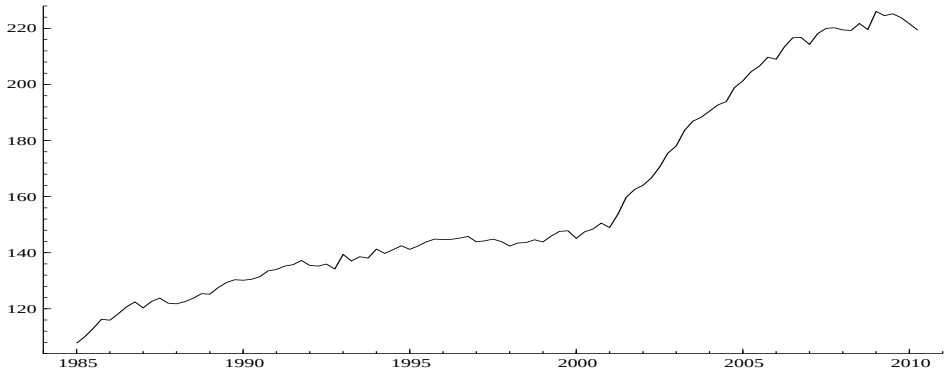
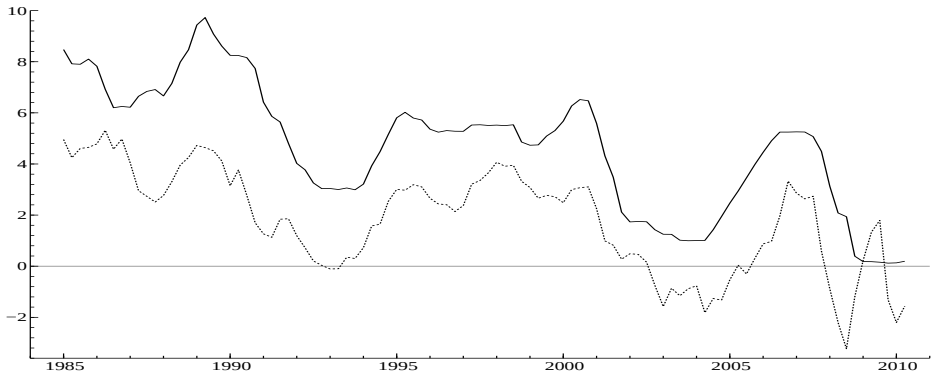
Sustainable Financial Obligations and Crisis Cycles

Mikael Juselius and Moshe Kim



(a) U.S. household sector total debt to income.



(b) Nominal (solid line) and real (dotted line) federal funds rate.

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"If there is one common theme to the vast range of crises we consider in this book, it is that excessive debt accumulation, whether it be by the government, banks, corporations, or consumers, often poses greater systemic risks than it seems during a boom."

– Carmen Reinhart and Kenneth Rogoff (2009)

Presentation at the 17th Dubrovnik Economic Conference, June 30th, 2011

Background

Recent theories of financial frictions suggest that aggregate debt can sometimes reach unsustainable levels:

- Dispersed beliefs or limited commitment in financial contracts can generate self-enforcing processes which can lead to asset price bubbles and excessive leverage (see e.g., Lorenzoni (2008), Miller and Stiglitz (2010)).

- When aggregate debt is excessive, debt holders ability to refinance become constrained making them highly vulnerable to negative aggregate shocks. In such situations, they may attempt to sell off assets and reduce spending.

- If agents do not internalize a pecuniary externality associated with such sales of assets, excessive leverage can potentially lead to a recession or even a systemic financial crisis (e.g.,Gai et al. (2008)).

Close association between high aggregate leverage and subsequent credit and output losses has been empirically established, for instance, by King (1994) and Mian and Sufi (2010).

- These studies exploit cross-sectional variation from individual episodes of financial distress, *and as a result are silent about what constitutes excessive aggregate debt*.

- Aggregate leverage, for example, has been upward trending from the mid-eighties up to the burst of the most recent bubble. This implies that the threshold where it becomes unsustainable must have been different in the early 1990's, say, compared to the recent crisis.

Borio and Lowe (2002) address this problem by using leverage and asset price "gaps", which are based on the Hodrick-Prescott filter *rather than economic rationale*. Hence these "gaps" run the risk of confusing sustainable developments in the variables, for instance due to declining interest rates, with excessive buildups.

