

# Predicting financial crises: Debt versus debt servicing

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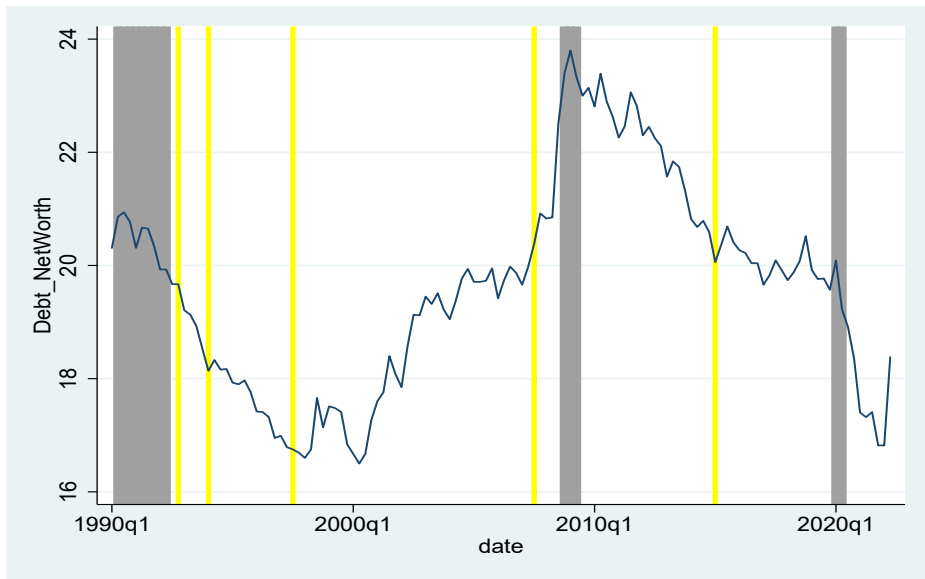
- We're grateful for the invitation.
- Our C.D. Howe *Commentary*  
[https://www.cdhowe.org/sites/default/files/2021-12/Commentary\\_564.pdf](https://www.cdhowe.org/sites/default/files/2021-12/Commentary_564.pdf)
- Our more technical paper on on debt servicing and financial vulnerability  
<http://www.steveambler.uqam.ca/papers/debtservice.pdf>

- We have been regularly told since the GFC that the debt levels of Canadian households are increasing
- The day of reckoning is fast approaching
- Right before the pandemic: individual insolvencies 8.9 % higher than the previous year (Office of the Superintendent of Bankruptcy)

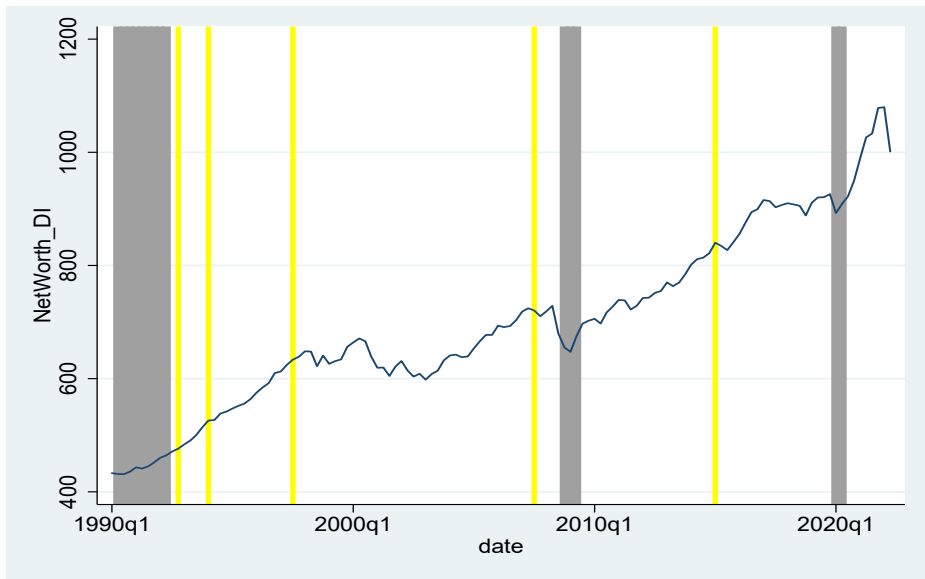
# Motivation (cont.)

