Using Microdata to analyse Macroprudential Policy and Financial Stability: the effort in Austria

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Outline



2 Literature

- Household Finance and Consumption Survey
 - 4 Definitions
- 5 Indebtedness of Vulnerable Households
- 6 Stress Testing Households
 - Integration of Micro and Macro Information/Tools
- 8 Further Analyses
 - Concluding Remarks

INTRODUCTION

- Information at the micro level essential for the anlysis of macroprodential policy and financial stability
 - ... distribution matters
 - ... many indicators not available form macro statistics (LTV, DTI)
 - micro level information supplements other data
- Presentation based on work over the last years
- Wider context of micro and macro data integration

3 / 68

INTRODUCTION



26th May 2015 4 / 68

INTRODUCTION

	No. of loans	Median (EUR th)	Mean (EURO th)	Mean/Median	Share of loans (%)	Total (EUR billion)	Share of Volume (%)
Foreign (Bank, FI)	9,896	3,899	20,242	5.2	8.6	200	29.6
Foreign Company	11,585	1,952	5,910	3.0	10.1	68	10.1
Bank, Fl	6,336	3,067	35,966	11.7	5.5	228	33.7
Company	54,903	802	2,837	3.5	47.6	156	23.0
Person	32,537	492	722	1.5	28.2	23	3.5
Total	115,257					676	

Figure: Credit Level Data (Loans>350,000 Euro):

- Close to full loan volume to companies covered
- About 18% of loan volume to households covered, and about 25% with regard to mortgage loans
- 350,000 treshold crossed at P98 of HFCS mortgage loans, so roughly 12,000 such loans covered, but in lower area (largest about 700,000)

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PROBLEMS ON THE MACRO-SIDE

Sparse information on households. In Austria

- Nothing on some measures, e.g. LTV, DTI, etc.
- > Data from banks come in bins, full distribution is not available
- Additional information like income or wealth of household missing (at least partly)
- Usually circumvent with crude assumptions
- Individuals might use different banks

 \Rightarrow Survey data supplement information from administrative sources.

DIFFICULTIES ON THE SURVEY-SIDE

- (Sub-)sample size.
- Information from memory of households (recollection bias).
- Missing information.
- \Rightarrow Integrated approach necessary.

Literature



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26th May 2015 8 / 68

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Household Finance and Consumption Survey (HFCS)



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26th May 2015 11 / 68

$\mathrm{HFCS} \hookrightarrow \mathsf{Basics}$

- Household Finance and Consumption Survey \Longrightarrow HFCS
- Euro area wide effort to collect micro data on household finances (Decision of the Gouverning Council in December 2006)
- 1st wave 2010/2011 with 15 countries
- Ongoing project with intention to collect data every 3 years
- 2nd wave under way (publishing of the data in summer 2016)
- Ex-ant harmonization not only of the questionnaire but the whole data production process
- Computer Assisted Personal Interviews (CAPI, exception: the Netherlands, Finland to some extent)
- Harmonized Bayesian-based multiple Imputation procedure (state of the art)
- ECB coordinates project and checks the quality
- First wave net sample 62.521 households in the euro area, 2.380 in Austria (SCF in the USA: 6.500)
- Role model for the HFCS is the SCF of the US Federal Reserve

$\mathrm{HFCS} \hookrightarrow \mathsf{Analyses}$

- Very wide usage of the HFCS in the research community. For the ESCB particularly important with respect to:
 - Monetary Policy (transmission mechanism, distributional effect of monetary policy, etc.)
 - Macroprudential policy and financial stability (distribution of debt and assets, analyses on vulnerability, etc.)
- Importance of cross country comparability due to harmonization
 ⇒ Analyses can be done at the euro area level.

