

Measuring and Forecasting Financial Stability

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„Credit, Asset Prices, and Financial Stress in Canada“

Credit, Asset Prices, and Financial Stress in Canada

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Context

Uniqueness of financial cycles?

- Conditions that lead to boom times seem unique (gold, tulips, land ...)
- Conditions that trigger reversals seem unique, and very difficult to anticipate ex ante

Seemingly idiosyncratic nature of these events does not constitute a promising ground for forecasting exercises

But isn't it all just fear and greed?

Historical narratives (eg. Kindleberger and Aliber (2005)) suggest some ‘more operational’ common features:

- Strong growth in credit and asset prices characterizes boom times
- Rapid reversals, and often prolonged periods of stagnation characterize downturns.

Borio and Lowe (2002), Kaminsky and Reinhart (1999) provide some pertinent empirical evidence.

Can we exploit these commonalities to arrive at an early-warning indicator of vulnerability in the financial system?

Possible, but the information content of different types and measures of credit (business credit, household credit), and asset prices (stock prices, bond prices, commodities, real estate) must be assessed on a country-by-country basis.

Typical approach: Examine the links between these variables and **financial crises** in various countries.

Problem: the approach does not really work for countries that have experienced few, or no crises over the period of interest.

Canada is such an example, but developed economies in general display similar features in this regard.

Absence of financial crises does not mean that all is well, and that the financial system has not, or cannot, come under stress.

How to proceed?

- Construct a measure of financial stress in the system
- Examine whether a useful early warnings model can be developed:
 - by using various measures of credit and asset prices jointly, and
 - by using only the information that is available to the policy maker at the decision time.

Outline

A. Financial crises and financial stress

B. Credit, asset prices, and financial stress

C. Summary and conclusions

A. Financial crises and financial stress

Why not financial stress?

Difficulties:

- Not clear what is meant by financial stress
- Not clear how to measure it
- How do we agree on a set of stressful episodes?

What do we mean by ‘**financial stress**’?

A situation in which large parts of the financial sector face the prospect of large financial losses

Usually accompanied by:

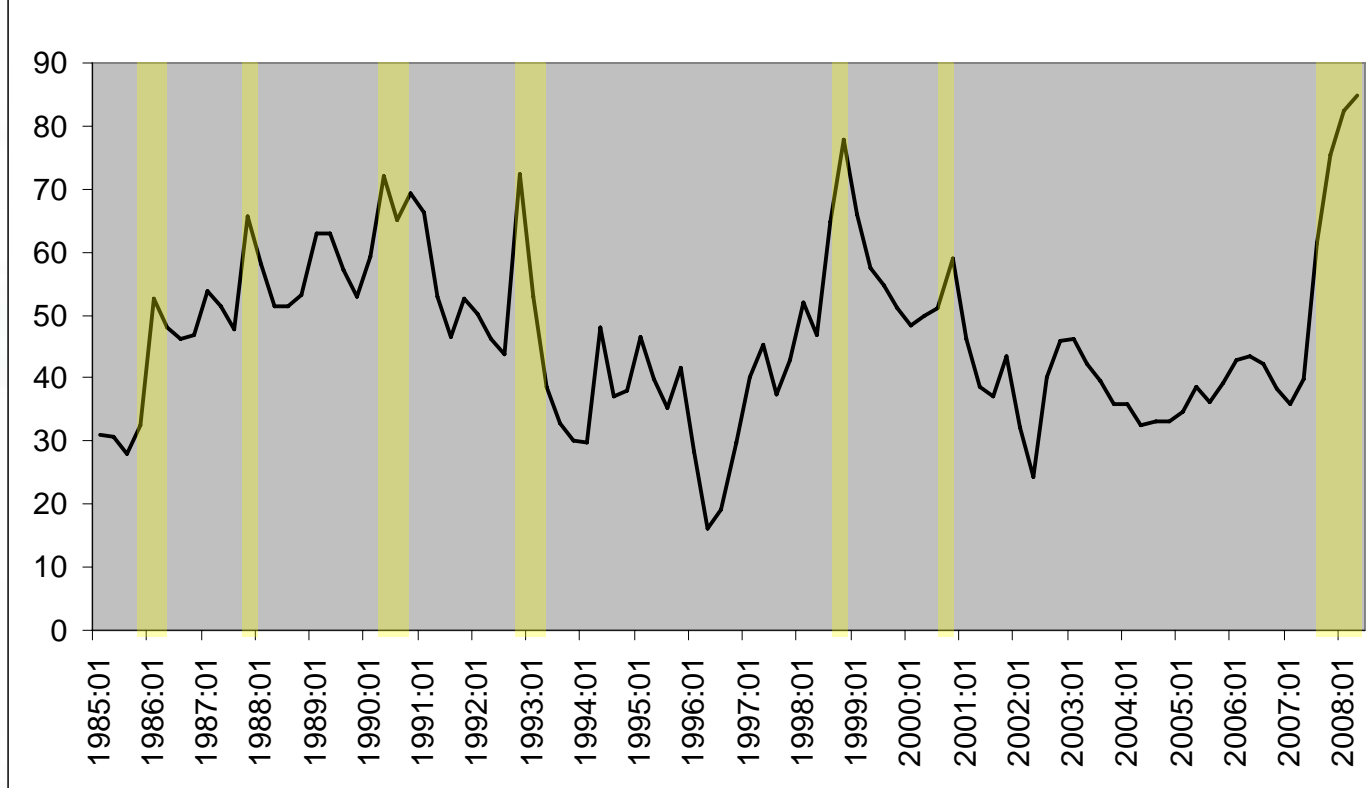
- an increased degree of (perceived) risk (a widening of the distribution of probable losses)
- An increased degree of uncertainty (decreased confidence in the shape of the loss distribution)

