



# Small open economies in the vast ocean of global high finance

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Macro-Theory Seminar Adam Smith Business School University of Glasgow

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## Presentation based on recent research project

“The long history of financial boom-bust cycles in Iceland – Part I: Financial crises“, Central Bank of Iceland *Working Papers*, no. 68/2015

“The long history of financial boom-bust cycles in Iceland – Part II: Financial cycles“, Central Bank of Iceland *Working Papers*, no. 72/2016 (forthcoming in *Revisiting Macro-Financial Linkages: Looking Back and Looking Ahead*. Proceedings of the 2016 Bangko Sentral ng Pilipinas International Research Conference)

„Small open economies in the vast ocean of global high finance“, Central Bank of Iceland *Working Papers*, no. 73/2016

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The opinions expressed herein are those of the authors and do not necessarily reflect the opinions or policy of the Central Bank of Iceland

# Seminar at the University of Glasgow

## Background: the recent financial crisis

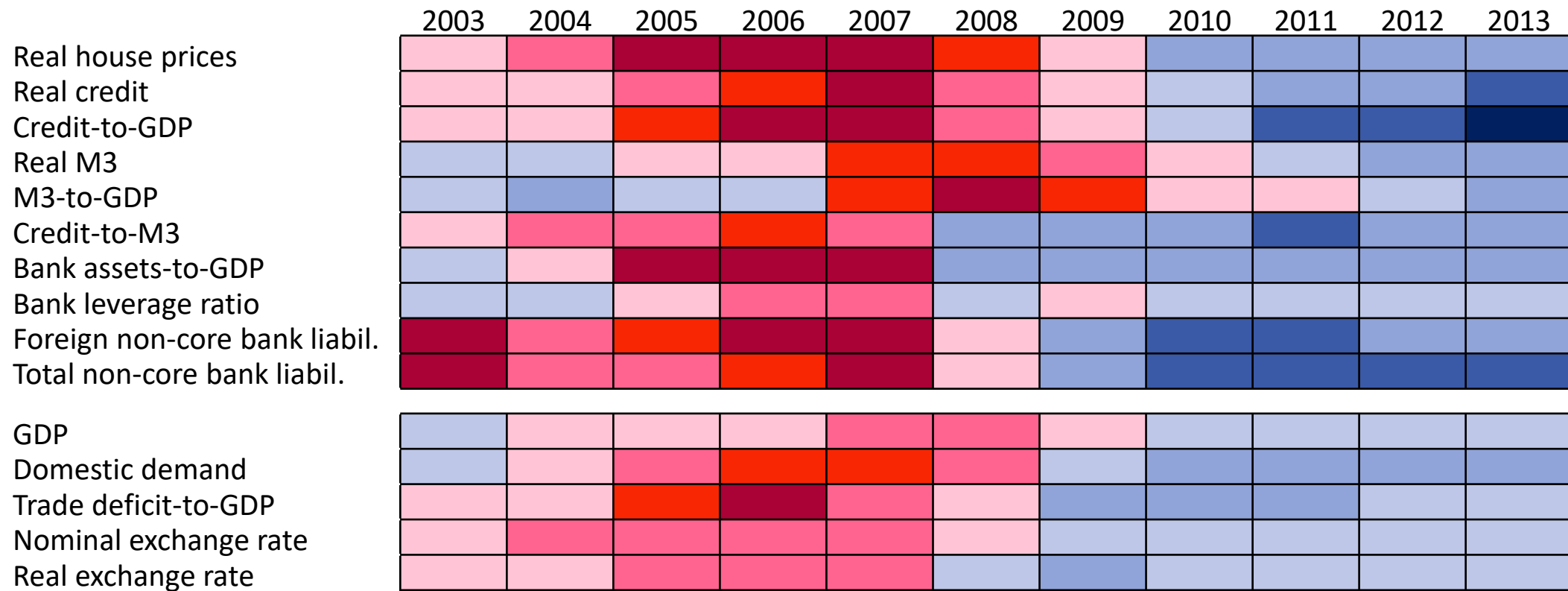
“This time its different”  
Numerous bankers, politicians, policymakers,  
regulators, and every other soothsayer  
in Iceland and elsewhere in the  
run-up to the global financial crisis

# The recent financial boom and bust ...



- The latter half of the 2000s saw an enormous build-up of internal and external macro-financial imbalances in Iceland: asset prices were rising fast, credit growth exploding, the banking system grew enormously, fed by rising leverage – in particular through cross-border wholesale funding
- The macroeconomy was overheating, the currency was overvalued, and a large trade deficit had build up

Financial and macroeconomic variables in the 2008 financial crisis<sup>1</sup>



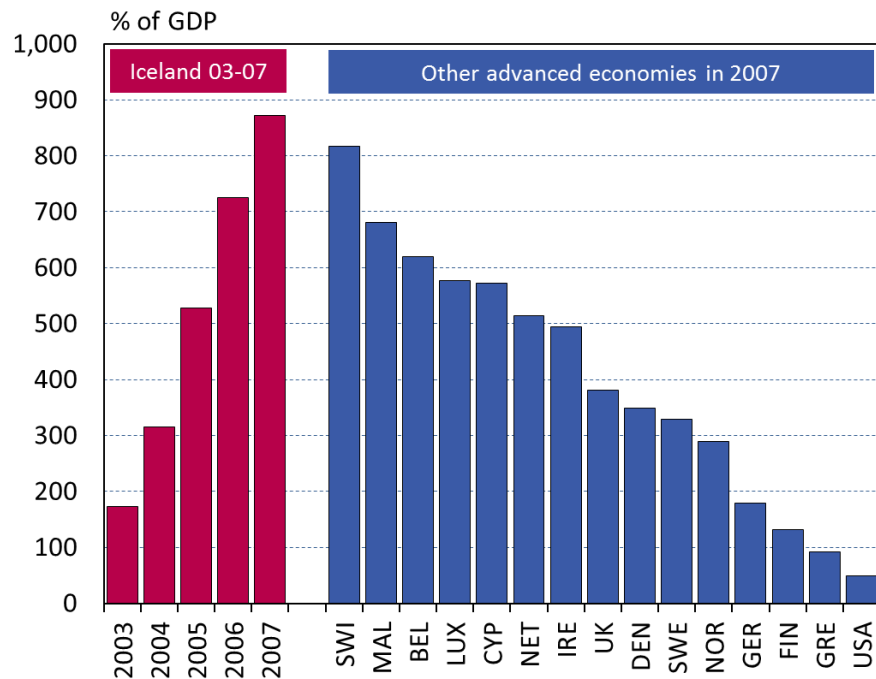
1. The table shows the development of each variable compared to its long-term trend for the five years in the run-up to and in the aftermath of a financial crisis (starting in 2008). The long-term trend is estimated for 1870-2013 using the Hodrick-Prescott filter with a smoothing parameter equal to 1,563. Red cells indicate that a variable was above trend in a given year with darker red cells indicating ever larger deviations above trend (■ indicates more than 1 standard deviation above trend, ■ more than 2 standard deviations above trend, and ■ more than 3 standard deviations above trend). Blue cells indicate that a variable was below trend in a given year with darker blue cells indicating ever larger deviations below trend (■ indicates more than 1 standard deviation below trend, ■ more than 2 standard deviations below trend, and ■ more than 3 standard deviations below trend).