- However, what's increasing is **gross** indebtedness and ratio of debt to disposable income
- Also true:
  - Debt to net worth falling over this period
  - Net worth to disposable income increasing
  - Means assets are growing faster than debt

# Evolution of debt to net worth ratio



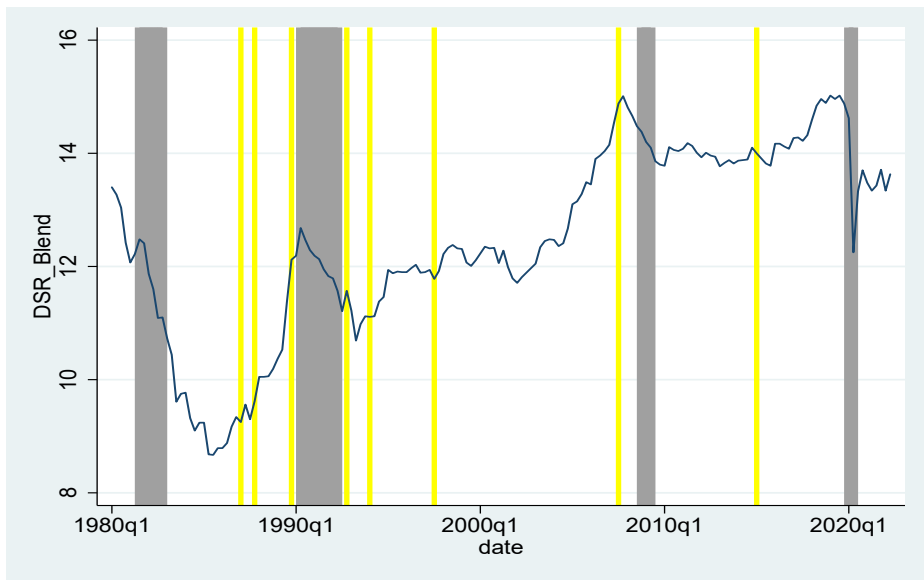
# Evolution of net worth to disposable income ratio



## Motivation (cont.)

- Insolvency data doesn't distinguish between **balance sheet insolvency**, negative net worth, and **cash flow insolvency**, the inability to make payments due to a lack of liquidity.
- They do distinguish between what they term bankruptcies and consumer proposals
- The latter is where the increase was pre-pandemic:
  - Formal agreements renegotiating the terms of the debt repayment between creditors and debtors
  - Debtor will pay part or all of the debt at a reduced rate over a specified period of time
- This suggests that **debt servicing** should be an important factor to predict “consumer proposals”

# Evolution of debt service ratio





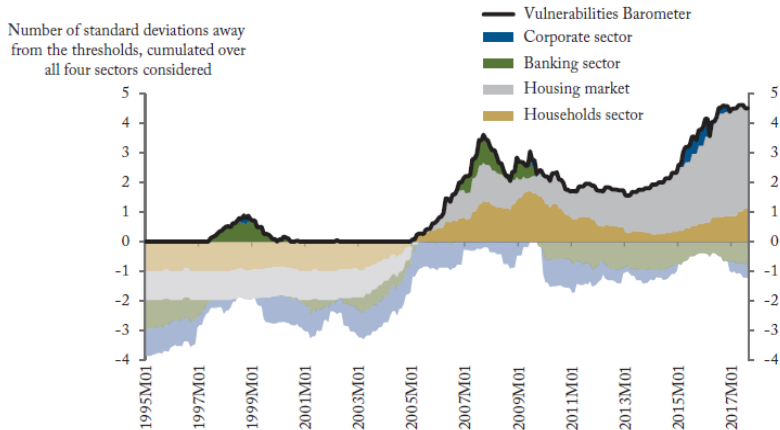
- 1 Construct a financial vulnerability barometer and evaluate the role of debt servicing
- 2 Examine the empirical and accounting link between new borrowing and debt servicing
- 3 Predict how economic growth and crises respond to changes in new borrowing and debt servicing, and how successful they are as a forecasting tool

