



Seðlabanki Íslands

# Financial cycle in Iceland

## Characteristics, spillovers, and cross-border channels

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## Macro-financial linkages and financial cycles

- The global financial crisis was a serious wake-up call emphasising the need to reintroduce the financial system as an essential actor in macroeconomics and economic policy
- Post-crisis period: a rapidly expanding literature on macro-financial linkages and the financial system's role in driving economic cycles and causing financial crises
- The financial cycle seems a promising approach in this regard

## Claudio Borio (2014, p. 183)

- „Macroeconomics without the financial cycle is like Hamlet without the Prince“
- In our paper we tackle the Prince's existential question head-on\*

\*The long history of financial boom-bust cycles in Iceland – Part II: Financial cycles. Central Bank of Iceland *Working Papers*, forthcoming.

# Definition and data



## Definition of the financial cycle

- The term generally refers to the co-movement of a set of financial variables, including both quantities and prices – its most parsimonious representation relies on house prices and credit
- We measure the financial cycle as the low-frequency cyclical co-movement of a broader set of financial variables to attain additional insight and expose potentially important small open economy features – including the role of global spillovers

## Annual data for the period 1875-2013\*

- Financial variables
  - Real house prices, credit, and money, as well as banking system assets, leverage, and liability composition
- Macroeconomic variables
  - GDP, domestic demand, trade deficit, the nominal and real exchange rate, terms of trade, and inflation
- In addition: international data to analyse global spillovers

\*Some banking system variables only extend back to 1886.

# Method to extract cyclical components from the data



## Medium-term cycles in individual series

- As has become standard in this literature, we apply the Christiano and Fitzgerald frequency filter to log-differences of our series
- We then cumulate these growth series into log-levels (starting from zero at the first observation of the variable) to construct medium-term cycles for each individual variable

