Credit Allocation and Macroeconomic Fluctuations
Online Appendix

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This appendix supplements the paper *Credit Allocation and Macroeconomic Fluctuations* by Karsten Müller and Emil Verner.

- Appendix A presents additional empirical results.

- Appendix B presents case studies of the sectoral dimension of major credit booms.

- Appendix C provides information on the methodology and coverage of the new database on sectoral credit.

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A Additional Tables and Figures

Table A.1: Sample of Countries for Main Analysis

Country	Years	Country	Years
Albania	2001-2014	Malawi	1990-2014
Argentina	1952-2014	Malaysia	1971-2014
Armenia	1999-2014	Mauritius	1998-2014
Australia	1948-1983	Mexico	1994-2014
Austria	1963-2014	Mongolia	2002-2014
Belgium	1976-2014	Morocco	1993-2014
Botswana	1990-2014	Nepal	2002-2014
Bulgaria	2000-2014	New Zealand	1956-2014
Chile	1993-2014	Nigeria	1966-1992
Colombia	1998-2014	Norway	1946-2014
Costa Rica	1987-2014	Oman	1990-2014
Czech Republic	1992-2014	Pakistan	1982-2014
Denmark	1986-2014	Panama	2002-2014
Dominican Republic	1996-2014	Peru	1990-2014
Estonia	1995-2014	Philippines	1981-2014
Finland	1958-2014	Portugal	1973-2014
Georgia	2003-2014	Russia	2002-2014
Germany	1968-2014	Saudi Arabia	1998-2014
Ghana	2005-2014	Sierra Leone	2001-2014
Greece	2002-2014	Singapore	1980-2014
Guatemala	2003-2014	Slovak Republic	1992-2014
Haiti	1999-2014	Slovenia	1994-2014
Honduras	1968-2014	South Africa	1994-2013
Hong Kong	1965-2003	South Korea	1953-2014
Hungary	1995-2014	Spain	1992-2014
India	1972-2013	Switzerland	1997-2014
Ireland	1985-2014	Taiwan	1997-2014
Israel	1974-2014	Tanzania	2003-2014
Italy	1948-2014	Thailand	1970-2014
Jamaica	1977-2014	Trinidad & Tobago	1963-2014
Japan	1948-2014	Tunisia	1962-2014
Jordan	1964-2014	Turkey	2002-2014
Kazakhstan	1997-2014	Uganda	2004-2014
Kenya	1965-2014	Ukraine	2000-2014
Kyrgyz Republic	1996-2014	United Arab Emirates	1998-2014
Latvia	2000-2014	United Kingdom	1946-2014
Lithuania	1995-2014	Venezuela	2004-2014
Macedonia	2004-2014		

Notes: This table reports the 75 countries and years covered in the main estimation sample. See Section 2.4 for a description of the criteria used to construct the sample used in the main analysis.

Table A.2: Correlation between Credit Risk Measures and Sectoral Credit Expansion

	(1) $\Delta_3 d_{it}^T$	(2) $\Delta_3 d_{it}^{NT}$	(3) $\Delta_3 d_{it}^{HH}$	(4) Δ_3NT sh.$_{it}$	(5) Δ_3NT+HH sh.$_{it}$
Panel A: Correlation with $ISS_{i,t}^{EDF}$					
ISS_{it}^{EDF} (Worldscope)	0.616**	1.448**	0.892**	0.518$^+$	-0.025
	(0.179)	(0.324)	(0.277)	(0.284)	(0.327)
Observations	662	662	662	662	662
# Countries	40	40	40	40	40
R^2	0.06	0.07	0.02	0.01	0.00
Panel B: Correlation with $ISS_{i,t}^{Leverage}$					
$ISS_{it}^{Leverage}$ (Worldscope)	0.839**	2.143**	0.943**	0.595	-0.071
	(0.154)	(0.161)	(0.313)	(0.363)	(0.340)
Observations	665	665	665	665	665
# Countries	40	40	40	40	40
R^2	0.10	0.13	0.02	0.01	0.00
Panel C: Correlation with HYS from Kirti (2021)					
High yield share$_{it}$(Kirti)	-0.002	-0.006	-0.040	-0.024	-0.027*
	(0.010)	(0.032)	(0.041)	(0.023)	(0.012)
Observations	516	516	516	516	516
# Countries	28	28	28	28	28
R^2	0.00	0.00	0.01	0.01	0.02

Notes: This table presents the correlation between credit risk and sectoral credit expansion variables. The ISS^{EDF} measure is defined as the average decile of expected default frequency (EDF) of firms in the top quintile of debt issuance minus the average decile of firms in the bottom quintile of debt issuance: $ISS_{i,t} = \frac{\sum_{f \in TopIssuers} Decile_{f,i,t}}{N_{it}^{TopIssuers}} - \frac{\sum_{f \in BottomIssuers} Decile_{f,i,t}}{N_{it}^{BottomIssuers}}$. $TopIssuers$ ($BottomIssuers$) refers to the top (bottom) quintile of the change in debt-to-assets in a country-year and $Decile$ refers to firm f's decile in the distribution of EDF across public firms within a country-year. $ISS^{Leverage}$ is defined analogously using firm leverage as the measure of credit risk. The NT sh.$_{it}$ is defined as the share of non-tradable credit relative to non-tradable and tradable credit. The NT+HH sh.$_{it}$ is defined as the share of non-tradable and household credit relative to non-tradable, tradable, and household credit. Driscoll and Kraay (1998) standard errors in parentheses with lag length $ceiling(1.5(3+h))$. +, * and ** denote significance at the 10%, 5% and 1% level.

Table A.3: Robustness – Sectoral Credit Expansion and Medium-Run GDP Growth

		N	# Countries	R^2	Tradables		Non-tradables		Households	
					β_T	$[t]$	β_{NT}	$[t]$	β_{HH}	$[t]$
(1)	Baseline	1,605	75	0.08	0.33	1.62	-0.23	-3.29**	-0.53	-5.06**
(2)	Lagged GDP growth control	1,605	75	0.09	0.31	1.54	-0.27	-3.54**	-0.52	-4.90**
(3)	Year fixed effects	1,605	75	0.04	0.26	1.36	-0.17	-2.20*	-0.32	-4.37**
(4)	Common time trend	1,605	75	0.16	0.12	0.75	-0.21	-3.00**	-0.36	-4.43**
(5)	Country-specific trends	1,605	75	0.04	-0.14	-0.93	-0.18	-3.69**	-0.28	-3.99**
(6)	Macroeconomic controls	1,265	72	0.12	0.38	1.77+	-0.25	-3.05**	-0.49	-5.51**
(7)	House price growth control	734	37	0.14	0.41	1.72+	-0.40	-4.77**	-0.41	-5.51**
(8)	Value added controls	1,373	69	0.11	0.25	1.35	-0.28	-4.39**	-0.53	-5.65**
(9)	Current account control	1,374	73	0.08	0.30	1.41	-0.24	-2.51*	-0.48	-5.34**
(10)	Add sectoral bond issuance	838	46	0.12	-0.01	-0.29	-0.12	-2.53*	-0.47	-7.16**
(11)	Bond issuance control	1,100	61	0.14	-0.04	-0.30	-0.21	-3.57**	-0.46	-5.58**
(12)	Pre-2000 only	972	48	0.03	0.18	0.83	-0.18	-2.49*	-0.33	-3.70**
(13)	Advanced economies	938	35	0.13	0.17	0.73	-0.30	-4.37**	-0.55	-4.84**
(14)	Emerging economies	667	40	0.03	0.40	1.40	0.00	0.01	-0.45	-2.83**
(15)	Control for ISS^{EDF}	508	37	0.19	-0.17	-0.89	-0.30	-3.69**	-0.34	-7.08**
(16)	Control for HYS	409	28	0.23	-0.53	-2.80**	-0.30	-2.65*	-0.29	-9.54**
(17)	Cross-border loan control	1,217	75	0.10	-0.01	-0.08	-0.27	-3.56**	-0.44	-5.48**
(18)	Real exchange rate control	1,508	75	0.09	0.19	0.95	-0.21	-2.50*	-0.49	-4.95**

Notes: This table presents the results of variants of the following multivariate linear regression model:

$$\Delta_3 y_{it+4} = \alpha_i + \beta_T \Delta_3 d_{it}^T + \beta_{NT} \Delta_3 d_{it}^{NT} + \beta_{HH} \Delta_3 d_{it}^{HH} + \epsilon_{it+4}$$

where $\Delta_3 y_{it+4}$ is real GDP growth from $t+1$ to $t+4$, α_i is a country fixed effect, and $\Delta_3 d_{it}^T$, $\Delta_3 d_{it}^{NT}$, and $\Delta_3 d_{it}^{HH}$ are changes in the credit/GDP ratio (in percent) for the tradable, non-tradable, and household sectors from $t-3$ to t. We compute Driscoll and Kraay (1998) standard errors with $ceil(1.5(3+4)) = 11$ lags. +, * and ** denote significance at the 10%, 5% and 1% level.

Model (1) is our baseline specification, corresponding to column 5 in Table 5 Panel B. Model (2) controls for real GDP growth from $t-3$ to t. Model (3) includes year fixed effects. Model (4) includes a common time trend. Model (5) includes country-specific time trends. Macroeconomic controls in model (6) are three lags of inflation, the short-rate, and the change in the dollar exchange rate. Model (7) controls for house price growth from $t-3$ to t. Model (8) controls for the change in non-tradable and tradable value added shares from $t-3$ to t. Model (9) controls for the cumulative current account deficit over $t-2$, $t-1$, and t. Model (10) adjusts d_{it}^T and d_{it}^{NT} to include the cumulative sum of gross bond issuance in the tradable and non-tradable sector, based on data from SDC Platinum. Model (11) controls for the change in outstanding bonds issued in international markets relative to GDP from $t-3$ to t, based on BIS data on debt securities. Model (12) restricts the sample to years $t \le 2000$. Models (13) and (14) restrict the sample to countries classified as high-income and low-income/middle-income by the World Bank in 2019, respectively. Model (15) controls for the ISS^{EDF} issuer quality measure of Greenwood and Hanson (2013), constructed using Worldscope data. Model (16) controls for the high yield share measure of Greenwood and Hanson (2013) constructed by Kirti (2018). Model (17) controls for the 3-year change in cross-border loans/GDP based on BIS data. Model (18) controls for the three-year change in the log of the real effective exchange rate.

Table A.4: Sectoral Credit Expansions and Growth: Alternative Sector Classifications

	Panel A: High vs low mortgage share industries					
	Dependent var.: GDP growth over...					
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_3 d_{it}^k$	(t-3,t)	(t-2,t+1)	(t-1,t+2)	(t,t+3)	(t+1,t+4)	(t+2,t+5)
High mortgage share	0.42**	0.15	-0.16	-0.34*	-0.41*	-0.35
	(0.13)	(0.15)	(0.15)	(0.14)	(0.19)	(0.22)
Low mortgage share	0.20	0.10	0.11	0.20	0.23	0.23
	(0.19)	(0.21)	(0.18)	(0.20)	(0.28)	(0.33)
R^2	0.05	0.01	0.00	0.02	0.02	0.02
	Panel B: High vs low small firm share industries					
	(1)	(2)	(3)	(4)	(5)	(6)
High small firm share	0.27*	-0.073	-0.37*	-0.59*	-0.67*	-0.62*
	(0.11)	(0.13)	(0.15)	(0.24)	(0.30)	(0.29)
Low small firm share	0.41**	0.33**	0.23	0.27	0.28	0.29
	(0.083)	(0.094)	(0.14)	(0.22)	(0.28)	(0.27)
R^2	0.05	0.01	0.01	0.03	0.04	0.03

Notes: This table presents the results from estimating the following linear regression model:

$$\Delta_3 y_{it+h} = \alpha_i^h + \beta_h^{High} \Delta_3 d_{it}^{High} + \beta_h^{Low} \Delta_3 d_{it}^{Low} + u_{it+h}, \quad h = 0, ..., 5$$

where $\Delta_3 y_{it+h}$ is the change in log real GDP (times 100) from $t - 3 + h$ to $t + h$, α_i^h is a country fixed effect, and $\Delta_3 d_{it}^{Low}$ and $\Delta_3 d_{it}^{High}$ are the changes in the credit/GDP ratio (in percentage points) for a specific sector grouping from $t - 3$ to t. Driscoll and Kraay (1998) standard errors in parentheses with lag length $ceiling(1.5(3 + h))$. +, * and ** denote significance at the 10%, 5% and 1% level.

Table A.5: Correlation of Credit Expansion Variables Based on Industry Traits

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta_3 d_{it}^k$							
(1) Non-tradables	1						
(2) High mortgage share	0.95	1					
(3) High small firm share	0.90	0.88	1				
(4) Tradables	0.51	0.57	0.50	1			
(5) Low mortgage share	0.62	0.55	0.56	0.90	1		
(6) Low small firm share	0.73	0.73	0.52	0.85	0.86	1	
(7) Household	0.52	0.53	0.53	0.18	0.19	0.26	1

Notes: This table presents the correlation matrix of various credit expansion variables. All variables are three-year changes in credit, scaled by GDP. "High" and "low" refers to firm credit split by sectors, depending on whether they are above or below the median of a given characteristic. The table shows that the expansion in credit to non-tradable sectors is strongly positively correlated with credit expansion to sectors that have a high mortgage share and high small firm share. See the data description in section 2 for the exact definitions of sector splits.

Table A.6: Sectoral Credit Expansions and Financial Crises – Robustness

		N	# Countries	# Crises	AUC	Tradables		Non-tradables		Households	
						β	$[t]$	β	$[t]$	β	$[t]$
(1)	Baseline (LPM, country FE)	1,557	72	47	0.73	-0.004	-1.82+	0.006	3.85**	0.004	2.03*
(2)	LPM, country + year FE	1,557	72	47	0.73	-0.002	-1.20	0.004	2.34*	0.004	3.67**
(3)	Logit	1,557	72	47	0.72	-0.001	-0.60	0.004	2.70**	0.002	2.60**
(4)	Logit, country FE	1,026	37	47	0.72	-0.028	-1.32	0.042	2.74**	0.024	2.56*
(5)	Boom (>= Mean + 2 × SD)	1,557	72	47	0.62	0.017	0.49	0.098	2.87**	0.063	1.68+
(6)	Boom (>= 80th percentile)	1,557	72	47	0.73	-0.013	-0.91	0.054	2.93**	0.052	2.12*
(7)	Boom (>= 80th percentile, OOS)	1,557	72	47	0.71	-0.014	-0.88	0.038	2.64*	0.035	2.42*
(8)	RR crisis dates	1,112	44	39	0.71	-0.003	-0.81	0.007	2.80**	0.003	1.32
(9)	LV crisis dates only	1,403	71	37	0.67	-0.003	-1.38	0.004	1.98+	0.003	0.99
(10)	BVX crisis dates only	1,015	36	38	0.75	-0.002	-0.97	0.007	3.72**	0.004	2.37*
(11)	Pre-2000 only	913	47	26	0.70	-0.005	-2.10*	0.006	3.53**	0.005	3.11**
(12)	Advanced economies	897	32	27	0.74	-0.003	-1.45	0.005	2.85**	0.004	2.14*
(13)	Emerging economies	660	40	20	0.74	-0.008	-1.62	0.011	2.74**	0.004	1.54
(14)	Value added controls	1,334	66	45	0.74	-0.004	-1.50	0.007	4.11**	0.004	1.73+
(15)	Credit/value added	1,334	66	45	0.72	-0.000	-0.65	0.002	2.97**	0.005	1.93+
(16)	Control for ISS^{EDF}	504	36	22	0.76	0.003	0.76	0.006	2.68*	0.002	0.84
(17)	Control for HYS	409	28	20	0.69	0.001	0.23	0.006	1.91+	0.004	1.57
(18)	Control for cross-border loan growth	1,179	72	45	0.71	-0.004	-1.07	0.007	4.20**	0.004	1.53
(19)	Control for real exchange rate	1,466	72	47	0.72	-0.004	-1.55	0.006	3.80**	0.004	1.92+

Notes: This table presents the results of variants of the following multivariate linear regression model:

$$Crisis_{it+1} = \alpha_i + \beta_1 \Delta_3 d_{it}^T + \beta_2 \Delta_3 d_{it}^{NT} + \beta_3 \Delta_3 d_{it}^{HH} + \epsilon_{it+3}$$

where $Crisis_{it+1}$ is a dummy variable that equals one for the start of a systemic banking crisis in country i over the next year, α_i is a country fixed effect and $\Delta_3 d_{it}^T$, $\Delta_3 d_{it}^{NT}$, and $\Delta_3 d_{it}^{HH}$ are changes in the credit/GDP ratio for the tradable, non-tradable, and household sectors from $t-3$ to t. We compute Driscoll and Kraay (1998) standard errors with 2 lags, except for logit models. +, * and ** denote significance at the 10%, 5% and 1% level.

Model (1) is our baseline specification as in the first column of Table 6, Panel A. Model (2) adds year FE to the model. Model (3) is a logit model with standard errors clustered by country. Model (4) reports results from a conditional/FE logit model. Model (5) replaces the independent variables with dummy variables equal to one if the 3-year change in credit/GDP is equal to its mean plus two standard deviations or higher. Model (6) creates a credit boom indicator following Greenwood et al. (2020) equal to one if the 3-year change in credit/GDP is equal to its 80th percentile or higher. Model (7) repeats the same exercise as in model (6) but only uses backward-looking information to construct booms. Models (8)-(10) use alternative systemic banking crisis dates from Reinhart and Rogoff (2009b), Laeven and Valencia (2018), and Baron et al. (2021), respectively; note that this results in very different samples. Model (11) restricts the sample to the years before 2000. Models (12) and (13) restrict the sample to countries classified as high-income and low-income/middle-income by the World Bank in 2019, respectively. Model (14) controls for three-year changes in sectoral value added/GDP. Model (15) uses d_{it}^T and d_{it}^{NT} with credit scaled over sectoral value added instead of GDP. Model (16) controls for the ISS^{EDF} issuer quality measure of Greenwood and Hanson (2013), constructed using Worldscope data. Model (17) controls for the high yield share measure of Greenwood and Hanson (2013) constructed by Kirti (2018). Model (18) controls for the 3-year change in cross-border loans/GDP based on BIS data. Model (19) controls for the three-year change in the log of the real effective exchange rate.