This paper

We study debt sustainability by modeling aggregate U.S. credit loss dynamics over the period 1985Q1-2010Q2.

To capture the notion that credit losses become more vulnerable to adverse shocks when the level of debt is excessive, we estimate a nonlinear regime switching model, where the transitions between regimes can depend on aggregate leverage or the financial obligations ratio.

Key findings:

- Aggregate business sector debt was excessive 1-2 years prior to each of the three U.S. recessions in our sample.

- Aggregate household sector debt, in particular the part related to real estate, was excessive 1-2 years prior to the severe recessions associated with saving and loan crisis in the early 1990's and the recent financial crisis.

- Together, excessive debt in the household and business sectors likely play a significant role in shaping business cycle movements. Moreover, the magnitude of excessive debt in each sector seems to account for the severity and length of ensuing recessions.

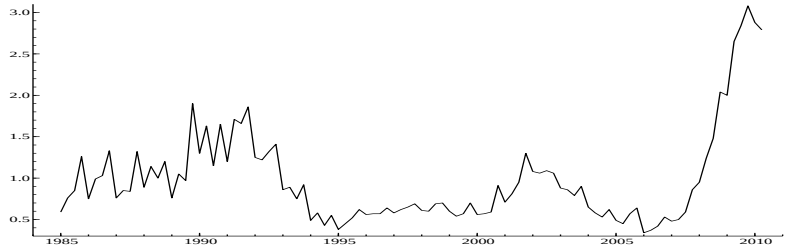
Technical findings:

- Leverage as such cannot adequately account for credit losses during systemic events, whereas financial obligations ratios can.

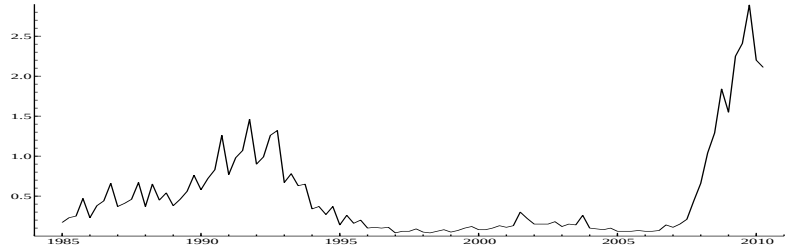
- We are able to estimate threshold values, each corresponding to specific financial obligations ratios, which can be interpreted as a measuring maximum sustainable debt burden (MSDB).

Data

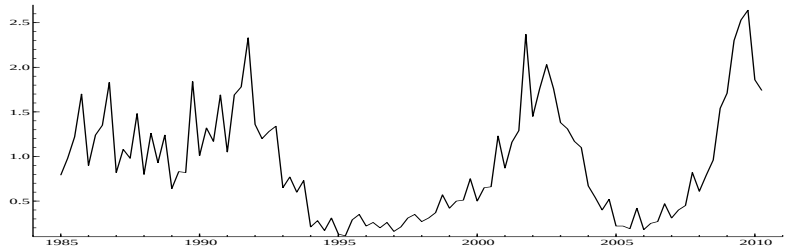
- We use net charge-off rates to capture credit losses. We distinguish between losses on total loans, real estate loans, and business loans. See Figure 1.
- We use debt to income ratios as measures of leverage. We distinguish between the household and business, as well as between total and real estate debt.
- We use the financial obligations ratio, as constructed by the Federal Reserve, to capture interest payments and amortizations. See Figure 2.
  - This measure is not available for the business sector: we construct it using the federal funds rates, a fixed maturity of 3 years, and linear amortizations.
- We control for several factors, such as interest rates and monetary policy.



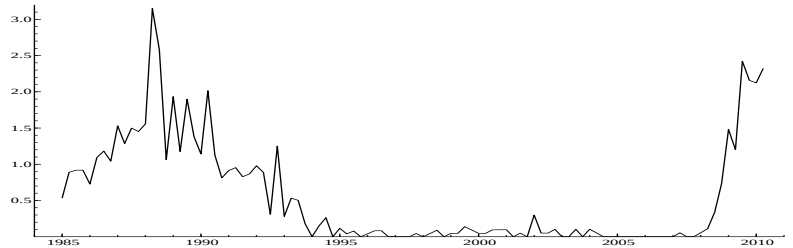
(a) Loss rate on total loans.