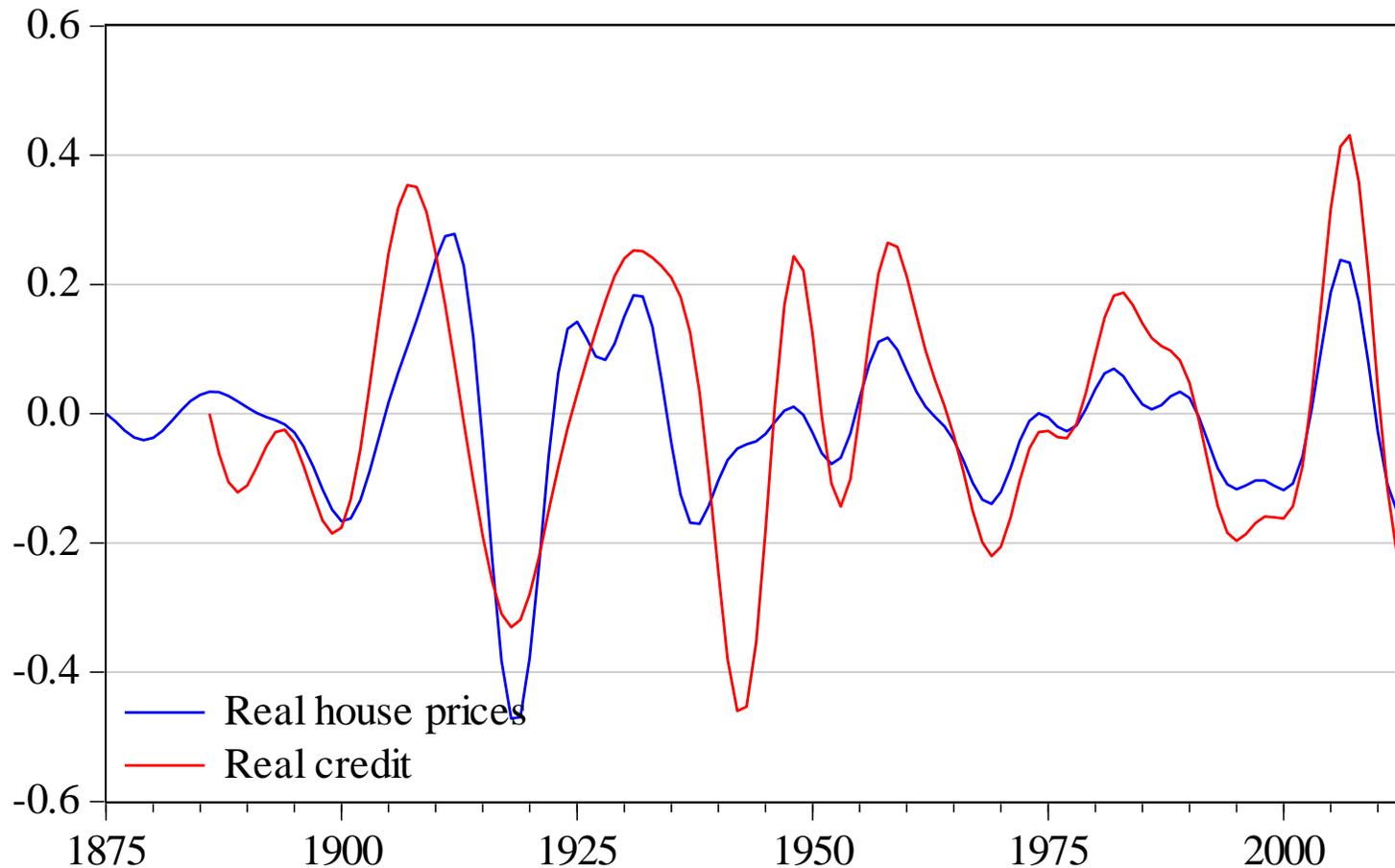
## The aggregate financial cycle

- We estimate the aggregate financial cycle using a principal component analysis to identify the low-frequency cyclical co-movement of our set of financial variables
- We thus identify the financial cycle as the first principal component, i.e. the one that explains most of the combined variability in our variables

# Medium-term cycles in individual series

- The figure gives an example of the medium-term cycle in two key financial series: house prices and credit
- Clear visual impression of strong co-movement of the medium-term cycles in the two series over the sample period
- This holds more broadly for our financial variables, except for money and leverage which are not well aligned with the corresponding cycles in the other seven financial variables

