Simulating the impact of borrower-based macroprudential policies on mortgages and the real estate sector in Austria

Evidence from the Household Finance and Consumption Survey 2014

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Outline

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SNAPSHOT OF THE RESULTS

- Income based criteria (DTI and DSTI in comparison to LTV) often binding
- Mean main residence prices do not seem to be strongly credit driven in Austria
- Macroprudential policy interventions effective in reducing credit supply to households
- Households affected by macropru policies are more vulnerable and less affluent than the average mortgage holder

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Motivation

Housing debt and house prices in Austria

Levels, 2006–2015

Housing debt in EUR million   House Price Index (100=2006)

Growth rates, 2006–2015

%
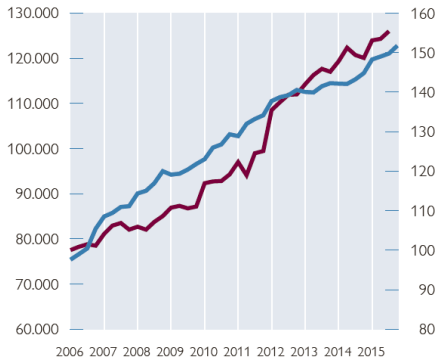
— Housing loans – stock (left-hand scale)
— Housing price index (right-hand scale)
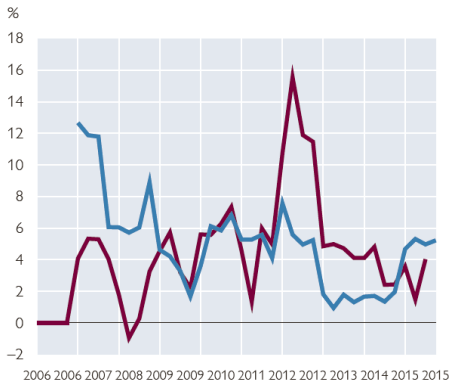
— Housing loans growth
— Housing price index growth

Source: OeNB.

Motivation ↪ Literature

- Strong increases in available house price indices in Austria are likely to be driven by the upper part of the house price distribution:
    - ▶ Albacete, N., Fessler, P. and Lindner, P. (2016) **"The Distribution of Residential Property Price Changes across Homeowners and its Implications for Financial Stability in Austria"** in Financial Stability Report 31/2016, pp. 62–81. OeNB.
- There are various reasons for debt sustainability of the mortgage market for households in Austria; see e.g.
    - ▶ Albacete, N. and Fessler, P. (2010) **"Stress Testing Private Households in Austria"** in Financial Stability Report 19/2010, pp. 72–91. OeNB,
    - ▶ Albacete, N. Fessler, P. and Schürz, M. (2012) **"Risk Buffer Profiles of Foreign Currency Mortgage Holders"** in Financial Stability Report 23/2012, pp. 58–71. OeNB,
    - ▶ Albacete, N. and Lindner, P. (2013) **"Household Vulnerability in Austria - A Microeconomic Analysis Based on the Household Finance and Consumption Survey"** in Financial Stability Report 25/2013, pp. 57–73. OeNB,
    - ▶ Albacete, N., Eidenberger, J., Krenn, G., Lindner, P. and Sigmund, M. (2014) **"Risk Bearing Capacity of Households – Linking Microlevel Data to the Macroprudential Toolkit"** in Financial Stability Report 27/2014, pp. 95–110. OeNB,
    - ▶ Albacete, N. and Lindner, P. (2015) **"Foreign currency borrowers in Austria evidence from the Household Finance and Consumption Survey"** in Financial Stability Report 29/2015, pp. 93–109. OeNB.

MOTIVATION ↪ Discussion on macroprudential policy

- On November 28, 2016: ESRB warning on medium-term vulnerabilities in the residential real estate sector for Austria and seven other EU countries:
  - ▶ Rapid rise in (residential) real estate prices, robust mortgage credit growth and risk of a (further) loosening of lending standards
- Response of the Austrian finance ministry, which had been agreed with the Financial Market Authority (FMA) and the Oesterreichische Nationalbank:
  - ▶ Mitigating factors not been considered adequately in the ESRB's analysis (low share of mortgage lending, low default and loss ratios, high significance of social and rental housing)
  - ▶ Recent measures taken are considered to be adequate in view of the current house price cycle and the current credit cycle:
    - ★ Initiative to preventively create a legal basis for additional macroprudential instruments to enable the FMA to impose limits on loans granted by commercial lenders (law was adopted on 29.06.2017)
    - ★ Communication on three criteria for sustainable real estate lending: LTV, DTI and DSTI ratios ("on the basis of improved reporting, [we] may specify in more detail the criteria [...] and issue recommendations if the need arises")

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Motivation ↪ Aim of the study

- So far all the analyses in Austria about household mortgage market and vulnerability focused on the identification of potential weaknesses (e.g. stress testing or FX loans)

- At least since the FMA statement there is a need to assess the potential impact of policy measures on households and the real estate market

- Until now there has been a lack of information on this topic. This study intends to shed some first light in this direction.

- The aim of our study: perform an impact analysis of macroprudential intervention in Austria setting constraints to the LTV, DTI and DSTI with a focus on measuring the effects of such interventions on the real estate sector, i.e. mortgage supply and house prices.

- Scenarios are purely hypothetical. No legal boundaries implemented so far. Legal foundations were set on summer of 2017.