$\mathrm{HFCS} \hookrightarrow \mathsf{Household's}$ Balance Sheet

HOUSEHOLDS' BALANCE SHEET

ASSETS

Real assets:

- Main residence
- · Other real estate property
- Investments in self-employed businesses
- Vehicles
- Valuables
- ÷

Financial assets:

- Sight accounts
- Savings deposits
- Savings plans with building and loan associations
- · Life insurance policies
- Mutual funds
- Debt securities
- · Publicly traded stocks
- · Money owned to household
- Other
 - GROSS WEALTH

LIABILITIES

Collateralized debt:

- by main residence
- by other real estate property

+

Uncollateralized debt:

- Bank overdrafts
- Credit card debt
- Other uncollateralized loans

DEBT

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14 / 68

GROSS WEALTH minus DEBT = NET WEALTH

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$\mathrm{HFCS} \hookrightarrow \mathsf{Additional}$ Information

Additional information on

- Income
- Consumption (expenditures)
- Employment
- Age
- Education
- etc.

$\mathrm{HFCS} \hookrightarrow \mathsf{Specific}$ information on liabilities

Information on each loan (up to three for every category) on:

- year when it was taken out
- level of amount at the time the contract was signed and outstanding at the time of the interview
- interest rates (level and fixed vs. variable)
- maturity
- repayment
- o purpose
- bullet loan (in AT)
- foreign currency loan (in AT)
- some information on renegotiation and additional money taken out

Very few households with more than three loans in a category.

$\mathrm{HFCS} \hookrightarrow \mathsf{Basic\ results\ I}$

Household Debt Participation and Shares of Debt Types

Debt Participation





Mortgage and nonmortgage debt Nonmortgage debt only

Source: HFCS Austria 2010, OeNB.

Shares of Debt Types

As a percentage of aggregated total debt



$\mathrm{HFCS} \hookrightarrow \mathsf{Basic\ results\ II}$

Debt Participation and Debt Level across Gross Wealth and Income Distributions



Conditional Median Debt across Gross Wealth Quintiles



% 60 50 40 50 70 70 71° quintile 2°" quintile 3°" quintile 4°° quintile 5°° quintile

Debt Participation across Gross Income Quintiles

Conditional Median Debt across Gross Income Quintiles



Definitions



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DEFINITIONS \hookrightarrow Probability of default (PD)

- In the supervisory framework, the PD of a household/loan refers to the probability that a household defaults within one year. A loan is defaulted if one of the default criteria under Basel II are met: full repayment unlikely and/or interest or principal payments on a material exposure more than 90 days past due. If PD_i = 1, the household has already defaulted. For non-defaulted households the PD lies in the open interval (0, 1) and is assigned by the bank to all indepted households / loans.
- Micro / household (HH) level literature: binary classification used, with PD(HH) defined as follows:

 $PD_i = 1$ if household i is classified as vulnerable. If not vulnerable $PD_i = 0$.

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DEFINITIONS \hookrightarrow Exposure at Risk / Default (SEvH, EAD)

Discrepancy of "exposure at default" (supervisory term) and "exposure at risk/default" (micro-literature):

- Supervisory: All on-balance credit and some part of the (off balance) credit lines
- Micro-level: share of debt held by households classified as vulnerable (denote this set by V):

 $SEvH = \frac{\sum_{i \in V} Debt_i}{\sum_{i \in D} Total Debt_i}$ where D is the set of indebted households.

DEFINITIONS \hookrightarrow Loss given Default (LGD)

Discrepancy of LGD in the micro-literature and as supervisory term

- Supervisory: specifies the proportion of a loan exposure that will be lost (i.e. will not be recoverable) under the assumption that the borrower defaults. The LGD represents a credit risk parameter that is used for determining a bank's capital requirement under the advanced internal ratings-based (IRB) approach of Basel II.
- Micro-level: estimated loss for banks caused by vulnerable households share of debt held by households classified as vulnerable and have negative equity (denote this set by A):

$$LGD = rac{\sum_{i \in A} (Debt_i - Assets_i)}{\sum_{i \in D} Total \ Debt_i}$$

$Definitions \hookrightarrow Standard definitions of vulnerability$

Three (four) definitions of vulnerability:

- Negative financial margin (FM): FM_i = Y_i − BC_i − DS_i where Y_i is income of household *i*, BC_i is basic consumption of household *i*, and DS_i is debt service of household *i* ⇒ Household *i* is vulnerable if FM_i < 0
- Debt to asset ratio: $DA_i = \frac{Total \ Debt_i}{Total \ Assets_i} \Rightarrow$ Household *i* is vulnerable if $DA_i \ge 75\%$
- Debt service to income: $DSI_i = \frac{Debt Service_i}{Y_i} \Rightarrow$ Household *i* is vulnerable if $DSI_i \ge 40\%$
- Direct question: "Expenses above income" and being indebted.

