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TECHNOLOGY, SKILLS AND INEQUALITIES

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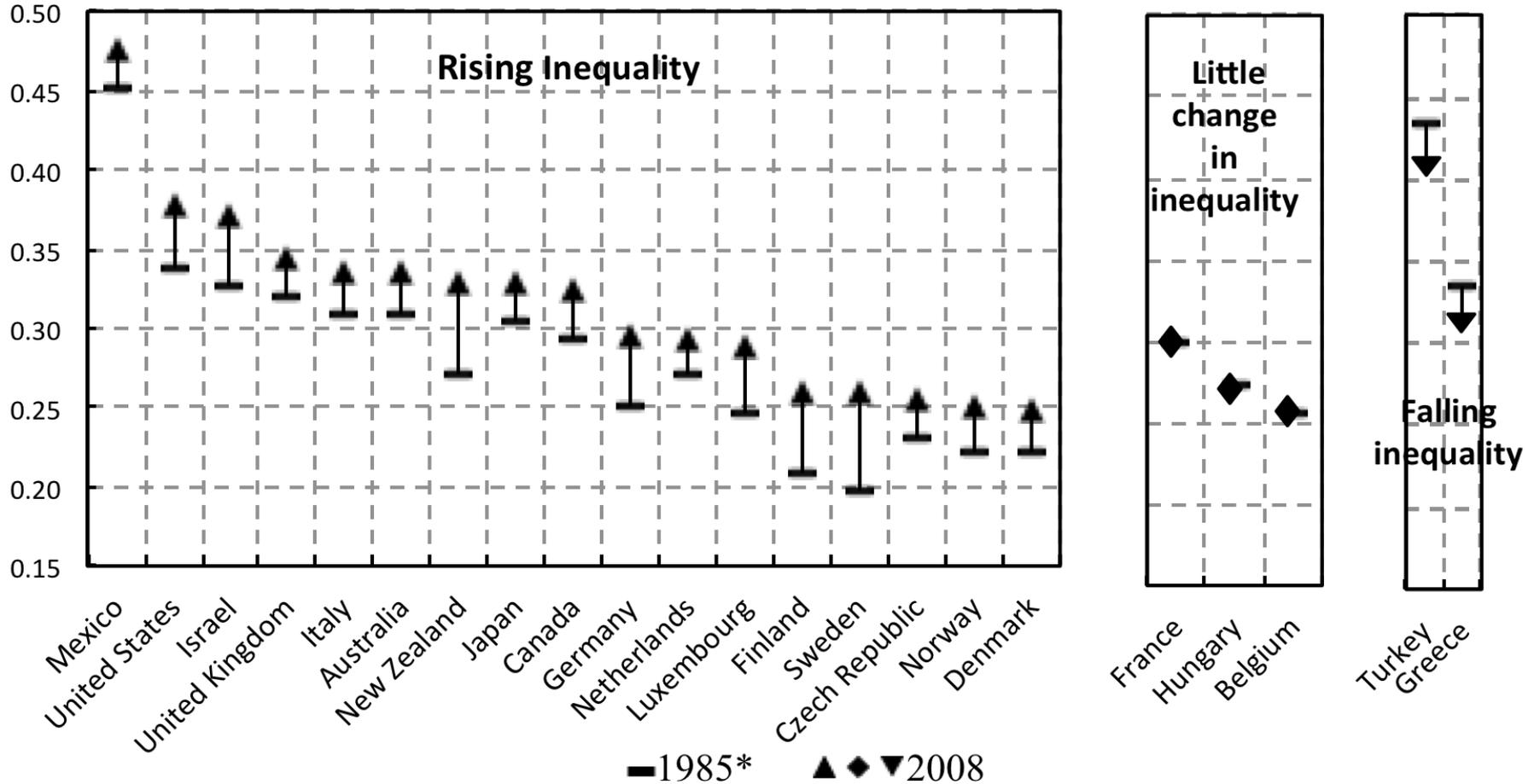
Inequality, Credit and Crisis