# ... saw the rise and fall of a gigantic banking system ...

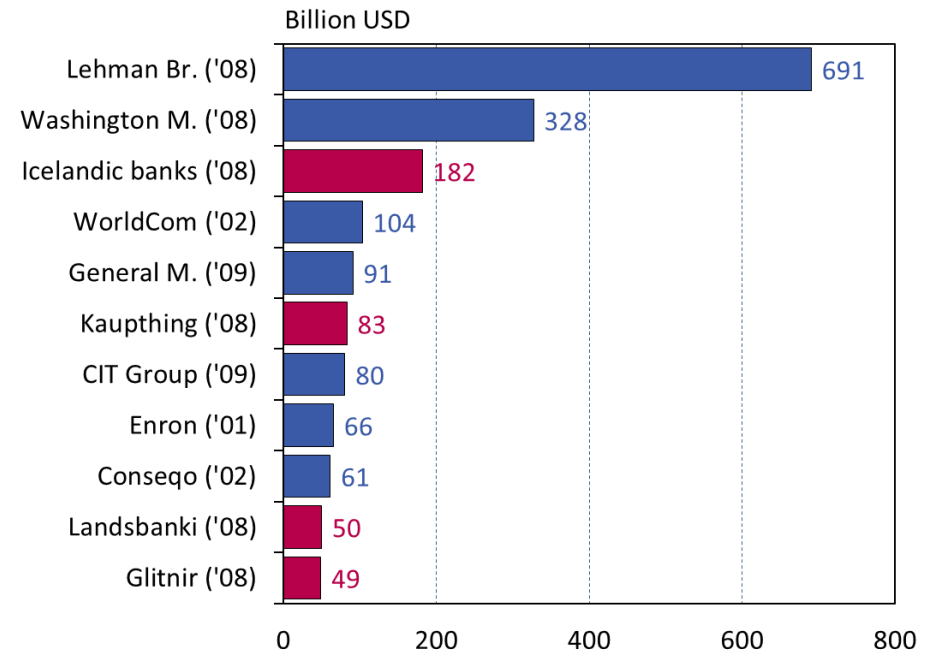


- The Icelandic banking system expanded rapidly following its privatisation in the early 2000s: increasing from less than 2 times GDP in 2003 to 10 times GDP by the time it collapsed in the autumn of 2008 – making it the largest banking system in the advanced world relative to GDP (except, perhaps, in Scotland) ...
- ... and among the largest bankruptcies in history – even in absolute terms

Banking system size in the run-up to the international financial crisis<sup>1</sup>



The largest bankruptcies in history



1. The figure shows the development in Iceland in 2003-2007 but the position in 2007 in other countries.

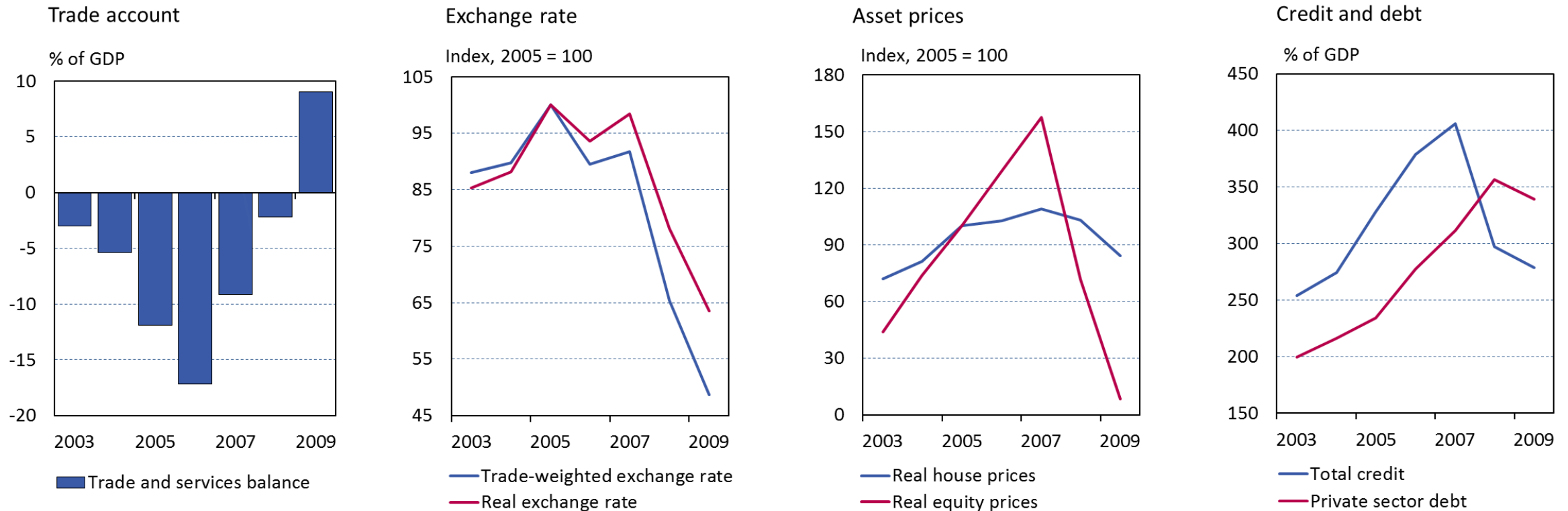
Sources: BankruptcyData.com, Interim Financial Statements of the Icelandic banks in September 2008, Central Bank of Iceland, Ólafsson, T. T., & Pétursson, T. G. (2011). Weathering the financial storm: The importance of fundamentals and flexibility. In *The Euro Area and the Financial Crisis*. Editors M. Bablavý, D. Cobham and L. Ódor. Cambridge University Press.

# ... coinciding with large swings in global financial conditions



- The build-up of large internal and external imbalances in the run-up to the financial crisis and the subsequent bust when the crisis hit coincided with the ample global liquidity in the pre-crisis period and its sharp curtailment following the collapse of Lehman Brothers in the autumn of 2008
- Is there a domestic financial cycle which is to a large extent driven by variations in global financial conditions?

## The boom-bust cycle 2003-2009

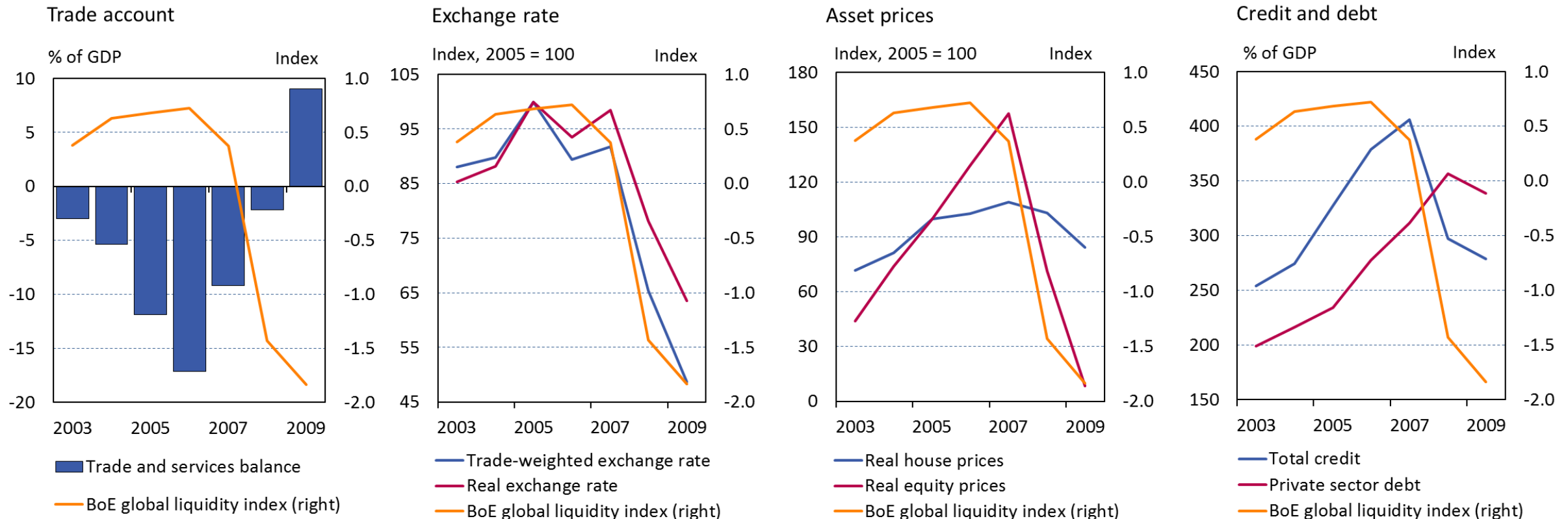


# ... coinciding with large swings in global financial conditions



- The build-up of large internal and external imbalances in the run-up to the financial crisis and the subsequent bust when the crisis hit coincided with the ample global liquidity in the pre-crisis period and its sharp curtailment following the collapse of Lehman Brothers in the autumn of 2008
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## The boom-bust cycle 2003-2009



The Bank of England global liquidity index shows the number of standard deviations from the mean (exponential moving average) from a simple unweighted average of nine liquidity measures, normalised on the period 1999-2004.