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$VULNERABILITY \hookrightarrow Preview of the some results$

Distribution of Debt Burden Measures across Percentiles



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$\operatorname{VULNERABILITY} \hookrightarrow \mathsf{Preview}$ of the some results

Vulnerability Measures across Household Groups

Variables	Debt to asset ≥75%	Debt service to income ≥40%	Expens- es above income
All	18.8	5.0	18.9
1–20 gross income pct 21–40 gross income pct 41–60 gross income pct 61–80 gross income pct 81–100 gross income pct	40.1 22.4 20.0 14.2 9.3	20.2 3.8 6.1 2.5 1.9	27.2 21.9 13.7 21.4 14.5
1–20 gross wealth pct 21–40 gross wealth pct 41–60 gross wealth pct 61–80 gross wealth pct 81–100 gross wealth pct	60.2 25.2 10.4 6.6	8.5 4.2 4.7	26.4 20.5 17.8 17.4

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Indebtedness of Vulnerable Households



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$\mathrm{VULNERABLE}\ \mathrm{HOUSEHOLDS} \hookrightarrow \mathsf{Indebtedness}$

Debt Holding, Indebtedness and Negative Wealth of Vulnerable Households

Participation (%)		(%)	Indebtedness (EUR)			Has Negative Net Wealth (%)		
Vulnerability measure	Has mortgage debt	Has nonmort- gage debt	Median debt	Median mortgage debt	Median nonmort- gage debt	All debt holders	Mortgage debt holders	Nonmort- gage debt holders
Debt to asset ≥75%	18.8	87.6	18,400	220,565	9,232	78.9	42.9	83.2
Debt service to income ≥40%	58.7	61.4	51,301	89,434	4,195	29.7		39.2
Expenses above income	39.0	75.0	13,473	32,223	3,794	22.7	2.2	29.8

Source: HFCS Austria 2010, OeNB.

Note: Cells that cannot be estimated because of no observations in some of the multiple imputation implicates are marked with "...".

$\mathrm{VULNERABLE}\ \mathrm{HOUSEHOLDS} \hookrightarrow \mathsf{Additional}\ \mathsf{Information}$

How Vulnerable Households Avoid Default

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Source of extra income to meet expenses	
Savings, assets	65.5
Credit card debt/overdraft	22.3
Another Ioan	27.9
Help from relatives/friends	26.0
Leaving bills unpaid	5.0
Other	6.0
Comparison of past 12 months' expenses	
Expenses higher than average	60.5
Expenses lower than average	6.8
Expenses lower than average	32.7
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Ability to get financial assistance from	
friends or relatives	
Able to get EUR 5,000 from friends	51.5

Source: HFCS Austria 2010, OeNB.

Notes: Vulnerable households are defined according to the expensesabove-income vulnerability measure.

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$\mathrm{VULNERABLE}\ \mathrm{HOUSEHOLDS} \hookrightarrow \mathsf{SEvH}/\mathsf{EAD}\ \mathsf{and}\ \mathsf{LGD}$

Exposure at Default and Loss Given Default according to Vulnerability Measures

	Exposure at	default (EAD	D)	Loss given default (LGD)			
Vulnerability measure	Any debt	Mortgage debt	Nonmort- gage debt	Any debt	Mortgage debt	Nonmort- gage debt	
	%						
Debt to asset ≥75%	29.3	24.0	54.7	10.2	6.4	26.1	
Debt service to income ≥40%	11.9	9.5	22.4	2.8		4.1	
Expenses above income	16.5	14.6	25.9	2.2		10.3	
Inability to meet expenses	0.8	0.8	1.1	0.2		0.3	

Source: HFCS Austria 2010, OeNB.

Notes: Cells that cannot be estimated because of no observations in some of the multiple imputation implicates are marked with "..".