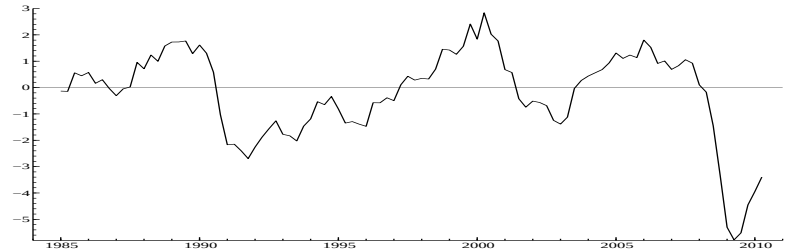
(b) Loss rate on real estate loans.



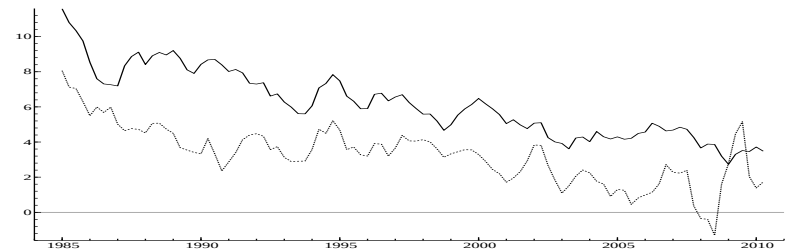
(c) Loss rate on business loans.



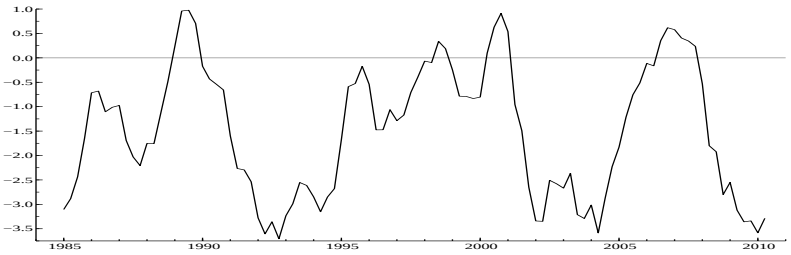
(d) Bank failure rate.



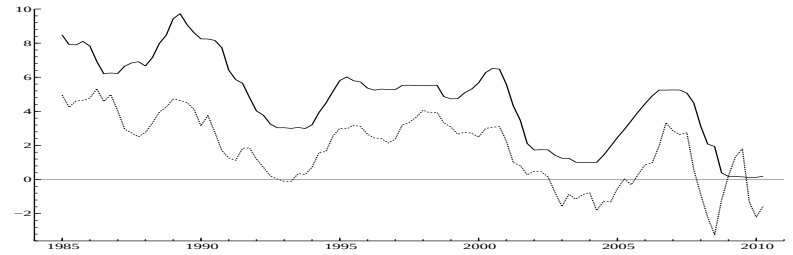
(e) Output gap



(f) Nominal (solid line) and real (dotted line) long-term government T-bill rate.

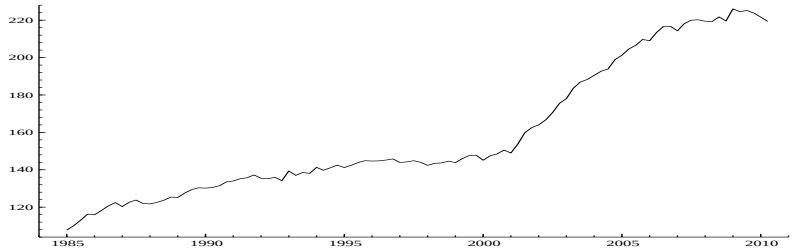


(g) Interest rate spread

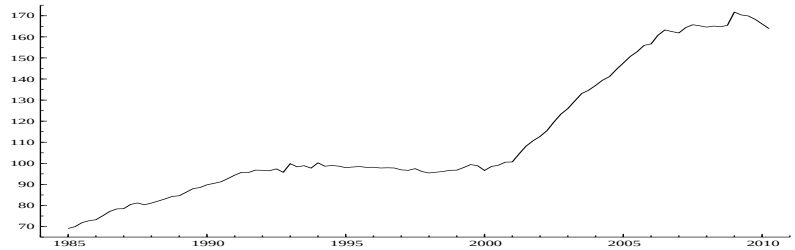


(h) Nominal (solid line) and real (dotted line) federal funds rate.