An indicator of financial stress

Financial Stress Index (FSI) for Canada by Illing and Liu (2003, 2006):

- Based on a variety of indicators from equity, bond, foreign exchange markets, as well as the indicators of the banking sector performance
- Combined into a weighted average in such a way that the signal/noise ratio is maximized
- Determination of historical episodes of stress based on a survey

**Figure 1:
Financial Stress Index**



Small bank failures
(Canada)

Real estate bubble
collapse (Canada)

LTCM collapse
Russian default

Subprime market
collapse

Stock market crash

ERM credit losses

Dot.com bubble
collapse (Canada)

Explanatory variables

- **Credit measures:** household credit, business credit, credit/GDP
- **Asset prices:** stock prices (TSX), commercial real estate prices (nominal and real), residential real estate prices, average house price to personal disposable income), gold price (CAD)
- **Macroeconomic variables:** investment/GDP, money (M1++, M2++), inflation (total CPI, core CPI)
- **Foreign variables:** price of crude oil, asset-price indexes (U.S., Australia, Japan), global GDP, U.S. bank credit, U.S. federal funds rate.

Frequency: quarterly

Sample period: 1984 -2006

Forecast period: 1996-2006

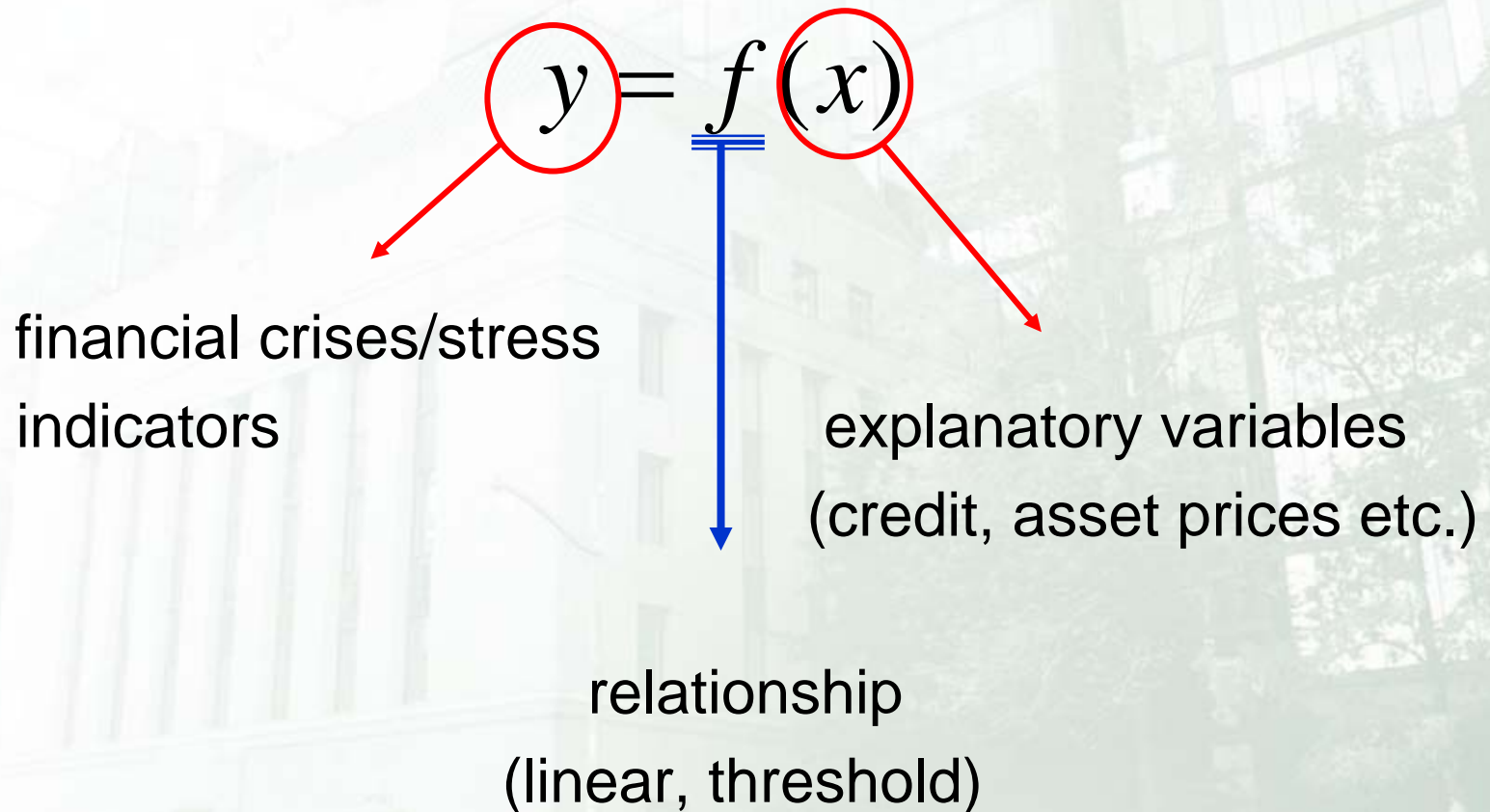
Relationship

- linear

$$y = a_0 + \sum_i a_i x_i$$

- non-linear, using threshold models, with:
 - exogenous thresholds (Borio and Lowe (2002))
 - **endogenous thresholds** (Tkacz and Wilkins (2006))

Simple explanatory framework:



B. Credit, asset prices, and financial stress

Questions:

- Linear or non-linear models?
- What variables have the best forecasting power?
- At what horizons?

Model-selection criterion:

$$rmr = \frac{RMSE_{augmented}}{RMSE_{benchmark}}$$

Interpretation:

- $rmr = 1$ – no contribution of variables in the augmented model
- $rmr < 1$ – positive impact of additional variables
- $rmr > 1$ – negative impact

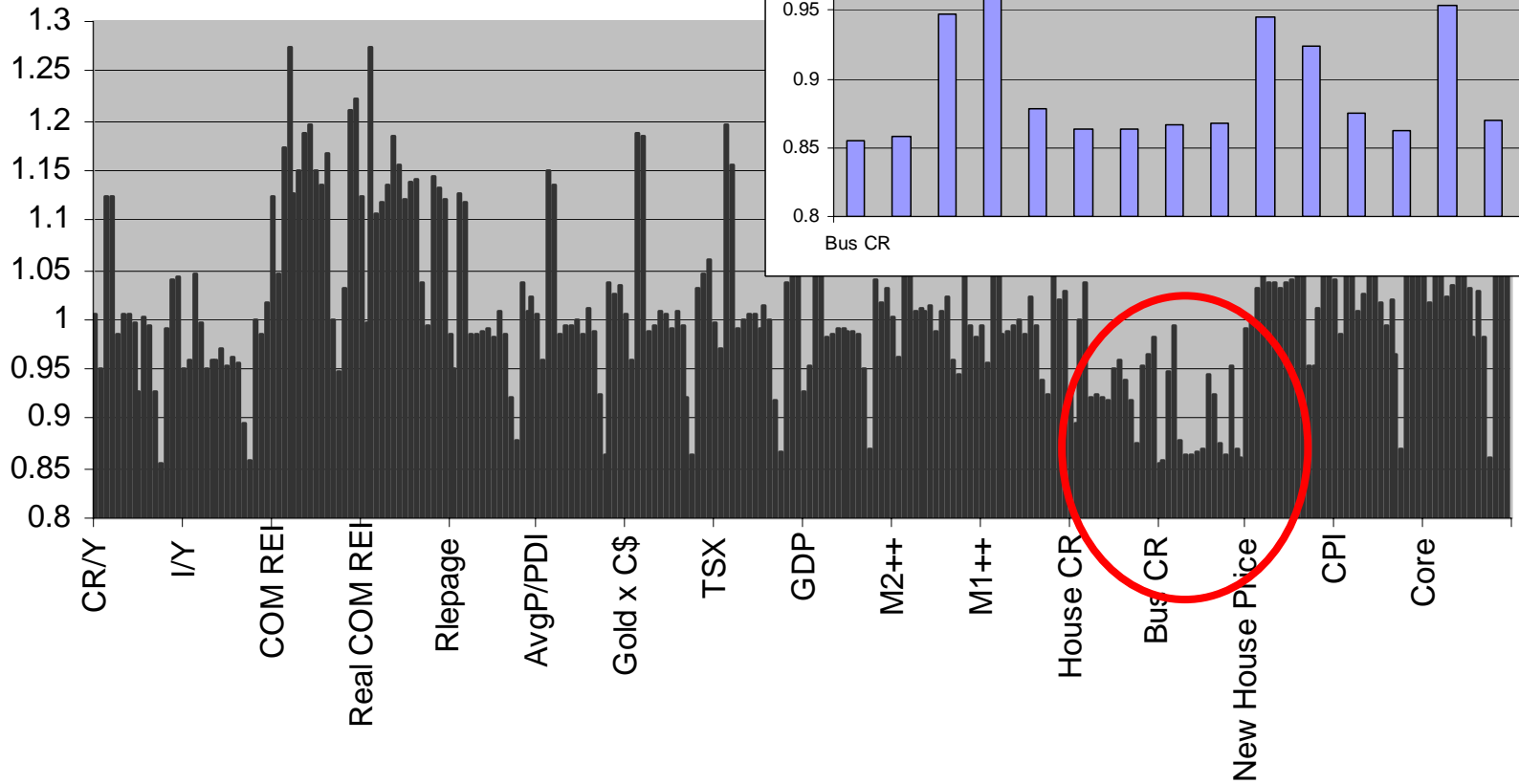
Notes:

- RMSE comes from the linear model (lagged value of the FSI)
- all models include the lagged value of the FSI
- we examine all combinations of models that incorporate one or two explanatory variables

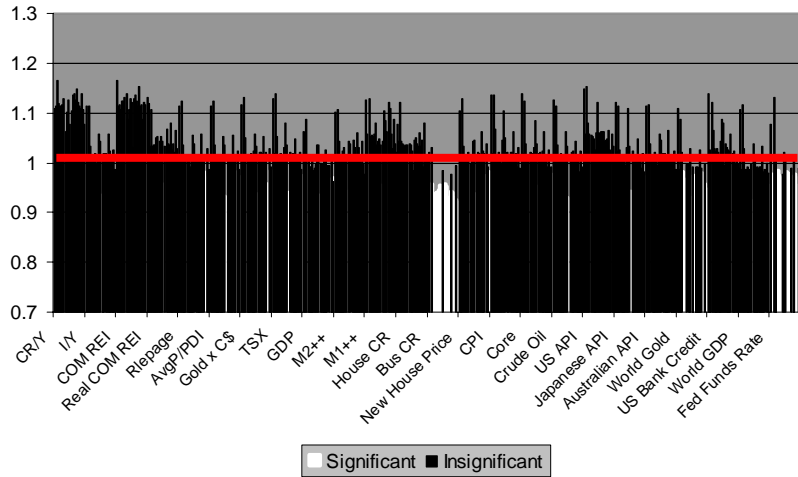