Stress Testing Households



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STRESS TESTING HOUSEHOLDS \hookrightarrow Basics

Four (six) shocks are modelled:

- Employment shock \leftarrow changes in the rate of unemployment
- Income shock
- Shocks in the interest rate: short term as well as long term interest rate
- Exchange rate shock
- (Change of asset prices)
- (Change of repayment vehicle development)

 ${\rm Stress} \ {\rm Testing} \ {\rm Households} \hookrightarrow {\rm Unemployment} \ {\sf I}$

$$\mathsf{Pr}(\mathit{unemployed}|X) = \mathsf{\Gamma}(eta'X) = rac{1}{1+e^{-eta'X}}$$

where the explanatory factors X are:

- Gender
- Education
- Income
- Interaction between partner in the household and employment status of the partner
- Region
- Number of adult household members
- Number of children
- Age and age squared

For some indicators the references person / financial knowledgeable person has to be defined.

STRESS TESTING HOUSEHOLDS \hookrightarrow Unemployment II

- Based on the predicted probability of becoming unemployed and a random number, we generate randomly chosen new unemployed persons, i.e. households whose reference person newly became unemployed.
- According to Austrian regulation household income drops by 45%.
- Monte Carlo simulation with 1.000 replications yield 1.000 changes of the parameters under investigation.
- Average over the simulations gives us the estimate.

Potential extensions:

- Incorporate all (adult) household members.
- Move out of unemployment (would only improve financial situation of households).

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STRESS TESTING HOUSEHOLDS \hookrightarrow Results based on Albacete and Fessler (2010)

Effects of a Rise in the Unemployment Rate

		Increase in overall unemployment rate by				
	Baseline scenario	1 percentage point	2 percentage points	3 percentage points		
% of vulnerable households (mean)	9.2	9.3	9.3	9.4		
Mean EAD	14.3	14.4	14.5	14.6		
Mean LGD1	2.6	2.6	2.6	2.6		
Mean LGD ₂	2.1	2.1	2.1	2.1		

Source: Authors' calculations.



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STRESS TESTING HOUSEHOLDS \hookrightarrow Income

Very simple approach:

 \rightarrow Income of every households changes by ex ante specified percent Difference to unemployment:

 \rightarrow All households are affected

Reason:

 \rightarrow Using information from macro level disposable income forecast (see below)

Once more waves of the HFCS become available, a potential improvement is to model different changes over the income distribution based on past changes.

35 / 68

STRESS TESTING HOUSEHOLDS \hookrightarrow Interest rates

Idea: Change in the interest rates affects repayments R_i a household has to make.

Short term:

 \rightarrow only loans with variable interest rates are affected.

Long term:

 \rightarrow both loans with variable and fixed interest rates are affected.

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36 / 68

STRESS TESTING HOUSEHOLDS \hookrightarrow Interest rates

Bullet loan:

 \rightarrow immediate repayment is just interest and thus change in repayment only directly are affected:

$$R_i = S_{t-1} * i$$

where S is the outstanding amount.

Other loans:

 \rightarrow repayment is estimated by

$$R_i = S_{t-1} \frac{i * (1+i)^{n-t}}{(1+i)^{n-t} - 1}$$

where n is the term of the loan and t is the time elapsed since the loan was taken out

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STRESS TESTING HOUSEHOLDS \hookrightarrow Results based on Albacete and Fessler (2010)

Short- and Long-Term Effects of Interest Rate Increases

		Interest rate increase by				
	Baseline scenario	1 percentage point	2 percentage points	3 percentage points		
Short-term						
% of vulnerable households	9.2	9.8	11.1	12.0		
EAD	14.3	16.8	19.8	21.4		
LGD,	2.6	3.7	3.9	4.1		
LGD,	2.1	2.9	2.9	2.9		
Long-term						
% of vulnerable households	9.2	10.1	11.9	13.0		
EAD	14.3	17.6	21.3	23.5		
LGD,	2.6	4.0	4.3	4.4		
LGD ₂	2.1	3.2	3.3	3.3		

Source: Authors' calculations.