Table A.7: Financial Crisis Likelihood by Type of Credit Expansion

Frequency of financial crisis within 1 year

Non-tradable and household credit expansion $(t-3,t)$	*Tradable credit expansion* $(t-3,t)$	
	Bottom 75%	Top 25%
Bottom 75%	0.02	0.00[+]
Top 25%	0.06	0.09[*]

Frequency of financial crisis within 2 years

Non-tradables and households	*Tradables*	
	Bottom 75%	Top 25%
Bottom 75%	0.04	0.02
Top 25%	0.13[+]	0.14[**]

Frequency of financial crisis within 3 years

Non-tradables and households	*Tradables*	
	Bottom 75%	Top 25%
Bottom 75%	0.05	0.06
Top 25%	0.19[*]	0.19[**]

Frequency of financial crisis within 4 years

Non-tradables and households	*Tradables*	
	Bottom 75%	Top 25%
Bottom 75%	0.08	0.10
Top 25%	0.23[*]	0.24[**]

Notes: This table reports the frequency of financial crises following credit expansions and normal times across bins of sectoral credit expansion. Top 25% is defined as country-years when the three-year change in sectoral credit-to-GDP from $t-3$ to t is above the 75th percentile. The table groups together non-tradable and household credit expansion. The "Frequency of financial crisis within 1 year" in the top panel is computed as the probability of a crisis occurring in year $t+1$. The remaining panels report the probability of a crisis occurring between years $t+1$ and $t+h$, with $h=2,3,4$. +, * and ** indicate whether the mean in a cell is statistically significantly different from the top left cell in each panel (bottom 75% of credit expansion in both sectors) at the 10%, 5% and 1% level based on Driscoll and Kraay (1998) standard errors with lag length $ceiling(1.5(3+h))$.
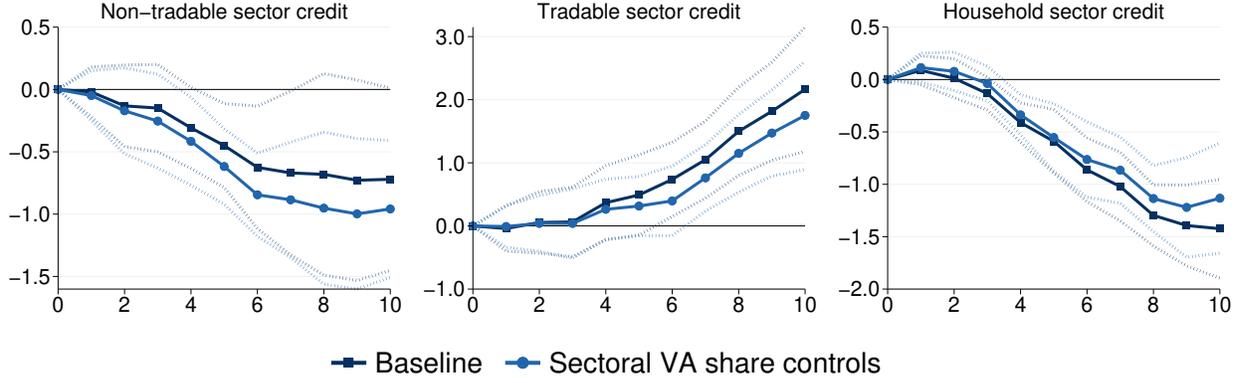
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Figure A.1: Output Dynamics around Credit Boom Episodes: Non-tradable versus Tradable Biased Booms, Excluding Household Debt
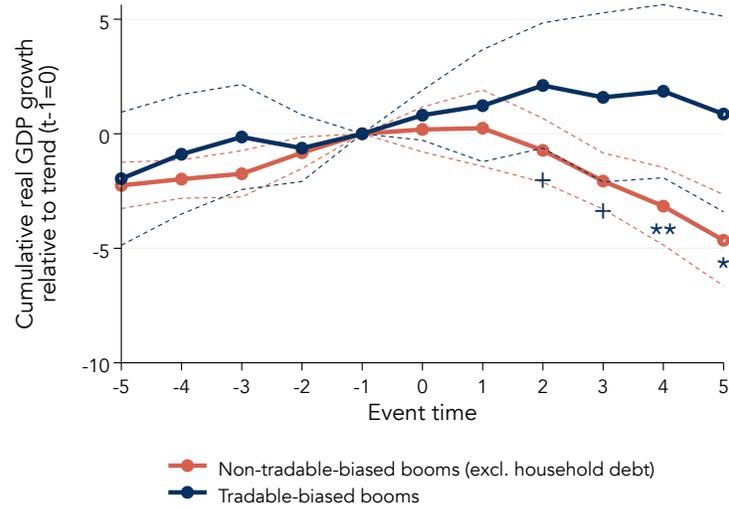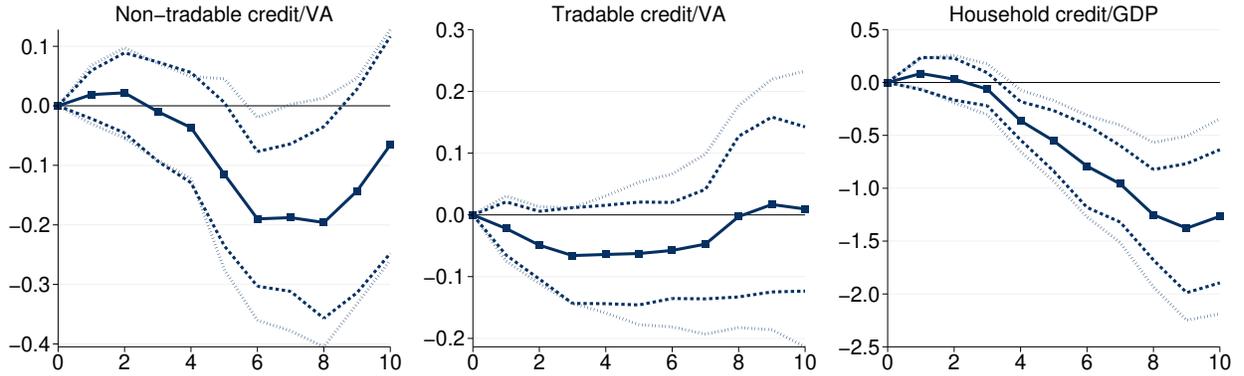

Notes: This figure is similar to Figure 5 but splits sectors by non-tradable vs. tradable, excluding household debt. Dashed lines represent 90% confidence intervals based on Driscoll and Kraay (1998) standard errors with lag length $ceiling(1.5(3+h))$. +, * and ** indicate that the difference between the estimates, $\hat{\beta}_T^h - \hat{\beta}_{NT}^h$, is statistically significant at the 10%, 5% and 1% level.

Figure A.2: Output Dynamics after Credit Expansions: Sector Size vs Sector Leverage

(a) Controlling for sectoral value added shares

Non–tradable sector credit   Tradable sector credit   Household sector credit

■ Baseline   ● Sectoral VA share controls

(b) Corporate Sectoral Credit Scaled by Value Added

Non–tradable credit/VA   Tradable credit/VA   Household credit/GDP

Notes: This figure presents two tests to disentangle the role of sectoral leverage from changes in sector size. Panel (a) presents estimates of (3) using credit variables scaled by GDP with additional controls for changes in the non-tradable and tradable value added shares. We include the same lags ($j = 0, ..., 5$) for the value added share controls. Panel (b) presents the impulse response of real GDP to an innovation in sectoral credit from the following local projection specification for $h = 1, ..., H$:

$$\Delta_h y_{it+h} = \alpha_i^h + \sum_{j=0}^{J} \beta_{h,j}^{NT} \Delta \tilde{d}_{it-j}^{NT} + \sum_{j=0}^{J} \beta_{h,j}^{T} \Delta \tilde{d}_{it-j}^{T} + \sum_{j=0}^{J} \beta_{h,j}^{HH} d_{it-j}^{HH} + \sum_{j=0}^{J} \gamma_{h,j} \Delta y_{it-j} + \epsilon_{it+h}.$$

In contrast to our baseline results in Figure 6, credit in corporate sector k is scaled by value added in that sector, i.e., $\tilde{d}_{it}^k = 100 \cdot \frac{D_{it}^k}{VA_{it}^k}$. We note that the number of observations in these regressions fall by approximately 15% because of missing sectoral value added data for some countries and time periods. Dashed lines represent 95% confidence intervals computed using Driscoll and Kraay (1998) standard errors, and dotted lines represent 95% confidence intervals from standard errors two-way clustered on country and year.

Figure A.3: Share of Bonds in Non-financial Corporate Debt (Average, 2010-2014)

**(a)** Advanced economies

(b) Emerging economies
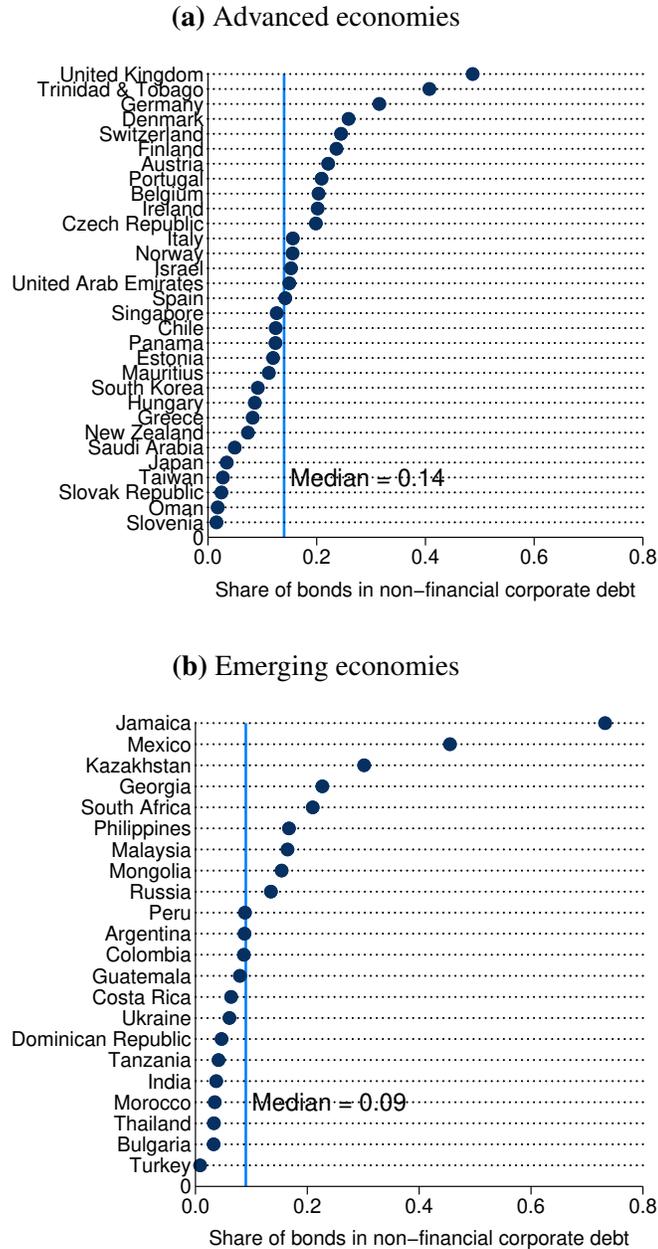
Sample: 31 advanced economies in Panel A and 22 emerging economies in Panel B.
Notes: We plot the average ratio of outstanding international debt securities of non-financial corporations to the sum of outstanding debt securities and outstanding credit to non-financial corporations for 2010-2014. Data on bonds is from the BIS Debt Securities dataset, data on credit to non-financial corporations from the data used in this paper.

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Figure A.4: Output Dynamics after Credit Expansions: Alternative Sector Classifications

(a) High vs. low mortgage share sectors
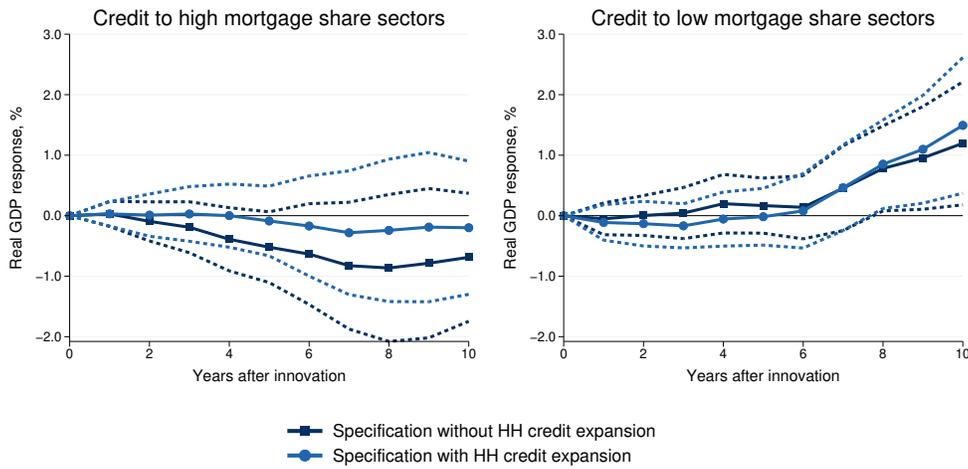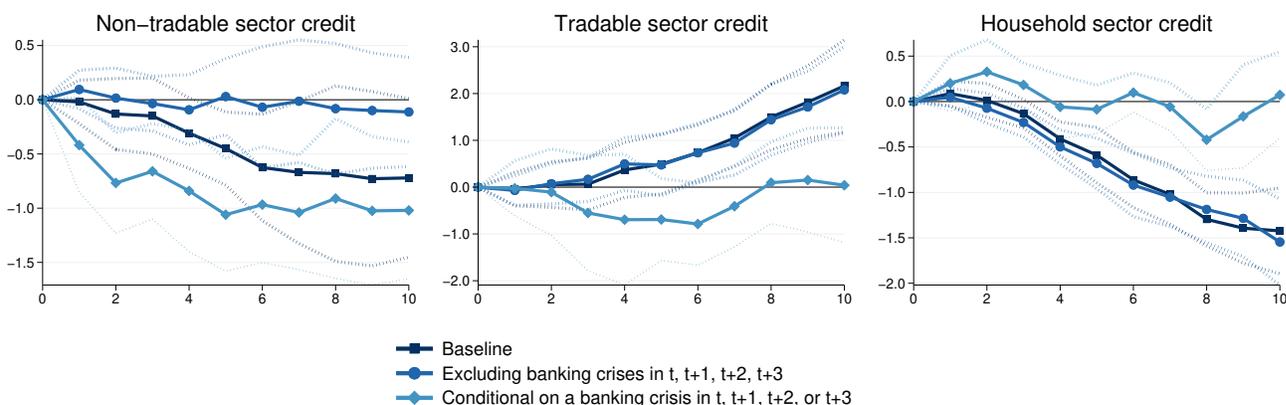

(b) High vs. low small-firm-share sectors
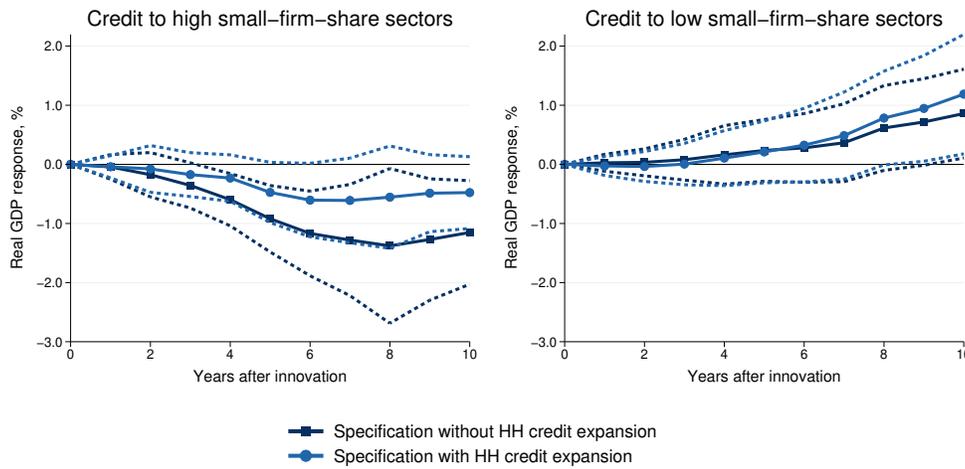
Notes: This figure presents local projection impulse responses of real GDP following innovations in sectoral credit based on alternative sector splits. Panels (a) and (b) split corporate sectors based on the mortgage share and the small firm share, respectively. Impulse responses are reported for local projection specifications that exclude and include household credit-to-GDP. Dashed lines represent 95% confidence intervals computed using Driscoll and Kraay (1998) standard errors.

Figure A.5: Unemployment Dynamics after Credit Expansions
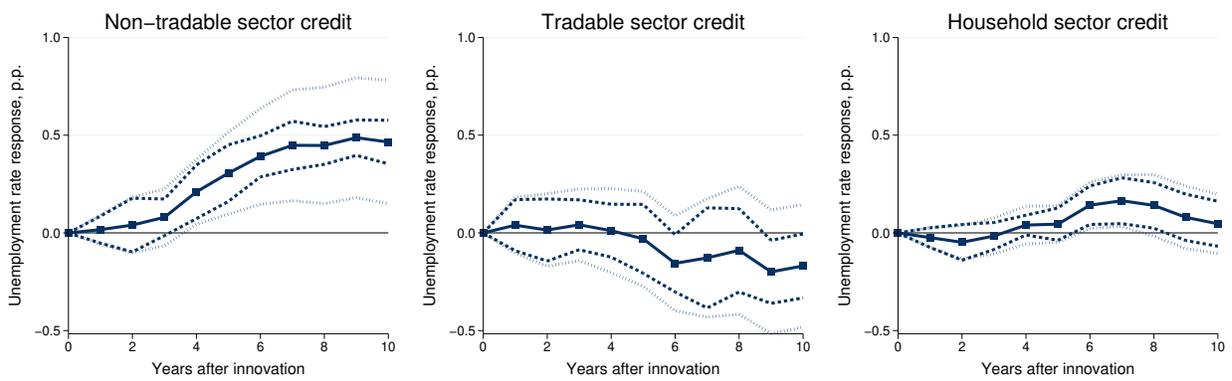
Notes: This figure presents local projection impulse responses of the unemployment rate to sectoral credit expansions. Dashed lines represent 95% confidence intervals computed using Driscoll and Kraay (1998) standard errors, and dotted lines represent 95% confidence intervals from standard errors two-way clustered on country and year.