Results

$$r_{mr} = \frac{RMSE_{(FSI_{t-1}, Bus_CR, x)}}{RMSE_{(FSI_{t-1})}}$$

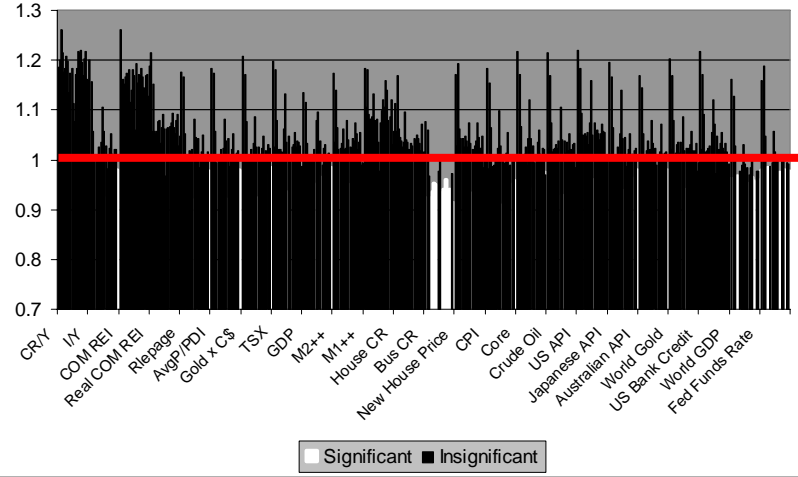
Linear RMSE Ra



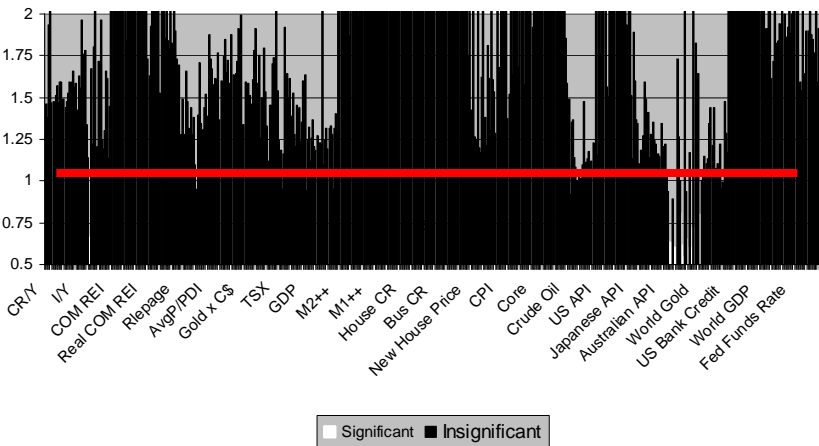
Linear RMSE Ratios: $k = 1, d=1$