Sources: Bank of England, Statistics Iceland, Central Bank of Iceland.

# Seminar at the University of Glasgow

## The financial cycle

“Macroeconomics without the financial  
cycle is like Hamlet without the Prince”

Claudio Borio, BIS



# Macro-financial linkages and the financial cycle



## Post-crisis refocus on macro-financial linkages

- The global financial crisis served as a big wake-up call
  - Highlighted the importance of macro-financial linkages and how the financial system can amplify macro imbalances ...
  - ... and the need to improve our understanding of the financial cycle

## Rapidly expanding literature

- Documenting macro-financial regularities over long periods
  - Highlighting importance of low-frequency cycles in financial variables and their importance in explaining economic booms and busts
- We add to that by looking at a richer set of financial variables, focusing on importance of global spillovers in a small open economy

# The financial cycle: definition and the data



## The financial cycle: what do we mean?

- The financial cycle can be characterised as the “self-reinforcing interactions between perception of value and risk, attitudes towards risk and financing constraints, which translate into booms followed by busts” (Borio, 2014, p. 183)
- Can therefore think of financial cycle as the systemic co-movement of a broad set of financial variables and is therefore closely related to the concept of pro-cyclicality of the financial system

## We need long data spans

- Need long data spans to capture the long, low-frequency cycles
- We construct a data set spanning almost one and a half century (1875-2013)
- Includes standard financial variables: credit, money, house prices ...
- ... and data on banking system balance sheet size, leverage, and liability composition (ten financial variables in total)

# The financial cycle: methodology



## Focus on low-frequency components of financial variables

- As has become standard in this literature, we apply the Christiano-Fitzgerald band-pass filter to the log-differences of each variable ...
- ... and cumulate these growth series into log-levels (starting from zero at the first observation) to construct medium-term cycles (8-30 years) for each variable

## The aggregate financial cycle

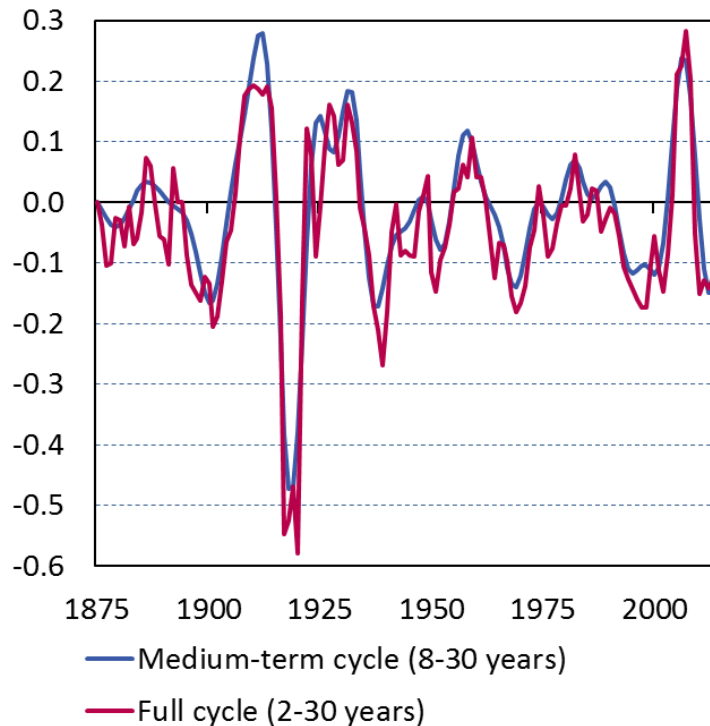
- The aggregate cycle is extracted from the set of medium-term cycles using a principal component analysis ...
- ... with the first principal component identified as the common financial cycle – i.e. the one that explains most of the combined variability in the set of medium-term cycles

# Financial variables dominated by low-frequency cycles ...

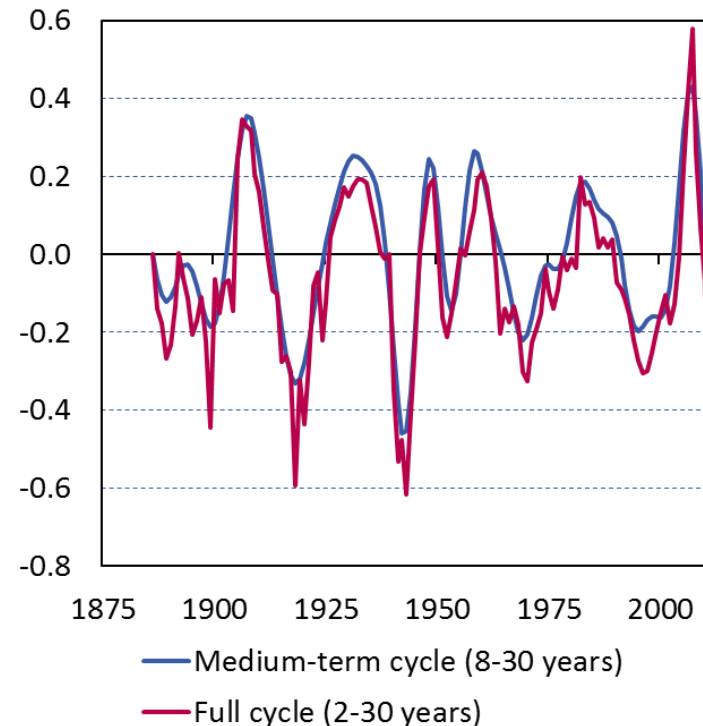


- The medium-term cycles (8-30 years) are found to dominate the cyclical behaviour of all the financial variables – with business cycles (2-8 years) playing a relatively small role ...
- ... with the standard deviation of the medium-term component typically more than two times larger than the standard deviation of the business cycle component

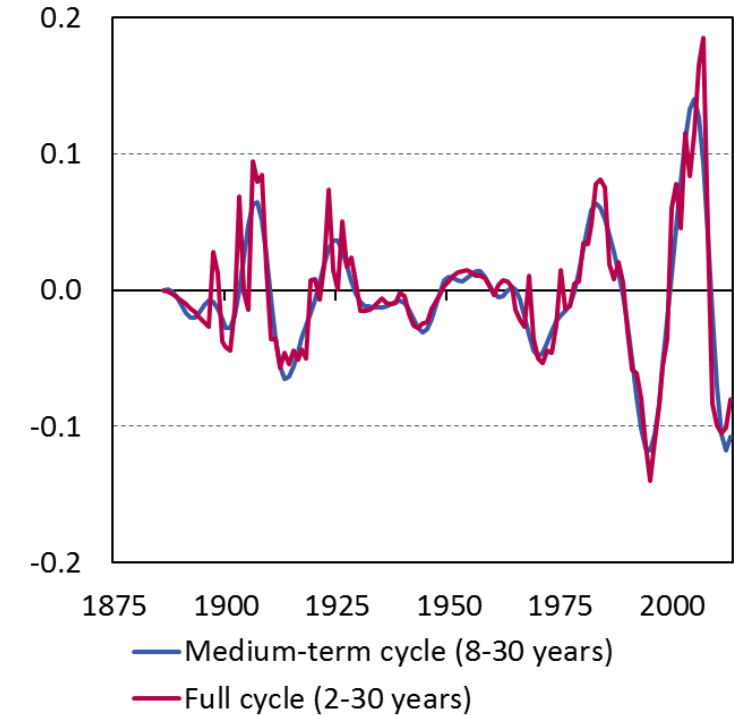
Cycles in real house prices<sup>1</sup>



Cycles in real credit<sup>1,2</sup>



Cycles in foreign non-core bank funding<sup>1,3</sup>



1. Medium-term cycles (8-30 years) and full cycles (2-30 years) extracted from the data using the Christiano-Fitzgerald asymmetric band-pass filter. 2. Credit is measured using the total lending and bond holdings of the credit system. 3. Foreign non-core bank funding is measured as the ratio of foreign non-core bank funding to total bank liabilities.