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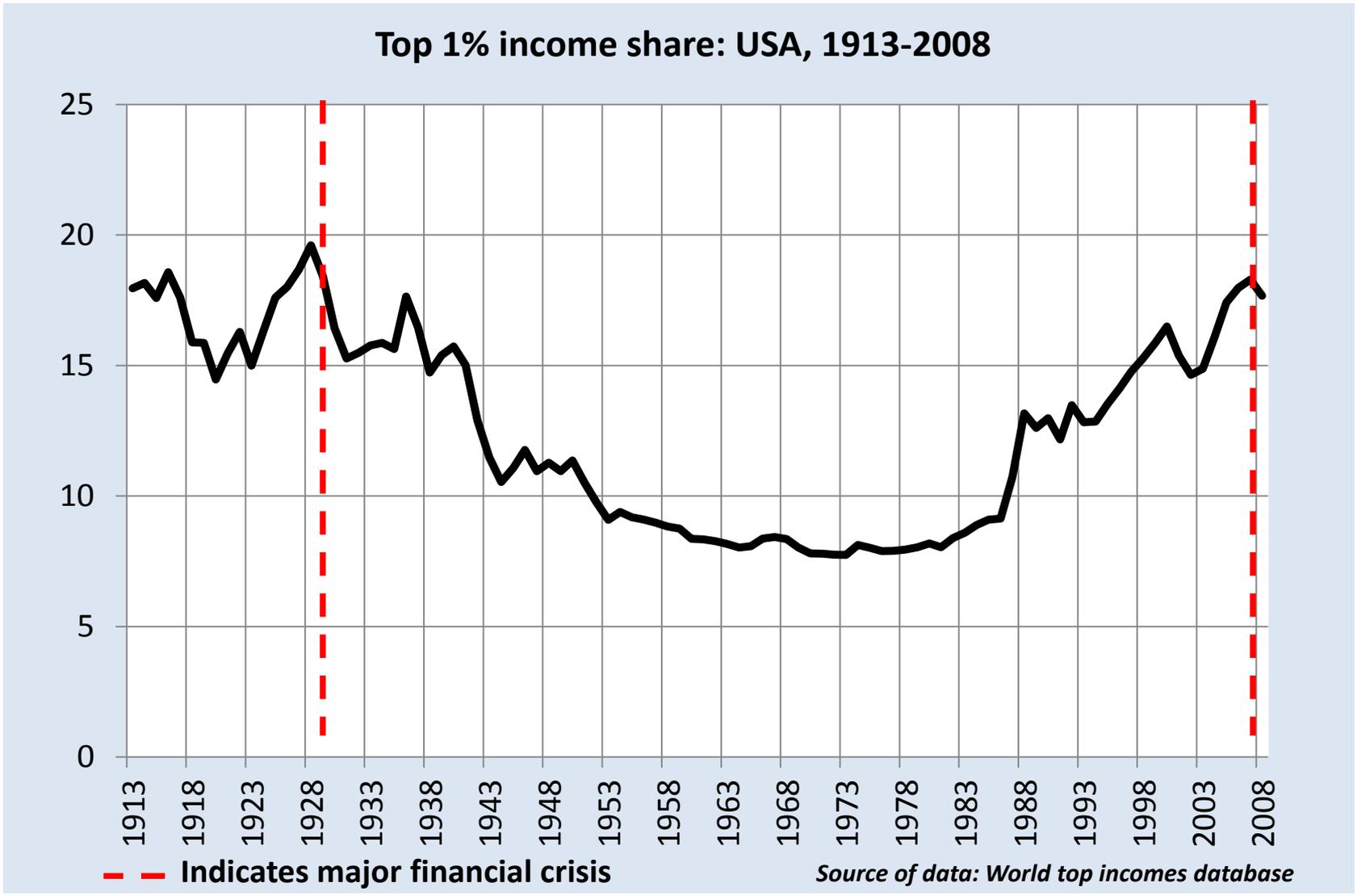
1. Introduction: (i) Context and motivation

Gini coefficients of income inequality, mid-1980s and late 2000s, selected OECD countries



In the three decades leading up to the financial crisis inequality rose across much of the developed world

1. Introduction: (i) Context and motivation



Inequality in America – at the epicentre of the recent crisis – reached levels observed last time in the period immediately preceding the 1929 crisis

1. Introduction: (i) Context and motivation

Conventional knowledge is that:

- Financial crises are triggered by excessive debt
 - Fisher (1933) debt deflation theory of great depressions
 - Minsky, (1975; 1982; 1986) Financial instability hypothesis
 - Kindleberger (1978) Manias, panics, crashes

- The excessive debt/crisis link is largely confirmed by empirical evidence
 - E.g.: Borio and White (2003) ; Mendoza and Terrones (2008) ; Elekdag and Wu (2011); Reinhart and Rogoff (2008); Schularick and Taylor (2012)

- Comprehensive empirical evidence has identified the factors behind excessive credit growth
 - Review in: Mendoza and Terrones, 2008



1. Introduction: (i) Context and motivation

Excessive credit growth is compatible with a number of theoretical explanations

(herd behaviours by banks, underestimation of risks, limited commitment by borrowers, business cycles and financial accelerators, loosening of lending standards)

On the empirical side, the main key drivers are identified with:

- **Financial market deregulation** (Demirguc-Kunt & Detriagiache, 1998; Kaminsky and Reinhart, 1998; Ranciére et al., 2006; Decressin and Terrones, 2011)
- **Accommodative monetary policy** (Borio & White, 2003; Elekdag and Wu, 2011; Mendoza and Terrones, 2008)
- **Strong economic growth** (Mendoza and Terrones, 2008)
- **Capital inflows** (Elekdag and Wu, 2011; Mendoza and Terrones, 2008; Decressin and Terrones 2011)

1. Introduction: (ii) Research question and aim of the paper

- *Is income inequality to be added to the list?*
- *To provide evidence on the relationship between income inequality, indebtedness, and financial crisis*

Perugini, C., Holscher, J., Collie, S. (2015), "Inequality, credit and financial crises", *Cambridge Journal of Economics*, (forthcoming)

2. Conceptual framework: inequality → crises?

(i) Theoretical relationship (Political Economy explanations)

- **Rajan (2010)**: Rising inequality in the USA drove politicians to use credit as a “palliative” for stagnating/declining incomes

Inequality → *Politics* → *Deregulation* → *Credit boom* → *Crisis*

- **Milanovic (2010)**: same pattern, but on the saving/credit supply side (wealth accumulation that needed profitable employment)

- **Acemoglu (2011), Krugman (2012)**: politics drove both inequality and the credit boom. There is concomitance, not causation

High-income minority → *Politics* → *Deregulation* → *Credit boom* → *Crisis*
Inequality

- **Stiglitz (2009); Fitoussi & Saraceno (2011)**: rising inequality suppresses consumption, loose monetary policy response creates a credit boom

Inequality → *AD* ↓ → *Monetary loosening* → *Credit boom* → *Crisis*

2. Conceptual framework: (i) inequality → crises?

(ii) Theoretical relationship (“direct” explanations)

- **Kumhof and Rancière (2010)**: DSGE model (K, W) in which rising inequality leads directly to increased demand for, and supply of, credit
- Workers have $C_t = f(C_{t-1})$ and they borrow if their income is not sufficient to attain C_t
- When a shock weakens the bargaining power of W, demand for credit grows, as does supply by K, whose income share increased