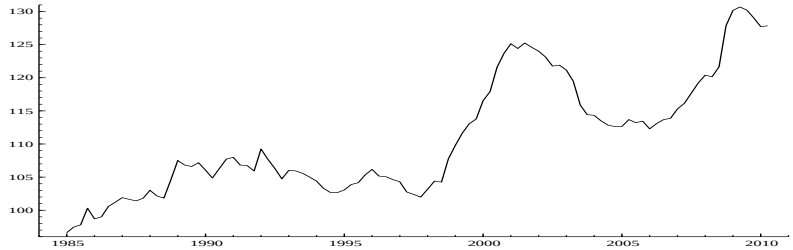
Figure 1: Credit loss rates and various indicators of financial, monetary, and real conditions in the United Sates. The real (ex-post) interest rates are constructed using the 4-quarter moving average inflation rate to facilitate the exposition.



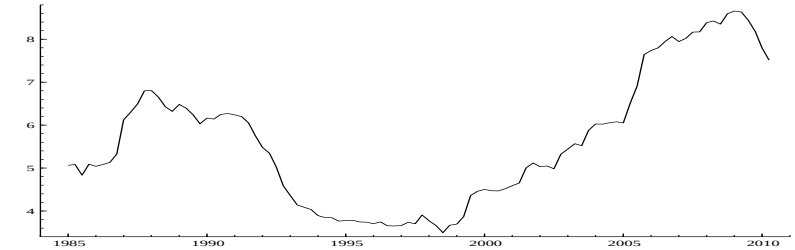
(a) Total leverage in the household sector.



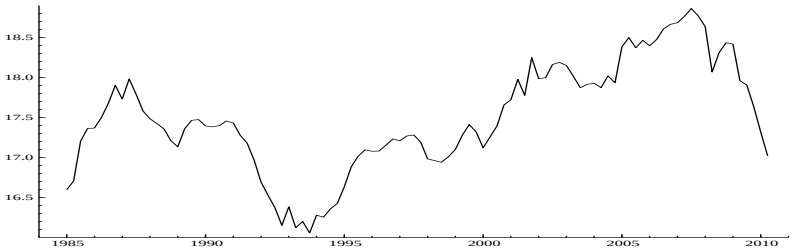
(b) Real estate leverage in the household sector.



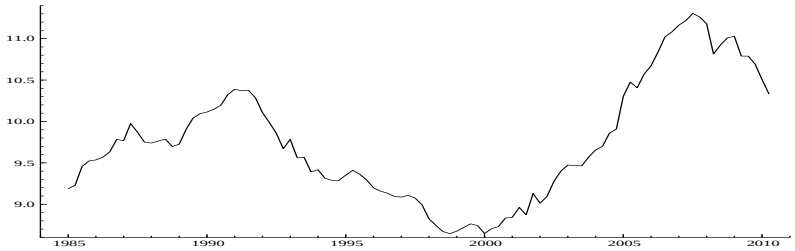
(c) Total leverage in the business sector.



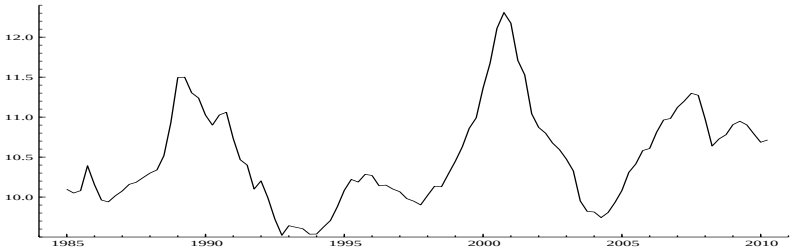
(d) Real estate leverage in the business sector.



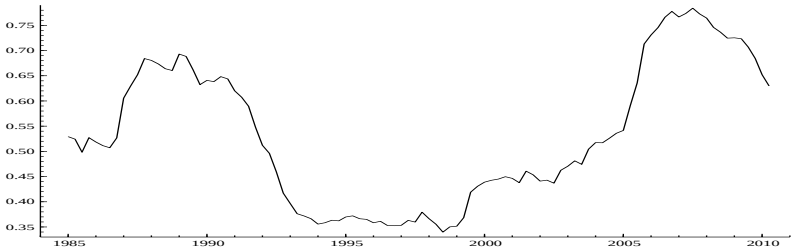
(e) Total financial obligations in the household sector.