Medium-term cycles in house prices and credit



## Key cyclical characteristics

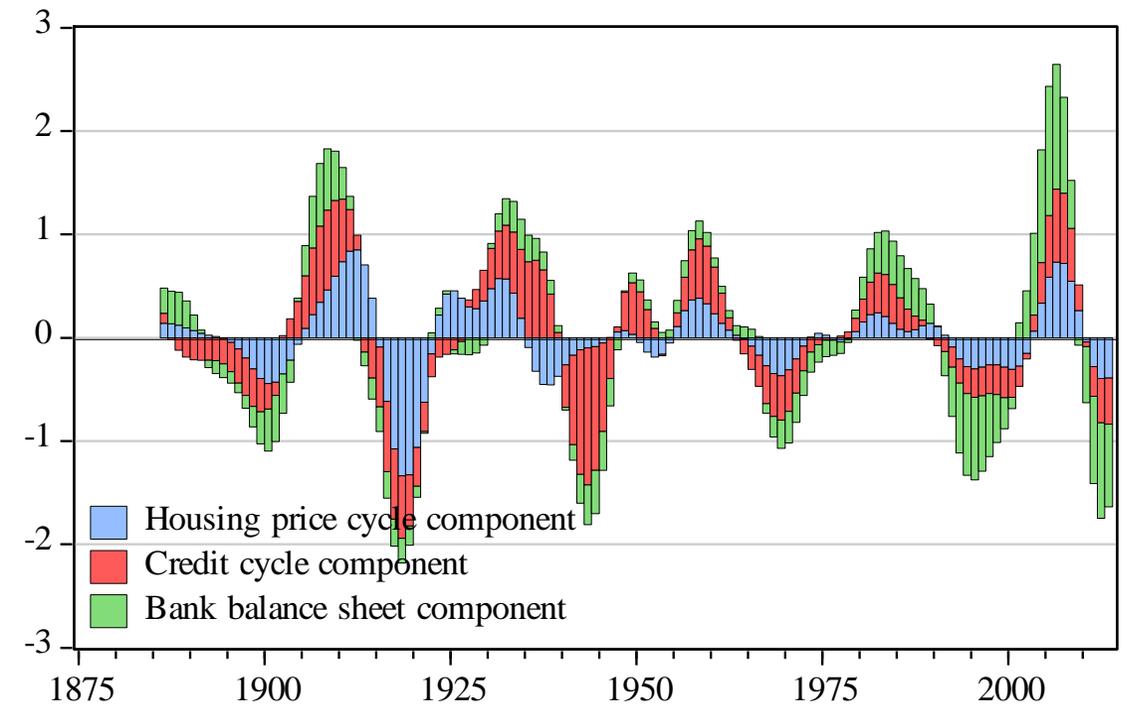
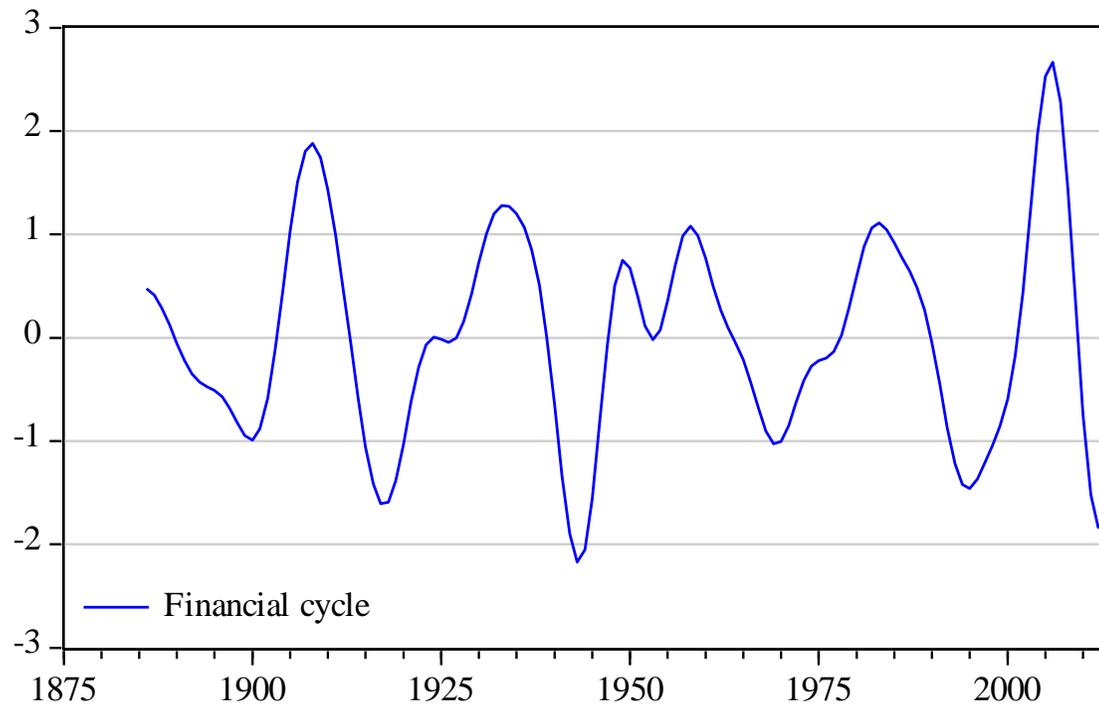
- Medium-term cycles play a dominant role in the overall behaviour of our variables
- Duration and intensity of the cycles grow over the sample period
- Considerable co-movement of medium-term cycles in most financial variables, which strengthens over time

# The financial cycle and its composition

- Our principal component analysis reveals that there indeed exists a well-defined aggregate financial cycle in Iceland
- Our results indicate roughly equal weights for the financial variables (except for money and leverage which we then exclude)
- First principal component explains 65% of the variance of our financial variables over the whole period (75% in post-WWII)
- Seven identified cyclical expansions: the latest one standing out in size and duration – important role of bank balance sheets

## The financial cycle and contribution of individual cyclical components

Financial cycle (left) and contribution of medium-term components (right)



Financial cycle and contribution of individual cyclical components, weighted with their normalised factor loadings. *House price cycle component* refers to the contribution of the medium-term cycle in real house prices to the financial cycle, *Credit cycle component* refers to the weighted average contribution of medium-term cycles in real credit, credit-to-GDP and credit-to-M3 to the financial cycle, *Bank balance sheet cycle component* refers to the weighted average contribution of medium-term cycles in bank assets-to-GDP, foreign non-core bank liabilities ratio and total non-core liabilities ratio to the financial cycle. The individual components are normalised so that their sum has the same mean and standard deviation as the aggregate cycle.