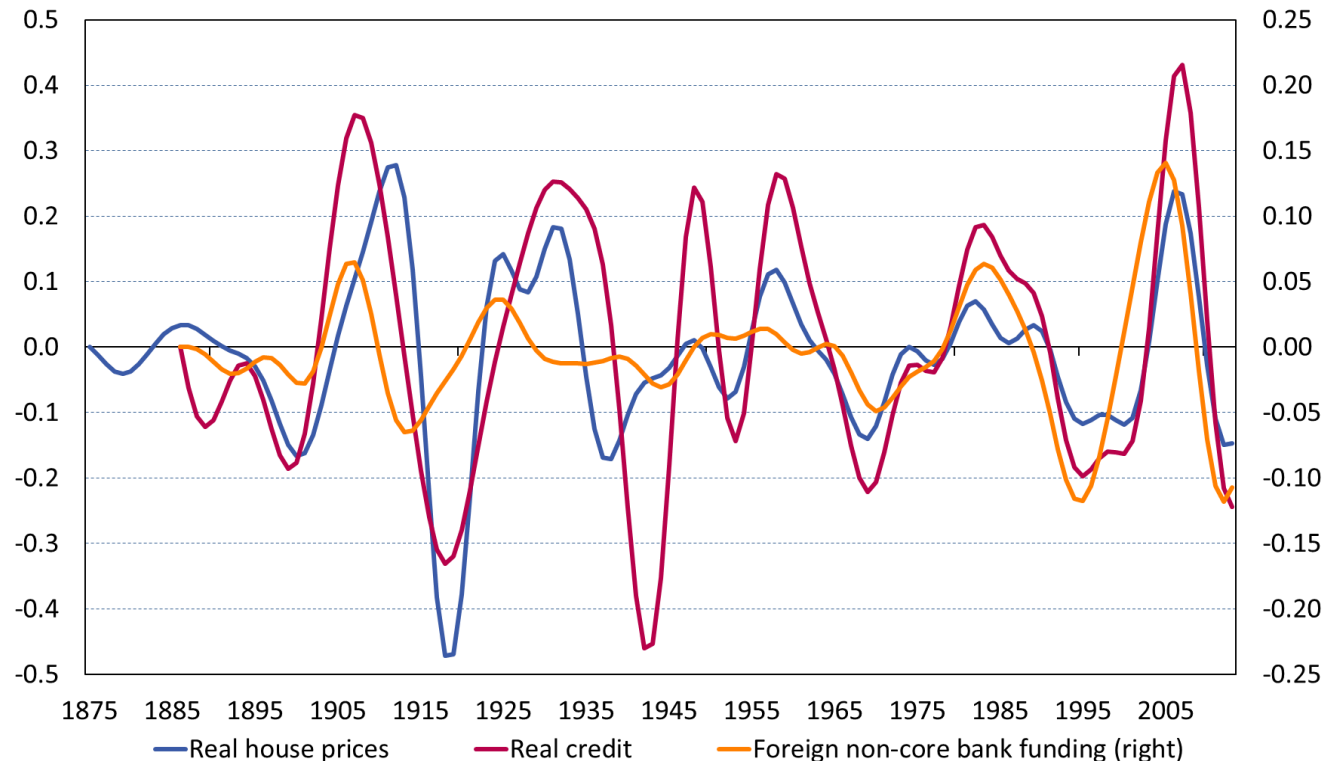
Source: Authors' calculations.

# ... which seem highly synchronised ...



- The medium-term cycles of most of the financial variables seem highly synchronised – and the co-movement grows stronger over time (the exception are the two money measures (real M3 and M3-to-GDP ratio) and the bank leverage ratio) ...
- ... but for the other seven financial variables the correlation coefficient averages 0.59 (0.70 in the post-WW2 period)

Medium-term cycles in house prices, credit, and foreign non-core bank funding<sup>1</sup>



1. Medium-term cycles (8-30 years) extracted from the data using the Christiano-Fitzgerald asymmetric band-pass filter. 2. Credit is measured using the total lending and bond holdings of the credit system. 3. Foreign non-core bank funding is measured as the ratio of foreign non-core bank funding to total bank liabilities.

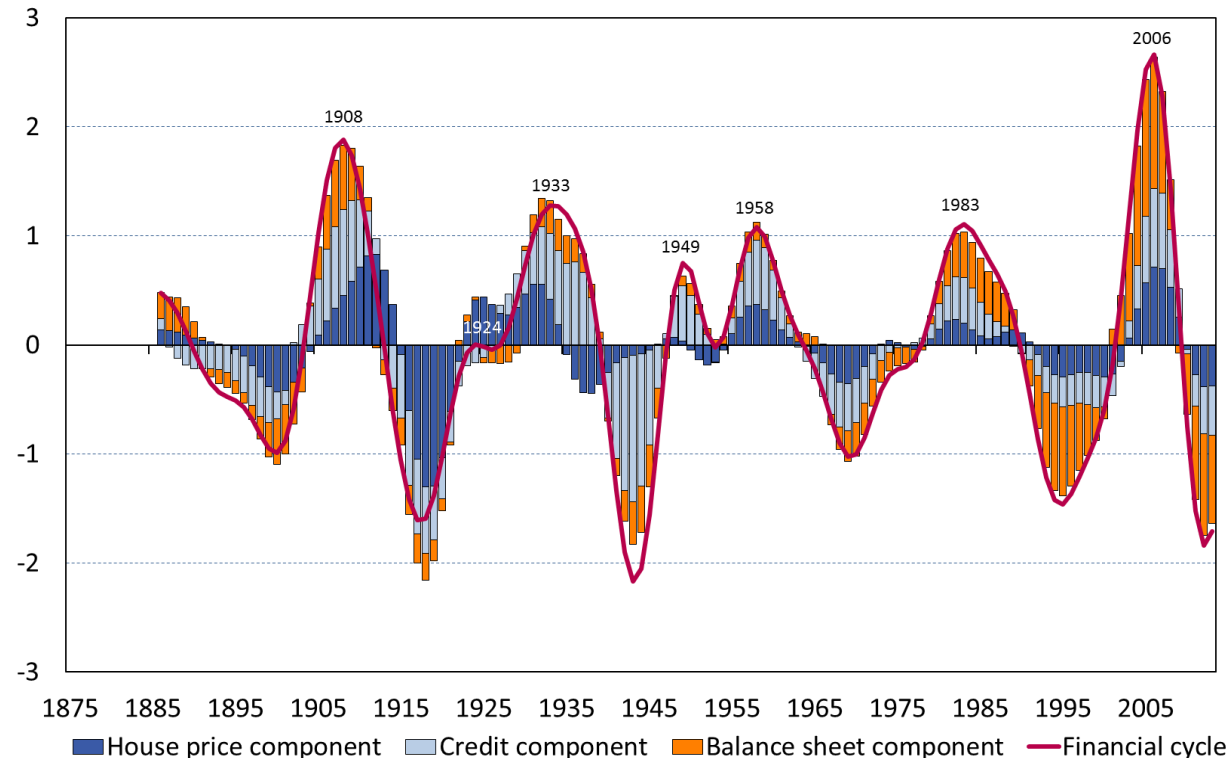
Source: Authors' calculations.