(f) Real estate financial obligations in the household sector.



(g) Total financial obligations in the business sector.



(h) Real estate financial obligations in the business sector.

Figure 2: Indicators of leverage and financial obligations in the household and business sectors.

Methodology

Episodes of high aggregate debt may imply greater vulnerability of bank loan portfolios to aggregate economic conditions due to, e.g., contagion effects and pecuniary externalities in the wake of negative shocks.

We model this type of interaction in a regime switching model for the credit loss rates in the different loan categories (adjusted to account for the steady decline in the interest rate level):

$$\tilde{cl}_t^j = (1-\varphi(\tau_t))(\mu_1 + \boldsymbol{\gamma}_1'\boldsymbol{x}_t) + \varphi(\tau_t)(\mu_2 + \boldsymbol{\gamma}_2'\boldsymbol{x}_t) + \boldsymbol{\psi}'\boldsymbol{d}_t + \upsilon_t \quad (1)$$

$$\varphi(\tau_t) = \frac{1}{1+e^{-\kappa_1(\tau_t-\kappa_2)}} \quad (2)$$

where $\tilde{cl}_t^j$ is the credit loss rate in loan category j, $\boldsymbol{x}_t$ is a vector of explanatory variables, τ_t is a transition variable, $\boldsymbol{d}_t$ is a vector of deterministic terms, and υ_t is assumed to be a mean zero stationary disturbance term (see Saikkonen and Choi (2004)).

- The transition variable, τ, is selected from a set which includes the leverage variables, l_t^{ij}, the financial obligations ratios, f_t^{ij}, and several control variables.

- $\boldsymbol{x}_t$ consists of various cyclical indicators, such as an output gap measure and the term spread.

Results

- Significant non-linearities. See Table 1.

Tests of linearity vs. regime shifts											
	1985Q1-2010Q2										
$\tilde{cl}_t^j \setminus \tau_t$	$\tilde{i}_t^T$	$\tilde{i}_t^S$	p_t^R	l_t^H	l_t^{HR}	l_t^B	l_t^{BR}	λ_t^H	λ_t^{HR}	λ_t^B	λ_t^{BR}
$\tilde{cl}_t^T$	0.819	**0.021**	**0.034**	**0.016**	**0.013**	**0.011**	**0.012**	0.181	**0.041**	0.411	**0.037**
$\tilde{cl}_t^R$	0.617	**0.015**	0.168	0.059	**0.042**	0.052	**0.021**	0.738	**0.018**	0.940	0.054
$\tilde{cl}_t^B$	0.784	0.338	0.068	**0.048**	**0.049**	**0.006**	**0.029**	0.058	0.151	**0.021**	0.064

Table 1: Tests of linearity against a STR alternative. Bold value: rejection at the 5% significance level.

- When any leverage variable is used as τ_t, either the estimated threshold parameter, κ_2, lies outside its range or that the statistical fit of the model is poor, or both. More important, unit-roots cannot be rejected in the residuals.

- When any of the financial obligations ratios are used we get stationary residuals, good statistical fits, and κ_2 estimates which lie in the variable's range.

STR estimates							
		Transition parameters		Regime 1		Regime 2	
$\tilde{cl}_t^i$	τ_t	κ_1	κ_2	$\gamma_{\tilde{i}S}$	$\gamma_{\tilde{y}}$	$\gamma_{\tilde{i}S}$	$\gamma_{\tilde{y}}$
$\tilde{cl}_t^T$	f_t^{HR}	**12.678** (5.630)	**10.192** (0.056)	-0.063 (0.034)	0.002 (0.045)	**-0.276** (0.094)	**-0.224** (0.051)
$\tilde{cl}_t^R$	f_t^{HR}	**3.609** (1.128)	**10.079** (0.106)	-0.023 (0.041)	-0.051 (0.038)	**-0.267** (0.099)	**-0.243** (0.049)
$\tilde{cl}_t^B$	f_t^{BT}	**2.318** (0.968)	**10.44** (0.199)	**-0.249** (0.085)	–	**-0.619** (0.119)	–

Table 2: Estimated transition parameters and regime coefficients from STR-models of the credit loss rates.