Figure A.6: Output Dynamics after Sectoral Credit Expansions: Robustness to Additional Controls and Subsamples
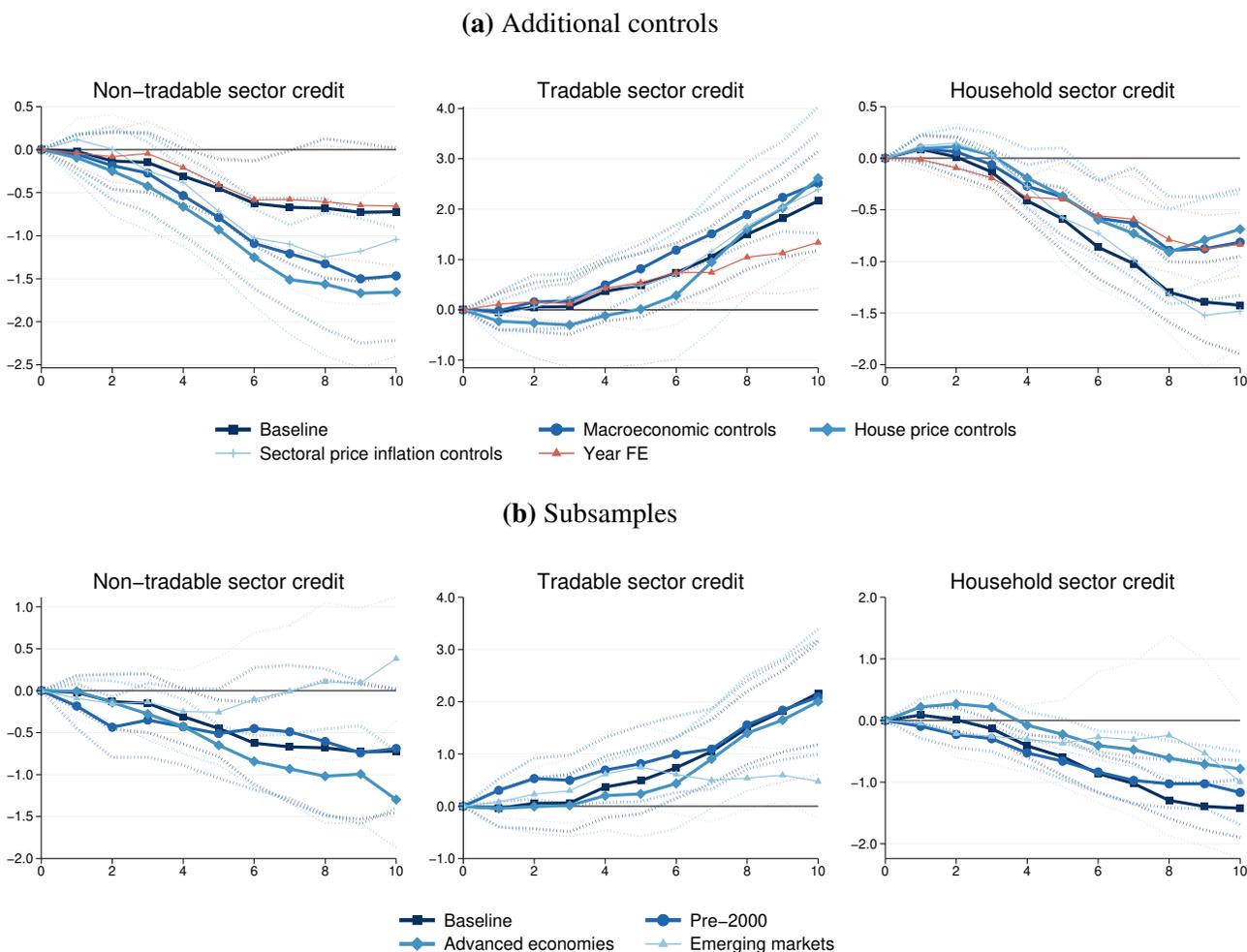
(a) Additional controls

Non–tradable sector credit | Tradable sector credit | Household sector credit

— Baseline | — Macroeconomic controls | — House price controls
— Sectoral price inflation controls | — Year FE

(b) Subsamples

Non–tradable sector credit | Tradable sector credit | Household sector credit

— Baseline | — Pre–2000
— Advanced economies | — Emerging markets

Notes: These figures present local projection impulse responses of real GDP following innovations in tradable sector credit, non-tradable sector credit, and household credit (all measured relative to GDP):

$$\Delta_h y_{it+h} = \alpha_i^h + \sum_{j=0}^{J} \beta_{h,j}^{NT} \Delta d_{it-j}^{NT} + \sum_{j=0}^{J} \beta_{h,j}^{T} \Delta d_{it-j}^{T} + \sum_{j=0}^{J} \beta_{h,j}^{HH} d_{it-j}^{HH} + \sum_{j=0}^{J} \gamma_{h,j} \Delta y_{it-j} + \sum_{j=0}^{J} X'_{it-j} \kappa_{h,j} + \epsilon_{it+h}, \quad h = 1, ..., H.$$

Panel (a) compares estimations with additional control variables to the baseline specification (X_{it-j}). Panel (b) considers other subsamples. Dashed lines represent 95% confidence intervals computed using Driscoll and Kraay (1998) standard errors, and dotted lines represent 95% confidence intervals from standard errors two-way clustered on country and year.

Figure A.7: Output Dynamics after Sectoral Credit Expansions: Excluding Banking Crises

Notes: These figures present local projection impulse responses of real GDP following innovations in tradable sector credit, non-tradable sector credit, and household credit (all measured relative to GDP). We estimate the impulse responses separately for observations with and without a banking crisis in year t, $t + 1$, $t + 2$, or $t + 3$. Dashed lines represent 95% confidence intervals computed using Driscoll and Kraay (1998) standard errors, and dotted lines represent 95% confidence intervals from standard errors two-way clustered on country and year.

Figure A.8: House Price Dynamics after Credit Expansions
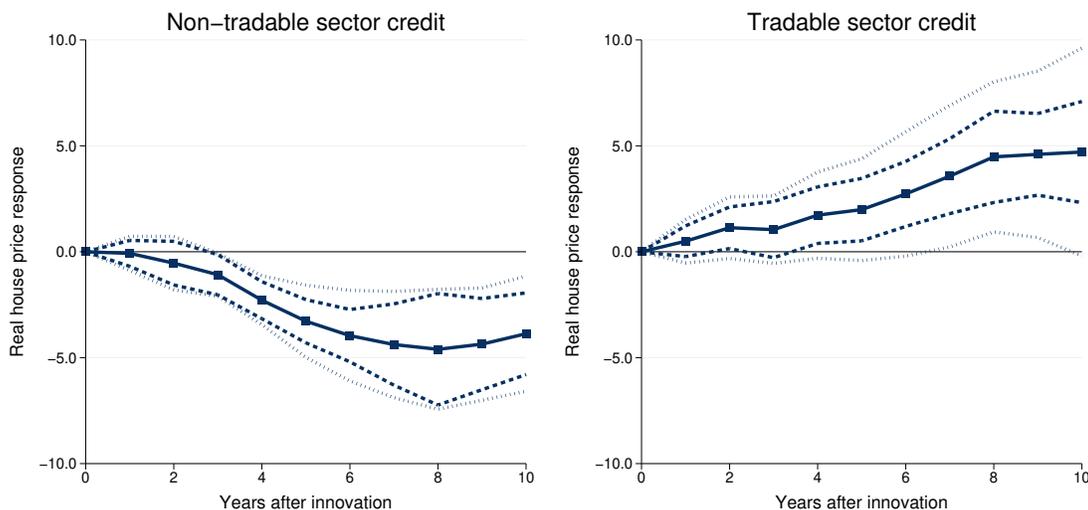
Notes: This figure presents local projection impulse responses of real house prices to sectoral credit expansions. Dashed lines represent 95% confidence intervals computed using Driscoll and Kraay (1998) standard errors, and dotted lines represent 95% confidence intervals from standard errors two-way clustered on country and year.

B   Case Studies

This appendix provides case studies illustrating sectoral credit dynamics during prominent credit expansions and crises. This serves to further showcase our sectoral credit data, support the quantitative evidence in the paper, and highlight commonalities and differences across credit booms. Our discussion is brief and selective, focusing on insights offered by the sectoral credit data.

Before discussing the individual cases, we highlight two important insights about the nature of major credit booms gleaned from these cases.

First, what are the proximate causes of credit growth during major credit booms? In the case studies we consider, credit expansions often follow financial liberalizations, increased competition in the financial sector, capital inflows from abundant foreign liquidity, or periods of loose monetary policy. Some credit expansions also come on the heels of exchange rate stabilizations that reduce inflation and country risk premia. Narrative accounts suggest that, during the boom, market participants are overoptimistic about future asset price valuations and cash flows, which reinforces lending growth. These observations are consistent with the narratives in Kindleberger (1978), Minsky (1977), Demirgüç-Kunt and Detragiache (1998), Diaz-Alejandro (1985), and Reinhart and Rogoff (2009b).

Second, what is the sectoral composition of major credit booms? A key finding is that many prominent credit booms which ended in financial crises involved substantial intersectoral reallocation of credit. Lending to the non-tradable and household sectors expand rapidly, while primary and manufacturing sector credit often stagnate. Once a crisis occurs, credit to the previously booming non-tradable and household sectors contracts, often dramatically, with less of a contraction in the tradable sector. On the other hand, the case study of Korea's financial reforms in the 1960s and subsequent growth "miracle" provides an example of an episode where credit growth mainly financed tradable sector firms and was associated with benign macroeconomic outcomes.

Case Studies around the 2008 Global Financial Crisis

Denmark   Denmark experienced strong credit growth in the run-up to the 2008 financial crisis. Total private credit-to-GDP increased by over 40 percentage points from 2000 to 2008. Figure B.1a illustrates that lending expanded fourfold to construction/real estate. In absolute terms, household lending also increased significantly. Lending to manufacturing also grew, though significantly less than lending to the property sector. These patterns are consistent with narrative evidence of a boom in lending and prices in commercial and residential real estate markets, including rapid lending growth to these markets by many small and medium-sized banks (Rangvid et al., 2013).

At the onset of the crisis in 2008, the banking sector had large and concentrated exposure to the property market, especially through risky commercial real estate loans Rangvid et al. (2013). These exposures translated into large bank losses from impairments and write-downs (IMF, 2014). Lending was financed by international wholesale funding, exposing banks to funding pressure during the crisis.

The crisis resulted in a consolidation of the banking system. Fifteen banks were closed and many others were acquired. The government implemented a blanket guarantee for creditors and government equity injections. The banking crisis was associated with, and contributed to, a severe real economic downturn (Jensen and Johannesen, 2017). Real GDP declined by over 5% from 2007 to 2009.

Figure B.1: Additional Cases in the Run-up to the 2008 Global Financial Crisis

(a) Denmark

(b) Estonia

(c) Iceland

(d) Hungary

(e) Slovenia

(f) United Kingdom
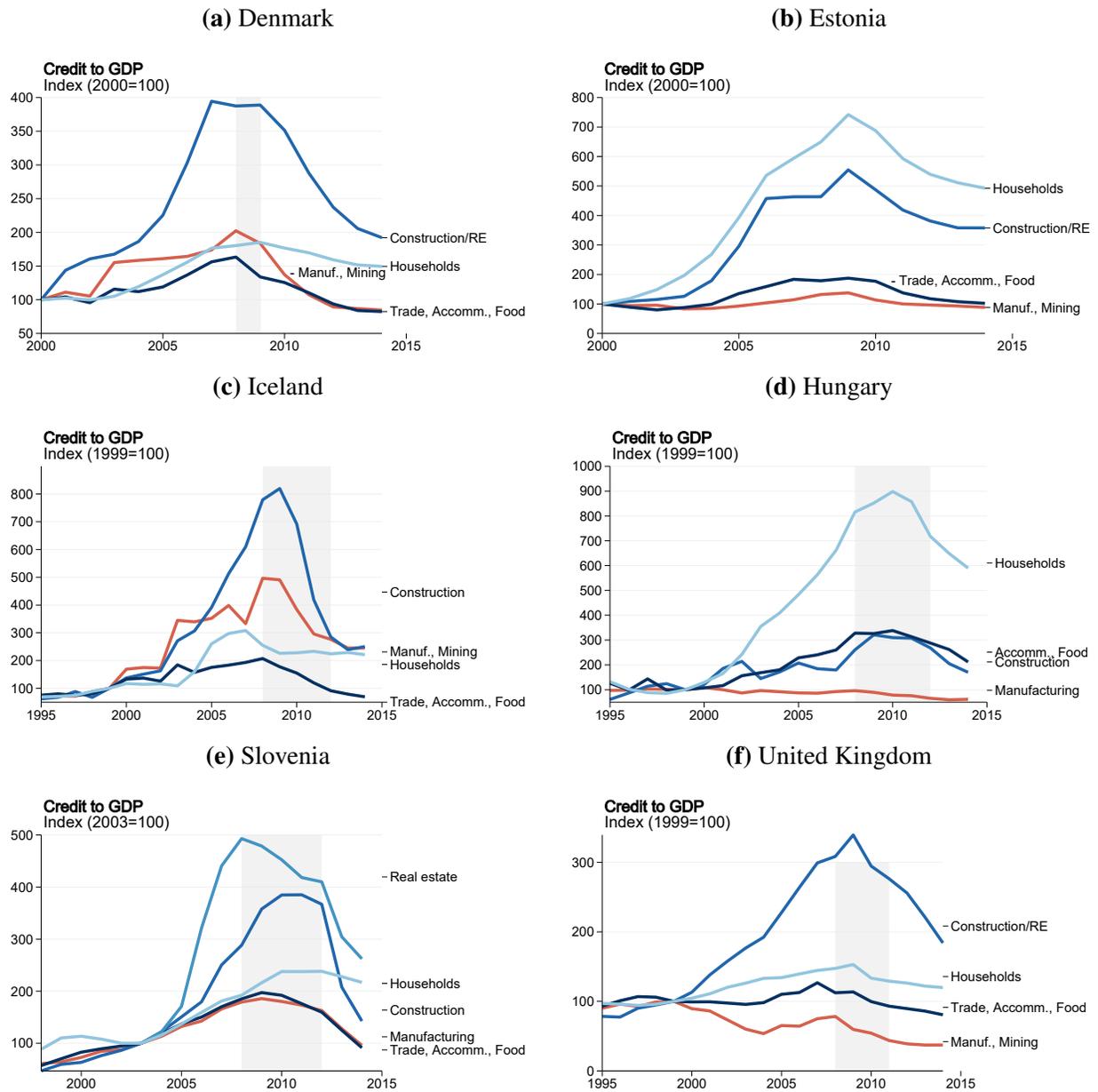
Notes: These figures plot the ratio of sectoral credit-to-GDP for various countries in the run-up to the 2008 Global Financial Crisis. We also plot data on household credit-to-GDP. The shaded in gray mark the years of a banking crisis according to Laeven and Valencia (2018).

Estonia Estonia saw a large housing boom and bust during the 2000s. Abundant global liquidity combined with a currency board, an open capital account, and the prospect of EU entry stimulated large capital inflows, reflected in large current account deficits over 2000-07 (IMF, 30 Jul. 2007). Foreign-owned banks competing for market share expanded lending aggressively at low rates (Brix-iova et al., 2010).

Figure B.1b shows that these inflows financed rapid lending growth. Credit to households increased seven times faster than GDP, fuelling and reinforced by rising house prices. Credit to construction and real estate also grew quickly. Lending to manufacturing, meanwhile, stagnated.

The Estonian case provides an example of a credit boom and economic bust *without* a clear-cut banking crisis (bank failures or widespread banking panic). Nevertheless, capital outflows, a contraction in credit supply, and elevated household debt contributed to an extremely severe recession.[18] Real GDP declined by 19% from 2007 to 2009.

Iceland   The privatization and deregulation of the Icelandic banking system in the early 2000s was followed by extremely rapid banking sector asset growth, driven by domestic and international expansion of the three largest banks (Landsbanki, Glitnir, and Kaupthing) (IMF, 2012a). This growth was financed by massive current account deficits, which surpassed 15% from 2004 to 2007.

Figure B.1c plots the growth in domestic lending across sectors in Iceland. The figure shows that, in relative terms, lending expanded most rapidly toward construction, followed by lending to manufacturing/mining, driven by investment in energy and energy-intensive industries. Lending to households also expanded significantly in absolute terms, by nearly 40 percentage points from 2000 to 2007. Lending growth fueled a boom in the valuations of a range of domestic asset classes, including real estate and the stock market. In October 2008, the three largest banks failed, plunging Iceland into a severe recession. Real GDP declined by over 10% cumulatively, while asset prices and the exchange rate also plummeted IMF (2012a).

Hungary   Hungary built up substantial vulnerabilities during the 2000s and, subsequently, experienced a major recession, a large exchange rate depreciation, and a banking crisis with a large increase in private sector non-performing loans. In Hungary, the entry of foreign banks led to increasing competition in the credit markets. This resulted in a boom in mortgage and consumer lending, much of which was denominated in foreign currency (Verner and Gyöngyösi, 2020).

Figure B.1d shows that credit growth was strongest for households, followed by construction and other non-tradables. Credit to the manufacturing sector, meanwhile, was flat. When the crisis arrived in 2008, the consequence was a sharp depreciation, a 7% cumulative decline in real GDP (Bakker and Klingen, 2012), severe household financial distress, and significant credit losses for banks.

Slovenia   Slovenia experienced a rapid expansion in credit starting in the mid 2000s. The boom was financed by capital inflows from abroad. It followed Slovenia's entry into the EU and ERM II in 2004 and adoption of the euro in 2007 (IMF, 2012b). Slovenia is a case where credit expansion was concentrated mostly in the non-tradable corporate sector, rather than households. In particular, the lending boom financed a construction boom. Credit to real estate and construction more than quadrupled during this period, as shown in Figure B.1e. Employment growth was also concentrated in construction and service sectors, reflecting the domestic boom (IMF, 2009). Credit to manufacturing grew slower compared to lending to property-related sectors. The boom coincided with a rise in wages and a real exchange rate appreciation, which worsened competitiveness (IMF, 2009).