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STRESS TESTING HOUSEHOLDS \hookrightarrow Results Short Term Simulation based on the HFCS I

Stress Test: General Results

	Baseline	Interest rate increase by			Change ¹
		0.7 percent- age points	1.3 percent- age points	2.9 percent- age points	
Households with a negative financial margin (% of debtors)	8.5	8.9	9.5	10.3	1.8
Debt of these households (% of total household debt)	21.3	22.0	23.2	25.1	3.8
Debt of these households not covered by their total wealth (% of total household debt)	3.2	3.2	3.6	4.0	0.8
Debt of these households not covered by their real assets (% of total household debt)	4.6	4.6	5.0	5.4	0.9

Source: HFCS Austria 2010, OeNB.

¹ Difference between scenario 3 (+2.9 percentage points) and the baseline scenario, given in percentage points.

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STRESS TESTING HOUSEHOLDS \hookrightarrow Results Short Term Simulation based on the HFCS II



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STRESS TESTING HOUSEHOLDS \hookrightarrow Exchange Rate

- Shock on the exchange rate very similar to the interest rates shocks.
- Development in the exchanges rates affect
 - outstanding amount, and
 - indirectly also interest payments
 - of FX loan holders.
- All FX loans are affected identically.

Only a relative small fraction of households is affected, but usually large principal.

41 / 68

STRESS TESTING HOUSEHOLDS \hookrightarrow Results based on Albacete and Fessler (2010)

Effects of an Appreciation of the Loan Currency against the Euro

		Appreciation by			
	Baseline scenario	1%	2%	5%	
% of vulnerable households	9.2	9.4	9.4	9.8	
EAD	14.3	14.6	14.6	15.1	
LGD ₁	2.6	2.7	2.7	2.7	
LGD,	2.1	2.2	2.2	2.2	

Source: Authors' calculations.

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STRESS TESTING HOUSEHOLDS \hookrightarrow Results based on Albacete and Fessler (2010)

Baseline Szenario in % der verschudleten Haushalte in % der Gesamtschulden -5 з Szenario 2: Aufwertung um 34% n з Unbesicherte Schulden der Haushalte mit negativer Finanzmarge (rechte Achse) Besicherte Schulden der Haushalte mit negativer Finanzmarge (rechte Achse)

Stresstest der privaten Haushalte: Aufwertung der Fremdwährung (nach Einkommensgruppen)



Szenario 1: Aufwertung um 7%



Szenario 3: Aufwertung um 65%



STRESS TESTING HOUSEHOLDS \hookrightarrow Asset Prices

- Asset prices also affect net positions of households and hence LGD.
- Both real as well as financial assets can be affected.
- Exposure at risk (SEvH, EAD) is not affected.
- Depending on definition of vulnerability, share of households that are vulnerable may be affected.
- (Via the repayment vehicle for bullet loans share of vulnerable households may be affected indirectly.)
- Approach: assets prices change by X% (exogenous).

This approach only taken in early papers.

44 / 68

STRESS TESTING HOUSEHOLDS \hookrightarrow Asset Prices: Results on LGD from Albacete and Fessler (2010)

Effects of Asset Price Changes

	Decrease in real estate wealth by									
	0%	10%	0% 20%							
Decrease ir	Decrease in total financial wealth by									
0%	2.1	2.3	2.6	2.9						
10%	2.1	2.4	2.7	3.0						
20%	2.1	2.4	2.7	3.1						
30%	2.2	2.5	2.8	3.1						

Source: Authors' calculations.

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STRESS TESTING HOUSEHOLDS \hookrightarrow Repayment vehicle

- Change of the repayment vehicle affects only bullet loan holders.
- Assumption: A change affects the amount that is paid into the repayment vehicle immediately.
- Assumption: Term of loan contract is held constant.
- All indicators are affected:
 - Share of vulnerable households
 - Exposure (SEvH, EAD)
 - Loss given default (LGD)
- Modelling over a change of the yield of the repayment vehicle.

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46 / 68

This approach only taken in early papers.