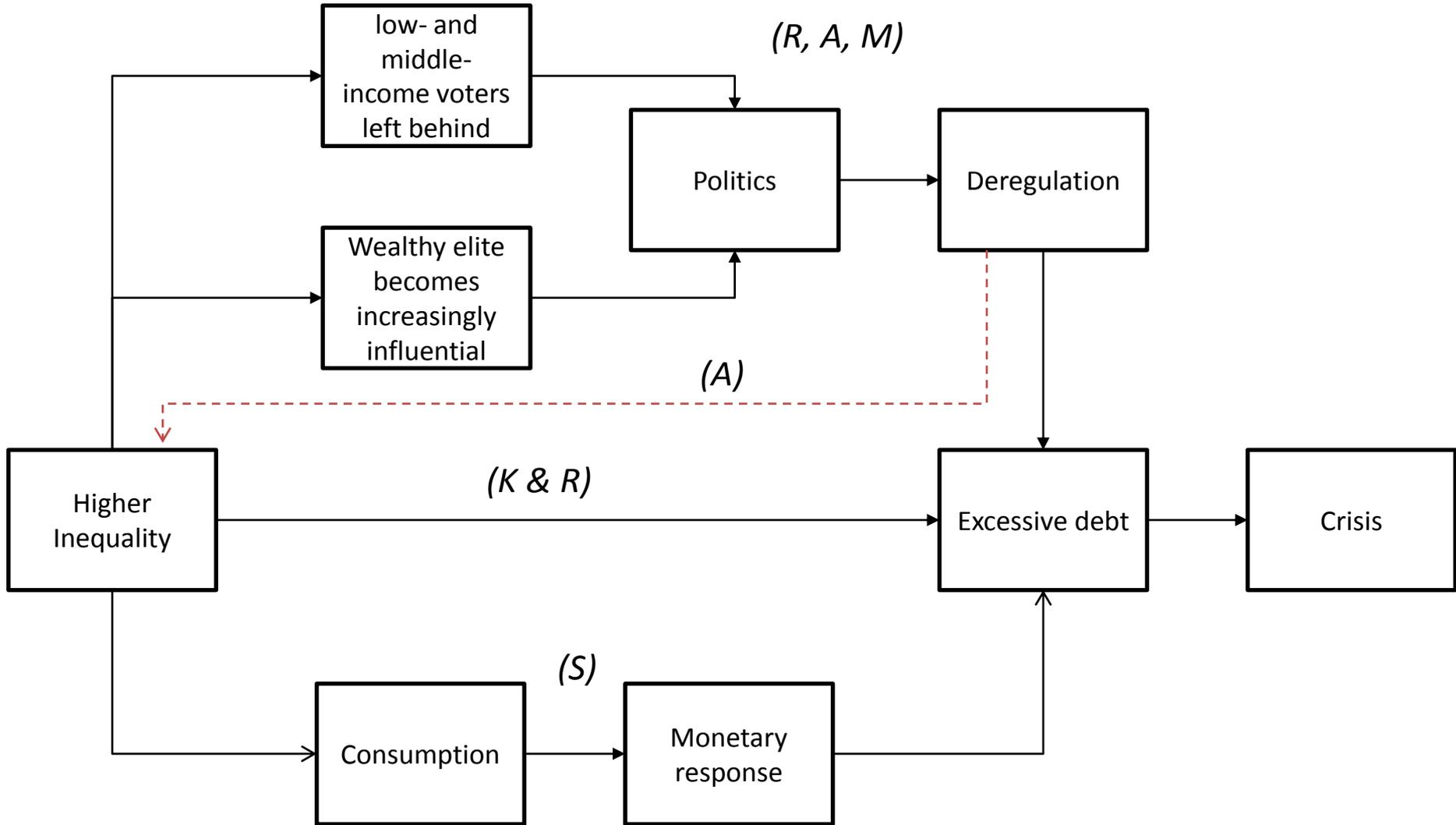
Inequality → *Credit boom* → *Crisis*

- **Van Treek (2013); Duesenberry (1949); Frank et al. (2010); Bertrande and Morse (2013)**: relative income, consumption cascade hypotheses

Consumption today is a function of past consumption and consumption of some reference households: $C_t = f(C_{t-1}; C_{rh})$

Increased expenditure by some people leads those just below them on the income scale to spend more, in turn leading those below them to buy more, etc.

2. Conceptual framework: (ii) inequality → crises? (summary)



2. Conceptual framework: (i) inequality → crises?

(iii) Empirical evidence

- **Atkinson and Morelli (2010; 2011)** evidence of a link ineq/crisis for US (1929, 2008), but no stable, universal link between *changes* in inequality and the occurrence of banking crises in developed nations
- **Bordo and Meissner (2012)** credit growth precipitates financial crises, but *rising* inequality is not a significant predictor of credit growth in a panel of 14 countries (1920 – 2008)
- **Kumhof *et al.* (2012)**, DSGE calibrated to UK: Inequality is associated with credit growth (and then capital inflows and widening external deficits) in a panel of 20 countries (1968-2006), increasing the probability of a crisis

Summary

- Numerous theoretical explanations for a relationship between inequality and financial fragility
- However, empirical evidence is mixed.

3. Empirics: (i) the Data

- **18 Countries:** Australia, Canada, Denmark, *Finland*, France, Germany, *Ireland*, Italy, Japan, Netherlands, *New Zealand*, Norway, *Portugal*, Spain, Sweden, Switzerland, UK, US
- **Time coverage:** 1970 – 2007

Core Variables:

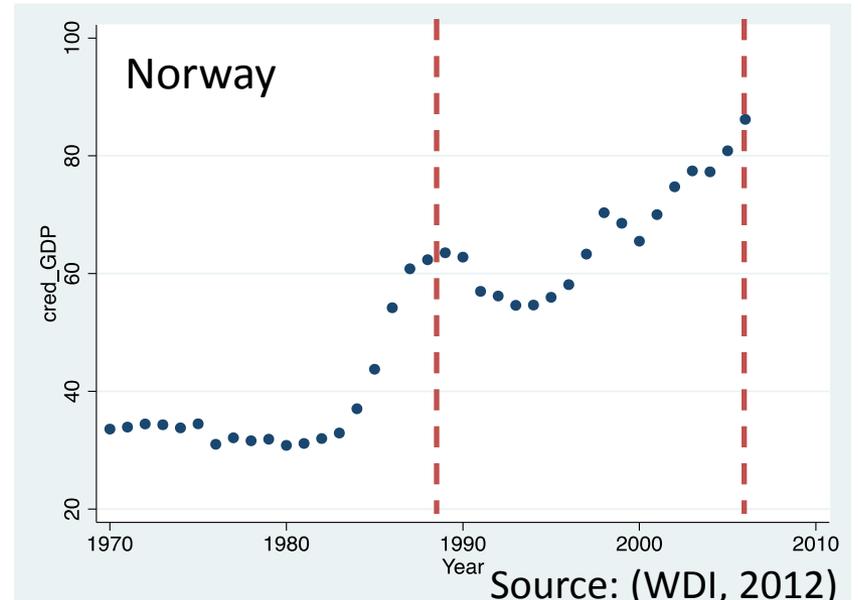
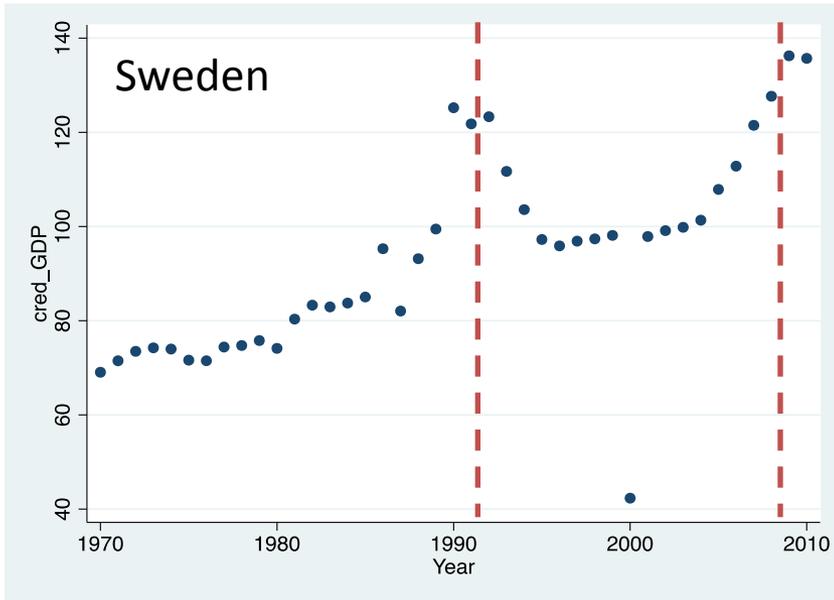
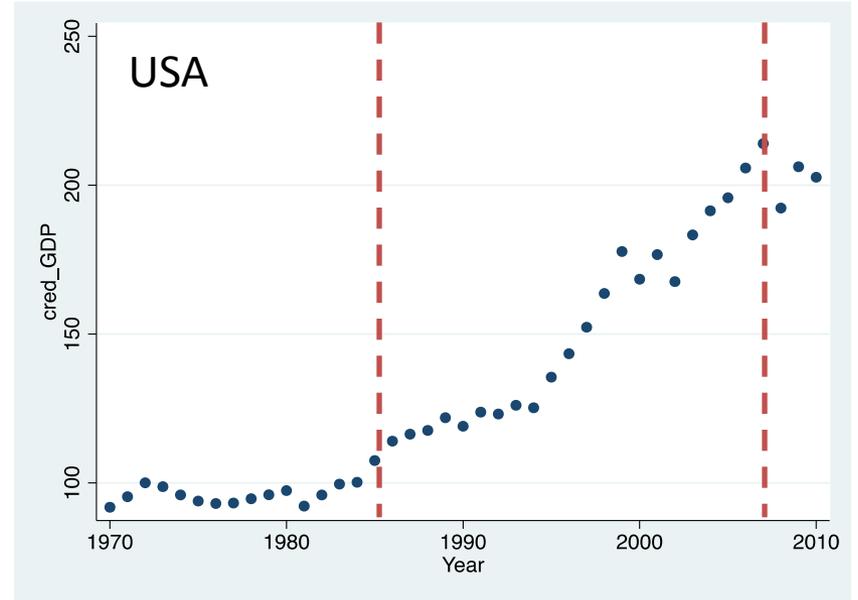
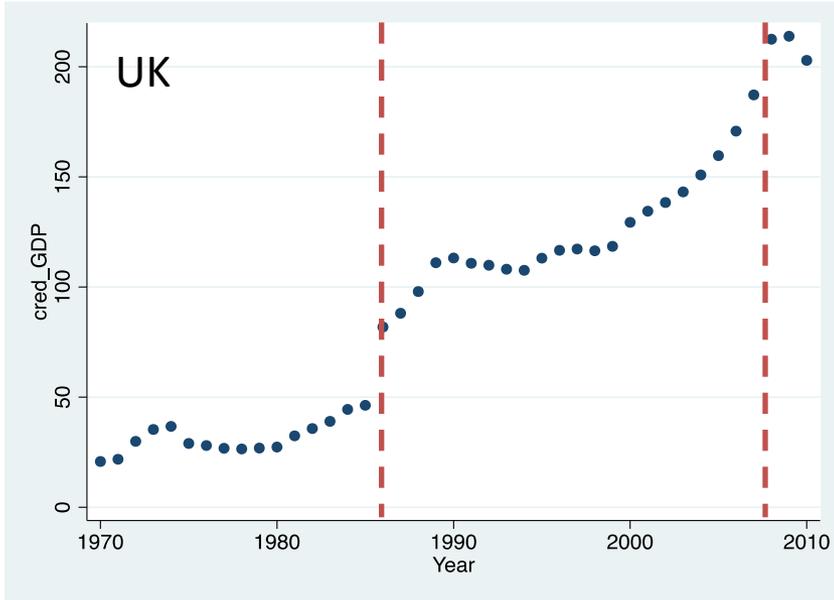
- **Credit as a % of GDP** (Dependent variable): private sector credit as a percentage of GDP (*Source: WDI*)
- **Income Inequality:** Income share of the top 1% (*Source: World Top Incomes Database*)
- **Credit Market (de)regulation:** Index of liberalizationn of credit market, range 0-10 (*Source: Economic Freedom of the World , 2010, Fraser Institute*)