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Methodology

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METHODOLOGY ↪ Main steps

- We adapt the approach developed by Robert Kelly, Fergal McCann and Conor O'Toole (2015) **"Credit conditions, macroprudential policy and house prices"** in Research Technical Papers 06/RT/15, Central Bank of Ireland

- There is an ongoing initiative (Task Force on operationalizing macro-prudential research) by the ECB in the same direction of which the authors are part. Hence there may be similar investigations with a more international focus published in the future.

- The methodology consists basically in four main steps:
  - identifying the market conditions,
  - estimating the maximum credit available to consumers,
  - running house price regressions, and
  - simulating various scenarios of macroprudential policy.

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$$Loan_{LTV_i} = \frac{deposit_i}{1 - LTV_{Max}} - deposit_i$$

- LTV_{Max} is the maximum LTV the market (MFI) provides and is estimated from the data, i.e. it is thought of as the prevailing market condition.
- Depending on the initial value of real estate each household i has an idiosyncratic $Loan_{LTV_i}$
- Note that $Loan_{LTV_i}$ is not defined for $LTV_{Max} = 100$. The intuition is that in such cases banks offer unlimited or "infinite" financing of properties through the LTV channel.

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$$Loan_{DTI_i} = income_i * DTI_{Max}$$

- DTI_{Max} is the maximum DTI the market (MFI) provides and is estimated from the data, i.e. it is thought of as the prevailing market condition.
- Depending on income each household i has a idiosyncratic $Loan_{DTI_i}$
- Specific income measure is discussed later

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METHODOLOGY ↪ Available credit over the DSTI channel

$$Loan_{DSTI_i} = RepayMax_i * \frac{1 - (1 + r_i)^{-TERM}}{r_i}$$

- $RepayMax_i$ is the maximum $DSTI$ the market (MFI) provides and the income level of the household, i.e. $RepayMax_i = DSTI_{Max} * income_i$.
- $TERM$ is given by the generally in the market available term length.
- r_i is idiosyncratic to the household and given by the interest rate a household pays on his mortgage.

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$$CA_i = Min(Loan_{LTV_i}, Loan_{DTI_i}, Loan_{DSTI_i})$$

- Depending on household characteristics different channels are binding.
- The intuition of CA_i (credit available) is the maximum a household given her characteristics can take out as a mortgage.
- The household does <u>not</u> have to take out the full amount.

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$$HousePrice_i = \beta CA_i + \gamma' X_i + \varepsilon_i$$

- CA_i is the credit available discussed above.
- X_i large set of controls (household as well as housing characteristics and paradata), including in particular:
  - ▶ Down payment
  - ▶ Income
  - ▶ Age
  - ▶ Dwelling characteristics
- Normal error ε_i.
- Absolute value as well as log-transformation.

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Methodology ↪ Simulation

We estimate the impact of macroprudential policy on credit available and house prices.
Scenarios are:

- LTV_{Max} minus 5 ppts
- DTI_{Max} minus 1 year
- $DSTI_{Max}$ minus 5 ppts
- Combined
- What does it take to reduce CA by 30% at the mean?

We finally analyse who is affected by changes.

- A household is defined to be affected by some new scenario if the newly derived maximum credit available is below the initial amount of loan taken out

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Data and model specification

Data and model specification ↪ HFCS

- Euro area wide effort to collect micro data on household finances
- Data on the whole balance sheet
- 2nd wave 2014/2015 with 20 countries (1st wave 2010/11 with 15 countries)
- Ongoing project with intention to collect data every 3 years
- Ex-ante harmonization not only of the questionnaire but the whole data production process
- Computer Assisted Personal Interviews (CAPI)
- Harmonized Bayesian-based multiple Imputation procedure
- ECB coordinates project and checks the quality
- Variance estimation based on 1.000 replicate weights (bootstrap procedure)
- Second wave net sample more than 84 thousand households, about 3.000 in Austria (SCF in the USA: 6.500)

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- Income based specification
  - HFCS in AT collects gross (net) yearly income for calendar year preceding interview → use trend of average disposable income to estimate income at the time of loan origination (income structure constant)
  - Use initial net income to be in line with general discussion
  - 95th Percentile of DTI and DSTI
- LTV
  - Initial LTV collected in the HFCS in terms of both value of HMR at the time of ownership transfer and loan at origination
  - Abstract from specifics of ownership transfer and building
  - 75th Percentile initial LTV
- Term length
  - Median maximum (if a household holds more than one HMR mortgage) term length of mortgage loan
  - Reflects 25 years common in Austria

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- Deposit or down payment
  - ▶ Estimated by the initial real estate value minus the initial loan
- Interest
  - ▶ Median of potentially multiple interest rates for HMR mortgage of a single household
- Robustness checks
  - ▶ House price regression:
    - ⋆ various specifications
    - ⋆ levels as well as logs (inverse hyperbolic sine transformation)
  - ▶ Market conditions:
    - ⋆ LTV of 90%
    - ⋆ LTV of close to 100%
  - ▶ Income:
    - ⋆ **net** and gross income
    - ⋆ **initial** and current income

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Results

Results ↪ Market conditions

Descriptive statistics of the components of credit avaliable and the binding condition

	All	up to 1989	1990 to 1994	1995 to 1999	2000 to 2004	2005 to 2009	2010 and younger (2015)
Share of households for which the binding condition is							
LTV	13.6%	6.5%	11.1%	12.6%	14.0%	16.8%	14.7%
DTI	49.8%	56.0%	43.7%	46.2%	44.8%	51.0%	52.6%
DSTI	36.6%	37.4%	45.2%	41.2%	41.2%	32.2%	32.7%
Conditional median of maximum credit given by (in EUR thousand)							
LTV[1]	924.4	530.3	768.5	1,069.5	902.0	1,046.0	1,126.5
DTI	367.8	124.7	182.3	327.5	374.4	427.5	492.0
DSTI	379.7	117.4	180.5	328.9	395.8	431.6	496.9
Market condition of thresholds							
LTV (P75)	90.5	83.6	68.5	79.8	100.5	85.4	102.4
DTI (P95)	12.4	19.5	9.3	12.5	12.5	11.8	8.6
DSTI (P95)	66.5	117.7	60.3	70.4	63.6	60.3	51.4

Source: HFCS Austria 2014, OeNB.