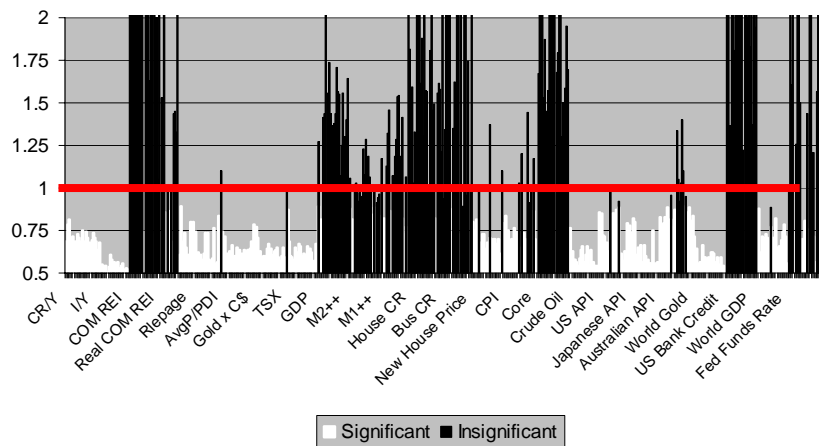
Linear RMSE Ratios: $k = 2, d=1$



Threshold RMSE Ratios: $d=1, k=1$



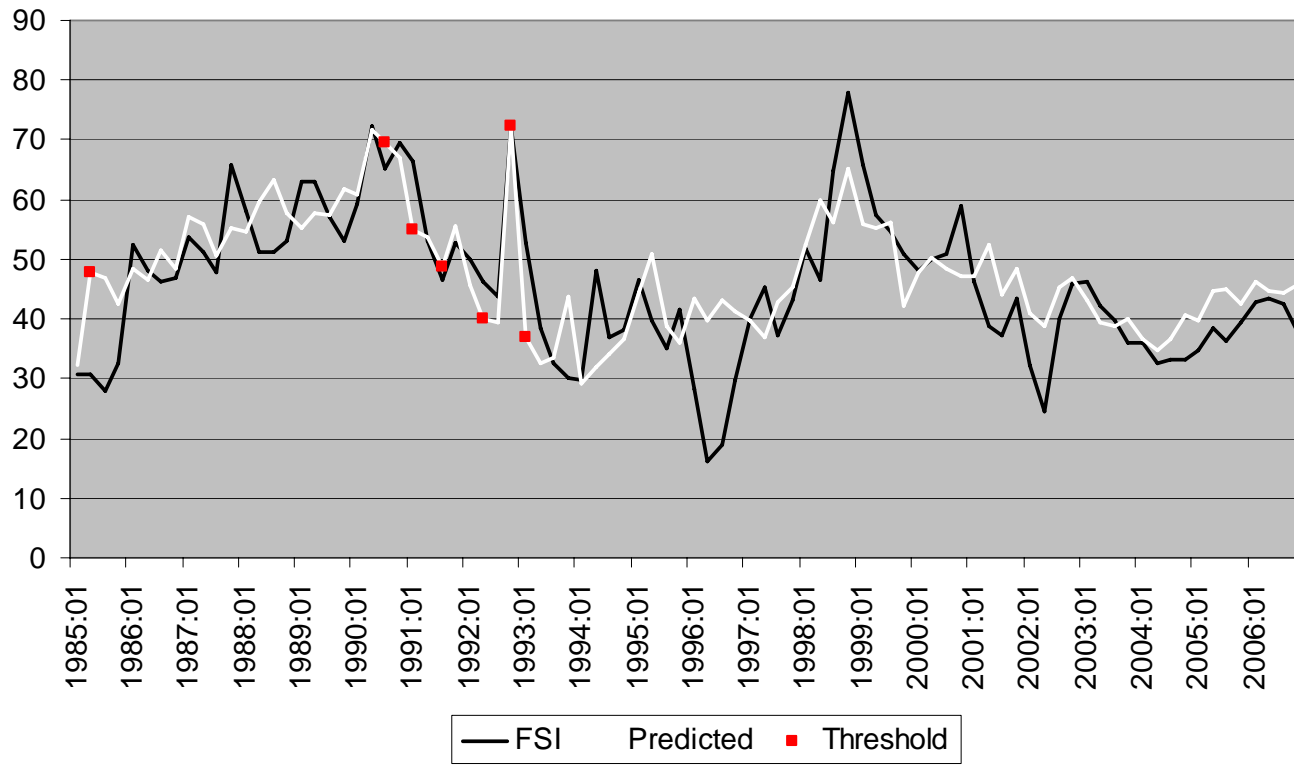
Threshold RMSE Ratios: $d=1, k=2$



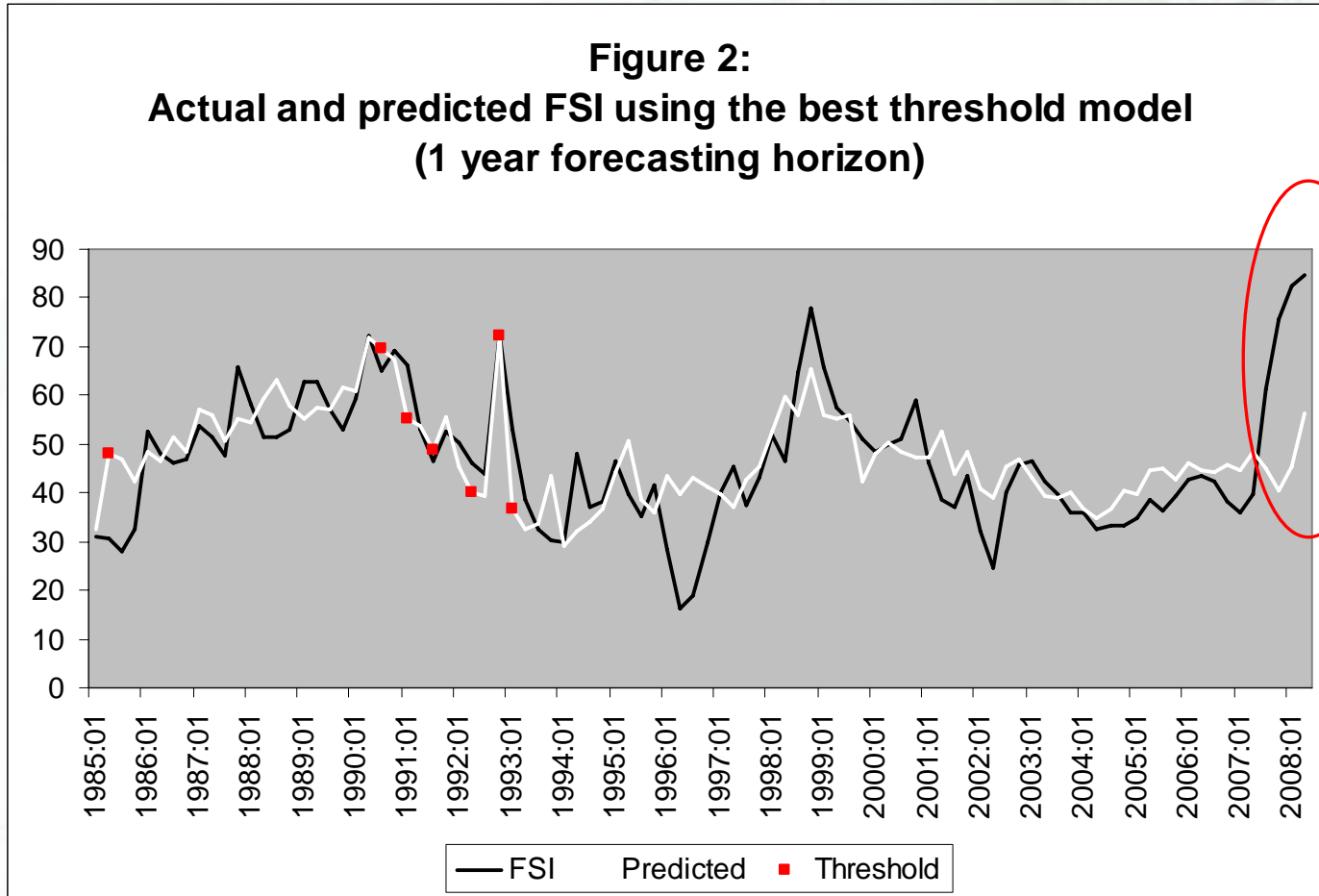
Results:

- At the one- and two-year horizons, **business credit** and **real-estate prices** emerge as important predictors of financial stress
- Importance of **non-linearities** (in line with Misina and Tessier (2007, 2008))
- various measures of **real estate prices** are identified as the key **threshold variables** in the best threshold models (1 - 3 years horizon)
- Adding international variables does not lead to improvements in the forecasting power (with the exception of the Fed funds rate at a short horizon)

Actual and predicted FSI using the best threshold model $d=1, k=4, 1985Q1 - 2006Q4$

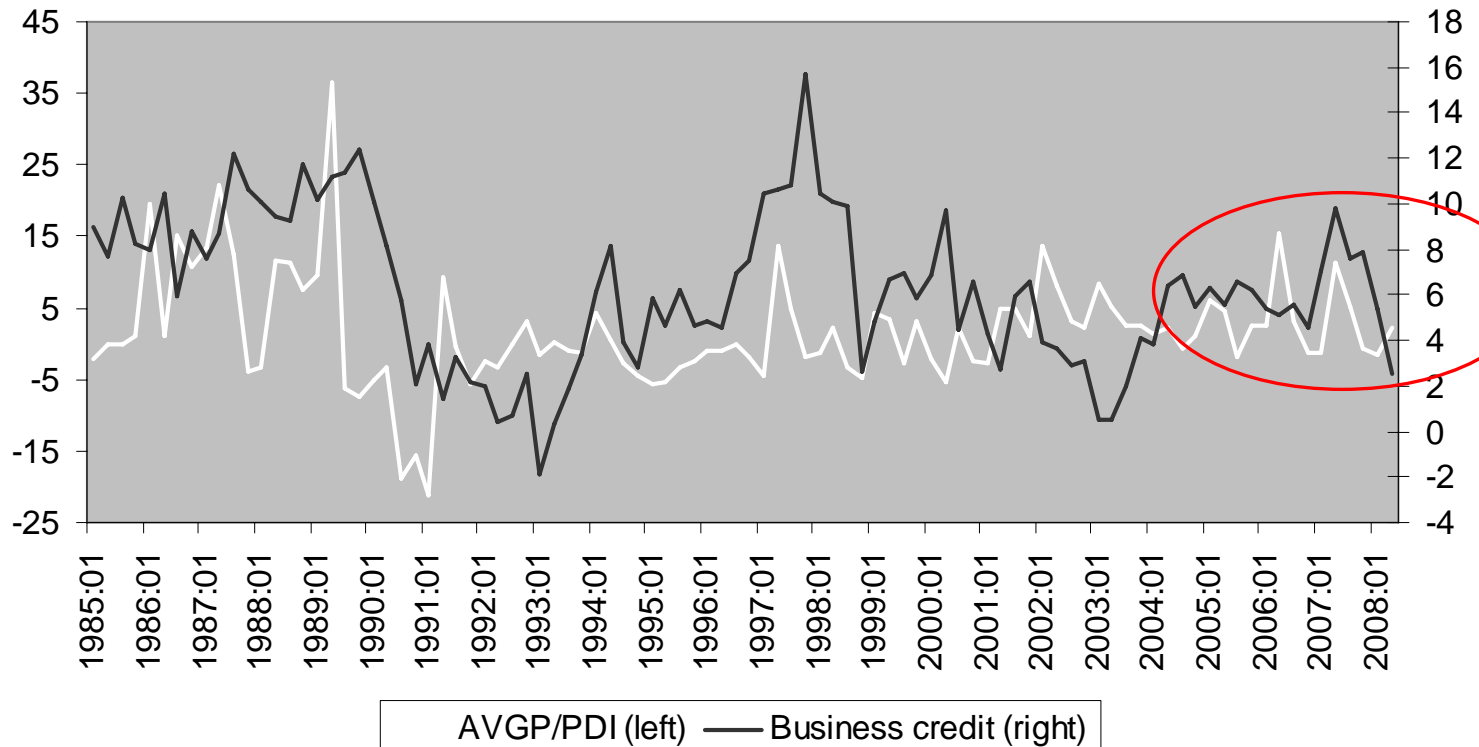


Latest episode?



- Increase in the FSI is predicted but the magnitude underestimated
- Not entirely surprising given that the shock is exogenous
- Interesting that the model predicts any increase