STRESS TESTING HOUSEHOLDS \hookrightarrow Repayment vehicle: Results from Albacete and Fessler (2010)

Effects of a Decrease in the Assumed Yield of Repayment Vehicles for Bullet Loans

		Decrease in yield by					
	Baseline scenario	1 percentage point	2 percentage points	3 percentage points			
% of vulnerable households	9.2	9.2	9.5	9.6			
EAD	14.3	14.3	15.2	15.4			
LGD ₁	2.6	2.6	2.7	2.8			
LGD ₂	2.1	2.1	2.2	2.2			

Source: Authors' calculations.



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STRESS TESTING HOUSEHOLDS \hookrightarrow First results of combined analysis based on Albacete and Fessler (2010)



Change in percentage points of...

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Integration of Micro and Macro Information/Tools



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26th May 2015 49 / 68

Integration of Micro and Macro Information/Tools \hookrightarrow Basics

- Sparse information on the households in the administrative records.
- Change in probability of default in the FSAP-Stress Tests taken from the model for business.
- For some parameters very crude assumptions, e.g. debt service to disposable income.
- Household sector modelled at the micro level.
- Change of appropriate estimates from the micro model applied to regulatory information/data.
- Models from the survey data provide an input to FSAP-Stress Tests.

50 / 68

Integration of Micro and Macro Information/Tools \hookrightarrow Basics

At the micro level four shocks are modelled (due to the available development of aggregate inputs to the FSAP):

- Change in unemployment rates.
- Change in income.
- Change in short term and long term interest rates.
- Change in the exchange rate.

Modelling approach as described above.

INTEGRATION OF MICRO AND MACRO INFORMATION/TOOLS \hookrightarrow Scenarios from the aggregate forecasts for the 2013 FSAP

Scenarios for Changes in Households' Vulnerability

	GDP	URX	PYR	STIR	LTIR	EX SFr	EX JPY		
	Annual growth	n rates in %							
Scenario 1: baseline									
First year	1.1	2.5	1.9	41.1	18.4	0.0	0.0		
Second year	2.0	-0.1	1.3	86.5	15.6	0.0	0.0		
Scenario 2: stress s	cenario I								
First year	-0.8	7.5	1.6	304.2	23.1	-7.9	-17.4		
Second year	1.1	4.0	1.3	30.2	15.0	-3.4	-7.6		
Scenario 3: stress so	Scenario 3: stress scenario II								
First year	-2.7	7.9	-2.3	57.7	10.7	-7.9	-17.4		
Second year	0.2	12.1	1.6	45.5	6.8	-3.4	-7.6		

Source: OeNB.

Note: This table shows the growth rates of specific indicators in various scenarios used in stress tests. The columns display the growth rates of GDP (real), the unemployment rate (URX), private sector disposable income (PYR), short- and long-term nominal interest rates (STIR and LTIR, respectively) and the euro exchange rates against the Swiss franc (EX SFr) and the Japanese yen (EX JPY).

INTEGRATION OF MICRO AND MACRO INFORMATION/TOOLS \hookrightarrow Combined results based on micro data

Micro Simulation of Stress Scenarios Using HFCS Data									
	PD (HH) ¹			LGD (HH) ²			LGD2 (HH) ³		
	All debt holders	Mortgage debt holders	Non- mortgage debt holders	All debt holders	Mortgage debt holders	Non- mortgage debt holders	All debt holders	Mortgage debt holders	Non- mortgage debt holders
	%								
Current situation									
	8.99	12.71	7.39	3.60	3.57	11.42	4.98	4.94	18.61
Scenario 1: base	eline								
First year Second year	9.32 9.21	13.27 13.08	7.80 7.77	4.21 4.21	4.28 4.28	11.45 11.42	5.61 5.60	5.66 5.66	18.64 18.61
Scenario 2: stre	ss scenaric								
First year	9.58	13.72	7.85	4.24	4.30	11.45	5.63	5.69	18.66
Second year	9.46	13.45	7.88	4.23	4.30	11.45	5.63	5.69	18.65
Scenario 3: stress scenario II									
First year	11.23	15.40	9.47	4.29	4.30	11.86	5.70	5.69	19.10
Second year	11.49	15.76	9.78	4.31	4.30	11.93	5.72	5.69	19.21

Source: HECS Austria 2010, OeNB

¹ PD (HH) = share of vulnerable households as a percentage of indebted households.