# ... suggesting a well defined financial cycle



- The final estimate of the aggregate financial cycle excludes the two money measures and the leverage ratio (which obtain negative loadings): the other seven variables receive broadly equal loadings and the aggregate cycle explains 65% of the variability in the data (75% in the post-WW2 period)
- Cycle with 7 peaks over 1886-2013 with varying contributions from cycles in house prices, credit, and balance sheets

The financial cycle and individual cyclical components<sup>1</sup>



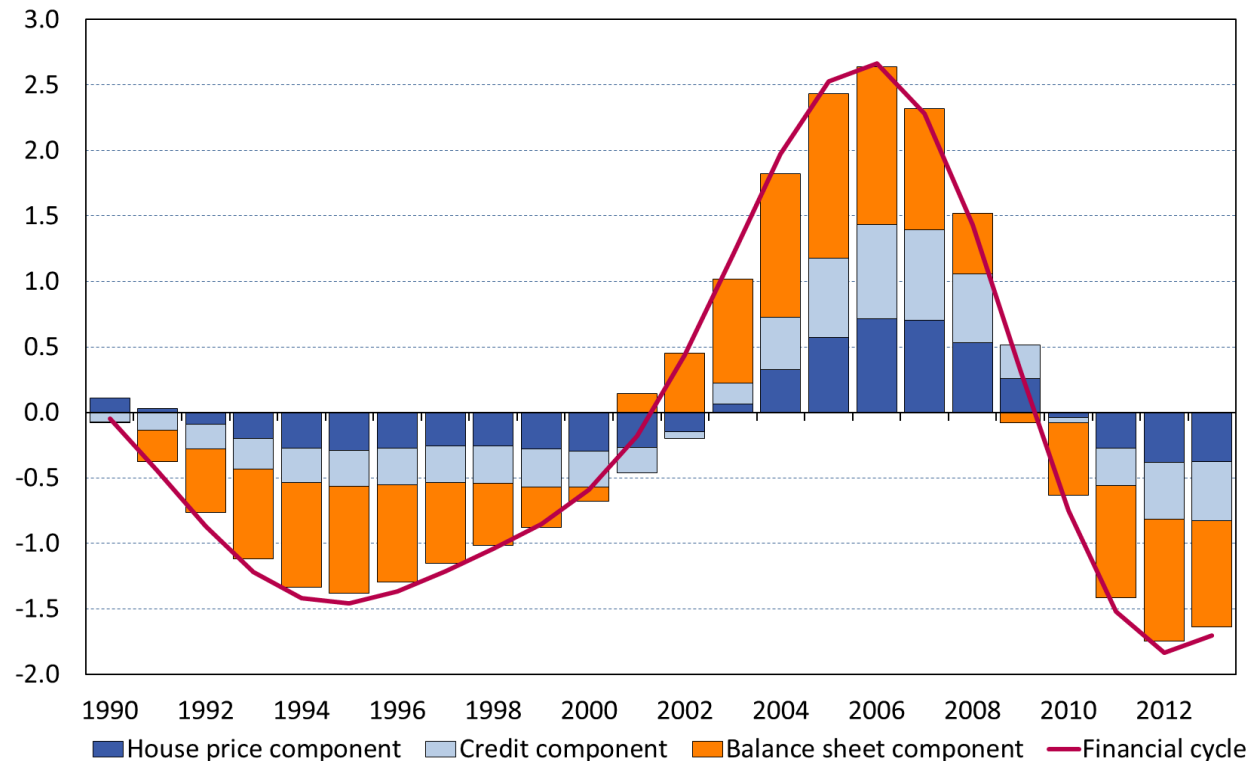
1. Financial cycle and contribution of individual cyclical components, weighted with their normalised factor loadings. *House price component* refers to the contribution of the medium-term cycle in real house prices to the financial cycle. *Credit component* refers to the weighted average contribution of medium-term cycles in real credit, credit-to-GDP and credit-to-M3 to the financial cycle. *Bank balance sheet 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.

Source: Authors' calculations.

# Zooming in on the most recent boom-bust cycle

- Expansion starts in 1995 with the birth phase driven by an expansion of bank balance sheets (to a significant degree cross-border) – coinciding with capital account liberalisation and a broad-sweeping privatisation of the domestic banking system
- Significant credit and house price expansions start in the early 2000s ... and all add to a massive cyclical expansion that peaks in 2006 (therefore lasting 11 years) before reversing sharply – with all factors contributing to the contractionary phase

The most recent financial boom-bust cycle<sup>1</sup>



1. Financial cycle and contribution of individual cyclical components, weighted with their normalised factor loadings. *House price component* refers to the contribution of the medium-term cycle in real house prices to the financial cycle. *Credit 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 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.  
Source: Authors' calculations.

# Strong co-movement with aggregate financial cycle

- Find strong co-movement of individual medium-term cycles with the aggregate cycle (except the three variables that drop out of the principal component measure of the aggregate cycle) that is rising over time
- Also find strong co-movement of medium-term cycles in key macro variables
- The strong co-movement with aggregate cycle continues to hold even when latest boom-bust phase is excluded

	Contemporaneous correlation				Concordance index			
	Total	1875-1944	1945-2013	1980-2013	Total	1875-1944	1945-2013	1980-2013
Real house prices	0.69	0.62	0.88	0.92	0.80	0.74	0.84	0.82
Real credit	0.91	0.95	0.89	0.92	0.84	0.78	0.90	0.88
Credit-to-GDP	0.87	0.91	0.87	0.90	0.80	0.76	0.83	0.79
Real M3	-0.11	-0.39	0.08	0.42	0.50	0.43	0.55	0.59
M3-to-GDP	-0.33	-0.58	-0.15	0.11	0.43	0.48	0.39	0.47
Credit-to-M3	0.79	0.90	0.69	0.79	0.80	0.79	0.81	0.71
Bank assets-to-GDP	0.71	0.47	0.87	0.95	0.74	0.69	0.78	0.76
Bank leverage ratio	-0.38	-0.70	0.10	0.54	0.35	0.16	0.51	0.62
For. non-core liabil.	0.75	0.50	0.91	0.95	0.76	0.60	0.88	0.97
Total non-core liabi.	0.91	0.90	0.91	0.93	0.87	0.91	0.83	0.88
Average	0.48	0.36	0.61	0.74	0.69	0.63	0.73	0.75
GDP	0.30	0.20	0.41	0.77	0.60	0.55	0.64	0.62
Domestic demand	0.28	0.10	0.42	0.89	0.58	0.52	0.64	0.71
Trade deficit	0.34	0.02	0.53	0.88	0.64	0.55	0.70	0.85

The table gives the contemporaneous correlations and concordance of the medium-term cyclical component of individual variables with the aggregate financial cycle. Shaded cells highlight numbers larger than or equal to 0.7.

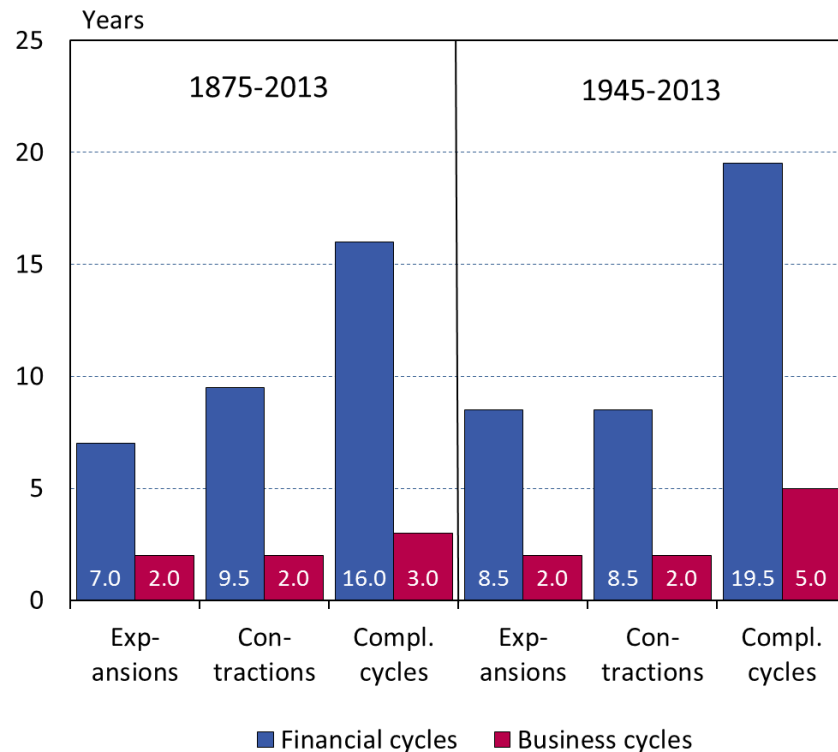
Source: Authors' calculations.