The aftermath of the boom resulted in a rise in non-performing loans, which created large losses for the domestic banking sector. By 2013, the banking sector was insolvent and required a govern-

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[18]Other important factors in the severity of the recession include large negative external shocks, lack of monetary policy flexibility, and fiscal austerity.

ment bail-out in December 2013. This prolonged Slovenia's slump, resulting in a second recession in 2012-13 (IMF, 2017).

United Kingdom   The United Kingdom experienced a lending boom and real estate price bubble during the 2000s. The lending boom occurred in an environment of loose credit conditions and a booming housing market. Figure B.1f shows that lending to construction/real estate surged from 1999 to 2008. This resulted in high leverage in the real estate sector, as noted by (IMF, 03 Aug. 2011). Household credit-to-GDP also increased significantly, rising by over 23 percentage points from 2000 to 2008. Growth in lending to trade/accommodation/food service was more modest, while credit to manufacturing declined relative to GDP. Starting in 2007, the disruption in global financial markets and the correction in UK house prices plunged the UK into a recession. Real GDP fell by nearly 4.5% from 2007 to 2009.

The Nordic Crises of the Late 1980s and Early 1990s: Finland and Norway

Finland and Norway experienced major credit expansions in the 1980s followed by systemic banking crises in the late 1980s (Norway) and early 1990s (Finland).[19] The credit expansion in both countries came after substantial deregulation of banking markets and capital flows.

Figure B.2 panels (a) and (b) show the evolution of sectoral credit in Finland and Norway during this period. In Finland, household credit saw by far the largest absolute increase, 15 percentage points from the early 1980s to 1990. Construction and trade, accommodation, and food service also increased rapidly. Manufacturing credit, in contrast, declined relative to GDP during the boom. When the Finnish banking crisis started in 1990, non-tradables and households saw the sharpest credit contractions.

Similarly, in Norway, credit growth was strongest in the construction and real estate sector. Trade, accommodation, and food services, along with household credit, also expanded. In absolute terms, household credit increased the most, by over 20 percentage points relative to GDP, followed by construction and real estate (about 8 percentage points of GDP). In contrast, manufacturing credit barely increased relative to GDP. A combination of external shocks, including the fall in oil prices in 1986, speculative attacks, and rising bankruptcies translated into severe banking sector distress from 1987 through the early 1990s.

### The 1994-95 Mexican "Tequila Crisis"

The 1994-95 Mexican crisis illustrates the role of the sectoral allocation of credit in the run-up to a prominent emerging market "sudden stop" episode.[20] Mexico experienced rapid capital inflows, large current account deficits, and real exchange rate appreciation following the capital account liberalization in 1989-90 and exchange rate stabilization. This was followed by a sudden stop in capital inflows and large depreciation starting in December 1994, when the government had trouble rolling over its debt. The sudden stop was associated with a severe recession in 1995, driven by a decline in non-tradable output (Kehoe and Ruhl, 2009).

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[19]Sweden also experienced a severe banking crisis in the early 1990s, but our sectoral credit database currently does not contain data for Sweden for this period.

[20]Appendix B contains additional examples of sectoral credit allocation around emerging market crises.

Figure B.2: The Nordic and Mexican Financial Crises

(a) Finnish Financial Crisis

(b) Norwegian Financial Crisis

(c) Mexican Tequila Crisis
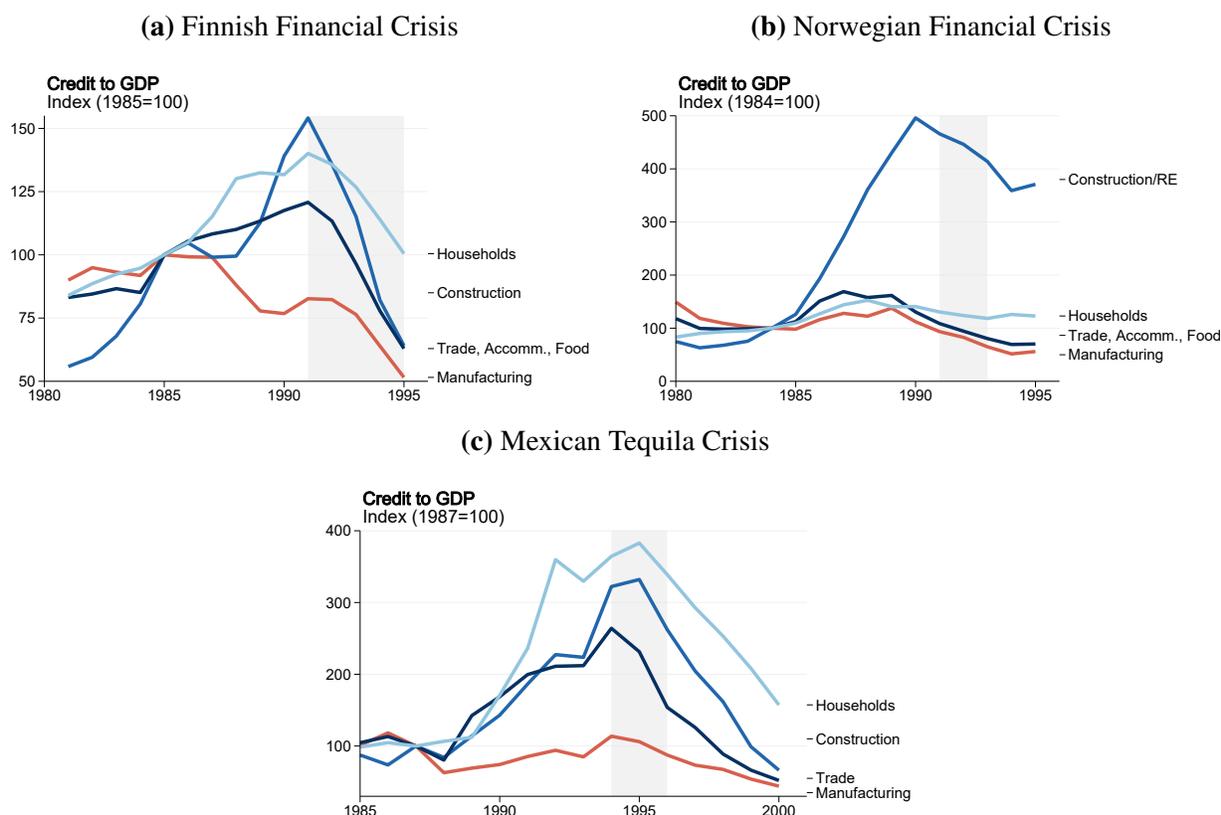
Notes: This figure plots the ratio of sectoral credit-to-GDP added for the construction (ISIC Rev. 4 section F), construction/real estate (F + L), trade/accommodation/food (G + I), and manufacturing (C) industries around the time of the Nordic, Japanese, and Mexican financial crises. We also plot household credit-to-GDP. The areas shaded in gray mark years the countries were in a systemic banking crisis as defined by Laeven and Valencia (2018).

Figure B.2c shows the dynamics of sectoral credit resemble the experience of other major crises. From 1988 to 1994, the credit to households, the construction sector, and wholesale and retail trade grew rapidly, as inflows financed strong growth in consumption (Dornbusch and Werner, 1994). For example, household credit-to-GDP increased nearly fourfold from 1988 to 1994. Meanwhile, manufacturing credit remained stable relative to GDP during the boom.

The Asian Financial Crisis

The 1997 Asian Financial Crisis was precipitated by the devaluation of the Thai baht in July 1997, which initiated a cascade of financial crises in Korea, Malaysia, Indonesia, and the Philippines. The Asian Crisis was preceded by a credit boom starting in the early 1990s, on the heels of domestic financial liberalization (Glick, 1998). Lending growth was financed by large capital inflows, a high proportion of which was denominated in foreign currency. Credit expansion inflated property and stock market valuations and increased banks' exposure to real estate, especially in Thailand and Malaysia. During the boom, the quality of bank loan portfolios deteriorated, leading to rising non-performing loans as the crisis unfolded (Glick, 1998).

Figure B.3 plots credit growth for various sectors in Thailand, Malaysia, Korea, and the Philippines.[21] In Malaysia and the Philippines, lending growth was skewed toward construction and other non-tradables. Lending to households also increased rapidly, financing a consumption boom (see also Graciela L. Kaminsky, 2001).

In Thailand, our data show that, unlike previous cases, manufacturing credit also increased rapidly. Yet narrative accounts emphasize that real estate and non-tradables, not manufacturing, were the central source of financial distress in Thailand (Corsetti et al., 1999). The discrepancy in part reflects a limitation of our data that is worth discussing. Lending by non-bank intermediaries is not always captured by our credit aggregates.[22] In the case of Thailand, non-bank intermediaries lent heavily to property and real estate sectors, as they were subject to less stringent regulation on credit quantities (Corsetti et al., 1999).[23]

Korea, in contrast, is a case where financial distress was concentrated in *tradable* sector conglomerates (Glick, 1998; Noland, 2000). Thus, while the thesis of our paper is that bad credit booms are often characterized by lending toward non-tradables and households, there are interesting exceptions. Nevertheless, even Korea experienced a deterioration of real estate markets and significant losses to real estate companies (Corsetti et al., 1999).[24]

Additional Case Studies of Pre-2008 Crises

Malaysia's 1985-88 Crisis   Malaysia experienced a banking crisis over 1985-88. The crisis followed a credit expansion, fraud and speculation in real estate and stock markets, and a sharp decline in Malaysia's terms of trade in 1985 (World Bank, 1993; Sheng, 1989).

Total private credit-to-GDP increased from 51% in 1979 to 97% in 1985. Over this period, Malaysia ran large current account deficits that coincided with real exchange rate appreciation (Sheng, 1989). Figure B.4b shows that lending to households and construction/real estate surged over this period, increasing four-fold. Credit to tradable sectors (agriculture and manufacturing/mining) and to other non-tradables (trade/accommodation/food) grew more slowly.

The credit boom was followed by financial distress at banks and finance companies. Property prices fell sharply in 1985. Depositor fears led to runs on 32 (out of 35) deposit-taking cooperatives (World Bank, 1993). The NPL ratio of commercial banks reached 30% in 1987 and 1988, mainly from exposure to the property sector (Athukorala, 2010). Real GDP growth per capita fell from 6.2% in 1983 and 7.7% in 1984 to -1.0% in 1985 and 1.2% in 1986. The unemployment rate increased from 3.8% in 1983 to 7.4% in 1986.

Colombia's 1998 Crisis   Colombia undertook significant structural reforms in the early 1990s, including a liberalization of its financial system (IMF, 2000; Barajas et al., 2000). The liberalization included a relaxation of interest rate restrictions; a relaxation of entry requirements, opening banking system to greater competition; and privatization of state-owned banks, which controlled nearly half of bank assets (Uribe and Vargas, 2002). These reforms coincided with strong capital inflows.

Credit expanded rapidly following the financial and economic reforms. Total private credit-to-GDP increased from 19% in 1991 to 41% in 1997. As seen in Figure B.4a, credit growth was

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[21]Our sectoral dataset does not contain data for Indonesia during this period.

[22]See the data appendix for a detailed discussion of the coverage of lending institutions.

[23]Corsetti et al. (1999) report that 40% of Thai finance companies' loan portfolios consisted of loans to the real estate sector, compared to 25% for commercial banks.

[24]For example, share prices of Korean property companies fell by roughly 30% from 1995 to 1996 (Glick, 1998).

Figure B.3: The Asian Financial Crisis

(a) Malaysia

(b) Thailand

(c) Korea

(d) Philippines
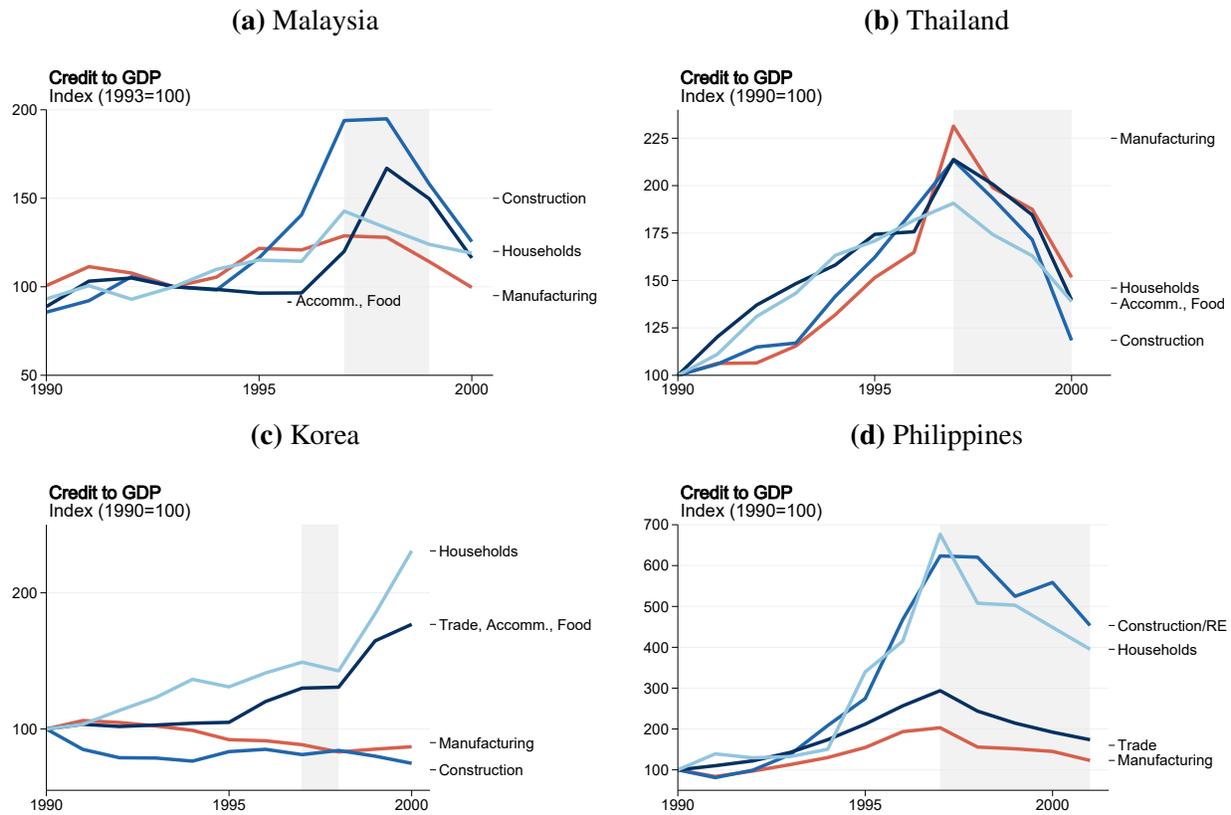
Notes: These figures plot the ratio of sectoral credit-to-GDP for various sectors around the 1997 Asian Financial Crisis. Our dataset covers four of the five major countries that were severely affected by the crisis (Indonesia is not covered for this period). We also plot household credit-to-GDP. The areas shaded in gray mark the years of systemic banking crisis according to Laeven and Valencia (2018).

strongest for lending to households, construction, and other non-tradables. Meanwhile, real estate prices grew quickly and credit quality deteriorated (Uribe and Vargas, 2002). In contrast lending to agriculture and manufacturing remained roughly constant relative to GDP.

Turmoil in international financial markets in 1998, a reversal of capital flows, and worsening terms of trade produced a financial crisis and credit contraction (Uribe and Vargas, 2002). Banks saw rising non-performing loans and a deterioration in their solvency. Real GDP growth slowed to 1% in 1998 and fell to -4% in 1999, the first contraction in Colombia since the 1930s (Uribe and Vargas, 2002).

UK's 1973 Crisis   The removal of credit controls and liberalization of the banking system in the early 1970s was followed by the worst banking crisis in the United Kingdom since the 19th century. Prior to 1971, the credit controls were used both for macroeconomic stabilization and to influence allocation of credit toward high-priority industries (Hodgman, 1973; Needham, 2015). The 1971 Act on Competition and Credit Control (CCC) replaced lending ceilings with monetary policy based on targeting interest rates. The policy was introduced to increase competition in deposit and lending markets, to phase out credit ceilings, and in response to regulatory arbitrage of lending ceilings

through non-bank lending. Banks responded to the CCC by raising deposit rates and reducing lending rates to compete for customers. The CCC was accompanied by a period of highly expansive monetary policy (Reid, 1982).

Figure B.4c shows that lending growth accelerated from 1971, following the implementation of the CCC.[25] Much of the new lending was by secondary (fringe) banks to firms in the construction and real estate sectors, "one of the least recommended categories of lending before 1971" (Reid, 1982, p. 59, quoting a property developer). These banks financed much of their lending through the rapidly expanding short-term wholesale funding markets. Lending growth to the property sector was accompanied by booming real estate prices, buoyant demand, and expansive fiscal policy (the "Barber Boom"). On the other hand, lending to tradables such as manufacturing hardly kept up with aggregate GDP growth.

"In the euphoria of the time, the increasingly prevalent view was that property values could only go up" (Reid, 1982, pp. 62-63). However, when interest rates rose sharply and property prices started declining in 1973, the boom was followed by the "Secondary Banking Crisis." This crisis involved the failure or rescue of dozens fringe banks involved in lending to the property market (Reid, 1982). The UK economy went into recession with real GDP growth of -2.5% in 1974.

The Korean Growth Miracle

We conclude this section by discussing Korea's growth "miracle," which provides an example of a credit expansion that accompanied sustained high economic growth and that was not followed by a slowdown in growth or a financial crisis. An interest rate reform in 1965 increased real deposit rates, which boosted and reallocated savings from the informal to the formal financial sector (McKinnon, 1973; Shaw, 1973). As part of its export-led development strategy, the government-controlled banking sector directed lending at preferential rates toward export activities, mostly in the manufacturing sector (Cho, 1989).