- We use a series of factors which can be shown to have predictive power for periods of financial instability (1980–2019)
- They are weighted by their ability to predict financial stress episodes compared to a coin flip

- Stress episodes are rare in individual countries, so we look at international episodes of stress:
  - 1 the recession of the early 1980s;
  - 2 the stock market crash in 1987;
  - 3 the recession of the early 1990s;
  - 4 the Mexican crisis (1994–1995);
  - 5 the Asian crisis (1997–1998);
  - 6 the Russian debt default (1998);
  - 7 the Long-Term Capital Management collapse (1998);
  - 8 the sub-prime crisis, financial crisis and Great Recession (2008–2009);
  - 9 the aftermath of the oil price collapse (early 2015).
  - 10 the global pandemic (2020)

- We use a subset of the indicators from past work (Duprey and Roberts 2017):
  - 1 the one-sided deviation of the ratio of household debt to disposable income;
  - 2 the one-sided deviation of the ratio of household debt to GDP;
  - 3 the one-sided deviation of the ratio of housing price to rent;
  - 4 the year-over-year growth rate of the ratio of non-financial corporate debt to GDP;
  - 5 the one-sided deviation of the ratio of non-financial corporate debt to GDP;
  - 6 the year-over-year growth rate of the ratio of financial institution debt to GDP;
  - 7 the one-sided deviation of the ratio of financial institution debt to GDP.

- Important to point out that we left out pure stock/flow variables, using only their deviations from trend
- And, critically, we include the deviation of the debt service ratio from its trend

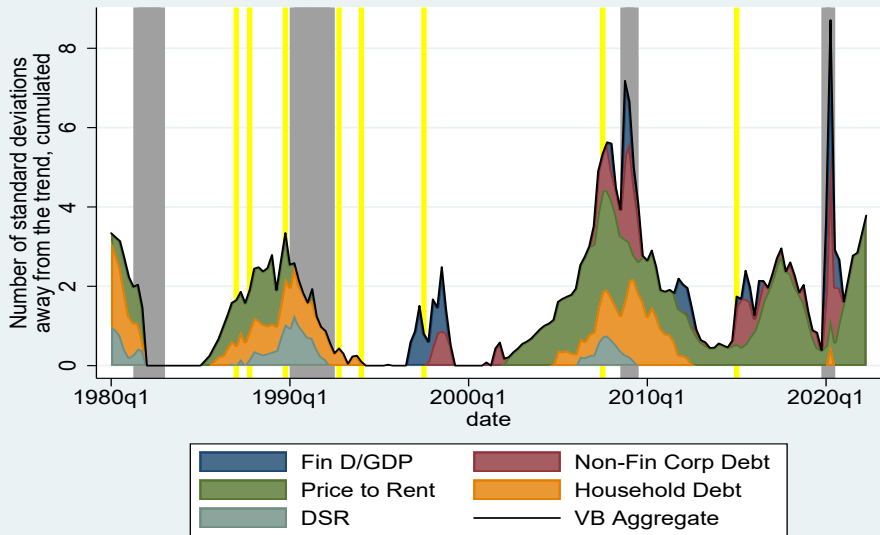


Notes: The areas below zero show the evolution of the indicators for each sector before they breach the vulnerability threshold. The barometer is restricted to be positive. However, each sectoral measure is bounded below at -1 since no individual indicator is allowed to be lower than one standard deviation away from the warning threshold.

Source: Chart 1 in Duprey and Roberts (2017).

- Key findings:
  - Pre-2005 not much in the way of concern
  - Starts to rise in the lead up to the GFC, and peaks right before
  - However, stays relatively high, and the overall peak occurs at the end of the sample, 2017
  - So, riskier in 2017 than pre-GFC? Odd...

# Barometer





- Key findings:
  - Debt servicing clearly an important predictor of recessions
  - Along with deviations of HH debt to GDP/disposable income from trend
  - And, price to rent ratios deviations from trend
  - Barometer has way fewer false positives - because no stock/flow variables
  - What matters is debt servicing and deviations from trend of stock/flow variables
- Today:
  - Debt servicing fell in the pandemic so recent increase catching us back up
  - Of course, more to follow, but as of now not vulnerable
  - Vulnerability comes from explosion of price to rent ratio
  - Though, this might change as house prices start to fall...