# Features of the financial cycle

## Duration of 16 years

- Duration of a complete financial cycle is 16 years on average in line with evidence from other countries (Drehmann et al., 2012)

## Evolving over time

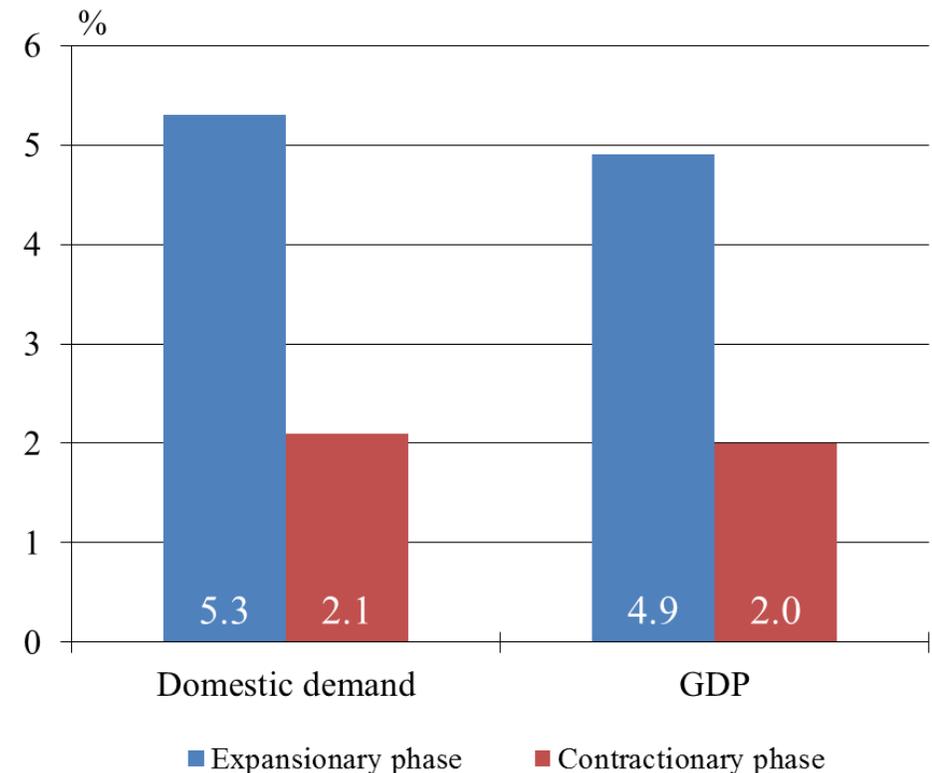
- The cycle's duration, amplitude, and intensity grows over the period spanning more than a century

## Co-movement with individual series

- Individual financial variables show strong co-movement with the aggregate cycle
- Some macro variables do as well – especially domestic demand and the trade deficit, but also GDP and the real exchange rate

## Important role in macroeconomic developments

Economic activity in different phases of the financial cycle 1875-2013<sup>1</sup>



1. The figure shows the median growth rate of domestic demand and GDP over the expansionary and contractionary phases of the financial cycle.