Figure B.5 shows the large rise in credit starting in 1965. The rise is concentrated in lending to manufacturing. At the same time, loans to non-tradable firms and households remained low, an explicit policy choice. The expansion in bank credit toward manufacturing coincided with the initial phase of Korea's sustained rapid economic growth. Manufacturing credit remained elevated during Korea's Heavy and Chemicals Industry drive, launched in 1973.

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[25]Reid (1982) directly connects the CCC with the lending boom: "The [CCC] scheme thus provided a framework within which a money boom of remarkable proportions was able to blow up, under expansive economic policies, in the succeeding two-and-a-half years, contributing strongly to the massive growth in the secondary banking sector which preceded the crisis" (pp. 32-33).

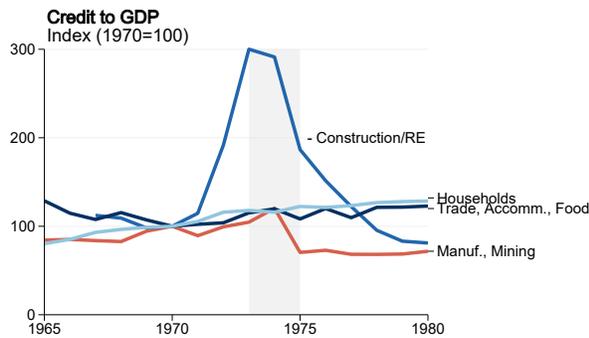**Figure B.4:** Additional Case Studies of Pre-2008 Crises
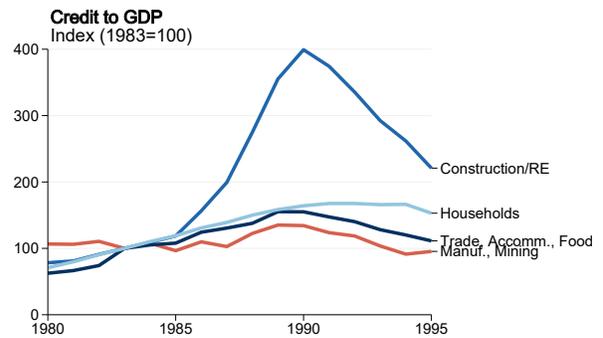
(a) Colombia's 1998 Crisis
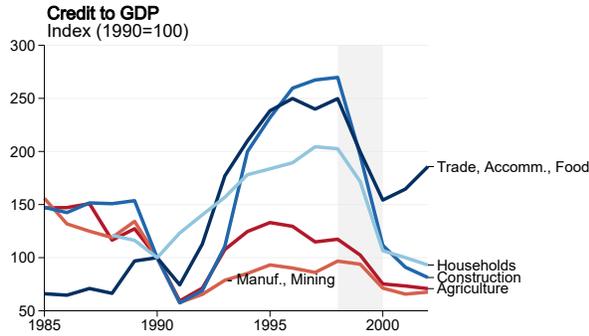
(b) Malaysia's 1985 Crisis
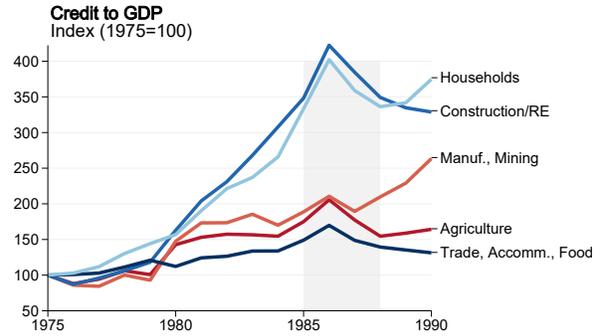

(c) UK 1973 Crisis

(d) UK 1991 Recession

Notes: These figures plot the ratio of sectoral credit-to-GDP during major credit booms in the run-up to various banking crises and recessions. We also plot data on household credit-to-GDP. The shaded in gray mark the years of a banking crisis according to Laeven and Valencia (2018) or Baron et al. (2021).

Figure B.5: The Korean Growth Miracle
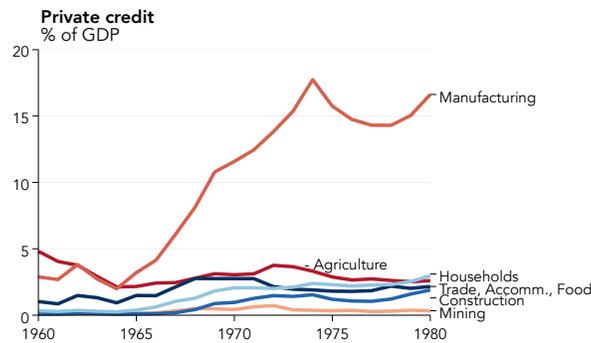
Notes: This figure plots the ratio of sectoral credit-to-GDP for the following industries: agriculture (ISIC Rev. 4 section A), mining (section B), manufacturing (section C), construction (section F), and trade/accommodation/food (section GI) for Korea between 1960 and 1980. We also plot household credit-to-GDP.

C   Data Appendix: Sectoral Credit Database

This data appendix describes the construction of the database on total private credit and the sectoral distribution of private credit introduced in Müller and Verner (2023). These data cover 117 countries from 1940 to 2014. We also extend existing data sources on total credit for a total of 189 countries. To do so, we draw on more than 600 country-specific sources, many of which were digitized for the first time. In this appendix, we focus the discussion on the construction of new annual series for total credit, household/corporate credit, and sectoral credit for broad sectoral aggregates.[26] The remainder of this appendix provides more details on how to access the data, the conceptual issues involved in constructing sectoral credit data, and how the data compare to existing sources.

C.1   Acknowledgements

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[26]In ongoing work, we are expanding the data to a higher frequency and to more disaggregated sectors (both for corporate and household credit).

Zedan (Central Bank of Jordan), Noémi Uri (Central Bank of Hungary), Arad May (Bank of Israel), Scott Walker (Australian Prudential Regulation Authority), Michael Leslie and Ian McIlraith (Reserve Bank of New Zealand), Lynne Mackie (Statistics New Zealand), Bryan Grant (Central Bank of Belize), Pornpen Powattanasatien (Bank of Thailand), Róisín Flaherty (Central Bank of Ireland), Maximilian Dell (Deutsche Bundesbank), Reet Nestor (Statistics Estonia), Jide Lewis (Bank of Jamaica), Jesús Saurina (Banco de España), Meder Abdyrahmanov (National Bank of Kyrgyz Republic), Pilar Mateo Mejía (Banco Central de la República Dominicana), Agenor Olivardia (Instituto Nacional de Estadística y Censo de Panama), Athanasios Eliades (Central Bank of Cyprus), George Theodoulou (Statistics Cyprus), Anahit Safyan (National Statistical Service of Armenia), and Eric Monnet (Banque de France). All remaining errors are ours.

C.2   Downloading the Data

Users can download the data on http://www.globalcreditproject.com.

Most users will be interested in the ready-to-use annual cross-country panel, which contains harmonized total credit data for 189 countries and sectoral data for 117 countries starting in 1940.

For users interested in the details of data construction for specific countries, we provide spreadsheets for each country that contain the raw data and documentation upon request. These files show precisely which source was used in each time period and contains notes about the raw data and adjustments.

The data are provided under the terms of a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License; more information is on the website. All users may use and/or share the licensed material, in whole or in part, provided that it is for non-commercial purposes, properly cited with credit to the authors, and only shared under identical license terms. Commercial data providers are forbidden to sell all or parts of this dataset.

When using the data, please use the following citation:

Müller, Karsten and Verner, Emil (2023). *Credit Allocation and Macroeconomic Fluctuations*.

C.3   Database Coverage

The Global Financial Crisis of 2007-08 has brought about a renewed interest in credit markets, prompting a few important efforts in assembling more detailed data for research purposes. The Bank of International Settlements has been at the forefront with its compilation of a "long series on credit to the private sector" (Dembiermont et al., 2013). Another important line of work by Óscar Jordà, Moritz Schularick, and Alan Taylor has resulted in the *Jordà-Schularick-Taylor Macrohistory Database* (Jordà et al., 2016a). These efforts added to existing data compiled in the World Bank's Global Financial Development Database (Cihák et al., 2013), which in turn largely builds on the International Monetary Fund's International Financial Statistics. Recently, the IMF has combined these data with a few additional sources in the Global Debt Database (Mbaye et al., 2018). Monnet and Puy (2019) digitized and harmonized quarterly data from the IMF's International Financial Statistics, including data on total credit to the private sector.

We build on this body of work by (i) *adding data on the sectoral allocation of credit* and (ii) *extending historical time series on household/firm and total private credit*. The collection and dissemination of sectoral credit data by national authorities has largely moved in line with contemporary

paradigms in central banking. As a result, the shift away from money and credit policies in many countries in the 1980s has brought about a somewhat paradox pattern in data availability: detailed credit data are often easier to retrieve for developing than advanced countries. For a few noteworthy cases, the United States, Sweden, China, and Russia, there exist no detailed publicly available sectoral credit data that is readily available; we are still in the process of constructing estimates for these countries. In other cases, such as Austria, Belgium or Finland, there are extensive historical data but scattered across many different sources (and even government agencies). On the other extreme, Kenya, Costa Rica, and Pakistan have data from a single source starting in 1947, 1953, and 1953, respectively.

Figure C.1: Global Database Coverage

(a) Geographical Coverage, by Years in Sample
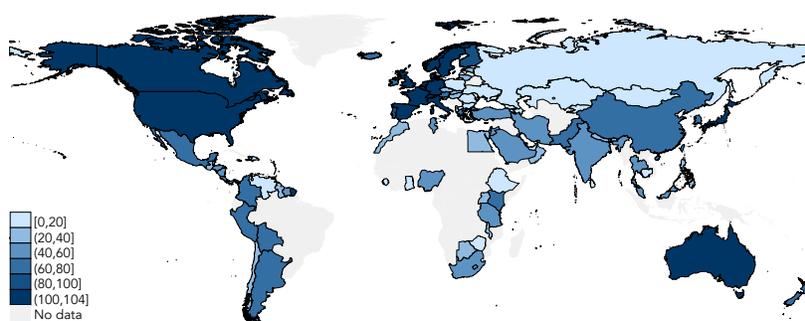
(b) Share of Database Countries in World GDP
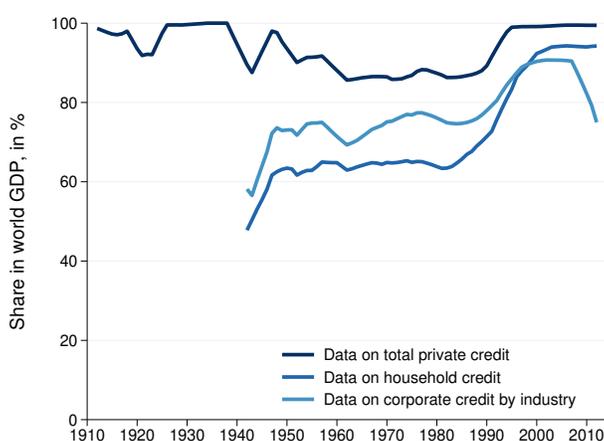
Notes: Panel (a) plots countries with data on total private credit by the number of years in the database, starting in 1910. Panel (b) plots the share of countries with total and household credit data in our database in world GDP from 1950 to 2014.

Table 1 in the main paper compares our dataset with existing efforts. The database includes an unbalanced panel of credit data for 189 countries, starting in 1940, covering 2–60 sectors. The total

number of unique country-sector-year observations is 89,019. Overall, there are 10,272 country-year observations.

Figure C.1a shows a world map with the initial year data becomes available. All continents are well-represented, including many small open economies in Africa, Southeast Asia and throughout the Caribbean. There is no strong geographical pattern regarding the length of the available time series: countries from all continents feature data starting before 1960. A noticeable pattern is the relatively recent entry of countries of the former Soviet Union in Central and Eastern Europe. Table C.1 lists the availability for all countries included in the database and the time periods for which data on broad sectors are available.

How does the coverage in the dataset compare to the size of the world economy? Figure C.1b plots the share of the countries for which we have data on total and household credit, or data on firm credit by industry, in world GDP. The data cover more than 80% of world GDP since at least 1935 and more than 95% today for total credit. Household credit is available for at least 60% of world GDP since around 1950 and hovers around 90% today. Firm credit by industry covers around 70% of world GDP since 1950.

Figure C.2 shows that the total number of country-year observations in our dataset is higher than that in datasets from the BIS, IMF International Financial Statistics (IFS) and Global Debt Database (GDD), World Bank Global Financial Development Database (GFDD), Jordà et al. (2016a), and Monnet and Puy (2019). Figure C.3 compares the number of countries in the sample by their availability of total and household/firm credit. Our database more than doubles the number of countries with data on household credit since 1970 compared to existing sources.

Figure C.2: Country-Year Observations
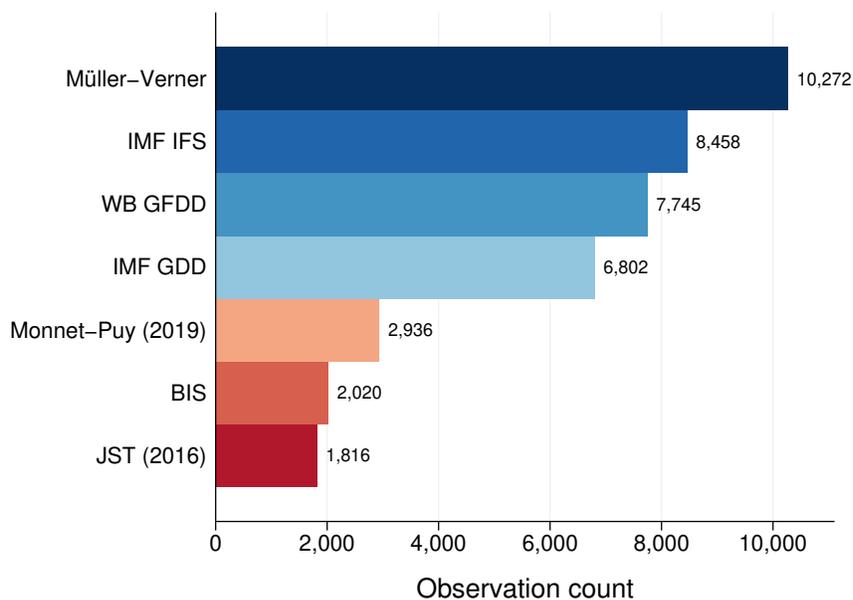
Notes: This figure compares the number of country-year observations in different datasets on private credit.

Our dataset allows a much deeper look into corporate and household credit markets by differentiating between different industries and purposes. Because of differing classification standards and

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levels of detail in the reporting, the number of the coverage varies much more here compared to the different types of household lending. Figure C.4 highlights this by showing the total number of sub-sectors across countries over time. We plot the average number of sectors per country-year, as well as confidence intervals for the 10th, 25th, 75th and 90th percentiles. The number of sectors ranges from 2–60, with an average of 16.