Control Variables

- **Capital formation as a % of GDP** (*source: WDI*)
- **Portfolio investments as a % of GDP** (*source: WDI*)
- **M2 as a % of GDP** (*source: WDI*)
- **Real Interest Rate** (*source: WDI*)
- **Real Per Capita GDP:** 1990 International Geary-Khamis dollars (*Source: Angus Maddison - Statistics on World Population, GDP and Per Capita GDP*)
- **Real GDP growth:** 1990 International Geary-Khamis dollars (*Source: Angus Maddison - Statistics on World Population, GDP and Per Capita GDP*)

3. Empirics: (ii) Preliminary evidence: credit > crisis

Private credit/GDP and crises: select countries, 1970-2010



Source: (WDI, 2012)

3. Empirics: (ii) Preliminary evidence: credit > crisis

$$\Pr(\text{bankingcrisis}_{i,t}) = f(\text{Cred}_{i,t} + \alpha_i + \tau_t + \varepsilon_{i,t})$$

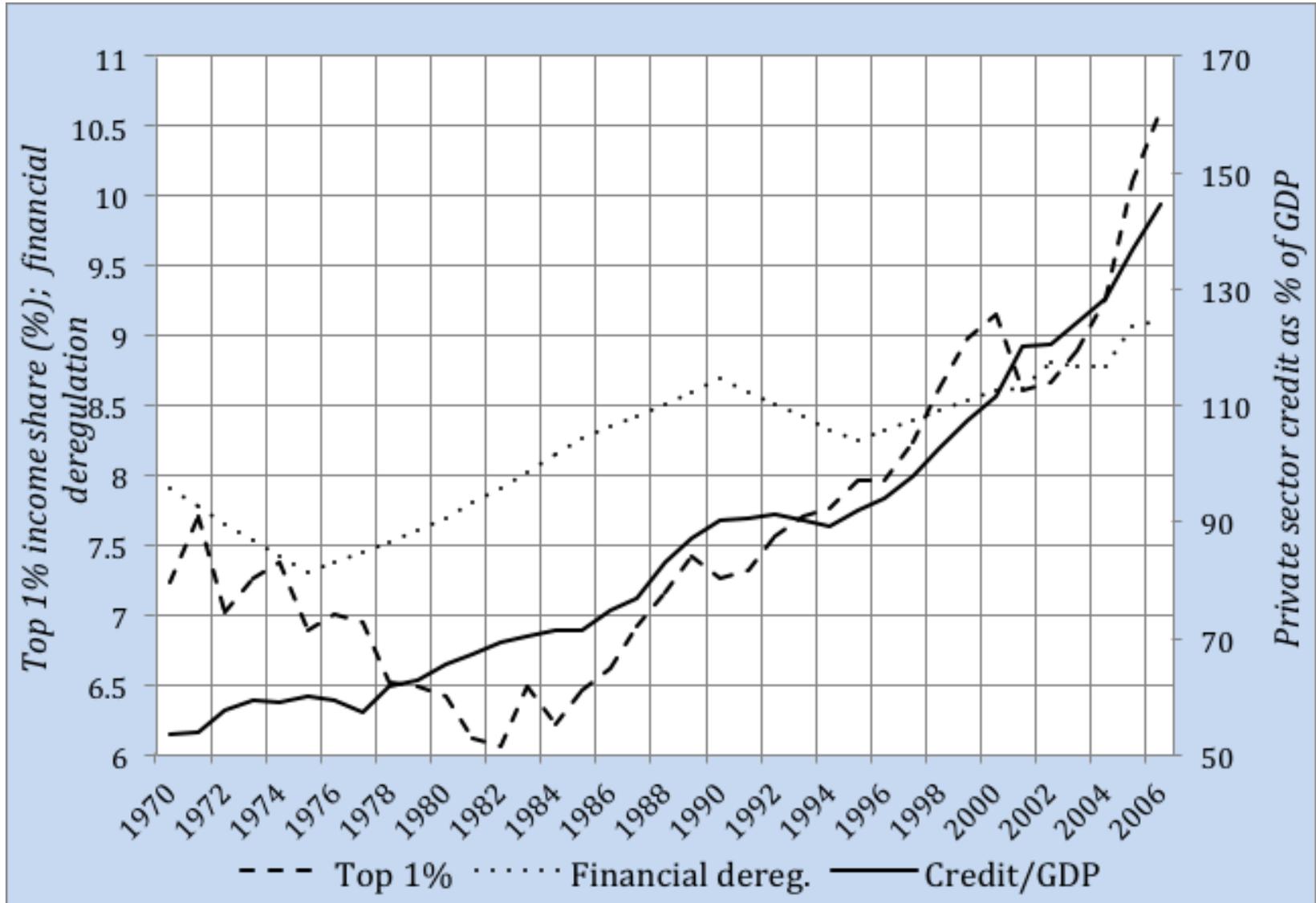
<i>Dep. Var.:</i> <i>Banking crisis</i>	Logit; RE (1)	Logit; RE (2)	Logit; FE (3)	Logit; FE (4)
cred_GDP	0.034*** (7.12)	0.036*** (3.80)	0.040*** (7.42)	0.046*** (3.86)
Const	-6.489*** (-8.80)	-28.714 (-0.00)	- -	- -
Time dummies	No	Yes	No	Yes
Wald test (RE) / LR test (FE)	50.73***	-	103.80***	213.27***
N observations	719	719	599	599