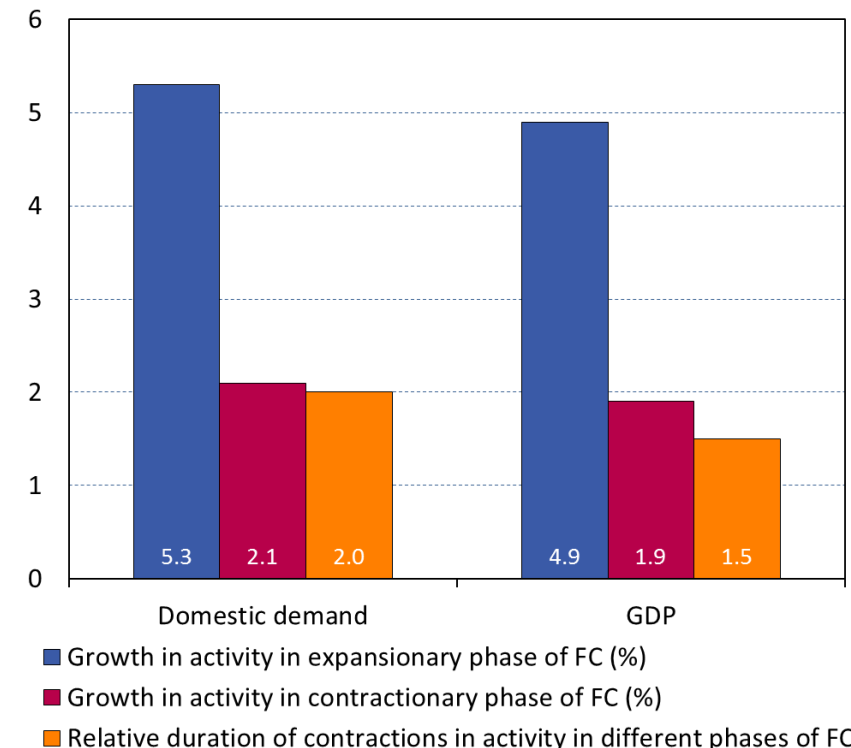
# Financial cycle is long and has large real effects ...

- The financial cycle is much longer than the typical business cycle: 16 years on average and has lengthened over time – lasting 19.5 years on average in the post-WW2 period (due to lengthening of expansionary phase)
- Large differences in economic activity over different phases of the financial cycle: growth is almost three times higher in the expansionary phase and business cycle contractions that coincide with financial cycle contractions are more drawn out

Median duration of financial and business cycles<sup>1</sup>



Economic activity in different phases of the financial cycle<sup>2</sup>



1. Business cycles refer to cycles of 2-8 years in GDP. Duration measured from troughs to peaks for expansions, from peaks to troughs for contractions, and from peak to peak for complete cycles. 2. Median growth rate of domestic demand and GDP over expansionary and contractionary phases of the financial cycle and the relative duration (in years) of contractions in each series that coincide with the contractionary phase of the financial cycle relative to contractions that do not coincide with contractionary phases of the financial cycle.

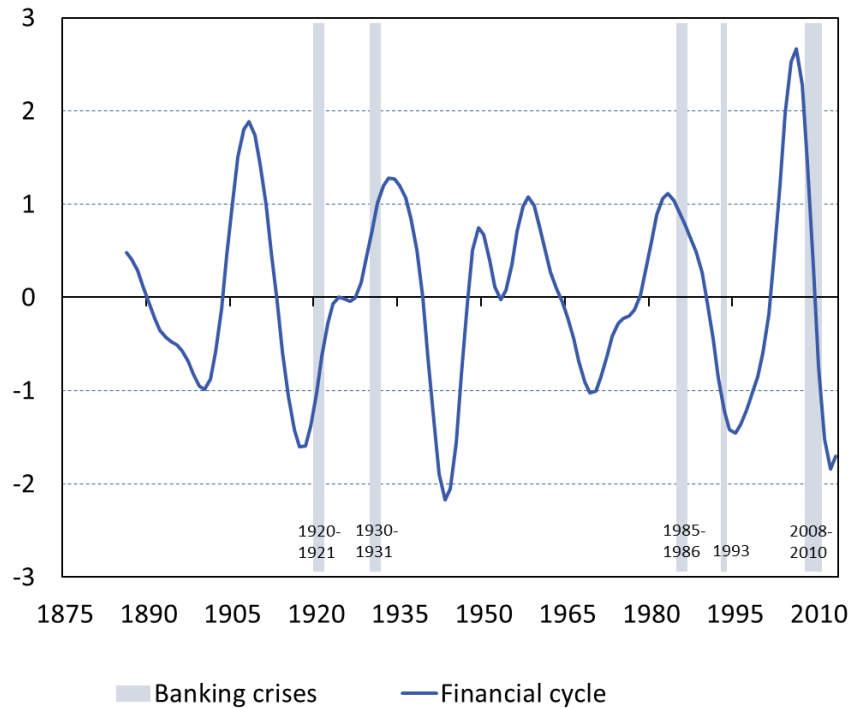
Source: Authors' calculations.

# ... with peaks frequently coinciding with financial crises

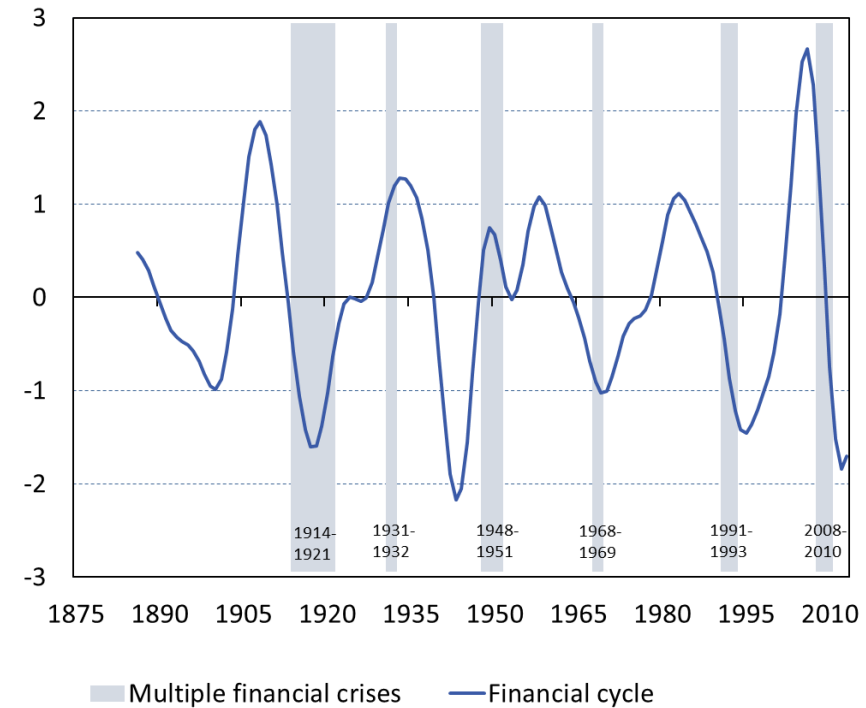


- Financial crises (5 banking and 6 “multiple” crises) are closely aligned with peaks in the financial cycle: about 80% of cyclical peaks coincide with a financial crisis within a 3 year window
- An early-warning exercise suggests that the aggregate financial cycle has a lower noise-to-signal ratio than the individual financial variables – highlighting their important interaction in amplifying financial imbalances

The financial cycle and banking crises



The financial cycle and multiple financial crises<sup>1</sup>



1. Multiple financial crises are estimated using a version of the Harding-Pagan non-parametric common cycle algorithm designed to capture the clustering nature of currency, inflation, and banking crises.  
Source: Authors' calculations.