Table C.1: Credit Data Coverage by Country

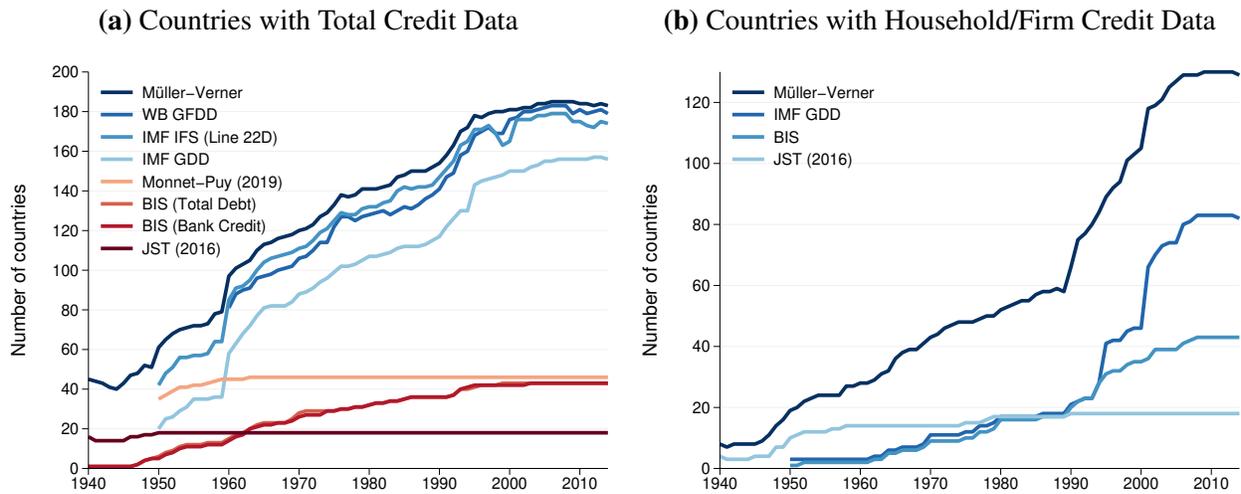| No.	Country	Total credit	Household/ firm credit	Major corporate sectors				
				Agriculture	Manuf., Mining	Constr., RE	Trade etc.	Transp., Comm.
1	Albania	2000-2014	2000-2014	2000-2014	2000-2014	2000-2014	2000-2014	2000-2014
2	Anguilla	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014
3	Antigua & Barbuda	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014
4	Argentina	1952-2014	1952-2014	1952-2014	1952-2014	1952-2014	1952-2014	1952-2014
5	Armenia	1998-2014	1998-2014	1998-2014	1998-2014	1998-2014	1999-2014	1998-2014
6	Australia	1948-2014	1948-2014	1948-2014	1948-2014	1948-2014	1948-2014	1948-1983
7	Austria	1946-2014	1949-2014	1946-2014	1946-2014	1963-2014	1946-2014	1946-2014
8	Azerbaijan	2000-2014	2000-2014	2000-2014	2000-2014	2000-2014	—	2000-2014
9	Bahrain	1998-2014	1998-2014	1998-2014	1998-2014	1998-2014	1998-2014	2000-2014
10	Barbados	1966-2014	1966-2014	1966-2014	1966-2014	1966-2014	1966-2014	1966-2014
11	Belgium	1976-2014	1976-2014	1976-2014	1976-2014	1976-2014	1976-2014	1976-2014
12	Belize	1970-2014	1970-2014	1970-2014	1970-2014	1976-2014	1970-2014	1970-2014
13	Bhutan	1983-2014	2005-2014	1983-2014	1983-2014	1983-2014	1983-2014	1983-2014
14	Bolivia	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1999-2000
15	Botswana	1990-2014	1990-2014	1990-2014	1990-2014	1990-2014	1990-2014	1990-2014
16	Bulgaria	1995-2014	1995-2014	2000-2014	2000-2014	2000-2014	2000-2014	2000-2014
17	Cambodia	2000-2014	2004-2014	2000-2014	2000-2014	2000-2014	2000-2014	2008-2014
18	Canada	1942-2014	1942-2014	1942-2014	1942-2014	1942-2014	1942-2014	—
19	Chile	1993-2014	1993-2014	1993-2014	1993-2014	1993-2014	1993-2014	1993-2014
20	China	1952-2009	1994-2009	1952-2009	—	—	—	—
21	Colombia	1952-2014	1988-2014	1952-2014	1952-2014	1952-2014	1952-2014	1998-2014
22	Costa Rica	1956-2014	1985-2014	1956-2014	1956-2014	1985-2014	1985-2014	1987-2014
23	Curaçao & St. Maarten	1978-2014	1978-2014	—	1978-2014	1978-2014	1978-2014	1978-2014
24	Cyprus	1963-2014	1963-2014	1963-2007	1963-2007	1963-2007	1963-2007	1963-2007
25	Czech Republic	1992-2014	1992-2014	1992-2014	1992-2014	1992-2014	1992-2014	1992-2014
26	Denmark	1951-2014	1951-2014	1951-2014	1978-2014	1978-2014	1978-2014	1986-2014
27	Dominica	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014
28	Dominican Republic	1996-2014	1996-2014	1996-2014	1996-2014	1996-2014	1996-2014	1996-2014
29	Egypt	1991-2014	1991-2014	1991-2014	1991-2014	—	1991-2014	—
30	Estonia	1993-2014	1993-2014	1995-2014	1995-2014	1995-2014	1995-2014	1995-2014
31	Ethiopia	2000-2014	—	2000-2014	2000-2014	2000-2014	2002-2014	2000-2014
32	Fiji	1973-2014	1973-2014	1973-2014	1973-2014	1973-2014	1973-2014	1973-2014
33	Finland	1958-2014	1958-2014	1958-2014	1958-2014	1958-2014	1958-2014	1958-2014
34	France	1993-2014	1993-2014	2006-2014	2006-2014	2006-2014	2006-2014	2006-2014
35	Georgia	1995-2014	1995-2014	2003-2014	2003-2014	2003-2014	2003-2014	2003-2014
36	Germany	1949-2014	1949-2014	1949-2014	1949-2014	1951-2014	1949-2014	1968-2014
37	Ghana	1997-2014	2005-2014	1997-2014	1997-2014	1997-2014	1997-2014	1997-2014
38	Greece	1950-2014	1950-2014	1950-2014	1950-2014	2002-2014	1950-2014	1955-2014
39	Grenada	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014
40	Guatemala	1990-2014	1990-2014	1990-2014	1990-2014	1990-2014	1990-2014	2003-2014
41	Guyana	1993-2014	1993-2014	1993-2014	1993-2014	—	1993-2014	1993-2014
42	Haiti	1999-2014	1999-2014	1999-2014	1999-2014	1999-2014	1999-2014	1999-2014
43	Honduras	1958-2014	1958-2014	1958-2014	1958-2014	1958-2014	1958-2014	1968-2014
44	Hong Kong	1965-2014	1965-2014	1965-2003	1965-2014	1965-2014	1965-2014	1965-2014
45	Hungary	1989-2014	1989-2014	1995-2014	1995-2014	1995-2014	1995-2014	1995-2014
46	Iceland	1950-2014	1958-2014	1950-2014	1955-2014	1970-2014	1958-2014	1958-2014
47	India	1972-2013	1972-2013	1972-2013	1972-2013	1972-2013	1972-2013	1972-2013
48	Iran	1967-2012	—	1967-2012	1967-2012	1967-2012	—	—
49	Ireland	1948-2014	1948-2014	1948-2014	1948-2014	1948-2014	1948-2014	1985-2014
50	Israel	1974-2014	1974-2014	1974-2014	1974-2014	1974-2014	1974-2014	1974-2014
51	Italy	1948-2014	1948-2014	1948-2014	1948-2014	1948-2014	1948-2014	1948-2014
52	Jamaica	1967-2014	1970-2014	1967-2014	1967-2014	1967-2014	1967-2014	1977-2014
53	Japan	1947-2014	1947-2014	1947-2014	1947-2014	1947-2014	1948-2014	1947-2014
54	Jordan	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014	1964-2014
55	Kazakhstan	1997-2014	1997-2014	1997-2014	1997-2014	1997-2014	1997-2014	1997-2014
56	Kenya	1947-2014	1965-2014	1947-2014	1947-2014	1965-2014	1965-2014	1965-2014

**Table C.1:** Credit Data Coverage by Country (continued)

No.	Country	Total credit	Household/ firm credit	Major corporate sectors				
				Agriculture	Manuf., Mining	Constr., RE	Trade etc.	Transp., Comm.
57	Kuwait	1972-2014	1972-2014	1972-2014	1972-2014	1972-2014	1972-2014	—
58	Kyrgyz Republic	1996-2014	1996-2014	1996-2014	1996-2014	1996-2014	1996-2014	1996-2014
59	Latvia	2000-2014	2000-2014	2000-2014	2000-2014	2000-2014	2000-2014	2000-2014
60	Lesotho	2002-2014	2002-2014	2008-2014	2002-2014	2002-2014	2002-2014	2007-2014
61	Lithuania	1993-2014	1993-2014	1995-2014	1995-2014	1995-2014	1995-2014	1995-2014
62	Luxembourg	1999-2014	1999-2014	—	—	—	—	—
63	Macedonia	2004-2014	2004-2014	2004-2014	2004-2014	2004-2014	2004-2014	2004-2014
64	Malawi	1990-2014	1990-2014	1990-2014	1990-2014	1990-2014	1990-2014	1990-2014
65	Malaysia	1968-2014	1971-2014	1968-2014	1968-2014	1968-2014	1968-2014	1968-2014
66	Maldives	1985-2014	1985-2014	1985-2014	1985-2014	1985-2014	1985-2014	1985-2014
67	Malta	1969-2014	1969-2014	1969-1992	1969-2014	1969-2014	1969-2014	1993-2014
68	Mauritius	1967-2014	1967-2014	1967-2014	1967-2014	1992-2014	1967-2014	1979-2014
69	Mexico	1942-2014	1984-2014	1942-2014	1969-2014	1969-2014	1969-2014	1969-2014
70	Mongolia	2000-2014	2000-2014	2000-2014	2000-2014	2000-2014	2002-2014	2000-2014
71	Montserrat	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014
72	Morocco	1977-2014	1993-2014	1977-2014	1977-2014	1977-2014	1977-2014	1977-2014
73	Nepal	1975-2014	2002-2014	1975-2014	1975-2014	2002-2014	1975-2014	2002-2014
74	Netherlands	1990-2014	1990-2014	2010-2014	2010-2014	2010-2014	2010-2014	2010-2014
75	New Zealand	1940-2014	1940-2014	1940-2014	1940-2014	1956-2014	1940-2014	1940-2014
76	Nicaragua	1960-2014	1995-2014	1960-2014	—	—	1960-2014	—
77	Nigeria	1960-2014	1966-1992	1960-2014	1960-2014	1960-2014	1960-2014	1966-2014
78	Norway	1946-2014	1946-2014	1946-2014	1946-2014	1946-2014	1946-2014	1946-2014
79	Oman	1990-2014	1990-2014	1990-2014	1990-2014	1990-2014	1990-2014	1990-2014
80	Pakistan	1953-2014	1982-2014	1953-2014	1953-2014	1953-2014	1953-2014	1953-2014
81	Panama	1963-2014	1963-2014	1963-2014	1963-2014	1963-2014	2002-2014	2002-2014
82	Peru	1947-2014	1947-2014	1947-2014	1947-2014	1947-2014	1947-2014	1990-2014
83	Philippines	1980-2014	1981-2014	1980-2014	1980-2014	1980-2014	1980-2014	1980-2014
84	Poland	1996-2014	1996-2014	2002-2012	2002-2012	2002-2012	2002-2012	2002-2012
85	Portugal	1947-2014	1947-2014	1966-2014	1966-2014	1973-2014	1973-2014	1973-2014
86	Qatar	1977-2014	1977-2014	1977-2002	1977-2014	1977-2014	1977-2014	1977-1994
87	Romania	2000-2014	2000-2014	2000-2014	2000-2014	2000-2014	—	—
88	Russia	1998-2014	1998-2014	2002-2014	2002-2014	2002-2014	2002-2014	2002-2014
89	Saudi Arabia	1970-2014	1998-2014	1970-2014	1970-2014	1970-2014	1970-2014	1970-2014
90	Seychelles	1997-2014	1997-2014	1997-2014	1997-2014	1997-2014	1997-2014	1997-2014
91	Sierra Leone	1997-2014	2001-2014	1997-2014	1997-2014	1997-2014	1997-2014	1997-2014
92	Singapore	1962-2014	1980-2014	1962-2014	1962-2014	1962-2014	1962-2014	1963-2014
93	Slovak Republic	1992-2014	1992-2014	1992-2014	1992-2014	1992-2014	1992-2014	1992-2014
94	Slovenia	1991-2014	1991-2014	1994-2014	1994-2014	1994-2014	1994-2014	1994-2014
95	South Africa	1994-2013	1994-2013	1994-2013	1994-2013	1994-2013	1994-2013	1994-2013
96	South Korea	1952-2014	1952-2014	1952-2014	1952-2014	1952-2014	1952-2014	1952-2014
97	Spain	1992-2014	1992-2014	1992-2014	1992-2014	1992-2014	1992-2014	1992-2014
98	Sri Lanka	1996-2014	1996-2014	1996-2014	1996-2014	1996-2014	1996-2014	2009-2014
99	St. Kitts & Nevis	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014
100	St. Lucia	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014
101	St. Vincent & Grenadines	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014
102	Suriname	1969-2014	1969-2014	1969-2014	1969-2014	1969-2014	1969-2014	1969-2014
103	Sweden	1975-2014	1975-2014	—	—	—	—	—
104	Switzerland	1977-2014	1977-2014	1997-2014	1985-2014	1985-2014	1997-2014	1997-2014
105	Taiwan	1956-2014	1956-2014	1956-2014	1956-2014	1997-2014	1956-2014	1956-2014
106	Tanzania	1967-2014	2003-2014	1967-2014	1967-2014	1967-2014	1985-2014	1967-2014
107	Thailand	1965-2014	1965-2014	1965-2014	1965-2014	1965-2014	1965-2014	1970-2014
108	Trinidad & Tobago	1946-2014	1954-2014	1946-2014	1946-2014	1963-2014	1954-2014	1963-2014
109	Tunisia	1962-2014	1962-2014	1962-2014	1962-2014	1962-2014	1962-2014	1962-2014
110	Turkey	1967-2014	1986-2014	1967-2014	1967-2014	1967-2014	1967-2014	2002-2014
111	Uganda	1991-2014	2004-2014	1991-2014	1991-2014	1991-2014	1991-2014	1991-2014
112	Ukraine	1995-2014	1995-2014	2000-2014	2000-2014	2000-2014	2000-2014	2000-2014
113	United Arab Emirates	1998-2014	1998-2014	1998-2014	1998-2014	1998-2014	1998-2014	1998-2014
114	United Kingdom	1946-2014	1946-2014	1946-2014	1946-2014	1946-2014	1946-2014	1946-2014
115	United States	1936-2014	1936-2014	1936-2014	—	—	—	—
116	Venezuela	2004-2014	2004-2014	2004-2014	2004-2014	2004-2014	2004-2014	2004-2014
117	Zimbabwe	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014

Figure C.3: Comparing the Country Coverage of Different Sources on Private Credit Data

(a) Countries with Total Credit Data

(b) Countries with Household/Firm Credit Data

Notes: These graphs compare the coverage of different datasets on total credit (panel a) and household/firm credit (panel b) over time. We compare our data to that compiled by the IMF IFS and GDD (Mbaye et al., 2018), BIS (Dembiermont et al., 2013), Jordà et al. (2016a), Monnet and Puy (2019), and World Bank GFDD. See text for more details.

Figure C.4: Numbers of Sectors per Country-Year Observation
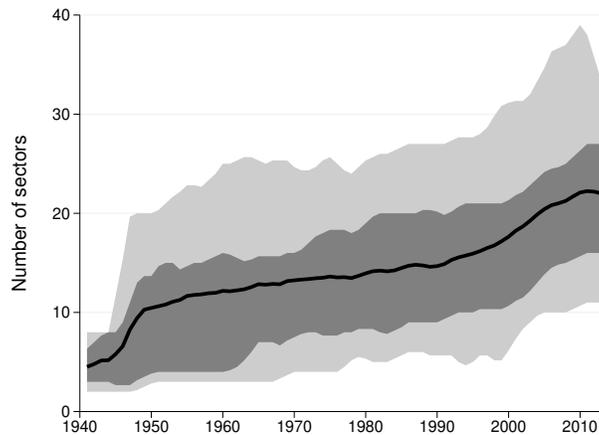
Notes: This graph plots the average number of sectors per country-year observation. The shaded areas represent the 10th, 25th, 75th, and 90th percentiles.

C.4 Data Construction

C.4.1 Credit Data Sources and Classification

The principal data sources for this project are publications by national central banks and statistical offices. To identify the availability of detailed credit data, we followed four simple steps.

Step 1: Identifying time series online We started by consulting the websites of national central banks and other regulators, as well as statistical offices. We used the native language versions

in most cases because these sometimes contain more data. Typically, the online databases of the national authorities contain time series for at least the most recent years, usually in the range of 10 to 25 years.

Step 2: Identifying data in PDF format or supervisory files   Next, we turned to the source publications of the data, often only available in their original languages, especially for historical data. In many cases, these were the annual reports and statistical bulletins published by national central banks or statistical yearbooks and abstracts published by statistical agencies. At times, further data were available from old research publications such as working papers or compilations of historical data (e.g. the Bank of England's "Statistical Abstract" or Swiss National Bank's "Historical Time Series"). In many cases, the data were not collected for public dissemination but supervisory purposes and thus only available as Excel sheets or PDF files for one period (e.g. in Israel or South Africa). Another variant we often encountered was the collection and publication of sectoral data as part of financial stability reports (e.g. in Slovenia). We combined the raw data by copying the data—sometimes from hundreds of individual files—into time series format.

Step 3: Contacting the national authorities   As a third step, we contacted the statistics and banking supervision departments of all national authorities who collected or published sectoral credit data at any point in time via email. The vast majority of agencies responded and provided helpful pointers to historical sources. In many cases, they also shared unpublished data with us. At times, our enquiry also prompted an overhaul of existing data and we were sent corrected versions which were more comparable over time. Interestingly, there were also a few cases where we were informed that no data was available before a certain date. When we consulted historical documents, however, it turned out there was indeed more data the providers were not aware of.

Step 4: Digitizing additional historical data   For countries without an online depository for historical publications, or where we suspected additional data, we searched the libraries of several universities and central banks for easily retrievable volumes. The Bank of Japan generously sent us large amounts of paper volumes containing historical data starting in 1948 via mail, which were photocopied from their archives. Large parts of the database are newly digitized time series we collected from such historical publications. Figure C.5 plots an example of what these historical data usually look like.

It is worth noting why certain countries were consciously not included in the database. Especially in developing countries which actively pursue credit policies, i.e. targeted credit controls, the classification of sectors and economic activities is at times difficult to compare with other economies or often yields only one or two comparable sub-sectors. We do not include such cases. We further required countries to have at least 10 years of available data when we started collecting data in 2015.

For total credit, we retrieved additional data from existing sources. These include the BIS long series on lending to the private sector, the IMF International Financial Statistics, UN Statistical Yearbooks, and the League of Nations' Commercial Banks and Statistical Yearbook publications. The latter two allow us to create long-run time series for the broadest range of countries we are aware of. For some countries, we also create new historical total credit series from national sources.

Figure C.5: Source Example – Canada, Data on Sectoral Credit, 1950-1952

17.—Loans of Chartered Banks, according to Class, Outstanding at Sept. 30, 1950-52

NOTE.—The classification of chartered bank loans was revised in 1950; the figures in this table are, therefore, not comparable with those for 1947-49 in the 1951 Year Book, pp. 1043-1044.

Class of Loan	1950	1951	1952
	$'000	$'000	$'000
Government and Other Public Services—			
Provincial governments	23,600	24,859	6,349
Municipal governments and school districts	91,505	114,531	102,399
Religious, educational, health and welfare institutions	33,143	45,912	43,284
Totals, Government and Other Public Services	148,248	185,302	152,032
Financial—			
Investment dealers and brokers to the extent payable on call or within thirty days	101,177	107,091	135,173
Trust, loan, mortgage, investment and insurance companies and other financial institutions	85,983	91,720	107,519
Totals, Financial	187,160	198,811	242,692
Personal—			
Individuals, for other than business purposes, on the security of marketable stocks and bonds	243,370	255,605	274,324
Individuals, for other than business purposes, *n.e.s*	218,201	211,303	227,992
Totals, Personal	461,571	466,908	502,316
Agricultural, Industrial and Commercial—			
Farmers	255,783	298,936	334,202
Industry—			
Chemical and rubber products	29,175	54,257	30,322
Electrical apparatus and supplies	14,310	41,388	22,886
Food, beverages and tobacco	122,514	171,968	168,366
Forest products	76,057	115,685	136,500
Furniture	16,188	19,776	14,363
Iron and steel products	53,389	97,509	95,641
Mining and mine products	26,015	33,381	47,991
Petroleum and products	22,914	31,055	32,813
Textiles, leather and clothing	138,862	213,377	157,963
Transportation equipment	30,102	46,437	52,810
Other products	55,180	63,118	53,156
Public utilities, transportation and communication companies	53,912	87,937	67,526
Construction contractors	122,736	151,774	158,643
Grain dealers and exporters	93,124	98,558	186,518
Instalment finance companies	96,476	100,830	149,397
Merchandisers	436,144	542,869	483,967
Other business	135,492	133,837	139,047
Totals, Agricultural, Industrial and Commercial	1,778,373	2,302,692	2,332,111
Grand Totals	**2,575,352**	**3,153,713**	**3,229,151**

Note: This figure shows a scan from the Canada Year Book containing data on credit by sector/type.

