House Prices and Negative Nominal Interest Rates

Genevieve Nelson

Danmarks Nationalbank

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Introduction	Model	Results	Conclusion
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Debt Substitution Channel



- Households substitute towards relatively cheaper debt.
- Increased demand for mortgage debt will push house prices up.

Introduction ○●○○○	Model	Results Co	onclusion
Evidence from the I	Danish Microdata		

$$\Delta i_{j,t}^{b} = \alpha + \eta I_{t}^{\text{negative}} + \beta \Delta i_{t}^{r} + \gamma \Delta i_{t}^{r} \times I_{t}^{\text{negative}} + \delta_{j} + z_{j,t}^{\prime} \theta + \epsilon_{j,t},$$

	(1)	(2)
	Bank Loans	Mortgage Loans
Δi_t^r	0.271***	0.040***
	(0.00)	(0.00)
$I_t^{negative} = 1 \times \Delta i_t^r$	-0.299***	0.068***
	(0.00)	(0.00)
$I_t^{negative} = 1$	-0.047***	0.112***
	(0.00)	(0.00)
Constant	0.033	0.083***
	(0.02)	(0.01)
Household FE	Yes	Yes
Household Controls	Yes	Yes
F statistic	7,319	2,726
Observations	12507980	10517470

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Introduction 00000	Model	Results	Conclusion
Different Funding			

Commercial Banks:

- Funded by deposits.
- Deposit rates: do not fall (much) below zero.
- Squeezes commercial banks' net interest margin

 \implies erodes profitability/capital.

Mortgage Banks:

- Funded by mortgage bonds.
- Do not face the same stickiness around zero.
- Mortgage bank profitability not eroded.



Question: How does the transmission of monetary policy to house prices change below zero?



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- Consumption goes up by less...
 - \implies attenuated impact on inflation.



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Roadmap:

- Simple model debt substitution channel.
- NK model implications for inflation.



Theory Linking Bank Profits and Lending Conditions

- Ulate (2021)
- Eggertsson, Juelsrud, Summers & Wold (2019)
- Brunnermeier & Koby (2019)

Negative Interest Rates in Denmark

- Adolfsen & Spange (2020)
- Abildgren & Kuchler (2020)

Negative Interest Rates Empirical

- Heider Saidi & Schepens (2019)
- Ampudia & van den Heuvel (2019)

Introduction 00000	Model	Results	Conclusion
Saver-Banks			

Introduction 00000	Model	Results	Conclusion
Saver-Banks			

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Saver-Banks		

$$\max_{\{\tilde{c}_t, b_t, l_t\}} E_0 \sum_{t=0}^{\infty} (\tilde{\beta}_t)^t \Big[\tilde{c}_t - \tilde{v}(l_t) \Big],$$

uncollateralized loans

Subject to:

$$\tilde{c}_t + l_t + b_t = \tilde{y} + R'_{t-1}l_{t-1} + R^b_{t-1}b_{t-1},$$

Introduction 00000	Model	Results	Conclusion
Saver-Banks			

$$\max_{\{\tilde{c}_t, b_t, l_t\}} E_0 \sum_{t=0}^{\infty} (\tilde{\beta}_t)^t \Big[\tilde{c}_t - \tilde{v}(l_t) \Big],$$



Introduction 00000	Model	Results	Conclusion
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Introduction Model Results Conclus	sion

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Subject to:

$$\tilde{c}_t + l_t + b_t = \tilde{y} + R_{t-1}^l l_{t-1} + R_{t-1}^b b_{t-1},$$

Exogenous Spread:
$$R_t^l - R_t^b = au_{l,t}$$
.

More Detail

Introduction Model Results Concl	

$$\max_{\{\hat{c}_t, b_t, l_t, \hat{h}_t\}} E_0 \sum_{t=0}^{\infty} (\hat{\beta}_t)^t \Big[\log(\hat{c}_t) + j \log(\hat{h}_t) \Big],$$

Introduction 00000	Model	Results	Conclusion
Borrowers			

$$\max_{\{\hat{c}_t, \hat{b}_t, l_t, \hat{h}_t\}} E_0 \sum_{t=0}^{\infty} (\hat{\beta}_t)^t \Big[\log(\hat{c}_t) + j \log(\hat{h}_t) \Big],$$

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Dermannen			
Introduction	Model	Results	Conclusion

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Introduction 00000	Model	Results	Conclusion
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$$\hat{c}_t + R_{t-1}^l I_{t-1} + R_{t-1}^b b_{t-1} + p_{h,t} \hat{h}_t = I_t + b_t + p_{h,t} \hat{h}_{t-1} + \hat{y},$$