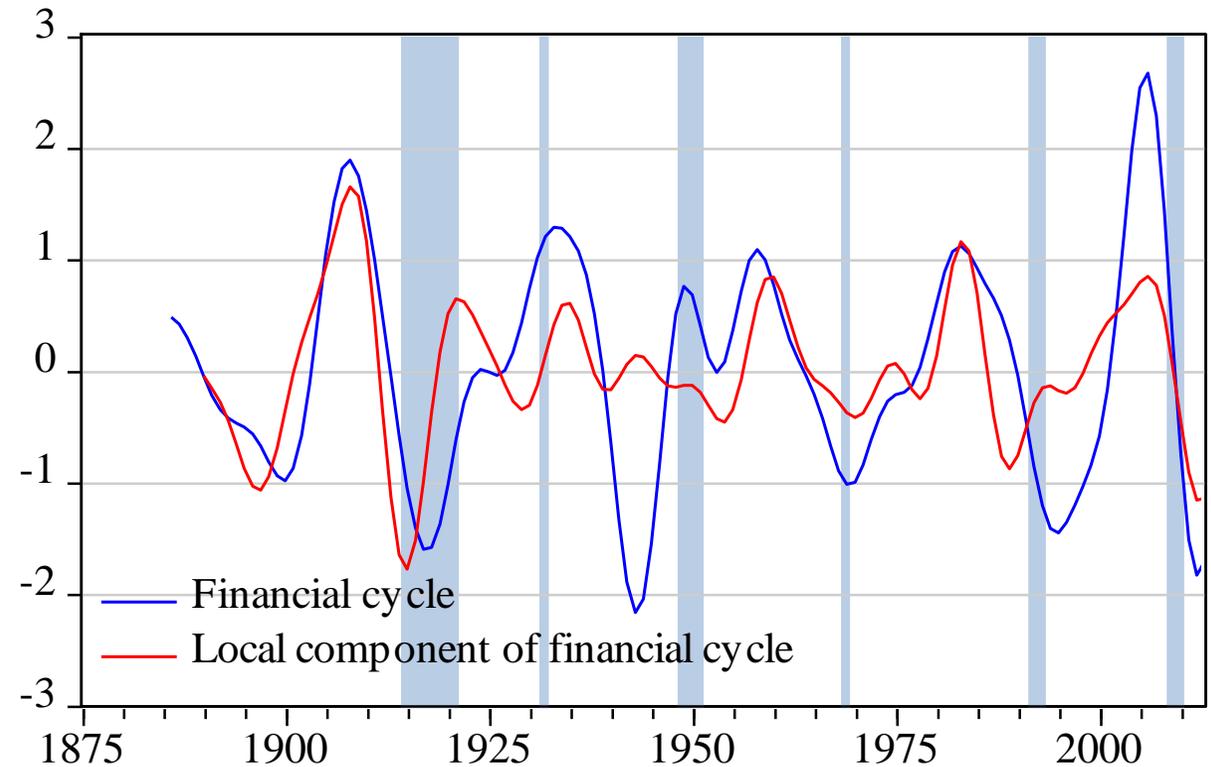
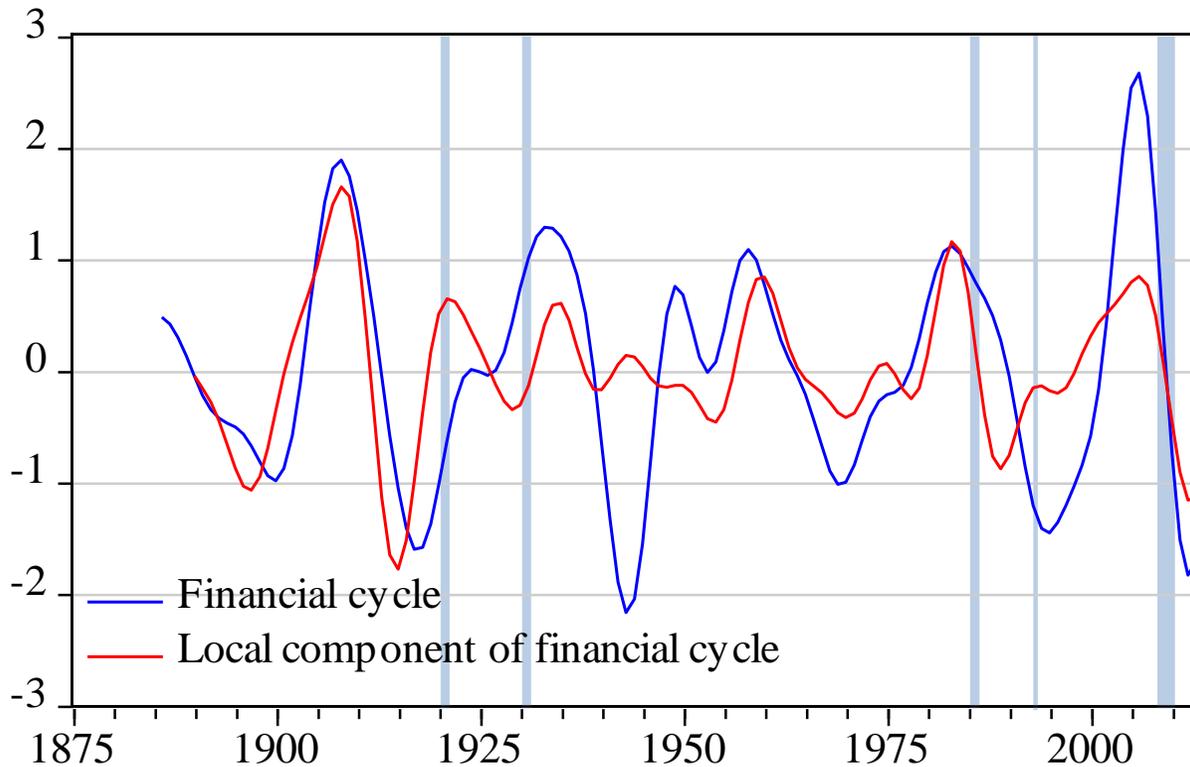
# Close relation between the financial cycle and crises



- Financial crises are closely aligned with financial cycle peaks (both banking crises and “multiple” financial crises)
- Almost all financial cycle peaks (aggregate or “local”) have some kind of a financial crisis within a three year window
- The financial cycle outperforms the early warning capacity of individual financial and macroeconomic series – a financial cycle expansion is followed by a banking crisis within three years in 60% of all expansionary phases