² LGD (HH) = sum of vulnerable households' debt that is not covered by their total wealth divided by total debt of all households.

³ LGD2 (HH) = sum of vulnerable households' debt that is not covered by their housing wealth divided by total debt of all households.

Note: The number of simulations is 1,000.

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53 / 68

INTEGRATION OF MICRO AND MACRO INFORMATION/TOOLS

Using the changes of the PDs in the FSAP gives for the household sector:



Source: OeNB.

¹ Based on the household vulnerability model, anchored at the unconsolidated average retail portfolio PD of IRB banks.

Integration of Micro and Macro Information/Tools \hookrightarrow FX sensitivity analyses

- The FSAP stress tests conduct a sensitivity analysis of the results with respect to FX loans.
- Key parameter: debt repayment obligation *D* over (disposable) income after deducting debt repayment and total consumption *I*.
- This parameter was initially set to around 2.
- With the survey data the parameter can be estimated.
- We estimated quintiles and the median within these quintiles as an input to the sensitivity analyses.

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Integration of Micro and Macro Information/Tools \hookrightarrow FX sensitivity analyses

		Median							
Percentile	Debt share	Repayment	Income after repayment and total consumption	Amount outstanding	D/I according to Income after repayment and total consumption	Remaining Maturity of the first loan	Collateral Value	Other assets	Repayment vehicle value
D/I quintile	5								
1-20pct	0,109	272	2.665	32.482	0,101	7	287.070	114.119	3.096
20-40pct	0,199	400	1.883	61.783	0,202	9	230.212	58.785	25.920
40-60pct	0,288	580	1.596	121.849	0,352	8	315.000	79.068	42.000
60-80pct	0,224	754	1.160	100.646	0,661	8	325.604	115.309	46.800
80-100pct	0,180	588	12	66.451	12,113	10	172.022	14.059	1.200

INTEGRATION OF MICRO AND MACRO INFORMATION/TOOLS \hookrightarrow FX sensitivity analyses

Share of Estimated Losses across Debt Repayment Obligation-to-Income Ratio Quintiles¹



Source: OeNB.

¹ Loss estimation based on the model used in the FSAP 2013 sensitivity analysis.

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Further Analyses



Albacete, Lindner (Economic Analysis Divisio Microdata for Macropru and Financial Stab

26th May 2015 58 / 68

LOAN TO VALUE RATIO \hookrightarrow Problem and Idea

Problem:

(Almost) no information in loan-to-value-ratios before the FSR 25 (2013)

Solution:

- HFCS includes necessary information to calculate LTV.
- Use the the initial LTV taking into account the year when the loan was taken into account.
- $\bullet \rightarrow$ gives LTV-ratios for various years.
- Take a 8-year moving average to estimate the development of the LTV over time.
- Sample size becomes an issue for early years (data from the second wave extend the information).

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LOAN TO VALUE RATIO \hookrightarrow Initial LTV over time



26th May 2015 60 / 68

LOAN TO VALUE RATIO $\hookrightarrow \mathsf{Distribution}\ \mathsf{of}\ \mathsf{LTV}$

Median Initial LTV Ratio across Debt Service-to-Gross Income Ratio Quintiles



$\mathrm{FX}\ \mathrm{LOAN}\ \mathrm{HOLDER} \hookrightarrow \mathsf{Problem}\ \mathsf{and}\ \mathsf{Idea}$

Relatively many households hold (large) FX loans:



 \Rightarrow Macro-data do not tell us much about the distribution and risk bearing capacity of these households.