Note: The timeline refers to the year when the highest mortgage for the household's main residence was taken out.

▸ Net current income   ▸ Gross initial income   ▸ Gross current income   ▸ 80th Percentile

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House price regression

	Full sample		Restricted sample		Unweighted regression	
	Level initial house value	Logarithm initial house value	Level initial house value	Logarithm initial house value	Level initial house value	Logarithm initial house value
	I	II	III	IV	V	VI
Credit available (CA)	0.062	0.332***	0.110	0.339***	0.061	0.351***
	(0.074)	(0.101)	(0.082)	(0.108)	(0.067)	(0.108)
Total household initial net income	−0.137	−0.149	−0.263	−0.139	−0.158	−0.176
	(0.898)	(0.130)	(0.840)	(0.124)	(0.965)	(0.137)
Value of put down deposit (equity capital, down payment)	0.835***	0.040***	0.652***	0.027***	0.880***	0.043***
	(0.186)	(0.007)	(0.218)	(0.006)	(0.116)	(0.006)
Age	−4,200.853	−0.013	−1,455.621	−0.007	−5,445.458	−0.021
	(5,891.842)	(0.026)	(4,164.130)	(0.022)	(4,791.668)	(0.020)
Age squared	33,836	0.000	13,071	0.000	43,119	0.000
	−57,930	(0.000)	−41,382	(0.000)	−48,594	(0.000)
Controlled for[1]						
Region	x	x	x	x	x	x
Time brackets of loan origination	x	x	x	x	x	x
Size of household main residence	x	x	x	x	x	x
Duration of living in the household main residence	x	x	x	x	x	x
Type of dwelling (paradata)	x	x	x	x	x	x
Dwelling rating (paradata)	x	x	x	x	x	x
Dwelling location (paradata)	x	x	x	x	x	x
Outward appearance of dwelling (paradata)	x	x	x	x	x	x

Source: HFCS Austria 2014, OeNB.

[1] *Every regression includes a constant.*

Simulation results

	Baseline	LTV 5ppts	DTI 1 year	DSTI 5ppts	Combined I
	Share of households for which the binding condition is				
LTV	13.6%	23.0%	12.9%	13.0%	20.9%
DTI	49.8%	43.9%	66.2%	33.2%	46.5%
DSTI	36.6%	33.2%	20.9%	53.8%	32.6%
	Conditional median of maximum credit given by (in EUR thousand)				
LTV	924.4	548.8	924.4	924.4	548.8
DTI	367.8	367.8	338.2	367.8	338.2
DSTI	379.7	379.7	379.7	351.1	351.1
	Changes with respect to				
House prices	..	−0.6%	−0.6%	−0.3%	−1.3%
Credit available	..	−5.8%	−5.5%	−3.2%	−12.1%

Source: HFCS Austria 2014, OeNB.

▸ Net current income   ▸ Gross initial income   ▸ Gross current income   ▸ 80th Percentile

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Simulating a reduction of available credit of 30%

	LTV scenario	DTI scenario	DSTI scenario	Example of a combined scenario II
Change of				
LTV (in percentage points)	−21	0	0	−10
DTI (in years)	0	−4.3	0	−2.8
DSTI (in percentage points)	0	0	−24.5	−18.0
Share of households for which the binding condition is				
LTV	57.2%	8.5%	8.5%	24.8%
DTI	22.9%	89.4%	0.0%	32.3%
DSTI	20.0%	2.1%	91.5%	42.9%
Conditional median of maximum credit given by (in EUR thousand)				
LTV	208.1	924.4	924.4	379.9
DTI	367.8	240.5	367.8	284.9
DSTI	379.7	379.7	239.8	276.9
Changes with respect to				
House prices	−3.2%	−3.1%	−3.2%	−3.2%
Credit available	−30%	−30%	−30%	−30%

Source: HFCS Austria 2014, OeNB.

▸ Net current income   ▸ Gross initial income   ▸ Gross current income   ▸ 80th Percentile

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RESULTS ↪ Affected households I

Characteristics of the households affected by macroprudential policy

	All	HMR Mortgage Holders	Affected households in combined scenario
Share of affected households	100.0%	15.5%	2.2%
Household wealth (in EUR thousand)			
Gross wealth mean	275.7	644.8	487.1
Gross wealth median	100.4	340.6	318.5
Household income (in EUR thousand)			
Gross current income mean	43.3	60.5	46.3
Gross current income median	35.7	54.5	41.0
Household financially knowledgable person − socio-demographics			
Mean age	53	48	48
Median age	54	46	47
Household debt structure			
Median current outstanding debt (in EUR thousand)	..	63.1	108.2
Share of vulnerable – DTA>100%	6.3%	1.4%	3.3%
Share of vulnerable – DTI>300%	6.2%	36.0%	62.7%
Share of vulnerable – DSTI>40%	2.6%	15.1%	37.2%
Share of vulnerable – expenses above income	6.9%	12.8%	11.1%

Source: HFCS Austria 2014, OeNB.