C.4.2 Definition and Coverage of Financial Institutions and Credit

We tried to achieve the broadest possible coverage of domestic private credit markets. There are, however, trade-offs regarding (1) the type of financial institutions, and (2) what constitutes "credit".

Which Financial Institutions Are Covered? The coverage of financial institutions varies from country to country, depending on the laws governing data compilation as well as the structure of the financial system. In many countries, increases in the market share of non-bank financial institutions have led to a broader coverage over time, often encompassing all lenders including leasing institutions, specialized financing companies, investment trusts, and so on. In other cases, disaggregated data exists only for commercial bank lending.

While the data collected by the Bank of International Settlements clearly shows that non-bank financial institutions can make up a significant share of total credit (Dembiermont et al., 2013; Drehmann, 2013), it would be inaccurate to simply "scale up" disaggregated data covering only commercial banks, for example, to match some broader aggregate total credit volume. Different types of financial institutions, after all, have different business models. In most cases, we thus use the most comprehensive lender coverage for which we were able to identify disaggregated *non-financial corporate credit* data. It should be noted that even this compromise comes at a cost, since for many countries there are separate tables for different institutions (e.g. "commercial banks" and

"other financial institutions"), which often had to be copied by hand and manually summed up. In general, form follows function in terms of coverage: most countries adjust the scope of covered institutions to include the bulk of the local financial system.

In some countries, the reporting standards for (disaggregated) non-financial corporate credit data diverge from that of broader sectoral aggregates. For example, detailed industry-level data are often only available for commercial banks, while broader sectors may include other lending institutions such as other MFIs. We dealt with these cases using one of two strategies. If the broader aggregates (households, non-bank financial, etc.) were also available for the same lender coverage as the disaggregated corporate credit data, we usually stuck with the conservative approach of limiting the lender coverage but retaining a representative picture of these intermediaries' balance sheet. In the example above, this would mean limiting the data to commercial banks. If, however, there was no data on the broad sectors available for the same lender coverage, or we had reason to believe that non-bank lenders or other MFIs made up a considerable market share of the credit market, we re-scaled the raw industry-level data. In particular, we multiplied the share of each industry in the total reported corporate credit market with the share of the credit market in the broader total credit aggregates that may also include other lenders. Implicitly, this assumes that the composition of the total corporate credit market portfolio is similar to that of the reporting institutions.

We use five different classifications for the coverage of financial institutions: "Commercial Banks (Banks)", "Credit Institutions (CIs)", "Monetary Financial Institutions (MFIs)", "All lenders", and "All lenders (incl. government)". We broadly follow the European Central Bank's definitions of MFIs and CIs. CIs include commercial banks and all other deposit-taking institutions, such as savings banks or credit cooperatives. MFIs additionally include money market funds (MMFs) and similar entities. "All lenders" further expands the definition to include all non-bank institutions, such as non-deposit taking specialised housing or shipping lenders, as well as investment trusts. Direct loans by the central bank are generally not included in these statistics, and we exclude them wherever they are separately reported. The institutional coverage of the raw data is noted for each individual data source in the series documentation file. Note that the reported lender coverage in the documentation refers to the raw data: where there are differences between different raw data sources that had to be adjusted to make them comparable, this is described in detail on a case-by-case basis.

Because of data limitations, we do not systematically differentiate by bank ownership, i.e. whether lenders are privately or state-owned. Since government ownership of banks is considerable in some countries (La Porta et al., 2002), this also guarantees the broadest possible coverage. In many emerging economies in particular, development banks have substantial market shares in the financing of sectors that are deemed national priorities.

In many countries, the share of covered institutions increases over time. When adjusting the data, we sometimes make the assumption that the more recent data is more accurate and scale up the older data using overlapping values. Costa Rica is a good example, where the statistics only include the "banking system" from 1956 to 1985 and the "total financial system" starting in 1985. To correct for a small level-shift in the data—which is most pronounced for mortgage lending—we scale up the pre-1985 data using the overlapping values to avoid exaggerated movements arising from the reclassification. Implicitly, we thus assume that the growth rates of the "banking system" are representative of the "total financial system" before 1985. The underlying assumptions are rarely strong: in most cases, differences in coverage come from commercial banks versus all monetary financial institutions, where the latter often include credit unions or savings banks with large market shares in residential mortgages but little other activities. In cases where the deviations in coverage

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are large or we have other background information (communicated via personal contact from or obtained from documents published by the national authorities), we stay on the conservative side and stick with a smaller coverage that is comparable over time. For more details on data adjustments and robustness tests, also see section C.4.4.

Coverage of Credit Instruments   Debt contracts come in different forms, with a major distinction between "debt securities" (mostly bonds) and "bank credit" (mostly loans). Depending on the country and time period, different types of credit may be more or less important, even though bank credit is still the overwhelming form of debt financing in almost all countries in the database. Unfortunately, most countries do not separately report the type of underlying contract. Instead, definitions are often vague—such as "Total Loans and Advances", "Domestic Lending" or "Claims"—and details are not always easy to verify. We thus include the broadest definition available where a distinction is made, e.g. the sum of "Loans" and "Debt securities" in the case of Greece. We retrieve data on end-of-period outstanding amounts of credit in all currencies, including lending in foreign currency, which can make up a significant fraction. Here again, form usually follows function in reporting classifications. In the few countries who do not report foreign currency lending, we manually verified that it plays little to no role.

We have not been able to systematically identify sectoral data for other types of claims or equity stakes, which might be especially relevant for credit to the non-bank financial sector. Due to the lack of more detailed information, we usually use a version of "credit to non-bank financial institutions". These time series—usually taken from broader surveys of the central bank—have a flow-of-funds type of character and usually include all claims. As explained in section C.4.4 below, we have invested significant resources to achieve the best possible comparability of the data with other loan aggregates, e.g. to households or industrial sub-sectors.

An important distinction has to be made between "gross" and "net" credit. All of the values we collected are "gross" in two respects. First, they constitute outstanding amounts (i.e. stocks) of credit without subtracting bank liabilities such as deposits, as is the case for some data published by the IMF. Second, they are gross of non-performing loans and thus *include* overdue claims. The latter is dictated by data availability, as most countries do not separately report sectoral breakdowns of non-performing loans (NPLs).[27] Since the desirability of excluding NPLs further depends on the application, we give preference to the data comparability across countries. Note that this has been standard procedure in previous efforts in collecting private credit data.

C.4.3   Sectoral and Industry Classification

The dataset includes credit for up to 60 individual sectors, where we differentiate between *broad sectors* (non-financial corporations, households, non-bank financial corporations) and *non-financial corporate sectors* (e.g. manufacturing, transport and communication). Given the detailed nature of the data and heterogeneous availability, the panel is strongly unbalanced. The average country reports values for 16 different sectors, the median country for 14. The data include lending to the sectors defined in more detail below irrespective of the ownership of the borrower: this means that lending to public (state-owned) corporations is sometimes included in the data.

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[27]Where countries report NPLs that are not included in the outstanding amounts, we manually add up the series. This is only the case for a handful of sources and noted in the series documentation.

Note that, in general, we only collected data on the broad sectors where more detailed industry data was available. In some countries, the broader aggregates are available for longer time periods, and the current coverage could be extended to include these data.

Classification of Broad Sectors   For the classification of credit into broad sectors, we follow the System of National Accounts (SNA 2008) (United Nations, 2009) and use the groups "households and non-profit organizations serving households", "non-financial corporations", and "non-bank financial corporations". In the publications we used as sources, the latter group is sometimes also referred to as "other financial corporations" or, somewhat confusingly, simply "financial corporations". Note that we always *exclude* interbank credit. Where the classification in the raw broad sectoral data was unclear, we verified it in personal contact with the respective authorities.

Since a breakdown of households into sole proprietors and private persons is usually not available, the sector includes *all* lending to households.[28] We further add the category "corporate credit", defined as the sum of credit to all non-financial and non-bank financial corporations. The data on credit by broad sectors are in many countries reported in a separate survey from credit to different industries. In some countries, data on credit to non-financial corporations, non-bank financial corporations, and households are reported in the same survey. Where the classification was unclear, or there were multiple diverging sources, we inquired about the exact concepts with the publishing organization.

Classification of Non-Financial Industries   One of the main contributions of the dataset is that it enables a cross-country comparison of the corporate credit market, which requires a classification of industrial sectors according to unified categories. Since many countries have implemented the United Nations' International Standard Industrial Classification of All Economic Activities (ISIC), we use its most recent version, Revision 4 (Rev. 4), to classify sectors.[29] However, some countries—including some major ones, notably Germany—have not yet adopted this classification and continue to use older revisions of the ISIC categories. Other countries use national classifications broadly in line with ISIC classification, which also applies to many historical sources. Sometimes, these differences can create challenges for the cross-country comparability of the industry credit data, which we address in detail in section C.4.4.

We let the data dictate the sectoral detail used for the classification. Since more detailed data are only available in a few cases, and are often excessively noisy, we retrieve data up to the 2-digit ("division") level in ISIC Rev. 4 for the sections A ("Agriculture, Forestry, and Fishing") and C ("Manufacturing"). For other sectors, we only record data on the 1-digit level ("section"). Data for the sectors "Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use" (T) and "Activities of extraterritorial organizations and bodies" (U) are only available sporadically and are bundled together with the category "Activity not stated" (Z).

In many countries, the most detailed available data is on the 1-digit (section) level. Where only broader data were available, we assigned them to multiple sections. For example, many countries report a time series for "credit to industry", which includes the ISIC Rev. 4 sections B ("Mining and Quarrying") and C ("Manufacturing"), because mining and quarrying activities are often negligible.

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[28]There are some exceptions to this rule because the industry classification in some countries explicitly includes sole proprietorships as corporations. These cases are documented accordingly.

[29]See United Nations (2008) for more details on the ISIC classification and conversion tables.

The data were then assigned to the total of the two sections ("B + C"). Note that, compared to the ISIC classification, we exclude lending to monetary financial institutions (including the central bank).

For our analysis in this paper, we construct sector credit aggregates that distinguish between agriculture (A), manufacturing and mining (B and C), construction and real estate (F and L), wholesale and retail trade, accommodation, and food services (G and I), transport and communication (H and J), and other sectors.

Classification of Credit to Financial Institutions (Excluding Banks)   Financial sector lending (excluding the interbank market) deserves a few extra comments, because of the special attention that was required in compiling these data. Depending on the country classification, tables on credit by non-financial corporate sectors (see Appendix C.4.3) sometimes include credit to the (non-bank) financial sector; sometimes they do not. As a result, tables on the credit market structure by individual industries were often matched to the non-bank data from broader surveys, which required clarification from the national authorities whether and to which extent these tables are comparable.[30] In some cases, the tables on credit by industry explicitly only included non-financial corporations but still reported a time series on ISIC section K, usually as *Finance and insurance activities* or similar. The values for these data series were usually very small, and when consulted, the data providers in all of these cases recommended us to use non-bank financial series from broader surveys as more accurate reflections. We thus excluded the finance series from the industry breakdown tables in these cases.

The time series exclude lending to banks or other MFI because interbank markets fundamentally differ compared to other types of credit. In a few cases it was not possible to disentangle non-bank financial and interbank credit, especially in historical sources. We usually excluded the values with unclear classification, unless the national authorities were able to assure us that interbank lending only made up an insignificant fraction of the data, or the growth rates of interbank and other financial lending were likely very similar. All of these cases are noted in the time series documentation of the respective country tables.

C.4.4   Adjustments and Harmonization

This section outlines the adjustments we made to make the data as comparable as possible across time and countries. Where necessary, adjustments were made for individual countries or even specific time series in consultation with the national authorities. All of these adjustments are described in country-specific documentation files (available upon request).

While these adjustments leave the growth rates of sectoral credit aggregates almost universally unchanged, they do affect the *level* of outstanding credit, particularly as one goes back further in time. In section C.5, we show that despite the trade-offs required in compiling a novel dataset from such detailed sources, the resulting values are remarkably consistent with those of existing sources.

Adjusting for Currency Changes   The raw data for some countries had to be adjusted in order to be comparable across time where currency changes occurred. For example, the values for Azerbaijan were reported in *second manat* for 2000 to 2005 and in *third manat* afterwards. To arrive at a

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[30]In the overwhelming majority of cases, these data are directly comparable.

consistent time series, we thus converted the old values to *third manat* using the applied conversion rate of 5,000 to 1. These cases are usually straightforward and noted in the series documentation.

The issue of currency conversion is perhaps most salient for the countries of the Eurozone. Here, we converted the data using the irrevocable Euro exchange rates. Researchers interested in using the sectoral data for exchange rate applications would thus have to convert back their original pre-Euro currencies using the respective irrevocable exchange rates.

Adjusting for Breaks   A major issue when compiling long-run time series from multiple sources are level-shifts or breaks in the data arising from re-classifications due to changes in sectoral classification, the scope of covered institutions, and inclusion of foreign currency loans. In many cases, there are overlapping values for the period in which a shift occurs. We adjusted older values at the break date (usually upward) using the simple chain-linking formula

$$New\ value_{it} = \frac{New\ series_{i,t+1}}{Old\ series_{i,t+1}} \times Old\ series_{i,t}. \tag{6}$$

The remaining values of the old series were then re-calculated backwards using their period-on-period growth rates. This is the same approach used in Dembiermont et al. (2013) and Monnet and Puy (2019). The procedure implicitly assumes that more recent data are more accurate and that the growth rates of the old series are representative of the data covered by the new series.

For some level shifts, no overlapping data is available. In these cases, we used one of two approaches. First, if available, we replaced the *New Series* and *Old Series* terms in the adjustment term $\frac{New\ series_{i,t+1}}{Old\ series_{i,t+1}}$ in equation 6 with a reference series that is conceptually related to the type of sectoral credit aggregate that we want to adjust, e.g. by using total mortgage credit as a reference series for adjusting a break in residential mortgages. Second, if no such reference series was available, we followed the procedure in Stock and Watson (2003), who calculate "typical" growth rates of the series in question during that time period under the assumption that the actual, unobserved growth rate is unlikely to be substantially different. In particular, they first calculate growth rates of the two periods before and after the level-shift, and then take the median value of these four percentage changes to arrive at the "typical" growth rate. Since the underlying raw data in our case often has monthly frequency, we use the median of the annualized growth rates three periods before and after a level-shift. We then follow the procedure outlined above for the overlapping values and adjust the older values backwards using their period-on-period growth rates.

Note that level-shifts are not always straightforward to detect, especially in historical data. However, we could usually infer the nature of such shifts by reading the meta data and table footnotes in historical documents. The identification of shifts was thus entirely done by reading data descriptions and is not based on econometric tests to keep the number of adjustments as small as possible.

Another challenge is that individual jump-corrected sectoral time series no longer add up to match aggregates. For example, after adjusting a break in total private credit and household credit, the sum of household and corporate credit will no longer add up to total private credit. To address this, we re-scale all break-adjusted series to match the next available aggregate, a process that the United Nations' suggested guidelines for backcasting national accounts data call "rebalancing" (United Nations, 2018). Consider, for example, a country where manufacturing exhibits a level-shift that is adjusted using overlapping data. After this adjustment, the sum of manufacturing and other industries no longer adds up to total firm credit. To remedy this, we first calculate the sum of the individual break-adjusted industry-level time series, and then multiply the share of each sector with

total break-adjusted firm credit. In practice, these adjustments only make a minor difference to the individual data points, but they guarantee internal consistency in the data by construction.

Adjusting Discrepancies Between National Data Sources   Surveys on the detailed breakdown of credit by industries at times do not directly correspond to broader classifications such as "non-financial institutions". The reason is that some economic activities, in particular agriculture, are often undertaken by sole proprietors, which are included in household credit. There may further be differences in the compilation of the statistics, e.g. due to difference in supervisory disclosure requirements or financial instruments, which result in slight discrepancies.[31]   None of these discrepancies were large or irreconcilable and the classification was undertaken in accordance with information from the national authorities. As shown in the respective country tables, the sum of the industrial sectors in the raw data is always equivalent or close to the aggregate data on "non-financial corporations", or the sum of "non-financial corporations" and "non-bank financial corporations" (depending on the survey).

To illustrate the issue, Figure C.6 shows a comparison of credit data reported separately by broad institutional sectors and detailed industries for Denmark, kindly provided by the Danish *National-banken*. The raw data here are a typical example of how a few noteworthy deviations between surveys on detailed sub-sectors (left) and broad sectors (right) can arise (note that, overall, this is rather rare). In particular, total corporate credit is not equal to sum of the industry sub-sectors, because the latter do not differentiate between non-financial corporations and sole proprietorships in classifying industrial activity. The table also shows how the sub-sector "Employees, etc." (DKK 410,936) refers only to a fraction of total household credit, the residual of which is made up by lending to sole proprietorships.

In cases such as the Danish example, we usually adjusted the underlying industry-level values by calculating their share in the manual sum of all industries and multiplied it with the broader sectoral values for non-financial corporate credit. This makes sure that the classification of corporations versus households remains comparable, while at the same time retaining a reasonable reflection of the industry exposures of the financial system, irrespective of an industry's typical legal form of organization. In many cases, we received additional guidance from the national authorities in how to best achieve comparability with other countries and followed their advice. As mentioned above, we document all such adjustments in great detail in the Excel file and further provide the unadjusted raw data for robustness checks. We aim to improve our estimates in the future.

Adjusting Sector Classifications Over Time   In many countries, older publications or historical files use different sectoral classifications than the most recent data. It is thus necessary to adjust for these changes over time to arrive at consistent time series. Such differences broadly fall into two categories: changes in classification between different versions of ISIC (often from Rev. 3.1 to Rev. 4) or changes where at least one source did not follow ISIC classification.

Changes across ISIC Versions   Where the data were classified according to an older version of ISIC, it was usually straightforward to assign values to the ISIC Rev. 4 categories. We used the

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[31]The Bank of England has two excellent publications outlining how such differences can arise (Bank of England, 2012, 2017).

conversion tables available from the United Nations' statistics division to adjust tables using older revisions.[32] Two issues demand further explanation.