 \Rightarrow Micro-data can fill this gap, paper in the forthcoming financial stability report of the OeNB

$\mathrm{FX}\xspace$ Loan Holder \hookrightarrow Information from the HFCS I



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26th May 2015 63 / 68

$\mathrm{FX}\ \mathrm{LOAN}\ \mathrm{HOLDER} \hookrightarrow \mathsf{Information}\ \mathsf{from}\ \mathsf{the}\ \mathsf{HFCS}\ \mathsf{II}$

Debt in FX vs euro by household characteristics

		Debt in FX			Debt in euro		
	Share in households with debt in FX	Median	Mean	Share in households with debt in euro	Median	Mean	
	%	EUR	EUR	%	EUR	EUR	
Gross income percentile							
1-50	16.9	1	1	39.3	4,270	20,811	
51-100	83.1	65,119	102,421	60.7	18,000	49,642	
Gross wealth percentile							
1-50	3.1	.1	.1	42.2	3,080	10,702	
51-100	96.9	72,178	101,916	57.8	23,014	58,476	
Household size							
1 hh member	18.0	1	1	29.8	3,558	18,631	
2 hh members	29.1	71,046	102,697	29.7	11,253	31,861	
3+ hh members	52.9	76,992	109,256	40.5	22,579	57,589	

Source: HFCS Austria 2010. OeNB.

1 " indicates that the estimation result had to be suppressed due to an estimation sample of fewer than 15 observations.

Note: The regions in Austria are based on the NUTS-1-level codes. Eastern Austria: Burgenland, Lower Austria and Vienna; southern Austria: Carinthia and Styria; western Austria: Upper Austria, Salzburg, Tyrol and Vorarlberg, The household's reference person is defined as the household member with the highest income.

$\mathrm{FX}\ \mathrm{LOAN}\ \mathrm{HOLDER} \hookrightarrow \mathsf{Information}\ \mathsf{from}\ \mathsf{the}\ \mathsf{HFCS}\ \mathsf{III}$

Risk indicators for households with FX debt and households with euro debt

	Households with debt in FX	Households with debt only in euro	Difference
Household characteristics			
Gross income (EUR, median)	63,102	38,633	24,469
Net wealth (EUR, median)	212,794	87,234	125,559
Part of top 5% wealth class	6.8	6.0	0.9
Has negative net wealth	7.8	15.7	-7.8
Unemployed household reference person ¹	5.6	5.7	-0.1
Risk averse household	50.4	57.7	-7.3
Properties of highest loan			
Interest rate (median)	2.274	2.900	-0.626
Proportion with adjustable interest rate	76.2	66.4	9.8
Total maturity (median)	20	19	1
Remaining maturity (median)	16	12	4
Source: HECS Austria 2010 OeNB			

¹ The reference person is defined as the household member with the highest income.

Note: Households whose highest loan was not a mortgage are excluded from the computation of interest rate and remaining maturity. Households without loans but with other nonmortgage debt are excluded from the computation of the proportion with adjustable interest rates and total maturity.

$\mathrm{FX}\ \mathrm{LOAN}\ \mathrm{HOLDER} \hookrightarrow \mathsf{Integration}\ \mathsf{of}\ \mathsf{Micro}\ \mathsf{and}\ \mathsf{Macro}\ \mathsf{Information}$

Market price developments relevant for households with FX debt

	At the time the FX loan was ta (household lev	e highest ken out rel)	January 2015 (macro level)	Difference	
	Median	Mean	The second	Median	Mean
CHF/EUR ¹ exchange rate	1.550	1.583	1.094	-0.456	-0.489
3m EURIBOR ² – 3m LIBOR (CHF)	1.569	1.595	0.512	-1.057	-1.083
Austrian 10y bonds	4.267	4.454	0.550	-3.717	-3.904
ATX index	1,977	2,293	2,172	195	-121
Eurostoxx	3,252	3,308	3,204	-48	-104

Source: HFCS Austria 2010, OeNB, Thomson Reuters.

1 Up to end-1998: ATS.

² Up to end-1998: VIBOR.

Note: Households whose highest loan was not a mortgage are excluded from the computation.

Concluding Remarks



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26th May 2015 67 / 68

CONCLUDING REMARKS \hookrightarrow The Way Forward (wishlist)

- Integrated use of available information, e.g. making use of the credit registry.
- Collect additional information from bank, e.g. LTV-ratios, and evaluate results form survey data.
- Model in more detail shocks to households:
 - Move into and out of employment for all household members.
 - More precise shock of income.
 - Empirical foundation of other assumptions.
- Try to incorporate behavioural responses to these shocks at the household level.
- Use results from micro data in the standard FSAP stress tests.
- Integrated approach using both waves of the HFCS once data are available.

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