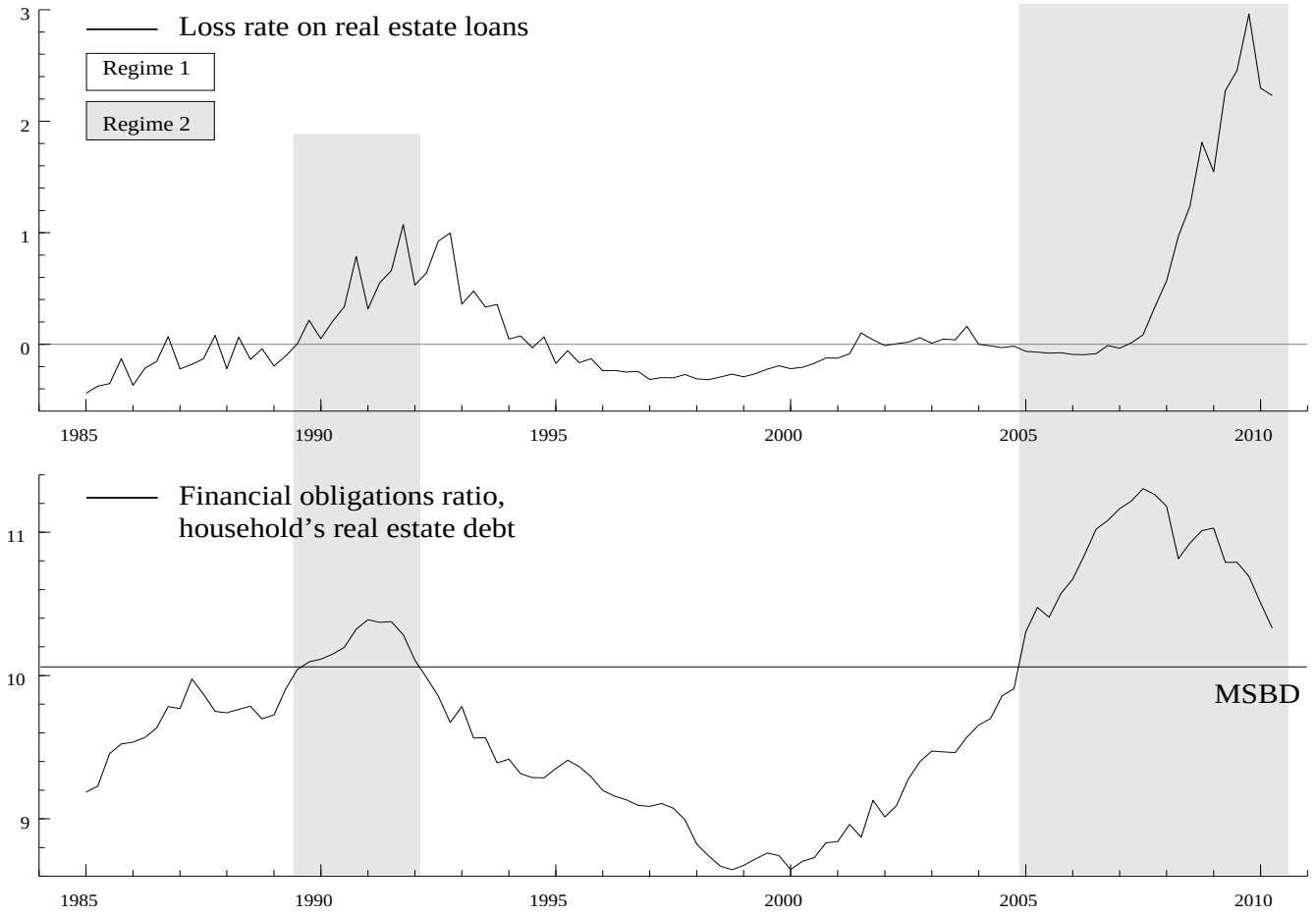


Figure 1: Transitions in the loss rate on real estate loans. The upper panel depicts the loss rate on real estate loans, whereas the lower panel depicts the financial obligations ratio associated with household's real estate debt and the corresponding MSDB estimate. Episodes when regime 2 dominate are demarked by grey bars.