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▸ Net current income ▸ Gross initial income ▸ Gross current income ▸ 80th Percentile

Share of aggregate debt held by households affected by macroprudential policy

	Baseline	Combined scenario I
Conditional share of affected households	9.7%	14.0%
Conditional current share of aggregate household main residence mortgage	16.6%	23.4%
Conditional initial share of aggregate household main residence mortgage	8.3%	11.1%

Source: HFCS Austria 2014, OeNB.

▸ Net current income   ▸ Gross initial income   ▸ Gross current income   ▸ 80th Percentile

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Conclusion

Conclusion ↪ Summary

- Income based criteria (LTI and DSTI) are the ones which are most often binding for Austrian households

- Mean main residence prices do not seem to be strongly credit driven in Austria

- Macroprudential policy interventions effective in reducing credit supply to households, but less so in calming a rapid increase in the housing market (impact depends on the levels at which LTV, DTI and DSTI limits are set)

- Households affected by the macroprudential policies are more vulnerable and less affluent in terms of both wealth and income levels than the average mortgage holder, but still more affluent than the average household in the entire population

- Importance of rental market as an alternative for real estate acquisition

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Conclusion ↪ The way forward

The following extensions are left for future research:

- Effect of credit available on house price quantiles instead of mean or across borrower groups (e.g. FX borrowers)

- Effect of credit available on house prices of other properties than the main residence

- Impact of macroprudential policies on rental prices

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Appendix

Table A1a: Descriptive statistics of the components of credit avaliable and the binding condition - based on current net income

	All	1990 to 1994	1995 to 1999	2000 to 2004	2005 to 2009	2010 and younger (2015)
Share of households for which the binding binding condition is						
LTV	13.5%	11.5%	14.1%	13.4%	11.8%	10.2%
DTI	56.1%	47.9%	51.4%	51.3%	62.4%	61.5%
DSTI	30.4%	40.6%	34.5%	35.3%	25.8%	28.3%
Conditional Median of Maximum Credit given by (in 1.000€)						
LTV[1]	924.4	768.5	1,069.5	902.0	1,046.0	1,126.5
DTI	328.7	228.9	348.0	360.6	330.9	342.1
DSTI	350.3	245.8	368.8	390.4	352.7	366.6
Market condition of thresholds						
LTV (P75)	90.5	68.5	79.8	100.5	85.4	102.4
DTI (P95)	8.2	4.7	7.5	9.1	10.3	8.1
DSTI (P95)	45.3	27.7	43.1	45.0	51.7	47.7

Source: HFCS Austria 2014, OeNB.

Note: The time line refers to the year when the highest household main residence mortgage was taken out.

▸ Back

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Table A1b: Descriptive statistics of the components of Credit Avaliable and the binding condition - based on initial gross income

	All	1990 to 1994	1995 to 1999	2000 to 2004	2005 to 2009	2010 and younger (2015)
Share of households for which the binding binding condition is						
LTV	14.5%	11.9%	13.8%	14.0%	17.9%	15.8%
DTI	56.6%	51.2%	50.7%	53.7%	59.2%	59.6%
DSTI	28.9%	36.9%	35.5%	32.3%	22.9%	24.5%
Conditional Median of Maximum Credit given by (in 1.000€)						
LTV[1]	924.4	768.5	1,069.5	902.0	1,046.0	1,126.5
DTI	383.2	185.5	337.5	403.7	449.4	508.0
DSTI	401.6	182.4	342.9	422.5	475.0	540.9
Market condition of thresholds						
LTV (P75)	90.5	68.5	79.8	100.5	85.4	102.4
DTI (P95)	9.6	7.1	11.6	9.3	9.0	6.7
DSTI (P95)	52.9	45.7	62.7	46.1	51.1	39.0

Source: HFCS Austria 2014, OeNB.

Note: The time line refers to the year when the highest household main residence mortgage was taken out.

▸ Back

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Table A1c: Descriptive statistics of the components of Credit Avaliable and the binding condition - based on current gross income

	All	1990 to 1994	1995 to 1999	2000 to 2004	2005 to 2009	2010 and younger (2015)
Share of households for which the binding binding condition is						
LTV	15.1%	15.7%	14.5%	14.0%	14.4%	10.7%
DTI	50.6%	41.8%	42.6%	48.6%	53.8%	60.0%
DSTI	34.3%	42.5%	42.9%	37.4%	31.8%	29.4%
Conditional Median of Maximum Credit given by (in 1.000€)						
LTV[1]	924.4	768.5	1,069.5	902.0	1,046.0	1,126.5
DTI	360.4	229.8	378.4	390.8	365.5	380.1
DSTI	369.3	234.2	382.0	412.6	375.7	391.1
Market condition of thresholds						
LTV (P75)	90.5	68.5	79.8	100.5	85.4	102.4
DTI (P95)	6.6	3.7	6.8	6.7	7.8	6.6
DSTI (P95)	35.5	23.7	38.1	32.8	42.9	37.6

Source: HFCS Austria 2014, OeNB.

Note: The time line refers to the year when the highest household main residence mortgage was taken out.