# Account for the evolution of borrowing and debt servicing

- We have Statcan data on total credit and principal reimbursements
- The second over the first gives the amortization rate  $\delta$ . We have

$$D_t = (1 - \delta_{t-1}) D_{t-1} + B_{t-1}$$

$D_t$  : debt.  $B_{t-1}$  : new borrowing.  $\delta_{t-1}$  amortization rate

$$S_t = (\delta_t + r_t) D_t$$

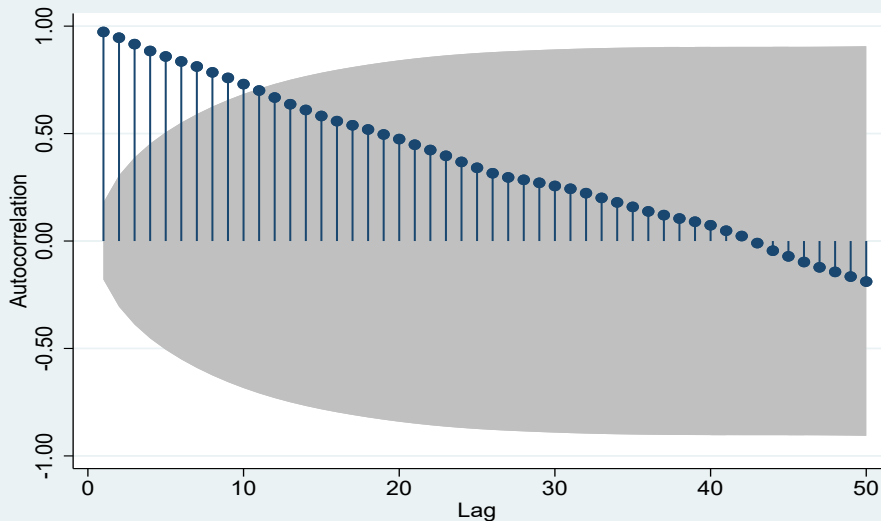
$S_t$  : debt servicing.  $r_t$  : average interest rate on the debt

$$N_t = B_t - S_t$$

$N_t$  : “cash flow” or net flow of payments

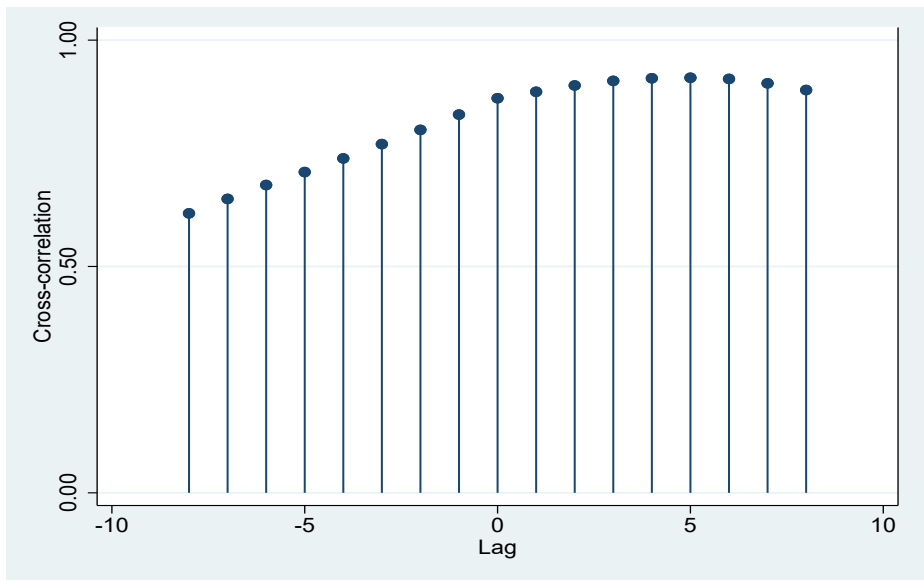
- We divide  $S_t$  and  $B_t$  by seasonally-adjusted GDP