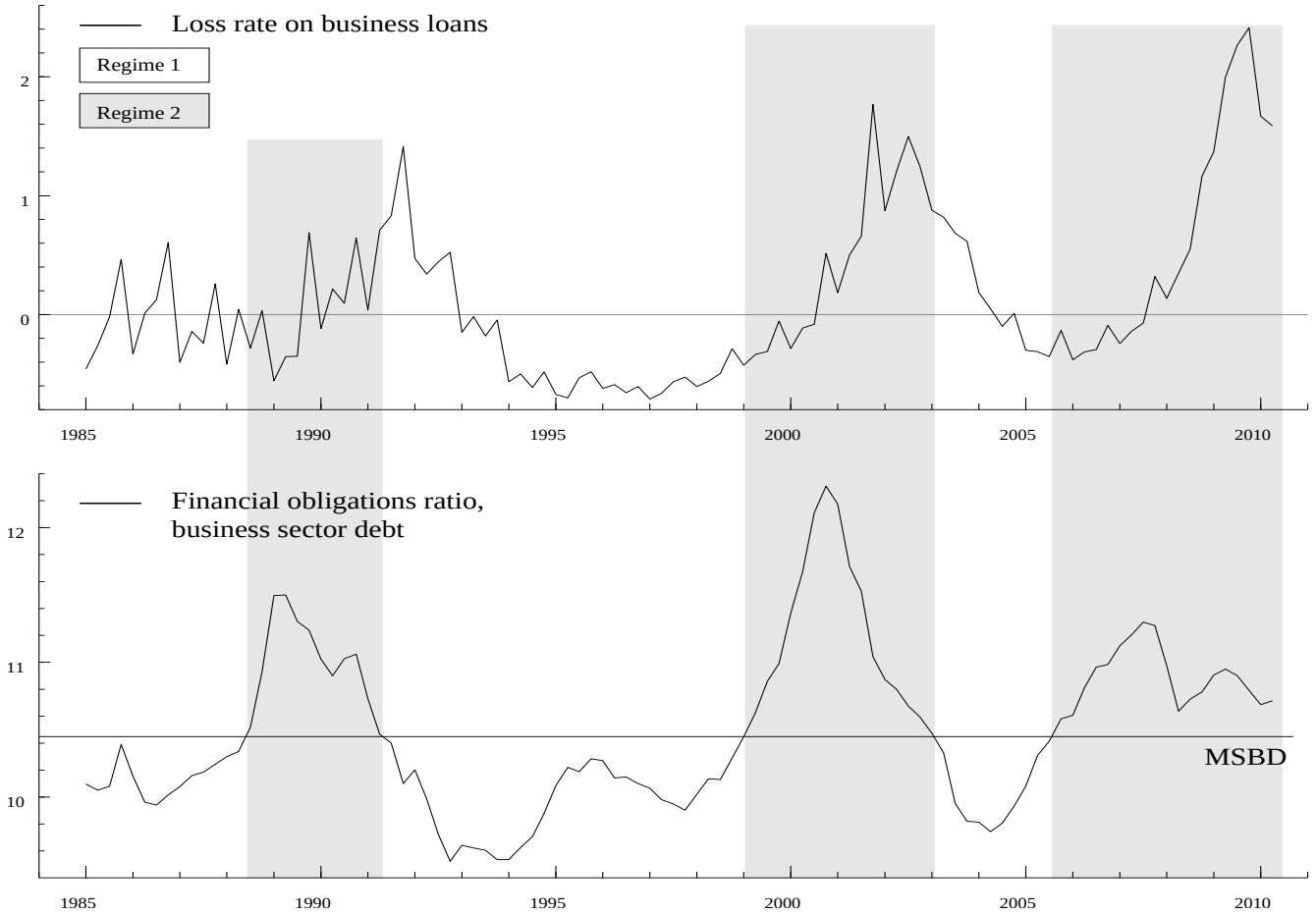


Figure 2: Transitions in the loss rate on business loans. The upper panel depicts the loss rate on business loans, whereas the lower panel depicts the financial obligations ratio associated with total business sector debt and the corresponding MSDB estimate. Episodes when regime 2 dominate are demarked by grey bars.

Implications

- **Bank capital requirements**: Our analysis suggests that credit risk assessment based on financial obligations ratios is likely to achieve more counter-cyclical capital standards and, therefore, could be an integral part of such a system.

- **Macro prudential policies**: The financial obligations ratios, in particular those related real estate debt, may be useful as early warning indicators of such long-term debt accumulations which may eventually threaten financial stability.

- **Monetary policy**: Interest rate increases, intended to curb inflationary pressure, is likely to be detrimental to financial stability in periods when aggregate debt is close to or above the sustainable level.