▸ Back

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Table A2a: House price regression - based on current net income

	Full Sample		Restricted Sample		Unweighted Regression	
	Level initial house value	Logarithm initial house value	Level initial house value	Logarithm initial house value	Level initial house value	Logarithm initial house value
	I	II	III	IV	V	VI
Credit available (CA)	0.062	0.355***	0.121	0.364***	0.058	0.360***
	(0.087)	(0.132)	(0.094)	(0.134)	(0.082)	(0.131)
Total household current net income	-0.101	-0.164	-0.221	-0.149	-0.091	-0.166
	(0.679)	(0.148)	(0.621)	(0.145)	(0.744)	(0.149)
Value of put down deposit (equity capital, down payment)	0.839***	0.041***	0.668***	0.028***	0.883***	0.043***
	(0.184)	(0.007)	(0.215)	(0.006)	(0.115)	(0.006)
Age	-3,938.245	-0.012	-1,129.387	-0.006	-5,216.587	-0.021
	(5,848.027)	(0.026)	(4,152.149)	(0.022)	(4,757.427)	(0.019)
Age squared	31250	0.000	9749	0.000	40948	0.000
	-57566	(0.000)	-41282	(0.000)	-48424	(0.000)
Controlled for [1]						
Region	X	X	X	X	X	X
Time brackets of loan originiation	X	X	X	X	X	X
Size of HMR	X	X	X	X	X	X
Duration of living in the HRM	X	X	X	X	X	X
Type of dwelling (paradata)	X	X	X	X	X	X
Dwelling rating (paradata)	X	X	X	X	X	X
Dwelling location (paradata)	X	X	X	X	X	X
Outward appearance of dwelling (paradata)	X	X	X	X	X	X

Source: HFCS Austria 2014, OeNB.
Notes:
1) Every regression includes a constant.

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▶ Back

Table A2b: House price regression - based on initial gross income

	Full Sample		Restricted Sample		Unweighted Regression	
	Level initial house value	Logarithm initial house value	Level initial house value	Logarithm initial house value	Level initial house value	Logarithm initial house value
	I	II	III	IV	V	VI
Credit available (CA)	0.052	0.333***	0.097	0.339***	0.054	0.351***
	(0.074)	(0.104)	(0.074)	(0.110)	(0.065)	(0.113)
Total household initial gross income	0.006	-0.151	-0.116	-0.140	-0.032	-0.174
	(0.679)	(0.121)	(0.629)	(0.121)	(0.710)	(0.128)
Value of put down deposit (equity capital, down payment)	0.835***	0.041***	0.655***	0.028***	0.881***	0.043***
	(0.186)	(0.007)	(0.214)	(0.006)	(0.117)	(0.006)
Age	-4,466.209	-0.014	-1,725.724	-0.008	-5,713.470	-0.023
	(5,907.298)	(0.026)	(4,198.316)	(0.023)	(4,843.869)	(0.020)
Age squared	36624	0.000	15918	0.000	45935	0.000
	-58192	(0.000)	-41954	(0.000)	-49213	(0.000)
Controlled for [1]						
Region	X	X	X	X	X	X
Time brackets of loan originiation	X	X	X	X	X	X
Size of HMR	X	X	X	X	X	X
Duration of living in the HRM	X	X	X	X	X	X
Type of dwelling (paradata)	X	X	X	X	X	X
Dwelling rating (paradata)	X	X	X	X	X	X
Dwelling location (paradata)	X	X	X	X	X	X
Outward appearance of dwelling (paradata)	X	X	X	X	X	X

Source: HFCS Austria 2014, OeNB.
Notes:
1) Every regression includes a constant.

▸ Back

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APPENDIX ↪ House price regression - gross current income

Table A2c: House price regression - based on current gross income

	Full Sample		Restricted Sample		Unweighted Regression	
	Level initial house value	Logarithm initial house value	Level initial house value	Logarithm initial house value	Level initial house value	Logarithm initial house value
	I	II	III	IV	V	VI
Credit available (CA)	0.045	0.336***	0.093	0.340***	0.042	0.339***
	(0.079)	(0.130)	(0.083)	(0.131)	(0.071)	(0.129)
Total household current gross income	-0.001	-0.147	-0.093	-0.129	-0.005	-0.146
	(0.471)	(0.132)	(0.430)	(0.139)	(0.508)	(0.131)
Value of put down deposit (equity capital, down payment)	0.840***	0.041***	0.677***	0.028***	0.884***	0.043***
	(0.183)	(0.007)	(0.212)	(0.006)	(0.115)	(0.006)
Age	-4,072.262	-0.014	-1,266.116	-0.008	-5,334.493	-0.023
	(5,841.180)	(0.026)	(4,176.144)	(0.022)	(4,801.896)	(0.020)
Age squared	32661	0.000	11245	0.000	42187	0.000
	-57621	(0.000)	-41802	(0.000)	-48974	(0.000)
Controlled for [1]						
Region	X	X	X	X	X	X
Time brackets of loan originiation	X	X	X	X	X	X
Size of HMR	X	X	X	X	X	X
Duration of living in the HRM	X	X	X	X	X	X
Type of dwelling (paradata)	X	X	X	X	X	X
Dwelling rating (paradata)	X	X	X	X	X	X
Dwelling location (paradata)	X	X	X	X	X	X
Outward appearance of dwelling (paradata)	X	X	X	X	X	X

Source: HFCS Austria 2014, OeNB.

Notes:

1) Every regression includes a constant.