Introduction 00000	Model	Results	Conclusion
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Introduction 00000	Model	Results	Conclusion
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$$\underbrace{R^b_t b_t}_{\text{repay on mortgage debt}} \leq \underbrace{m_b \ E_t \ \underline{p_{h,t+1} \hat{h}_t}}_{\text{future value of housing}},$$

 $\underbrace{l_t+b_t}_{} \leq m_y \underbrace{\hat{y}}_{}.$ total borrowing



Introduction 00000	Model	Results	Conclusion
Market Clearing			

Housing supply:

$$\hat{h}_t = H$$

Resource constraint:

$$\hat{c}_t + \tilde{c}_t = \hat{y} + \tilde{y}$$

Model

Results

Conclusion



Model

Results

Conclusion

Monetary Policy Cut



• Blue = monetary policy cut above zero.

Model

Results

Conclusion



- Blue = monetary policy cut above zero.
- Black = monetary policy cut below zero.

Model

Results

Conclusion



- Blue = monetary policy cut above zero.
- Black = monetary policy cut below zero.
- Red = marginal impact of the debt substitution channel.

Model

Results

Conclusion



- Blue = monetary policy cut above zero.
- Black = monetary policy cut below zero.
- Red = marginal impact of the debt substitution channel. More

Introduction 00000		Model		Results		Conclusion
Monetary	Policy	Hikes -	Weaker	at Fighting	Inflation	(1)



	Deller		M/aalian a		Inflation	(0)
Introduction 00000		Model		Results		Conclusion

Monetary Policy Hikes - Weaker at Fighting Inflation (2)



Introduction 00000	Model	Results	Conclusion
Conclusion			

When the nominal policy rate is negative:

- Monetary policy pass-though is different to mortgage rates vs other lending rates.
- Monetary policy cuts pushes house prices up by more.
- Monetary policy cuts are less effective at simulating borrower consumption and inflation.
- Monetary policy hikes (from low or negative nominal levels) are less effective at fighting inflation.

Tak!

Introduction Backup Slides

Results

Conclusion

Both Spreads



Introduction	

Mode

Result

Conclusion

Both Quantities and Spreads Changed



Data Backup Slides

Introduction

Results

Conclusion

Conditional Interest Rates



Bank Loans

Mortgage Loans



troduction	

Result

Conclusion

Reduced Pass-Through

$$\Delta i_{i,t}^{b} = \alpha + \eta I_{t}^{\text{negative}} + \beta \Delta i_{t}^{r} + \gamma \Delta i_{t}^{r} \times I_{t}^{\text{negative}} + \delta_{i} + \epsilon_{i,t},$$

	(1)	(2)	(3)
	Bank Loans	Housing related bank loans	Mortgage Loans
Δi_t^r	0.366***	0.322***	0.071***
	(0.03)	(0.04)	(0.01)
$I_t^{negative} = 1 \times \Delta i_t^r$	-0.525***	-0.365***	-0.066
	(0.11)	(0.08)	(0.03)
$I_t^{negative} = 1$	-0.022***	-0.027***	0.012***
	(0.00)	(0.01)	(0.00)
Constant	-0.001	0.001	-0.028***
	(0.00)	(0.00)	(0.00)
Bank FE	Yes	Yes	Yes
F statistic	135.45	51.96	22.41
Observations	3,274	3,252	1,326

Note: ***p < 0.01, **p < 0.05, *p < 0.1.



Introd	uction

Results

Conclusion

Reduced Pass-Through

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Model Backup Slides

Introduction	Model	Results	Concl

Mapping Savers to Banks



Source: Danmark Nationalbank's MFI Statistics.

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Introduction	Model	Results	Cone

Mapping Savers to Banks



Source: Danmark Nationalbank's MFI Statistics.



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Source: Danmark Nationalbank's MFI Statistics.



Introduction	Model	Results	Conclusion

Mapping Savers to Banks



Source: Danmark Nationalbank's MFI Statistics.

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$$\tilde{\mathbf{v}}(\mathbf{I}_t) = \tilde{\beta}_t \tau_{\mathbf{I},t} \mathbf{I}_t,$$

Introduction 00000	Model	Results	Conclusion
House Pricing Equ	lation		

$$p_{h,t} = j\hat{c}_t + j\sum_{i=0}^{\infty} \hat{c}_{t+i+1} \left\{ \prod_{k=0}^{i} \left[\frac{\hat{c}_{t+k}}{\hat{c}_{t+k+1}} \hat{\beta} \right] \right\}$$



Introduction 00000	Model	Results	Conclusion
House Pricing Equa	ition		

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Introduction 00000	Model	Results	Conclusion

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Results Backup Slides

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Introduction 00000	Model	Results	Conclusion





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Model

Result

Conclusion

Monetary Policy Cuts - Less Inflationary



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