## The financial cycle and financial crises

Banking crises (left) and multiple financial crises (right) shown as shaded areas

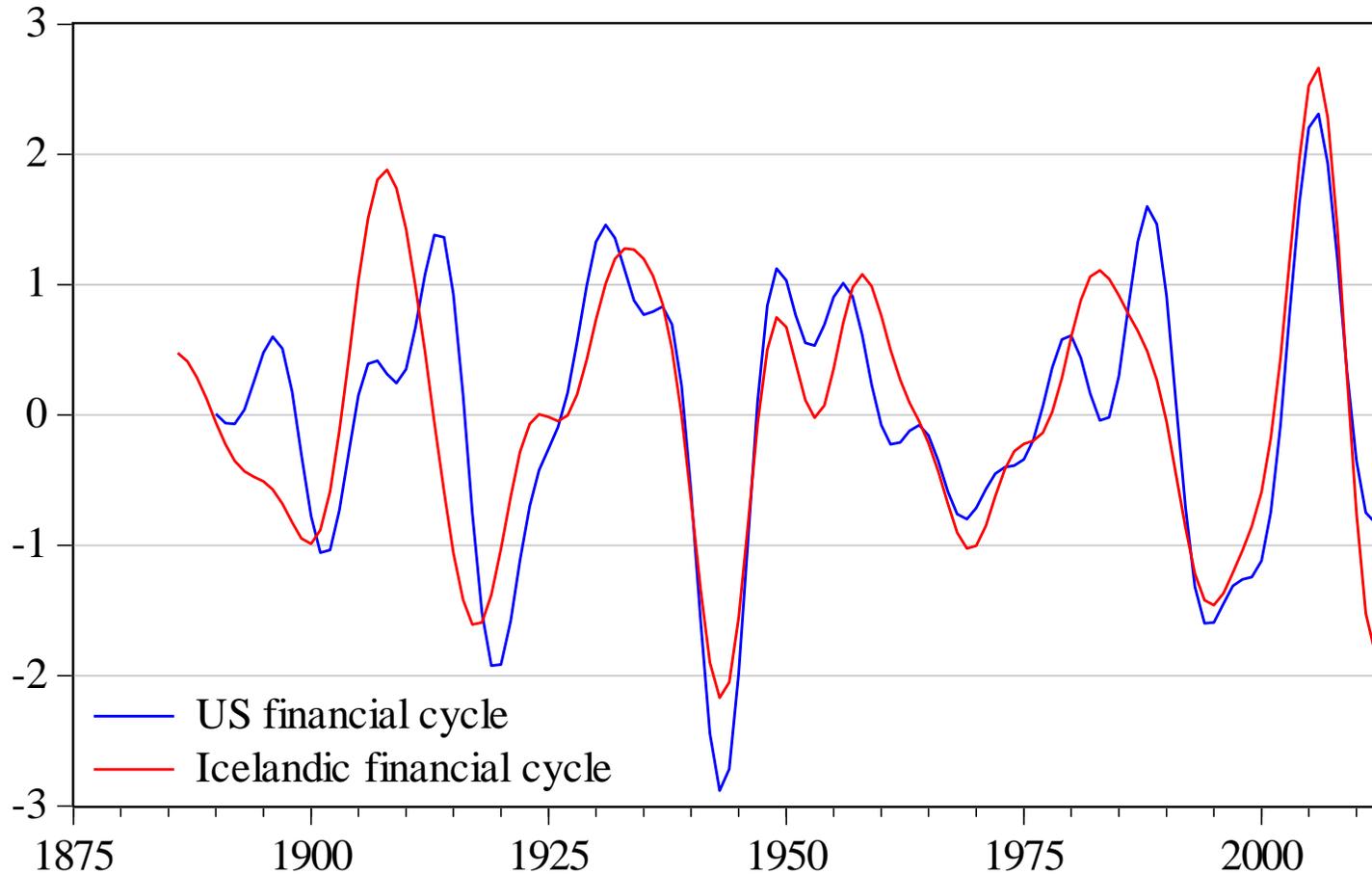


# Global financial cycle spillovers



- We find strikingly strong ties between the Icelandic financial cycle and its global counterpart (proxied by the US financial cycle)
- 6 of 7 peaks in the Icelandic cycle occur close to global cycle peaks (coinciding or with the Icelandic peak lagging by 1-2 years)
- Domestic and global cycle are roughly 75% of the period in the same phase notwithstanding different policy and openness regimes
- Spillover effects seem to grow stronger over time