APPENDIX ↪ Simulation I - net current income

Table A3aa: Simulation results - based on current net income

	Base Line	LTV - 5ppts	DTI - 1 year	DSTI - 5ppts	Combined I
Share of households for which the binding condition is					
LTV	13.5%	23.3%	12.4%	12.8%	19.5%
DTI	56.1%	49.5%	75.4%	30.5%	53.9%
DSTI	30.4%	27.2%	12.3%	56.7%	26.6%
Conditional Median of Maximum Credit given by (in 1.000€)					
LTV[1]	924.4	548.8	924.4	924.4	548.8
DTI	328.7	328.7	288.7	328.7	288.7
DSTI	350.3	350.3	350.3	311.6	311.6
Changes with respect to					
House prices	.	-0.5%	-0.9%	-0.4%	-1.5%
Credit available	.	-5.4%	-9.4%	-4.6%	-15.2%

Source: HFCS Austria 2014, OeNB.

▸ Back

ONB

APPENDIX ↪ Simulation I - gross initial income

Table A3ab: Simulation results - based on initial gross income

	Base Line	LTV - 5ppts	DTI - 1 year	DSTI - 5ppts	Combined I
Share of households for which the binding condition is					
LTV	14.5%	24.6%	13.6%	14.3%	22.0%
DTI	56.6%	48.9%	73.3%	34.7%	52.8%
DSTI	28.9%	26.5%	13.1%	51.1%	25.2%
Conditional Median of Maximum Credit given by (in 1.000€)					
LTV[1]	924.4	548.8	924.4	924.4	548.8
DTI	383.2	383.2	343.1	383.2	343.1
DSTI	401.6	401.6	401.6	363.6	363.6
Changes with respect to					
House prices	.	-0.6%	-0.7%	-0.3%	-1.4%
Credit available	.	-6.4%	-7.9%	-3.4%	-14.4%

Source: HFCS Austria 2014, OeNB.

▸ Back

ᎾNB

APPENDIX ↪ Simulation I - gross current income

Table A3ac: Simulation results - based on current gross income

	Base Line	LTV - 5ppts	DTI - 1 year	DSTI - 5ppts	Combined I
Share of households for which the binding condition is					
LTV	15.1%	25.5%	13.6%	14.0%	21.1%
DTI	50.6%	44.3%	75.9%	14.1%	48.7%
DSTI	34.3%	30.2%	10.4%	72.0%	30.3%
Conditional Median of Maximum Credit given by (in 1.000€)					
LTV[1]	924.4	548.8	924.4	924.4	548.8
DTI	360.4	360.4	306.0	360.4	306.0
DSTI	369.3	369.3	369.3	317.3	317.3
Changes with respect to					
House prices	.	-0.5%	-0.9%	-0.6%	-1.4%
Credit available	.	-6.3%	-11.4%	-7.5%	-18.1%

Source: HFCS Austria 2014, OeNB.

▸ Back

ⒺNB

Table A3ba: Simulating a reduction of available credit of 30% - based on current net income

	LTV - scenario	DTI - scenario	DSTI - scenario	Combined scenario II
Change of				
LTV (in ppts)	-21	0	0	-10
DTI (in years)	0	-4.3	0	-2.8
DSTI (in ppts)	0	0	-24.5	-18.0
Share of households for which the binding condition is				
LTV	55.7%	6.1%	5.9%	20.0%
DTI	27.5%	93.7%	0.0%	34.5%
DSTI	16.8%	0.2%	94.1%	45.6%
Conditional Median of Maximum Credit given by (in 1.000€)				
LTV[1]	208.1	924.4	924.4	379.9
DTI	328.7	156.6	328.7	216.6
DSTI	350.3	350.3	160.6	211.0
Changes with respect to				
House prices	-2.7%	-4.7%	-4.5%	-3.8%
Credit available	-27.6%	-48.3%	-47.2%	-39.3%

Source: HFCS Austria 2014, OeNB.

▸ Back

ᗋNB

Appendix ↪ Simulation II - gross initial income

Table A3bb: Simulating a reduction of available credit of 30% - based on initial gross income

	LTV - scenario	DTI - scenario	DSTI - scenario	Combined scenario II
Change of				
LTV (in ppts)	-21	0	0	-10
DTI (in years)	0	-4.3	0	-2.8
DSTI (in ppts)	0	0	-24.5	-18.0
Share of households for which the binding condition is				
LTV	58.1%	7.0%	7.1%	24.0%
DTI	25.6%	92.3%	0.0%	35.9%
DSTI	16.3%	0.7%	92.9%	40.1%
Conditional Median of Maximum Credit given by (in 1.000€)				
LTV[1]	208.1	924.4	924.4	379.9
DTI	383.2	210.9	383.2	271.0
DSTI	401.6	401.6	215.6	265.0
Changes with respect to				
House prices	-3.0%	-3.9%	-3.7%	-3.4%
Credit available	-32.0%	-40.8%	-38.4%	-35.4%

Source: HFCS Austria 2014, OeNB.

‣ Back

Table A3bc: Simulating a reduction of available credit of 30% - based on current gross income

	LTV - scenario	DTI - scenario	DSTI - scenario	Combined scenario II
Change of				
LTV (in ppts)	-21	0	0	-10
DTI (in years)	0	-4.3	0	-2.8
DSTI (in ppts)	0	0	-24.5	-18.0
Share of households for which the binding condition is				
LTV	58.0%	4.0%	3.1%	18.1%
DTI	23.3%	96.0%	0.0%	11.8%
DSTI	18.8%	0.0%	96.9%	70.1%
Conditional Median of Maximum Credit given by (in 1.000€)				
LTV[1]	208.1	924.4	924.4	379.9
DTI	360.4	126.3	360.4	208.0
DSTI	369.3	369.3	114.5	182.1
Changes with respect to				
House prices	-2.3%	-4.7%	-5.0%	-3.8%
Credit available	-30.1%	-61.2%	-64.4%	-48.6%

Source: HFCS Austria 2014, OeNB.