Notes: *The dependent variable is a dummy equal to 1 when a banking crisis occurred according to Laeven and Valencia (2013)*

*Z statistics (reported in brackets) are based on robust standard errors. * p<0.10, ** p<0.5, *** p<0.01*

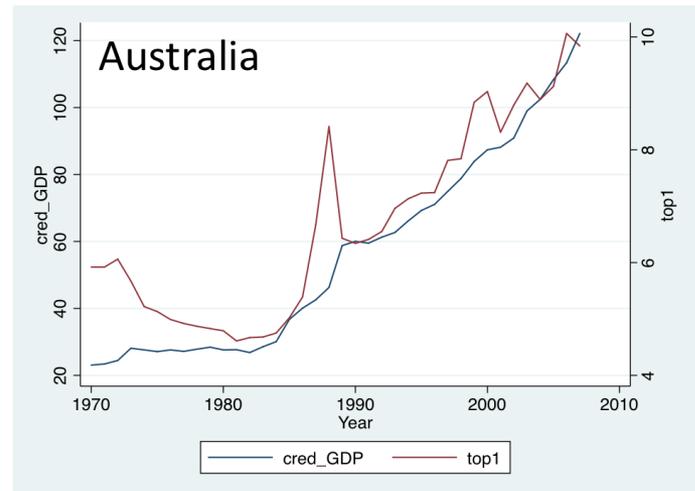
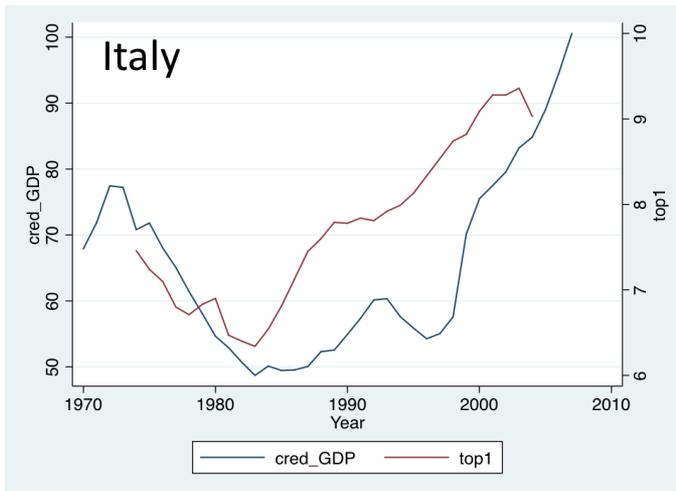
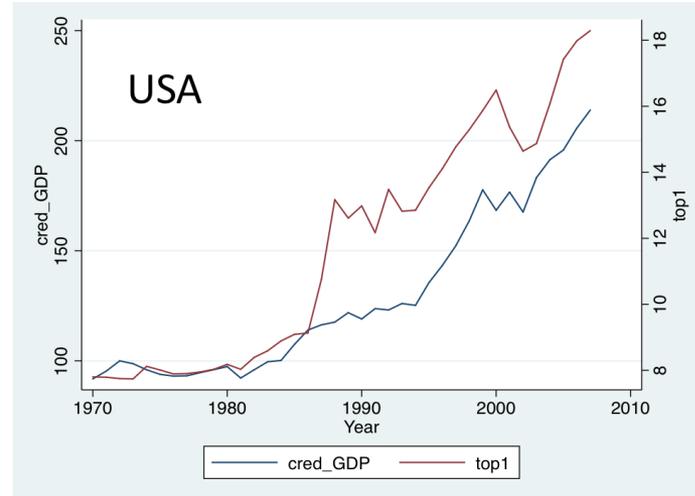
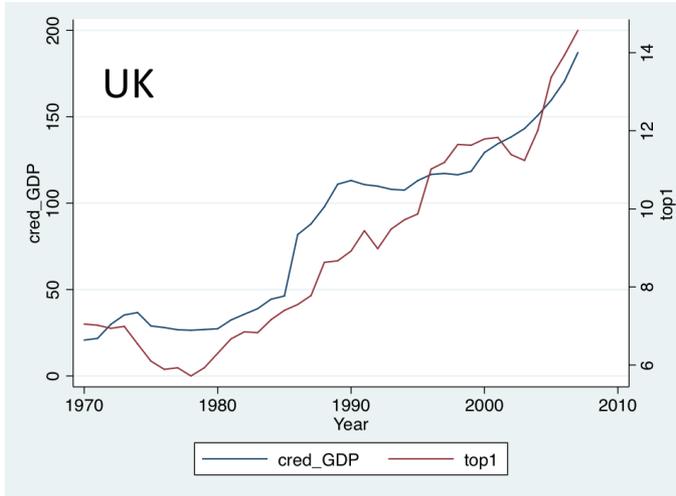
- In our sample, a higher credit to GDP ratio is shown to increase the probability of a systemic financial crisis (1% point rise in cred/GDP leads to increased probability of crisis by approx. 0.04%)

3. Empirics: (iii) Preliminary evidence: inequality, credit, financial markets deregulation



3. Empirics: (iii) Preliminary evidence: inequality, credit, financial markets deregulation

Private credit/GDP and inequality: select countries, 1970-2010



3. Empirics: (iv) granger causality tests

	<i>H0:</i> <i>Dereg_cred_mkt does not Granger cause Ineq (top1%)</i>	<i>H0:</i> <i>Ineq (top1%) does not Granger cause Dereg_cred_mkt</i>		<i>H0:</i> <i>Ineq (top1%) does not Granger cause M2_gdp</i>	
	F-stat [p_values]	F-stat [p_values]	N. obs	F-stat [p_values]	N. obs
1 lag	1.467 [0.226]	0.981 [0.322]	487	1.387 [0.238]	489
2 lags	2.794 [0.062]	1.570 [0.209]	468	0.487 [0.615]	470
3 lags	1.977 [0.116]	1.514 [0.210]	449	0.407 [0.748]	451
4 lags	1.346 [0.251]	1.194 [0.313]	430	0.341 [0.850]	432
5 lags	1.591 [0.161]	1.802 [0.111]	411	0.230 [0.949]	413