The US and Icelandic financial cycles



Concordance index of US and Icelandic financial cycles

US financial variable	Total sample	1875-1944	1945-2013	1980-2013
House prices	0.57	0.45	0.67	0.74
Real credit	0.65	0.59	0.70	0.71
Credit-to-GDP	0.72	0.67	0.75	0.74
Real M3	0.39	0.34	0.42	0.56
M3-to-GDP	0.60	0.66	0.55	0.53
Credit-to-M3	0.67	0.62	0.72	0.62
Assets-to-GDP	0.73	0.78	0.70	0.76
Real interest rate	0.59	0.64	0.55	0.56
Real stock prices	0.46	0.59	0.36	0.38
US financial cycle	0.74	0.67	0.80	0.74

■ indicates numbers between 0.6 and 0.7, ■ numbers between 0.7 and 0.8, and ■ numbers higher than 0.8.

# Cross-border transmission channels



- We analyse possible transmission channels of global spillovers and find significant spillover effects on many of the domestic financial variables, most clearly for credit and non-core bank liabilities, as well as bank assets and house prices in the second half of the sample period
- Shows the additional value from including bank balance sheet series in capturing cross-border transmission channels

Spillover channels from the global cycle

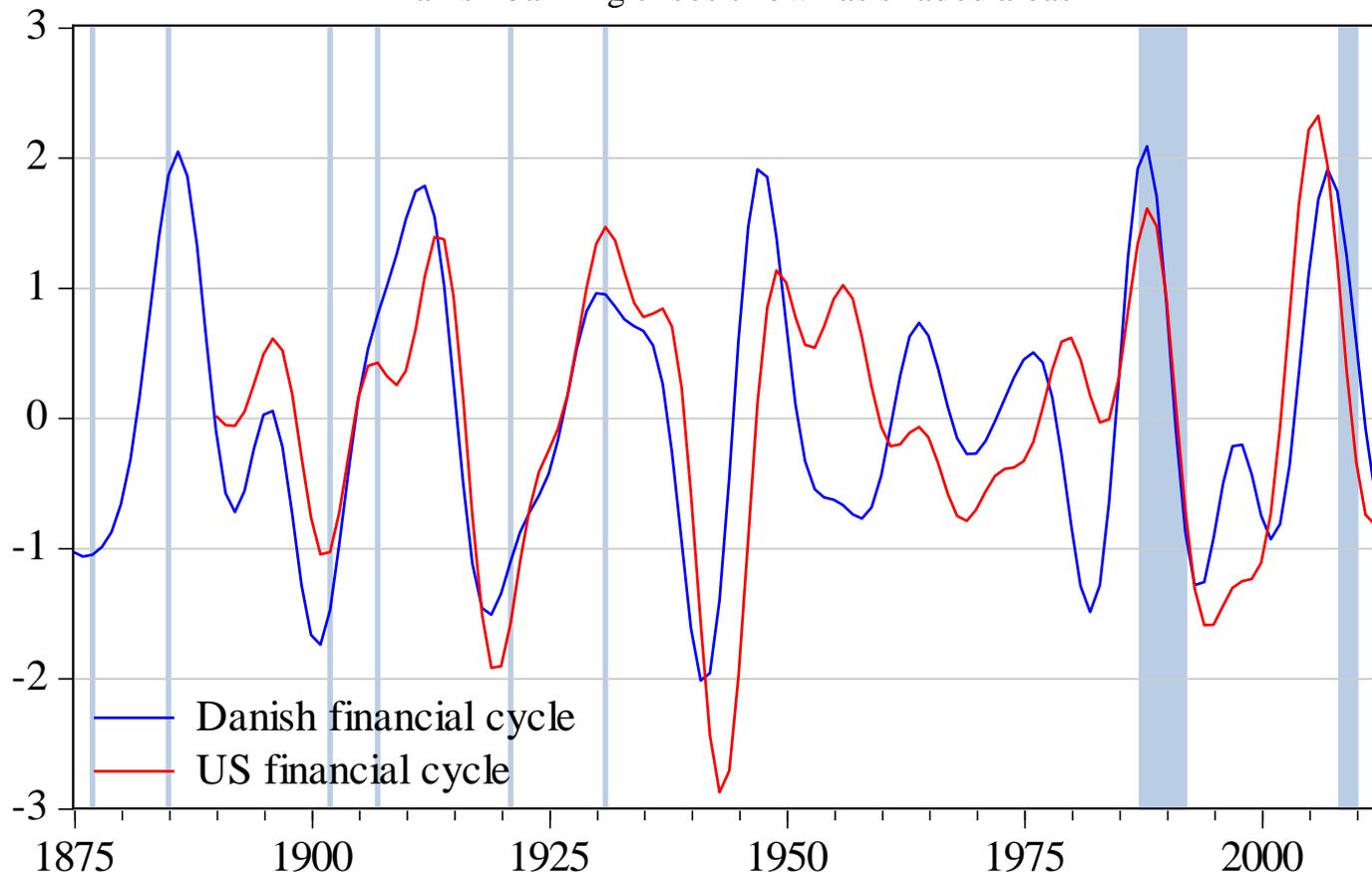
Icelandic financial variable	Total sample	1875-1944	1945-2013	1980-2013
House prices	0.37	0.31	0.58	0.77
Real credit	0.56	0.53	0.59	0.74
Credit-to-GDP	0.38	0.29	0.57	0.59
Real M3	0.00	0.08	-0.01	0.38
M3-to-GDP	0.15	0.53	0.00	0.09
Credit-to-M3	0.42	0.48	0.35	0.20
Assets-to-GDP	0.33	0.03	0.65	0.83
Leverage	0.11	0.32	-0.01	0.19
Foreign non-core	0.21	-0.02	0.53	0.58
Total non-core	0.54	0.47	0.61	0.63
Aggregate financial cycle	0.61	0.47	0.74	0.76