# Autocorrelation, new borrowing



Bartlett's formula for MA(q) 95% confidence bands

# Cross correlations, new borrowing and debt servicing



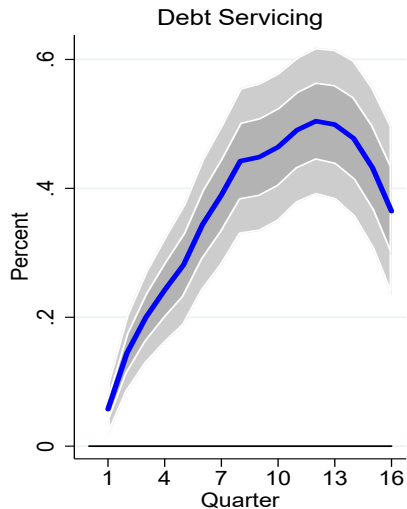
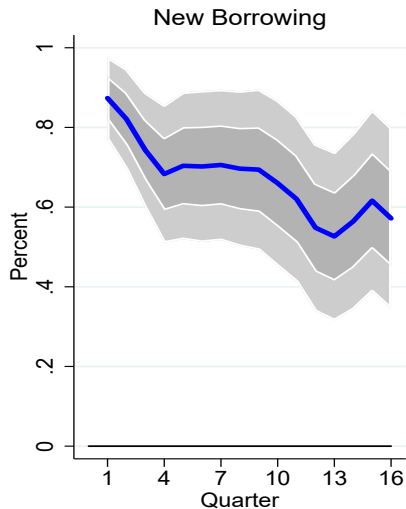
# Joint dynamics of new borrowing and debt

$$b_{t+h} = \beta_0 + \beta_{bb}^h b_t + \beta_{bs}^h s_t + \text{controls} + \epsilon_{b,t+h}^h$$

$$s_{t+h} = \beta_0 + \beta_{sb}^h b_t + \beta_{ss}^h s_t + \text{controls} + \epsilon_{s,t+h}^h$$

- We use local projections based on Jorda (2005)
- The  $h$  coefficients  $\beta_{bb}^h$  and  $\beta_{sb}^h$  give the responses of new borrowing and debt servicing to a unit increase in borrowing in  $t$   $h$  periods down the road

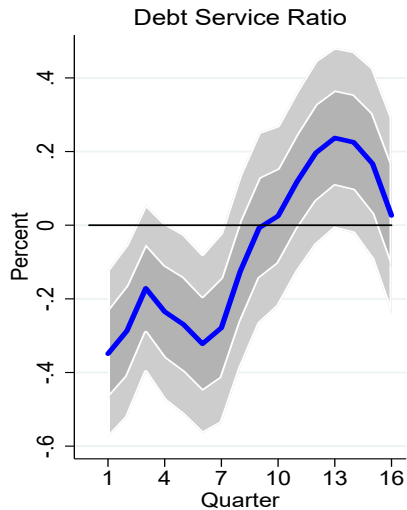
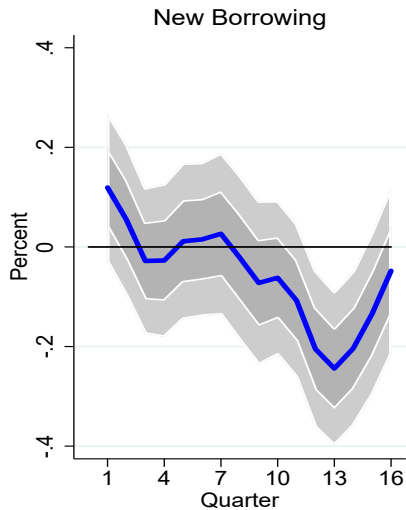
# Dynamic responses



# Impact of new borrowing and debt servicing on GDP

$$\Delta y_{t+h} = \beta_0 + \beta_{yb}^h b_t + \beta_{ys}^h s_t + \text{controls} + \epsilon_{y,t+h}^h$$