In our sample:

(i) Deregulation does not Granger cause Inequality (as per Acemoglu's hypothesis)

(ii) Inequality does not Granger cause Deregulation (as per Rajan's hypothesis)

(iii) Inequality does not Granger cause lax monetary policy (as per Stiglitz's Hypothesis)

3. Empirics: (v) Econometric model and methodology

Dynamic panel approach, 18 (i) countries and 38 (t) years:

Country and time specific effects Lagged dep. variable Key variables Control variables

$$Cred_{i,t} = \alpha_i + \tau_t + \gamma Cred_{i,t-1} + \beta_1 Ineq_{i,t} + \beta_2 Fin_Dereg_{i,t} + \beta_3 Inv_{i,t} + \beta_4 Port_Inv_{i,t} + \beta_5 M2_{i,t} + \beta_6 Int_rate_{i,t} + \beta_7 GDP_gr_{i,t} + \beta_8 PCgdp_{i,t} + \varepsilon_{i,t}$$

Panel approach allows us to control for unobservable, time- and country-specific effects that may result in a missing-variable bias.

Dynamic, instrumental variable approach (a) to allow for persistence in the dependent variable, and (b) to address possible endogeneity issues (reverse causality) of explanatory variables (Instrumented variables: Ineq, Inv, GDP_gr, PCgdp)

Estimation methods

- (i) PCSE (FE with HAC correction), no endogeneity controls
- (ii) Panel IV (xtivreg2): FE Hansen (1982) GMM specification, robust HAC Std Err, endogeneity controls
- (iii) System GMM estimator (xtabond2) Blundell and Bond (1998)

3. Empirics: (vi) Results – base model

<i>Dep. Var.:</i>	PCSE	IV (1)	IV (2)	IV (3)	IV (4)	GMM sys (1)	GMM sys (2)	GMM sys (3)	GMM sys (4)
<i>Cred GDP</i>									
L (1) cred_GDP	0.829*** (0.016)	0.852*** (0.049)	0.845*** (0.049)	0.870*** (0.054)	0.870*** (0.054)	0.831*** (0.021)	0.832*** (0.021)	0.836*** (0.020)	0.841*** (0.017)
Ineq (top 1%) ^(a)	0.417** (0.199)	0.818** (0.310)	0.805** (0.387)	0.811* (0.456)	0.810* (0.456)	1.131* (0.596)	1.042* (0.611)	0.897* (0.505)	0.734*** (0.210)
Dereg (cred mkt)	2.105*** (0.408)	1.644*** (0.537)	1.693*** (0.512)	1.951*** (0.564)	1.952*** (0.565)	1.416*** (0.429)	1.560*** (0.534)	1.791*** (0.492)	1.478*** (0.471)
cap_form_gdp ^(b)	0.999*** (0.119)	0.868*** (0.203)	1.000*** (0.249)	0.775*** (0.239)	0.774*** (0.239)	0.514*** (0.138)	0.679* (0.412)	1.176*** (0.398)	0.482* (0.273)
portf_inv_gdp	-0.018*** (0.005)	-0.000 (0.014)	-0.001 (0.012)	-0.003 (0.014)	-0.003 (0.014)	-0.028*** (0.011)	-0.028*** (0.011)	-0.030*** (0.011)	-0.024** (0.010)
M2_gdp	0.076*** (0.013)	0.063* (0.037)	0.078* (0.042)	0.053 (0.039)	0.052 (0.039)	0.084*** (0.015)	0.080*** (0.018)	0.068*** (0.017)	0.083*** (0.016)
real_int_rate	0.081 (0.071)	0.006 (0.156)	-0.030 (0.152)	0.003 (0.172)	0.003 (0.173)	0.049 (0.158)	0.043 (0.158)	0.087 (0.158)	0.076 (0.158)
Real_gdp_growth ^(c)	0.938 (14.758)	4.779 (17.852)	5.144 (16.891)	-63.917 (63.676)	-63.900 (63.669)	-6.933 (24.919)	-4.961 (25.152)	54.577 (41.006)	-25.534 (22.558)
pc_gdp (ln) ^(d)	14.472*** (3.714)	15.516*** (5.029)	18.327*** (5.670)	13.664* (7.077)	13.724* (7.087)	7.867*** (2.418)	8.217*** (2.491)	10.129*** (2.673)	7.557*** (2.405)
<i>Instrumented Variables</i>	-	<i>a</i>	<i>a, b</i>	<i>a, b, c</i>	<i>a, b, c, d</i>	<i>a</i>	<i>a, b</i>	<i>a, b, c</i>	<i>a, b, c, d</i>
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
[Joint significance]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.012]	[0.002]	[0.001]
Wald Test	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
N	505	469	445	469	469	505	505	505	505
R2	0.991	-	-	-	-	-	-	-	-
Centered R2	-	0.922	0.917	0.921	0.921	-	-	-	-

Under-identification, weak instruments, over-identification tests: passed AR (1) and AR (2) tests in the GMM-sys: passed