▸ Back

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Table A4a: Affected Households I - net current income

	All	HMR Mortgage Holders	Affected households in combined scenario
Share of affected households	100.0%	15.5%	2.3%
Household Wealth (in 1.000€)			
Gross Wealth Mean	275.7	644.8	514.7
Gross Wealth Median	100.4	340.6	354.4
Household Income (in 1.000€)			
Gross Current Income Mean	43.3	60.5	48.5
Gross Current Income Median	35.7	54.5	43.8
Household financial knowledgable person - socio-demographics			
Mean Age	53	48	45
Median Age	54	56	58
Household debt structure			
Median current outstanding debt (in 1.000€)	.	63.1	132.4
Share of vulnerable - DTA>100%	6.3%	1.4%	4.1%
Share of vulnerable - DTI>300%	6.2%	36.0%	67.7%
Share of vulnerable - DSTI>40%	2.6%	15.1%	22.9%
Share of vulnerable - expenses above income	6.9%	12.8%	10.7%

Source: HFCS Austria 2014, OeNB.

▸ Back

ǝNB

Table A4b: Affected households I - initial gross income

	All	HMR Mortgage Holders	Affected households in combined scenario
Share of affected households	100.0%	15.5%	2.3%
Household Wealth (in 1.000€)			
Gross Wealth Mean	275.7	644.8	496.3
Gross Wealth Median	100.4	340.6	329.7
Household Income (in 1.000€)			
Gross Current Income Mean	43.3	60.5	45.6
Gross Current Income Median	35.7	54.5	40.5
Household financial knowledgable person - socio-demographics			
Mean Age	53	48	48
Median Age	54	46	46
Household debt structure			
Median current outstanding debt (in 1.000€)	.	63.1	106.1
Share of vulnerable - DTA>100%	6%	1%	3%
Share of vulnerable - DTI>300%	4%	25%	54%
Share of vulnerable - DSTI>40%	2%	9%	27%
Share of vulnerable - expenses above income	7%	13%	11%

Source: HFCS Austria 2014, OeNB.

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Table A4c: Affected households I - current gross income

	All	HMR Mortgage Holders	Affected households in combined scenario
Share of affected households	100.0%	15.5%	2.3%
Household Wealth (in 1.000€)			
Gross Wealth Mean	275.7	644.8	496.5
Gross Wealth Median	100.4	340.6	338.2
Household Income (in 1.000€)			
Gross Current Income Mean	43.3	60.5	46.0
Gross Current Income Median	35.7	54.5	41.2
Household financial knowledgable person - socio-demographics			
Mean Age	53	48	46
Median Age	54	46	46
Household debt structure			
Median current outstanding debt (in 1.000€)	,	63.1	125.0
Share of vulnerable - DTA>100%	6.3%	1.4%	3.9%
Share of vulnerable - DTI>300%	3.3%	18.5%	55.5%
Share of vulnerable - DSTI>40%	0.6%	2.7%	13.4%
Share of vulnerable - expenses above income	6.9%	12.8%	12.3%

Source: HFCS Austria 2014, OeNB.

Table A5a: Share of aggregate debt held by households affected by macroprudential

	Base Line	Combined Scenario I
Conditional share of affected households	9.4%	14.7%
Conditional current share of aggregate HMR mortgage	20.4%	29.3%
Conditional initial share of aggregate HMR mortgage	8.8%	12.2%

Source: HFCS Austria 2014, OeNB.

▸ Back

ⒺNB

Table A5b: Share of aggregate debt held by households affected by macroprudential policy - based on initial gross income

	Base Line	Combined
Conditional share of affected households	9.5%	14.7%
Conditional current share of aggregate HMR mortgage	15.5%	24.8%
Conditional initial share of aggregate HMR mortgage	8.3%	11.3%

Source: HFCS Austria 2014, OeNB.

▸ Back

ⓔNB

Table A5c: Share of aggregate debt held by households affected by macroprudential policy - based on current gross income

	Base Line	Combined
Conditional share of affected households	9.7%	14.5%
Conditional current share of aggregate HMR mortgage	20.0%	27.1%
Conditional initial share of aggregate HMR mortgage	8.8%	12.3%

Source: HFCS Austria 2014, OeNB.

▸ Back

ƏNB

Table 1: Descriptive statistics of the components of credit avaliable and the binding condition - P80

	All	up to 1989	1990 to 1994	1995 to 1999	2000 to 2004	2005 to 2009	2010 and younger (2015)
Share of households for which the binding binding condition is							
LTV	0.4%	0.3%	0.0%	0.5%	0.5%	0.3%	0.5%
DTI	58.3%	59.8%	48.4%	53.0%	52.9%	63.6%	61.0%
DSTI	41.4%	39.9%	51.6%	46.6%	46.6%	36.2%	38.4%
Conditional Median of Maximum Credit given by (in 1.000€)							
LTV[1]	9,273.1	5,398.5	7,738.0	10,947.0	10,013.2	10,603.0	10,317.3
DTI	367.8	124.7	182.3	327.5	374.4	427.5	492.0
DSTI	379.7	117.4	180.5	328.9	395.8	431.6	496.9
Market condition of thresholds							
LTV (P80)	99.8	96.5	76.5	88.3	106.6	92.7	120.3
DTI (P95)	12.4	19.5	9.3	12.5	12.5	11.8	8.6
DSTI (P95)	66.5	117.7	60.3	70.4	63.6	60.3	51.4

Source: HFCS Austria 2014, OeNB.