# GDP response



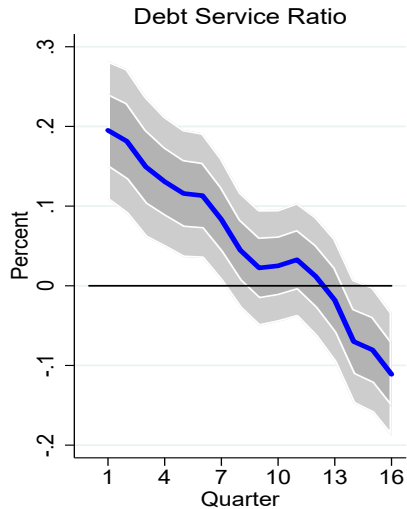
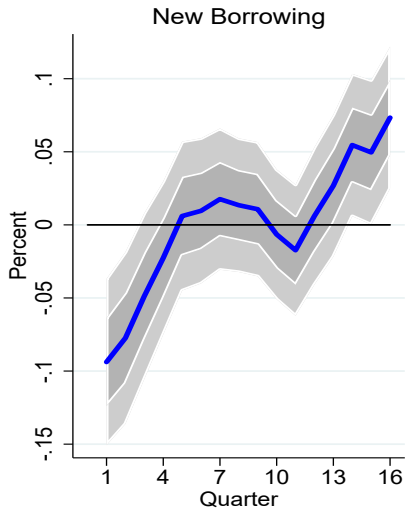


# Impact of new borrowing and debt servicing on financial instability

$$c_{t+h} = \beta_0 + \beta_{yb}^h b_t + \beta_{ys}^h s_t + \text{controls} + \epsilon_{y,t+h}^h,$$

- We use OLS. Logit gives similar results

# Crisis response



# Out-of-sample prediction

- Horse race between debt service ratio and more traditional measures to predict GDP growth and crisis periods.
- The first table below shows new borrowing and debt servicing are significant predictors of GDP growth. More standard measures, less so.
- The second table shows similar results for predicting crisis periods
- Our results are similar to Drehmann, Juselius and Korinek (2017) who use a panel of countries

# Out-of-sample predictive power (GDP growth)

Table 2: The effects of different credit measures on output growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
New Borr	0.092 (0.056)					0.226*** (0.057)	0.116* (0.061)	0.166*** (0.063)	0.062 (0.055)
DSR	-0.267*** (0.085)					-0.415*** (0.092)	-0.253*** (0.082)	-0.362*** (0.102)	-0.219*** (0.081)
Credit Gr		-0.187** (0.080)				-0.278*** (0.076)			
Cr/GDP Gr			-0.017 (0.028)				-0.027 (0.032)		
Gap HP1				-0.015 (0.040)				-0.067 (0.045)	
Gap HP2					0.097*** (0.033)				0.087** (0.034)
Observations	118	118	115	118	118	118	115	118	118
R <sup>2</sup>	0.41	0.42	0.31	0.36	0.41	0.50	0.35	0.42	0.44

# Out-of-sample predictive power (Crises)

Table 3: The effects of different credit measures on crisis probability (OLS)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
New Borr	-0.089*** (0.030)					-0.125*** (0.033)	-0.133*** (0.034)	-0.144*** (0.035)	-0.091*** (0.030)
DSR	0.167*** (0.045)					0.207*** (0.049)	0.179*** (0.044)	0.237*** (0.053)	0.169*** (0.044)
Credit Gr		0.023 (0.028)				0.075*** (0.028)			
Cr/GDP Gr			0.010 (0.010)				0.034** (0.013)		
Gap HP1				0.005 (0.014)				0.050*** (0.016)	
Gap HP2					-0.006 (0.015)				0.004 (0.013)
Observations	118	118	115	118	118	118	115	118	118
R <sup>2</sup>	0.55	0.48	0.41	0.48	0.48	0.59	0.53	0.59	0.55

# Conclusions

- Debt servicing plays a significant role in our fragility barometer
- Debt servicing is a significant predictor of GDP growth and crises out-of-sample
- Stock/flow variables are much less successful in predicting GDP growth/crises, while deviations from trend do better

For a full list of references, see our paper

- Drehmann, Mathias, Mikael Juselius and Anton Korinek. 2017. “Accounting for Debt Service: The Painful Legacy of Credit Booms.” Working Paper 645, Bank for International Settlements
- Duprey, Thibaut and Tom Roberts. 2017. “A Barometer of Canadian Financial System Vulnerabilities.” Staff Analytical Note 2017-24, Ottawa, Bank of Canada
- Jorda, Oscar. 2005. “Estimation and inference of impulse responses by local projections.” *American Economic Review* 95, 161–182