**Figure 4:
Explanatory variables
(annualized quarterly growth rates)**

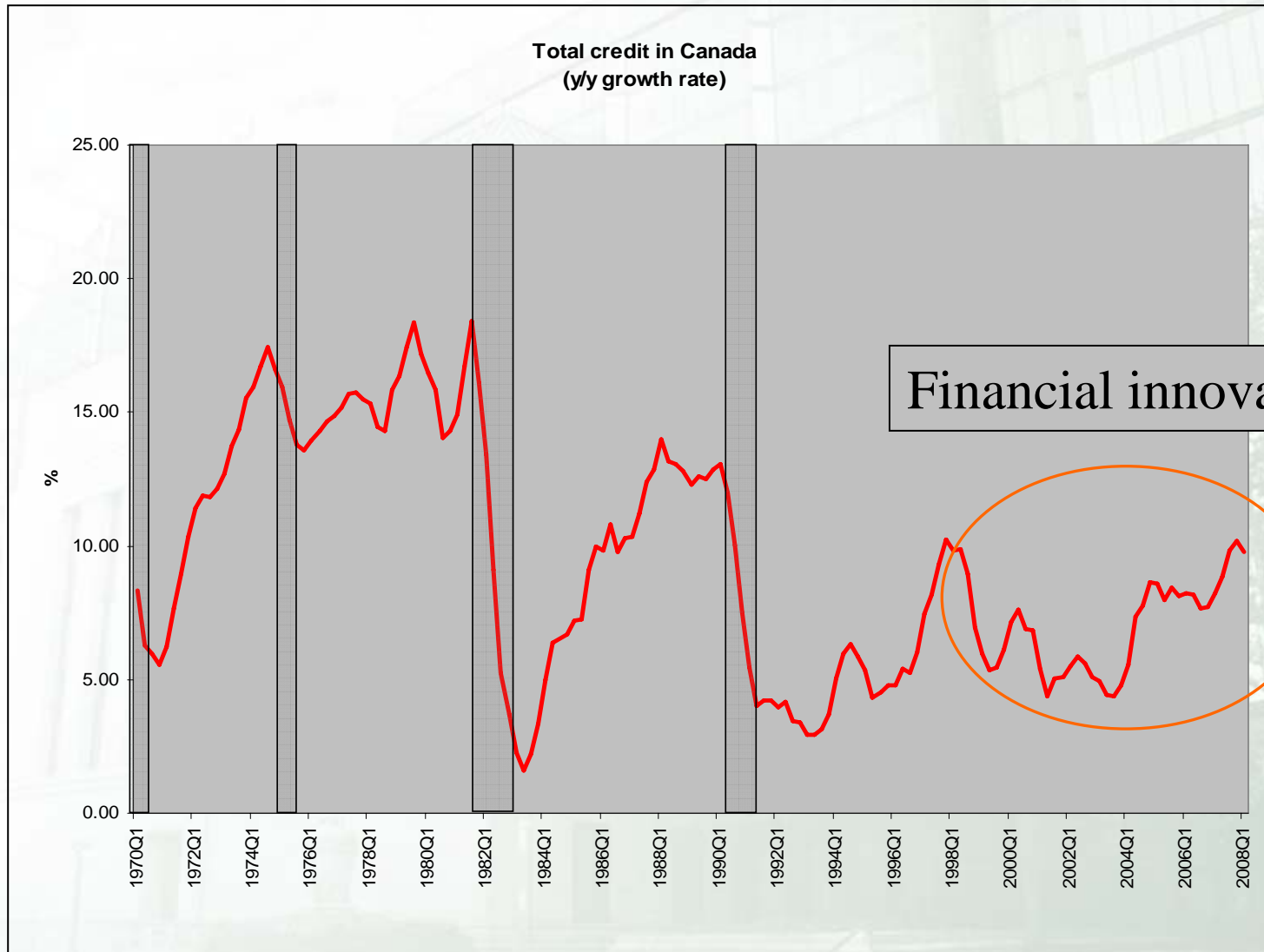


Both explanatory variables peaked in 2007:2, but:

- their peaks are below their historic highs
- not growing at a pace consistent with the very large increase in the FSI.

The behaviour of explanatory variables ahead of the shock is an indication of relatively good health of the system, and may be an important contributing factor to its resilience so far ...

... unless we are missing something ...



Financial innovation?

(More than?) anecdotal evidence: strong financial innovation over the last few years, new sources and instruments of financing.

Credit aggregates may be missing some of this:

- venture capital and private equity financing are not included
- hedge funds lending and some asset backed securities (e.g. some commodity linked notes) are captured either partially or not at all

Implication: Use of the existing aggregates may understate the true growth rates.

C. Summary and conclusions

Answers to the questions:

- Linear or non-linear models?

Non-linear models lead to greater reduction in rmr

- What variables have the best forecasting power?

Business credit and various asset prices (house, TSX, gold)

- At what horizons?

1 – 2 years.

Further work

- **Models:**
 - different ways of introducing non-linearities (Misina and Tessier (2008))
 - Different model selection criteria (rnr is symmetric)
- **Variables:**
 - FSI for different countries
 - Credit measures and financial innovation
 - international comparison
- **Horizon:** the longer the horizon the more important it becomes to take into account interactions between the financial sector and economic activity (e.g. Carlson, King and Lewis (2008))



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Thank you!