# Seminar at the University of Glasgow

## Global financial spillovers

“Are the financing conditions set in the main world financing centers setting the tone for the rest of the world, regardless of the exchange-rate regime?”

Hélène Rey, LSE

# The financial cycle and global spillovers



## The financial crisis brought financial spillovers sharply into focus

- Financial spillovers can reflect both a common source shared across countries (e.g. the credit and asset price bubbles occurring in many advanced economies in the run up to the global financial crisis) ...
- ... and the transmission of financial booms and busts from one country (often a global financial centre) to another through cross-border financial contagion
- Recent findings by Hélène Rey suggest the importance of US monetary policy for global financial conditions – even in countries with flexible exchange rates

## Again, we need a long data span

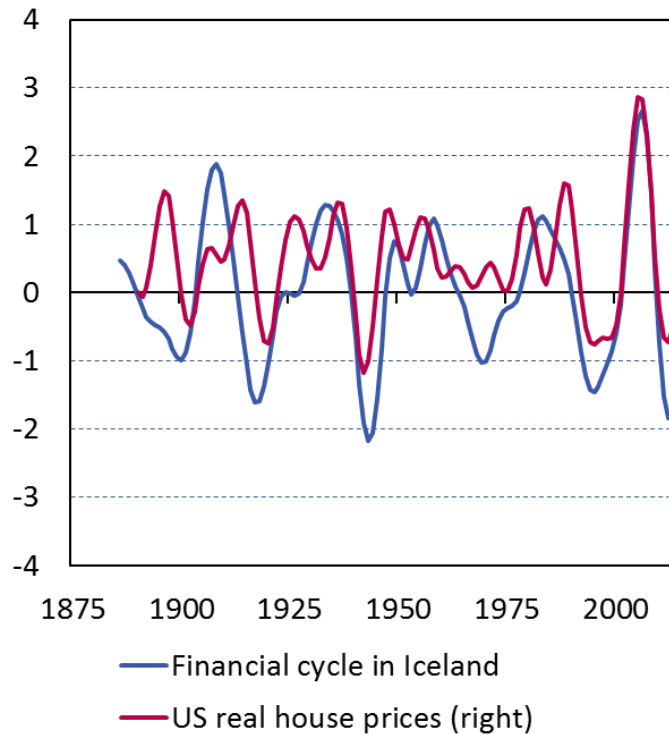
- Use US as a proxy for global financial cycle
  - Data from the Jorda, Schularick and Taylor (except house prices from Shiller)
  - The Reinhart-Rogoff database to test for coincidence of financial crises

# Strong spillover effects from global financial cycle ...

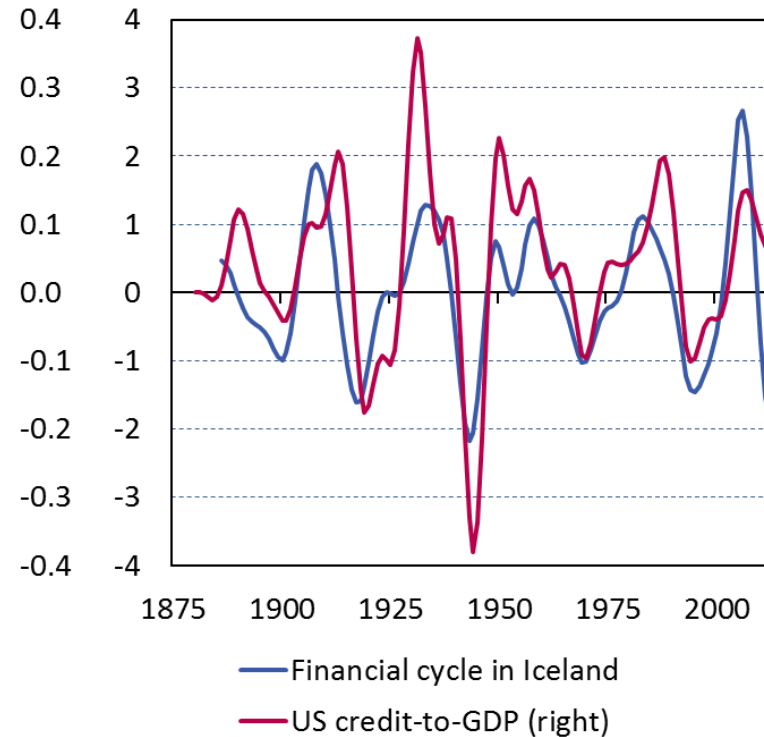


- Strikingly strong ties between the Icelandic financial cycle and medium-term cycles in many US financial variables ...
- ... and a simple measure of the US financial cycle: correlation rises from its full sample 0.78 to a post-WW2 of 0.86 ... with 6 of the 7 peaks in Iceland coinciding with a corresponding peak in the US
- The transmission of these global spillovers seems strongest through domestic credit and wholesale bank funding

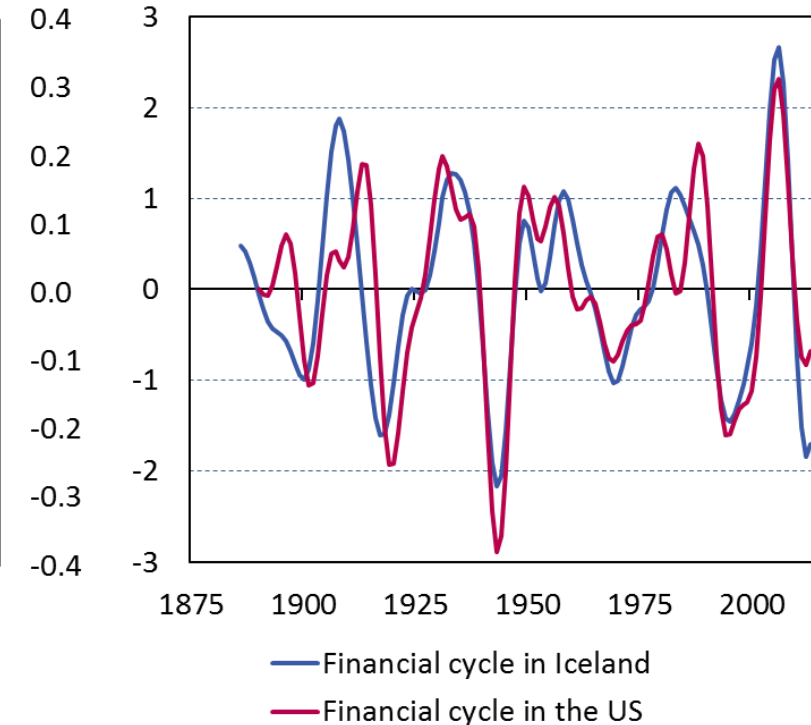
Financial cycle in Iceland and US house price cycle<sup>1</sup>