▶ Back

OeNB

Table 2: House price regression - P80

	Full Sample		Restricted Sample		Unweighted Regression	
	Level initial house value	Logarithm initial house value	Level initial house value	Logarithm initial house value	Level initial house value	Logarithm initial house value
	I	II	III	IV	V	VI
Credit available (CA)	0.079	0.082	0.091	0.088	0.054	0.100
	(0.245)	(0.416)	(0.179)	(0.384)	(0.232)	(0.364)
Total household initial net income	-0.414	0.090	-0.180	0.100	-0.179	0.059
	-3080	(0.434)	-2062	(0.392)	-3080	(0.375)
Value of put down deposit (equity capital, down payment)	0.839***	0.039***	0.682***	0.026***	0.883***	0.042***
	(0.182)	(0.007)	(0.204)	(0.006)	(0.114)	(0.005)
Age	-4,330.020	-0.017	-1,836.547	-0.012	-5,469.899	-0.025
	(5,991.958)	(0.026)	(4,313.163)	(0.021)	(4,826.635)	(0.020)
Age squared	35151	0.000	16821	0.000	43303	0.000
	-58987	(0.000)	-42647	(0.000)	-48955	(0.000)
Controlled for [1]						
Region	X	X	X	X	X	X
Time brackets of loan originiation	X	X	X	X	X	X
Size of HMR	X	X	X	X	X	X
Duration of living in the HRM	X	X	X	X	X	X
Type of dwelling (paradata)	X	X	X	X	X	X
Dwelling rating (paradata)	X	X	X	X	X	X
Dwelling location (paradata)	X	X	X	X	X	X
Outward appearance of dwelling (paradata)	X	X	X	X	X	X

Source: HFCS Austria 2014, OeNB.
Notes:
1) Every regression includes a constant.

▶ Back

Table 3a: Simulation results - P80

	Base Line	LTV - 5ppts	DTI - 1 year	DSTI - 5ppts	Combined I
Share of households for which the binding binding condition is					
LTV	0.4%	6.2%	0.4%	0.4%	5.4%
DTI	58.3%	54.5%	76.1%	38.2%	56.6%
DSTI	41.4%	39.3%	23.6%	61.4%	38.1%
Conditional Median of Maximum Credit given by (in 1.000€)					
LTV[1]	9,273.1	1,670.4	9,273.1	9,273.1	1,670.4
DTI	367.8	367.8	338.2	367.8	338.2
DSTI	379.7	379.7	379.7	351.1	351.1
Changes with resect to					
House prices	.	-0.5%	-0.9%	-0.5%	-1.6%
Credit available	.	-3.0%	-6.1%	-3.5%	-10.3%

Source: HFCS Austria 2014, OeNB.

▸ Back

ONB

Table 3b: Simulating a reduction of available credit of 30% - P80

	LTV - scenario	DTI - scenario	DSTI - scenario	Combined scenario II
Change of				
LTV (in ppts)	-21	0	0	-10
DTI (in years)	0	-4.3	0	-2.8
DSTI (in ppts)	0	0	-24.5	-18.0
Share of households for which the binding binding condition is				
LTV	38.8%	0.3%	0.2%	10.4%
DTI	33.0%	97.4%	0.0%	39.2%
DSTI	28.2%	2.3%	99.8%	50.3%
Conditional Median of Maximum Credit given by (in 1.000€)				
LTV[1]	338.4	9,273.1	9,273.1	802.9
DTI	367.8	240.5	367.8	284.9
DSTI	379.7	379.7	239.8	276.9
Changes with resect to				
House prices	-3.1%	-4.6%	-4.6%	-4.2%
Credit available	-21.1%	-31.8%	-32.0%	-28.6%

Source: HFCS Austria 2014, OeNB.

▸ Back

ONB

Table 4: Characteristics of the households affected by macroprudential policy - P80

	All	HMR Mortgage Holders	Affected households in combined scenario
Share of affected households	100.0%	15.5%	1.3%
Household Wealth (in 1.000€)			
Gross Wealth Mean	275.7	644.8	514.2
Gross Wealth Median	100.4	340.6	350.5
Household Income (in 1.000€)			
Gross Current Income Mean	43.3	60.5	35.7
Gross Current Income Median	35.7	54.5	29.9
Household financial knowledgable person - socio-demographics			
Mean Age	53	48	49
Median Age	54	46	47
Household debt structure			
Median current outstanding debt (in 1.000€)	.	63.1	113.0
Share of vulnerable - DTA>100%	6.3%	1.4%	4.8%
Share of vulnerable - DTI>300%	6.2%	36.0%	66.8%
Share of vulnerable - DSTI>40%	2.6%	15.1%	57.3%
Share of vulnerable - expenses above income	6.9%	12.8%	12.4%

Source: HFCS Austria 2014, OeNB.

▸ Back

Table 5: Share of aggregate debt held by households affected by macroprudential policy - P80

	Base Line	Combined
Conditional share of affected households	6.4%	8.6%
Conditional current share of aggregate HMR mortgage	12.4%	15.6%
Conditional initial share of aggregate HMR mortgage	7.0%	8.3%

Source: HFCS Austria 2014, OeNB.

▸ Back