3. Empirics: (vi) Results - base model + interaction ineq*dereg

<i>Dep. Var.: Cred_GDP</i>	PCSE (1)	IV (2)	GMM sys (3)	PCSE (4)	IV (5)	GMM sys (6)
L (1) cred_GDP	0.829*** (0.016)	0.851*** (0.057)	0.829*** (0.023)	0.830*** (0.016)	0.867*** (0.054)	0.840*** (0.017)
Ineq (top 1%) ^(a)	-0.298 (1.979)	-2.067 (4.123)	0.225 (5.937)	0.416** (0.195)	0.786* (0.476)	0.704*** (0.212)
Dereg (cred mkt)	1.615 (1.419)	0.094 (2.697)	0.851 (4.575)	2.106*** (0.397)	1.870*** (0.568)	1.190** (0.529)
Ineq * Dereg ^(b)	0.081 (0.224)	0.335 (0.484)	-0.003 (0.669)	-	-	-
Top der_d * Ineq ^(b)	-	-	-	-0.001 (0.088)	-0.225 (0.184)	0.337 (0.277)
cap_form_gdp ^(c)	0.989*** (0.132)	0.758*** (0.232)	0.411 (0.304)	0.999*** (0.121)	0.790*** (0.226)	0.471* (0.271)
portf_inv_gdp	-0.018*** (0.005)	-0.004 (0.013)	-0.019* (0.011)	-0.018*** (0.005)	0.002 (0.013)	-0.024** (0.010)
M2_gdp	0.075*** (0.014)	0.055 (0.034)	0.100*** (0.025)	0.076*** (0.013)	0.065* (0.039)	0.085*** (0.016)
real_int_rate	0.083 (0.072)	-0.019 (0.168)	-0.009 (0.166)	0.081 (0.071)	-0.015 (0.178)	0.061 (0.158)
Real_gdp_growth ^(d)	0.463 (14.547)	-87.326 (68.970)	-6.732 (26.433)	0.943 (14.839)	-43.201 (58.716)	-25.141 (22.497)
pc_gdp (ln) ^(e)	14.662*** (3.835)	13.991** (6.992)	16.767** (7.103)	14.488*** (3.710)	17.543*** (6.241)	7.741*** (2.397)
<i>Instrumented Variables</i>	-	<i>a, b, c, d, e</i>	<i>a, b, c, d, e</i>	-	<i>a, b, c, d, e</i>	<i>a, b, c, d, e</i>
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
[Joint significance]	[0.000]	[0.001]	[0.191]	[0.000]	[0.000]	[0.002]
Wald Test	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
N	505	469	505	505	453	505
R2	0.991	-	-	0.957	-	-

The interaction terms is not significant and renders the main effects insignificant: no additional information added to the model, only disturbance (due to redundant – multicollinear – information)

The interaction terms is now between a dummy for top 10% deregulation and ineq: again not significant (no joint additional effect) and no disturbance problems

3. Empirics: (vi) Results – Robustness checks

<i>Dep. Var.: Cred_GDP</i>	Top 5 %			Top 10%		
	PCSE (1)	IV (2)	GMM sys (3)	PCSE (4)	IV (5)	GMM sys (6)
L (1) cred_GDP	0.829*** (0.015)	0.882*** (0.040)	0.843*** (0.019)	0.839*** (0.014)	0.882*** (0.040)	0.825*** (0.022)
Ineq ^(a)	0.256*** (0.092)	0.454* (0.251)	0.495*** (0.151)	0.209** (0.087)	0.306* (0.184)	0.447*** (0.118)
Dereg (cred mkt)	2.184*** (0.406)	1.843*** (0.627)	1.201*** (0.488)	1.773*** (0.414)	1.639** (0.677)	1.568*** (0.509)
cap_form_gdp ^(b)	0.954*** (0.061)	0.718*** (0.212)	0.502* (0.280)	0.838*** (0.129)	0.766*** (0.275)	0.666** (0.308)
portf_inv_gdp	-0.016*** (0.004)	0.002 (0.012)	-0.023** (0.010)	-0.016*** (0.005)	-0.002 (0.014)	-0.023** (0.010)
M2_gdp	0.069*** (0.011)	0.043 (0.036)	0.079*** (0.017)	0.085*** (0.014)	0.056 (0.040)	0.059*** (0.018)
real_int_rate	0.086 (0.059)	-0.030 (0.150)	0.103 (0.170)	0.111 (0.079)	0.004 (0.166)	0.039 (0.175)
Real_gdp_growth ^(c)	-5.724 (10.510)	-81.300 (52.604)	-32.391 (25.410)	-1.746 (17.433)	-110.000 (70.373)	-29.164 (26.712)
pc_gdp (ln) ^(d)	11.439*** (1.837)	9.009** (4.067)	10.538*** (3.044)	5.961*** (1.816)	10.478** (4.468)	9.374*** (2.678)
<i>Instrumented Variables</i>	-	<i>a, b, c, d</i>	<i>a, b, c, d</i>	-	<i>a, b, c, d</i>	<i>a, b, c, d</i>
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
[Joint significance]	[0.000]	[0.029]	[0.002]	[0.000]	[0.005]	[0.000]
Wald Test	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
N	484	441	484	459	383	459
R2	0.991	-	-	0.989	-	-
Centered R2	-	0.919	-	-	0.912	-

4. Summary and conclusions

- In theory, inequality may cause financial instability via a number of transmission mechanisms
- In practice, empirical evidence on the relationship is scarce, and conflicting
- In our sample, preliminary evidence from binary regressions suggests that

Higher indebtedness  *Higher risk of crisis*

- Findings from dynamic panel analysis suggest that

Inequality  *Increased debt*

Deregulation  *Increased debt*

The effects are separate, NOT join: i.e. rising inequality causes credit growth irrespective of deregulation.

4. Summary and conclusions

- Our outcomes are in contrast to B&M, but we: (i) use a broader, more inclusive metric of credit; (ii) estimate relationships in levels (not changes); (iii) address endogeneity issues; (iv) include financial deregulation among the RHS; (v) have a shorter time span, but more countries
- A *direct* link between income concentration and the level of indebtedness – and hence probability of a financial crisis – in developed economies cannot be written off
- Policy implications: policy makers wishing to make the financial system more robust may need to cast the net wider than regulatory reforms and monetary policy, and consider the impact of the distribution of income on household indebtedness