Financial cycle in Iceland and US credit cycle<sup>1</sup>



Financial cycles in Iceland and the US<sup>2</sup>



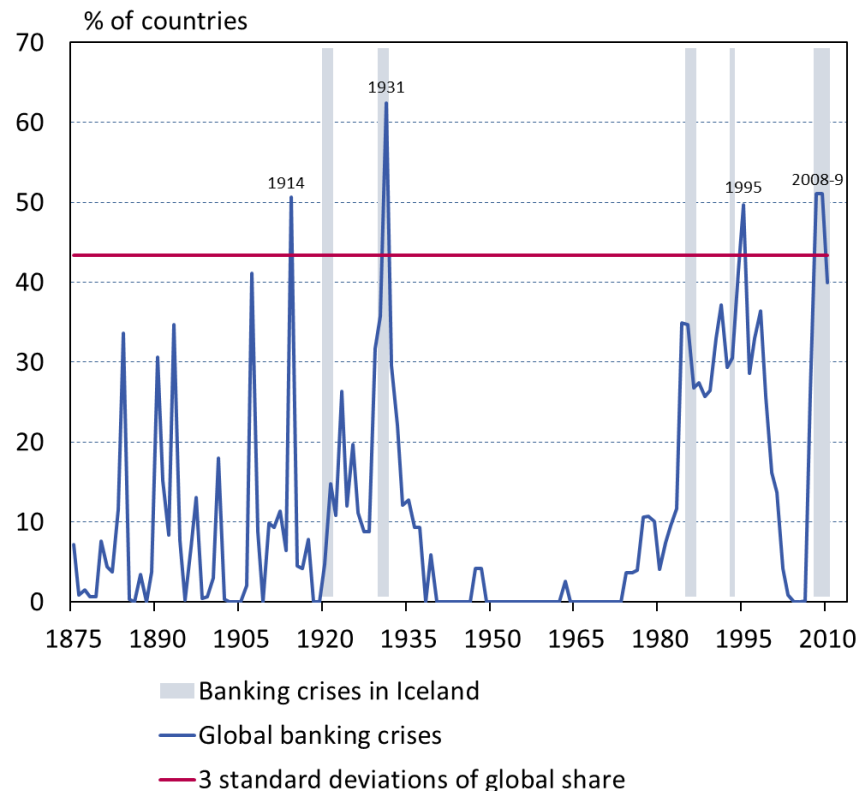
1. Medium-term cycles in US real house prices and the credit-to-GDP ratio. 2. US composite financial cycle is obtained as the first principle component of the medium-term cycles in US real house prices and the credit-to-GDP ratio.  
Sources: O. Jorda, M. Schularick & A. M. Taylor (2014), R. J. Shiller (2015), and authors' calculations.

# ... and contagion effects from global financial crises ...

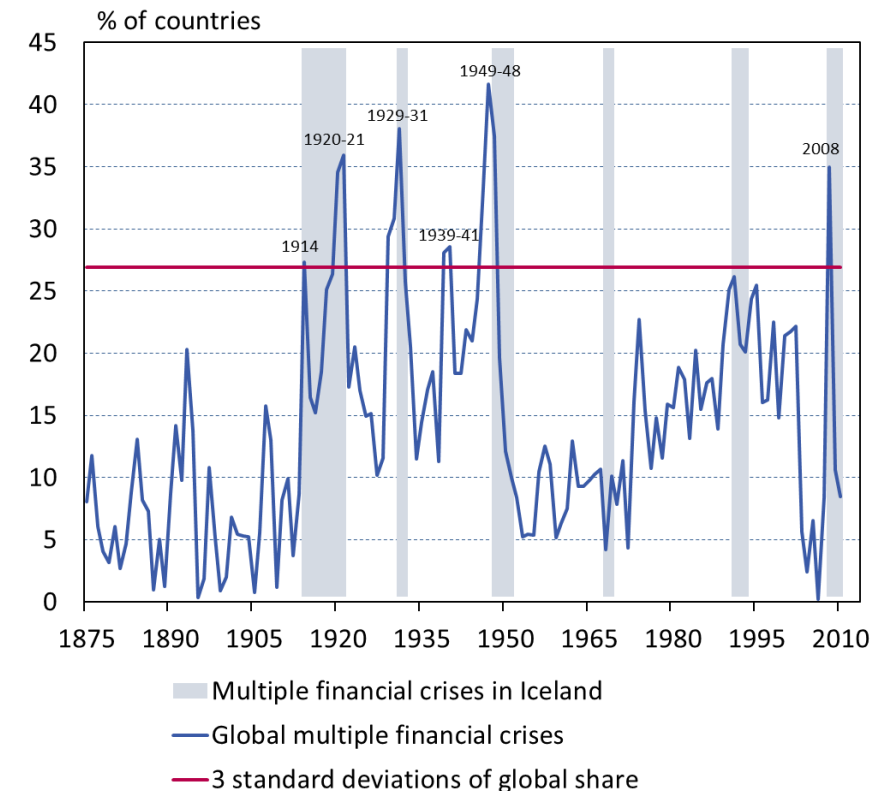


- Strong global spillover effects also evident in the incidence of financial crises: use GDP-weighted share of countries in financial crises and a threshold of 3 standard deviations to identify the most severe global episodes ...
- ... gives 4 severe global banking crises and 6 more “general” (banking, currency, debt, inflation, stock market) financial crises – most of which coincide with a similar financial crisis in Iceland

Banking crises in Iceland and the incidence of global banking crises<sup>1</sup>



Multiple financial crises in Iceland and the incidence of global multiple crises<sup>1</sup>



1. GDP weighted share of 70 countries in a given crisis from the Reinhart-Rogoff database on financial crises in 70 countries for the period 1800-2010. The multiple global financial crisis measure is obtained as the sum of currency, inflation, sovereign external debt, banking, and stock market crises indicators. Horizontal lines denote 3 standard deviations from the whole-sample average country share.

Sources: C. M. Reinhart & K. S. Rogoff (2011) and authors' calculations.

# ... with global crises markedly raising risk of crisis in Iceland



- A simple probit regressions backs up the visual impression: a rise in the share of countries in a financial crisis has a statistically significant effect on the probability of a financial crisis in Iceland ...
- ... the point estimates suggest that a severe global crisis (3 standard deviations from sample average) leads to a 2-3 fold increase in the probability of a crisis in Iceland

## International financial crises and the probability of a financial crisis in Iceland

	Constant	Lagged dependent variable	Share of countries in crises	Marginal effects	Pseudo $R^2$	LR-test ( $p$ -value)
Banking crises	-2.49 (0.37)	0.96 (0.53)	4.48 (1.32)	0.056 [0.167]	0.394	0.000
Multiple financial crises	-2.83 (0.60)	2.39 (0.42)	6.69 (2.51)	0.069 [0.207]	0.528	0.000

### Memo: financial crises in Iceland and globally

Banking crises in Iceland	–	1920-21	1930-31	–	–	–	1985-86	1993	2008-10
Global banking crises (using the 3sd threshold)	1914	–	1931	–	–	–	–	1995	2008-09
Multiple financial crises in Iceland	1914-21	–	1930-31	–	1948-51	1968-69	–	1991-93	2008-10
Global multiple financial crises (using the 3sd threshold)	1914	1920-21	1929-31	1939-41	1946-48	–	–	–	2008

The table reports the outcomes of probit regressions of an indicator of banking and multiple financial crises, respectively, on its own one-year lag (to capture the apparent persistence of financial crises) and the GDP-weighted share of countries in banking crises and general financial crises, respectively, from Reinhart and Rogoff (2011). The estimation period is 1875-2010 (135 observations). Numbers in parenthesis are robust (Hubert-White) standard errors. The LR test reports the  $p$ -value for the null hypothesis that the parameters (except the constant) in the probit regression equal zero. The table also reports the marginal effect of increasing the share of countries in crises by one standard deviation (three standard deviations in square brackets), evaluating the regressors at their sample mean.

Source: Authors' calculations.

# Conclusions



## Evidence of strong financial system co-movement ...

- Fluctuations in financial variables (prices, volumes, and balance sheets) seem to be dominated by a low-frequency common cycle ...
- ... the “Financial cycle”

## ... and important global spillovers with large macro effects

- The booms and busts in the financial cycle ...
  - ... seem to have played a major role in the macro developments in Iceland over a long period ... with cyclical reversals frequently coinciding with major financial distress
  - ... seem to a large extent to be driven by fluctuations in global financial conditions



# Conclusions ... and what to do about it



## Global spillovers encompass different regimes

- These strong spillover effects seem to be independent of the currency and monetary regime chosen ...
  - Membership in a monetary union with Denmark, the gold standard, a whole spectrum of pegs, or a floating exchange rate regime ...
  - ... thus consistent with the recent influential findings by Hélène Rey
- ... and even survive long periods of capital controls

## Policy responses

- How to design a policy framework that takes the financial cycle and global spillovers, as well as their associated macro-financial linkages, into account?