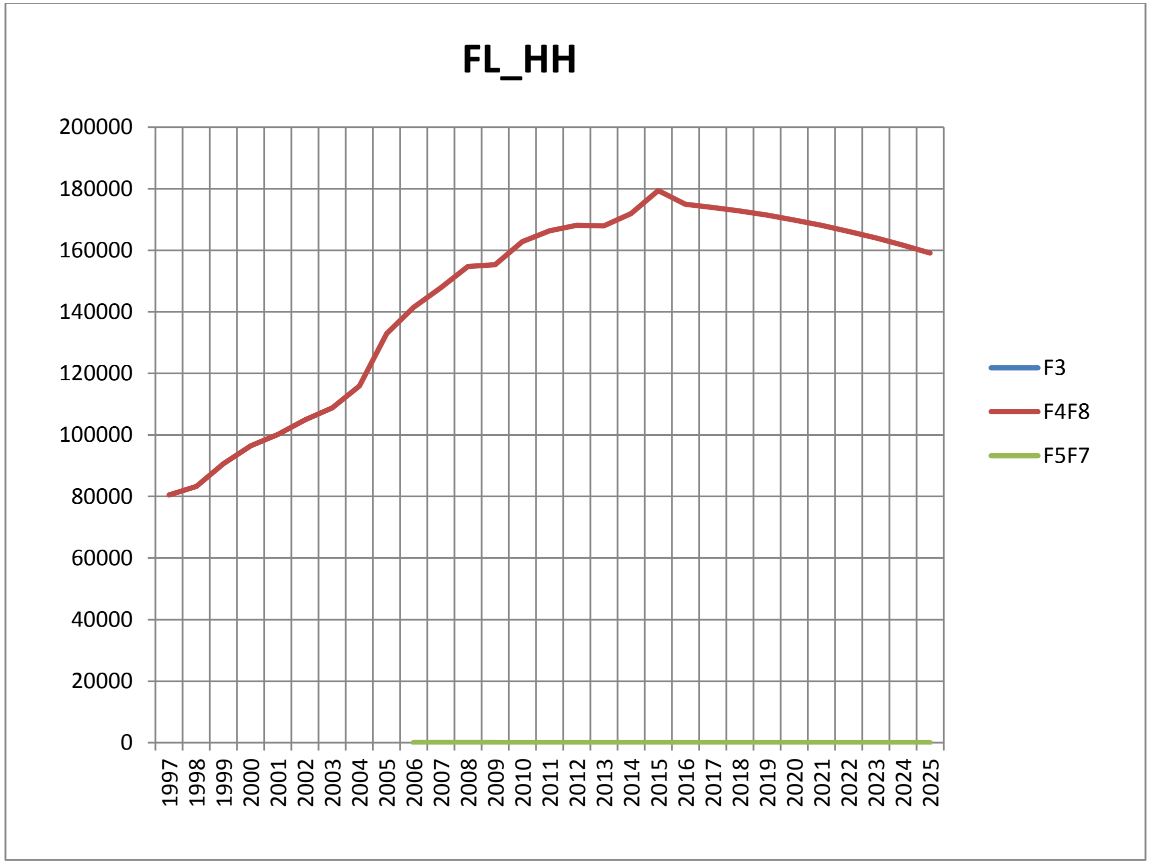


Figure 69: HH: Financial liabilites by asset class - Data and BAU forecast (in mln. Euro)



Authors: Stefan Schmelzer, Michael Miess
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Projektbericht/ Research Report

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