

# What Determines Financial Development? Bayesian Model Averaging Evidence

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# Outline

- Motivation
- Data
- Bayesian Model Averaging
- Regression Results
- Robustness Checks
- Conclusions

# What This Paper Does and Finds

- Examines the determinants of financial development
  - Global sample
  - Bayesian model averaging
  - Nearly 40 determinants of financial development
- 7 different measures of financial development
  - Depth, Efficiency, Stability, Access
- Rule of law and economic development most important
- Wealth inequality associated with stock market development
- Financial regulations matter for stability and efficiency

# Motivation

- Vast differences in financial development across countries
- Determinants of financial development
  - Financial and trade openness (Rajan and Zingales, 2003)
  - Social capital (Guiso et al., 2004)
  - Legal protection of creditors and shareholders (La Porta et al., 1998)
  - Political stability (Rajan and Zingales, 2003)
  - Rule of law (Beck et al., 2003)
  - Capital controls (Chinn and Ito, 2006)
  - Inequality? (Kumhof et al., 2015, Degryse et al., 2017)
- Which factors matter the most?

# Data

- Dependent variables: 7 measures of financial development
- 36 explanatory variables
  - Economic, financial, institutional, political, regulatory, geographical, religious, education and inequality variables
- 80 countries
- Dependent variable as of time  $t$ , average 2009-2013
- Explanatory variables as of time  $t-i$ , where  $i > 0$ , prior 2009

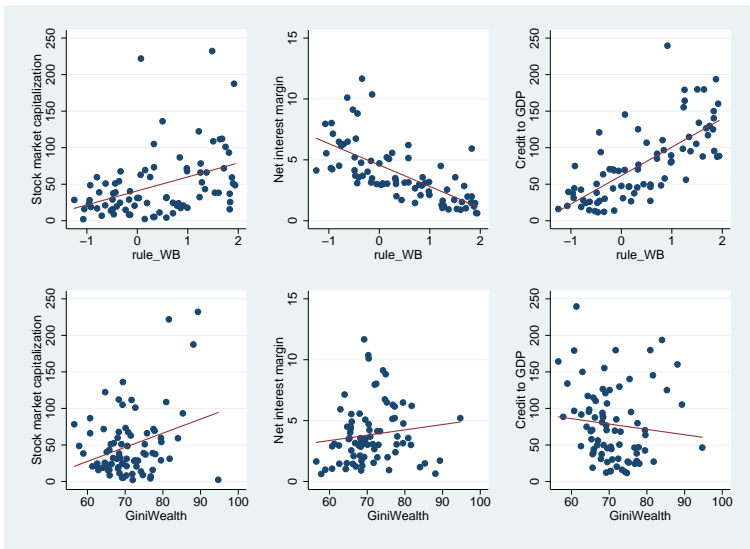
# Dependent variable

- 7 measures of financial development - multidimensionality of financial systems
  - Private sector credit to GDP: a measure of the depth of the banking sector
  - Stock market capitalization to GDP: a measure of the depth of stock markets
  - Stock Market Total Value Traded to GDP: a measure of the depth of stock markets
  - Net interest margin: a measure of the efficiency of the banking sector
  - Stock market turnover ratio: a measure of the efficiency of stock markets
  - Bank Z-score: a measure of the stability of the banking sector
  - ATM Machines: a measure of the access to finance

# Measures of Financial Development: Correlations

	Capital.	St. traded	St. turn.	ATMs	Credit	NIM	Z-score
Stock capital.	1						
Stocks traded	0.67	1					
Stock turnover	0.21	0.65	1				
ATMs	0.28	0.56	0.42	1			
Credit to GDP	0.47	0.57	0.36	0.56	1		
NIM	-0.36	-0.41	-0.33	-0.46	-0.63	1	
Z-score	0.36	0.25	0.11	0.05	0.1	-0.22	1

# Finance, Rule of Law and Wealth Inequality





# Explanatory variables

## ● Economics

- Log GDP, Non-equipment investment, Size of the labour force, Ratio of workers to population, Equipment investment, Outward orientation

## ● Politics and Institutions

- Rule of law, Political rights, Civil liberties, Number of war years, Revolutions and coups

## ● Inequality

- Wealth Inequality, Income Inequality

## ● Regulations

- Diversification index, Capital regulatory index, Financial conglomerates restrictiveness, Chinn-Ito index, Black market premium

## ● Religion

- Fraction: Hindu, Buddhist, Protestant, Jewish, Catholic, Muslim, Orthodox

## ● Geography and History

- Landlocked dummy, Sub-Sahara dummy, Area, British colony dummy, French colony dummy

## ● Other

- Ethnolinguistic fractionalization, Population growth, Primary education, Secondary education, Tertiary education, Life expectancy

# Bayesian Model Averaging

- Competing theories of financial development  $\Rightarrow$   
Regression model uncertainty  $\Rightarrow$  Bayesian model averaging
- Importance of various theories tested jointly within a unifying framework
- Well-established framework in the empirical growth regressions to address omitted variable bias and outliers