The table reports the results from regressing the medium-term cyclical component of the Icelandic financial variables and the aggregate financial cycle, respectively, on a constant and the composite US financial cycle. Reported are the  $R^2$  (degrees of freedom adjusted). The associated  $p$ -values are reported in Table 10 in the paper. ■ indicates  $R^2$  between 0.5 and 0.6, ■  $R^2$  between 0.6 and 0.7, ■  $R^2$  between 0.7 and 0.8, and ■  $R^2$  higher than 0.8.

# The Danish financial cycle and regional spillovers

- There are also strong ties between the Danish financial cycle and its global counterpart: the two cycles tend to be in the same phase close to 80% of the time and the US cycle explains about 40% of the variation in the Danish cycle
- Similarly, cyclical expansions have significant predictive power for impending financial crises as in the Icelandic case
- Finally, there is evidence of regional effects from the Danish credit cycle on the Icelandic financial cycle in 1875-1944

Danish and US financial cycle  
Danish banking crises shown as shaded areas



Concordance index for the aggregate  
Icelandic financial cycle and regional cycles

	Total sample	1875-1944	1945-2013	1980-2013
DK credit/GDP	0.53	0.76	0.33	0.35
DK house prices	0.55	0.55	0.55	0.53
DK financial cycle	0.55	0.67	0.45	0.41
NOK credit/GDP	0.52	0.57	0.48	0.59
NOK house prices	0.45	0.48	0.42	0.44
NOK fin. cycle	0.45	0.53	0.38	0.50
UK credit/GDP	0.52	0.64	0.42	0.32
UK house prices	0.51	0.47	0.55	0.68
UK financial cycle	0.51	0.55	0.48	0.47

The table reports the concordance index for the aggregate Icelandic financial cycle and the local component of the medium-term cyclical components of individual series and the aggregate cycle, respectively, in Denmark, Norway and the UK. The local components are obtained as the residual from regressing the original cyclical components on a constant and the composite US financial cycle. ■ indicates numbers between 0.6 and 0.7, ■ numbers between 0.7 and 0.8.

The composite financial cycles are estimated as the first principal component of the medium-term cycles of the credit-to-GDP ratio and real house prices for each country. Dates for banking crises in Denmark are from Reinhart and Rogoff (2011).

# Conclusions and some policy issues



## Conclusions

- There exists a well-defined financial cycle in Iceland that seems to have played an important role in the country's macroeconomic developments and financial crises over the last roughly 130 years (role for Hamlet's Prince)
- Evidence of strong global financial cycle spillovers across different policy and openness regimes – operating through various transmission channels
- Hence, the financial cycle entails powerful, pro-cyclical, and long-lasting forces, which to a significant degree originate outside the domestic domain

## Policy issues

- How can the design of domestic policy frameworks take the financial cycle and global spillovers, as well as their associated macro-financial linkages, into account to attenuate the boom-bust dynamics they give rise to?