First, many countries adapt ISIC classifications in line with national requirements, and the resulting (sub-)categories may differ slightly from the United Nations recommendation. Where it was the case, e.g., for the General Industrial Classification of Economic Activities within the European Communities (NACE), the differences were of minor importance at the 2-digit level, and documents of the national authorities were consulted to resolve any remaining issues.

Figure C.6: Discrepancies between Broad and Detailed Sector Classification – The Case of Denmark

DNPUDDKB - Lending to Activities for Danish residents	2015M07	million DKK	2015M07	DNPUD - Lending to sectors - ONLY Danish residents
All industries in total	1,357,346		1,357,346	X000: All sectors domestic and foreign
Agriculture, forestry and fishing	74,125	371,157	331,939	- X100: Non-financial corporations
Mining and quarrying	497		241,363	- - X2aa: Monetary Financial Institutions (MFI)
Manufacturing	58,624	462,630	167,669	- - X2bb: Other financial institutions excl. insurance corp. and pension funds
Electricity, gas, steam and air conditioning supply	13,443		53,688	- - X2cc: Insurance corporations and pension funds
Water supply; sewerage, waste management and remediation activities	2,465	37,620	36,468	- X300: General government
Construction	20,304	75,002	112,216	- - X410: Households - sole proprietors and unincorporated partnerships
Wholesale and retail trade; repair of motor vehicles and motorcycles	64,744	410,936	410,330	- - X430: Households - employees, etc.
Transportation and storage	21,148		3,673	- X500: Non-profit institutions serving households
Accommodation and food service activities	7,288			
Information and communication	6,889			
Financial and insurance activities	462,630			
Real estate activities	107,867			
Professional, scientific and technical activities	28,713			
Administrative and support service activities	20,430			
Public administration, defence; compulsory social security	37,618			
Education	2,957			
Human health and social work activities	6,851			
Arts, entertainment and recreation	2,718			
Other service activities	6,219			
Activities of households as employers; undifferentiated goods- and servi	877			
Activities of extraterritorial organisations and bodies	2			
Employees, etc.	410,936			

Note: The screenshot shows how different modes of data compilation can lead to discrepancies between broad sectoral and more detailed non-financial corporate credit classifications. Note, in particular, the different total values of total non-financial corporate credit and the sum of the sub-sectors (DKK 331,939 and DKK 371,157, respectively), despite the same total credit values for both surveys (DKK 1,357,346). The table also shows how the sub-sector "Employees, etc." (DKK 410,936) refers only to a (albeit large) fraction of total household credit, which also includes lending to sole proprietorships.

Second, ISIC Rev. 4 introduced two entirely new sections—"Water supply; sewerage, waste management and remediation activities" (E) and "Information and communication" (J)—and split up "Real estate, renting and business activities" into "Real estate" (L), "Professional, scientific and technical activities" (M), and "Administrative and support service activities" (N). Since many of the re-classifications are on the detailed division or group levels, some discretion had to be used to assign values to the most appropriate categories. We took a conservative approach and assigned only time series where the divisions were relatively clean. Where it was not possible, we calculated the sum of multiple divisions and assigned it to the broader sections, again documenting the original time series used in the country table.

Changes across Non-ISIC Classifications   Where the raw data was not compiled in accordance with the ISIC classification, adjustments across time were done in accordance with notes in the

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[32]See https://unstats.un.org/unsd/classifications/Econ/ISIC.cshtml for more details on the ISIC classification and conversion tables.

original statistical publications and with the help of the country authorities. The description and documentation of the original data in footnotes or additional documents usually provided a clear picture of the sectors captured. For example, the time series "Kuljetus, varastointi ja tietoliikenne" ("Transport, storage and communications") for Finland starting in 1958 was assigned to the ISIC Rev. 4 sections "Transportation and storage" (H) and "Information and communication" (J).

Miscellaneous Issues For Cross-Country Harmonization   The possibly most challenging aspect of the data adjustment process was to make the sectoral values comparable across countries. Luckily, the industrial classification used for credit market surveys is remarkably similar across countries, even where it does not strictly follow the ISIC scheme.

As for all other adjustments to the raw data, we refrained from using unclear classifications. An example for such ambiguity would be a time series with descriptions like "Services", where they do not clearly specify details, documentations are not available or unclear, and national authorities did not respond to email inquiries. In such cases, we assigned the values as "Activity not stated" (Z). Where other service sectors were specified—i.e. electricity, gas, and water supply (D and E), trade (G), transport (H), information and communication (J), accommodation and food services (I), and non-bank finance (K)—it was sometimes possible to classify such time series as the sum of the sections L to S (business, government, social, and personal services).[33]

Despite the widespread adoption of the ISIC classification, some countries use different categories for reports on credit to industrial sectors. One of the issues, the treatment of credit to general or local governments, has already been mentioned in section **??**. Other issues include series descriptions whose meaning is fairly straightforward but not directly specified in the ISIC scheme. For example, in the case of Germany, ISIC section E ("Water supply; sewerage, waste management and remediation activities") was largely bundled together with agricultural activities (A) in the series "Agriculture, forestry, and water regulation and supply" before 1968. However, there is an additional category of "Public utilities" in the raw data. Since mining and quarrying is captured in yet another series ("Mining"), and transport and communication classified under "Others", "Public utilities" mostly refers to the provision of electricity and gas. It is thus assigned to ISIC section D. Such detailed information on the sectoral classifications were obtained from footnotes or additional documentation documents. We hope these examples illustrate the significant care and resources we invested in making the time series comparable across countries and time.

Data Revisions   Data revisions may contain information about data quality and further matter for users interested in forecasting/nowcasting exercises using the sectoral credit data. Overall, data revisions are a relatively minor issue for sectoral credit data, and mainly arise from institutions dropping out of the sample or other changes in classification. Most data we retrieved are not revised at all, and data based on supervisory returns are almost never revised.

The statistical data in some source publications, e.g., the historical data for Austria and Greece, are revised with a one period lag, possibly in line with the audit of individual institutions. To circumvent the issue, we always retrieved and copied the data in reverse chronological order, starting with the newest available. Where revisions play a role, the database should in principle reflect the most current values.

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[33]Note that public administration (section O) only makes up a tiny fraction of total credit in most countries.

C.5   Comparability With Other Sources

We cross-checked the data with six major sources of credit data: (1) the World Bank Global Financial Development Database (Cihák et al., 2013), (2) the IMF's Global Debt Database (GDD), (3) the IMF's International Financial Statistics (IFS) data on total private credit, (4) historical IMF IFS volumes by Monnet and Puy (2019), (5) the BIS long series on credit to the private sector (Dembiermont et al., 2013), and (6) the Macrohistory Database assembled by Jordà et al. (2016a). Where we detected significant discrepancies, we inquired about them with the national authorities. In this section, we show that the aggregates in our data closely track these other sources.
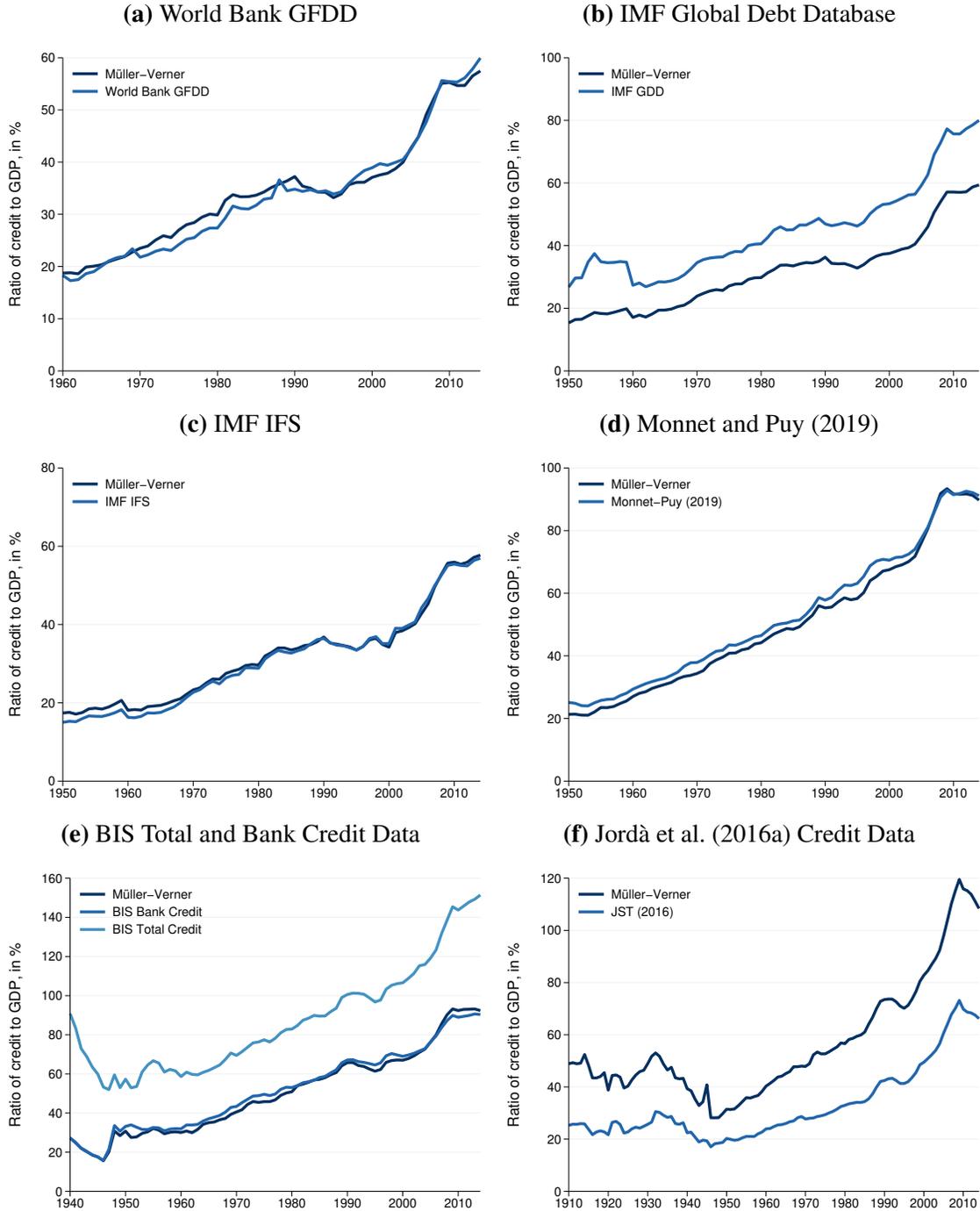
C.5.1   Discussion of Existing Data Sources

In Table 1 of the paper, we already plotted the coverage of existing sources on credit market data as well as our database. Before comparing the six alternative resources with the newly compiled data, it is important to highlight important classification differences. Apart from differences in the available countries, sectors, and time periods, they also differ in their coverage of lending institutions. Jordà et al. (2016a) largely capture bank credit. The World Bank's Global Financial Development Database (Cihák et al., 2013) and the BIS data on credit to the private sector (Dembiermont et al., 2013) include multiple time series for banks and total credit by all financial institutions. The recent IMF Global Debt Database also reports multiple series, but always include loans and debt securities. The IMF's International Financial Statistics and Monnet and Puy (2019) capture total private credit, which often only includes commercial banks. It is important to keep these different classification regimes in mind when comparing the data.

C.5.2   Comparing Total Credit Values

Due to the different sample composition highlighted above, we compare the total credit values in our database separately against each of the six sources mentioned above

Figure C.7a starts by plotting our data side-by-side with the total values on credit to the private sector from the World Bank's Global Financial Development database starting from 1960, when the World Bank data become available. The sample here are 180 countries for which there is data for both sources. The graph shows that our series closely tracks the World Bank data throughout, both in terms of its trend and overall level of credit as a percentage of GDP.

Figure C.7: Comparison of Total Credit with Six Other Sources

(a) World Bank GFDD

(b) IMF Global Debt Database

(c) IMF IFS

(d) Monnet and Puy (2019)

(e) BIS Total and Bank Credit Data

(f) Jordà et al. (2016a) Credit Data

Panel (a) sample: 180 countries in our dataset and the World Bank's Global Financial Development Database, 1960-2014. Panel (b) sample: 158 countries in our dataset and the International Monetary Fund's Global Debt Database, 1950-2014. Panel (c) sample: 184 countries in our dataset and the IMF's International Financial Statistics, 1948-2014. Panel (d) sample: 45 countries in our dataset and the IMF data digitized and harmonized by Monnet and Puy (2019), 1950-2014. Panel (e) sample: 43 countries in our dataset and the BIS private credit data, 1940-2014. Panel (f) sample: 18 countries in our dataset and the Jordà et al. (2016a) data on private credit, 1940-2014.
Notes: Average ratio of total private credit to GDP (unweighted). IFS variables in panel (a) are *FOSAOP* and *22D* (Claims on Private Sector).

The recently introduced IMF Global Debt Database features perhaps the broadest cross-country credit dataset that singles out lending to firms and households. Figure C.7b shows that the broader coverage of lending institutions yields higher ratios of credit to GDP in their dataset in a sample of 158 overlapping countries, but the overall *trend* in total credit is similar to that in our data.

An early attempt at constructing data on private credit are the IMF's International Financial Statistics (IFS). Figure C.7c compares this data source with our data and shows that the overlapping values are highly similar. Monnet and Puy (2019) recently digitized and harmonized some of the older credit data for from the print volumes of the International Financial Statistics. Figure C.7d shows that the data track each other almost one-to-one in the overlapping sample of 45 countries.

Next, we compare our dataset with the data compiled by the BIS (Dembiermont et al., 2013). Figure C.7e plots the average values for a sample of 43 countries for which the BIS total bank credit series is available (note that the BIS data on bank credit also includes lending by other MFIs). Again, we can see that this time series closely tracks the aggregate credit in our data. It is also instructive to further compare the data with the BIS time series on "total credit", which is supposed to capture total credit in the economy coming from all sources. We can see that this series closely follows the *trend* of the other values, but at a considerably higher level.

As a last exercise, we compare our data with the values compiled in the "Jordà-Schularick-Taylor Macrohistory Database" (Jordà et al., 2016a). Again, we restrict the sample to the overlapping country-years in both data sources and plot the result in Figure C.7f. For the 18 overlapping countries, the picture is reassuringly very similar to the other data sources. However, our data suggest higher credit to GDP ratios, which is likely because we capture lending by all monetary financial institutions in most countries, while Jordà et al. (2016a) largely only consider bank credit.

Overall, our new credit data closely track other existing sources. For the sources that use a similar coverage of lending institutions, the deviations are marginal; for those with a different lender coverage, the gap with our data is constant over time, suggesting similar trends. A natural interpretation of the sectoral data we have compiled is thus that it represents the underlying sectoral structure of the already known and widely used credit aggregates, plus further extended historical data on total private credit.

C.5.3 Comparing Household Credit Values

The previous section suggests that our new credit dataset essentially provides a sectoral breakdown of the total private credit known from other sources, while also adding additional data on total outstanding credit. In this section, we provide additional evidence that our data is also highly similar to data on household credit put together by the BIS and the IMF Global Debt Database.

Figure C.8a shows the evolution of BIS household credit and the newly compiled data over time in a sample of 43 countries. Note that these series have substantially different creditor coverage: as we could see above in Figure C.7e, the total volumes of our data almost perfectly track the BIS data on *bank* credit, while *total* credit is substantially higher. Despite these differences, the two series follow highly similar trends over time and exhibit the same patterns. Figure C.8b compares our new data with the IMF Global Debt Database on outstanding household credit scaled over GDP. This exercise is based on an overlapping sample of 83 countries. Given the slightly broader coverage in the IMF GDD data, it is unsurprising that their values are slightly higher. Apart from this minor difference, the trends of the series track each other closely.

Figure C.8: Comparison with BIS and IMF GDD Household Credit Data

(a) BIS Data

(b) IMF Global Debt Database
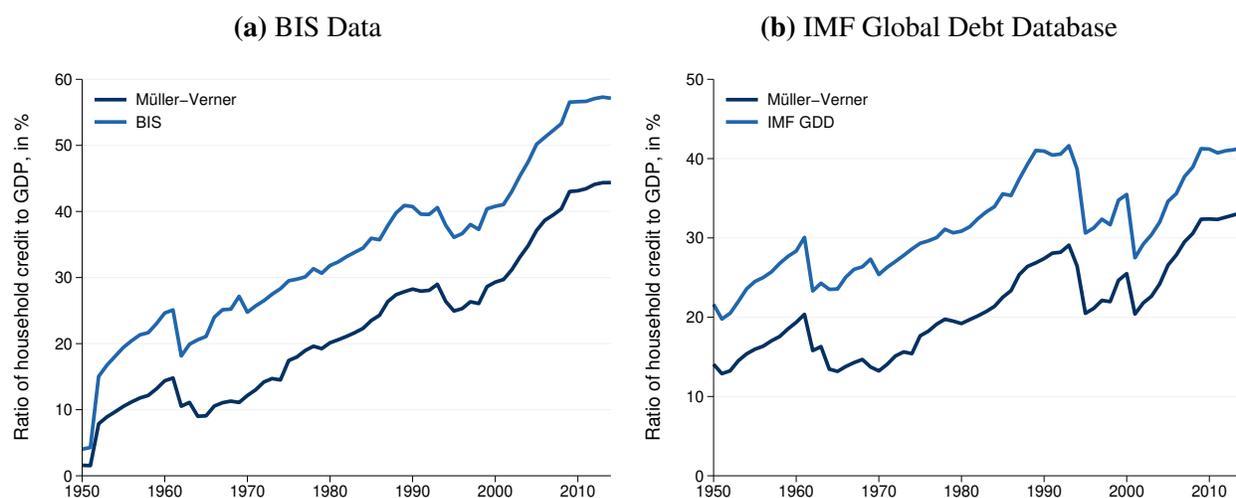
Sample: In panel (a), 43 countries in our dataset and the BIS data on credit to the non-financial private sector, 1950-2014. In panel (b), 83 countries in our dataset and the International Monetary Fund's Global Debt Database, 1950-2014. Notes: Average ratio of total private credit to GDP (unweighted).

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