# Bayesian Model Averaging

$$y = \alpha + X\beta + \varepsilon \quad \varepsilon \sim N(0, \sigma^2 I) \quad (1)$$

- $y$  - measure of financial development,  $\alpha$  - constant,  $X$  - explanatory variables,  $\beta$  - coefficients, and  $\varepsilon$  - vector of normally distributed IID error terms with variance  $\sigma^2$ .
- Intuition: BMA considers all possible combinations of  $X$  from equation 1 and takes a weighted average of the coefficients
  - MC<sup>3</sup> sampler to approximate the crucial part of the posterior model distribution containing the most likely models

# Bayesian Model Averaging: Remarks

- Prior structure
  - Baseline: hyper-g parameter prior and uniform model prior (Feldkircher and Zeugner, 2012)
- BMA provides **posterior inclusion probability** (PIP), which gives the probability that explanatory variable should be included in the 'true' model of financial development
- Birth-death MC3 sampler to approximate the PMP distribution, 5 million iterations with 1 million initial burn-ins for the convergence of sampler

# Results

- The Determinants of
  - Financial Depth
  - Efficiency of Financial Intermediaries
  - Access to Finance
  - Financial Stability

# Financial Depth

## The Determinants of Stock Market Capitalization to GDP

	PIP	Post Mean	Post SD
Rule of law	1.00	25.35841	6.99792
Log GDP	1.00	7.67166	2.53851
British colony dummy	0.99	22.02539	8.98886
Wealth Inequality	0.99	1.47428	0.60249
Non-equipment investment	0.95	2.85978	1.42078
Size of the labour force	0.95	-0.00000	0.00000
Civil liberties	0.90	11.23297	5.95356
Ethnolinguistic fractionalization	0.84	22.96285	16.34634
Outward orientation	0.79	0.98702	0.77587
Income Inequality	0.76	0.75625	0.63283

## Financial Depth (II)

### The Determinants of Stock Market Total Value Traded to GDP

	PIP	Post Mean	Post SD
Log GDP	1.00	12.97662	1.91247
Rule of Law	1.00	15.86420	5.44725
Wealth Inequality	0.85	0.77531	0.49481
Fraction Catholic	0.72	-0.15280	0.12365
Tertiary education	0.67	1.23622	1.11844
Ratio of workers to population	0.51	0.31253	0.38441

# Financial Depth (III)

## The Determinants of Private Credit to GDP

	PIP	Post Mean	Post SD
<b>Rule of Law</b>	1.00	34.40369	5.92648
Fraction Orthodox	0.91	0.52698	0.28097
Ratio of workers to population	0.43	0.34445	0.49655
<b>Log GDP</b>	0.42	1.86484	2.66959



# Financial Depth - Results summary

- Rule of law and economic development main determinants of financial depth
- Stock markets more developed in countries with greater wealth and income inequality, but inequality irrelevant for banking sector development
  - Turner and Zhan (2012) and Degryse et al. (2017): limited voting rights, wealth inequality and stock market development positively associated with each other

# Efficiency of Financial Intermediaries

## The Determinants of Bank Net Interest Margin

	PIP	Post Mean	Post SD
<b>Rule of Law</b>	1.00	-1.59973	0.27000
British colony dummy	1.00	1.21570	0.39903
Sub-Sahara dummy	0.95	1.84333	0.76485
Ethnolinguistic fractionalization	0.95	-1.75390	0.76173
Ratio of workers to population	0.92	0.04830	0.02407
Fraction Protestant	0.51	0.00814	0.01016

# Efficiency of Financial Intermediaries (II)

## The Determinants of Stock Market Turnover Ratio

	PIP	Post Mean	Post SD
<b>Log GDP</b>	1.00	13.54549	3.29549
British colony dummy	1.00	-42.34344	11.57984
Sub-Sahara dummy	1.00	52.14916	18.80614
<b>Rule of Law</b>	1.00	25.01907	7.50697
Fin. conglomerates restrictiveness	0.97	7.64876	3.49957
Income inequality	0.97	1.51641	0.74475
Fraction Catholic	0.92	-0.32712	0.16743
Outward orientation	0.89	-1.53431	0.95219
Capital regulatory index	0.76	-4.24452	3.56762
Size of the labour force	0.75	0.00000	0.00000

# Efficiency of Financial Intermediaries - Results summary

- Rule of law matters both for bank efficiency and stock market efficiency
- Financial market regulations matter for stock market efficiency
  - Greater restrictiveness on forming financial conglomerates conducive for stock market efficiency
    - Financial markets value financial conglomerates less in comparison to specialized fin. intermediaries (Laeven and Levine, 2007)
  - Greater stringency in capital requirements associated with lower stock market efficiency

# Access to Finance

## The Determinants of ATMs per 100,000 Adults

	PIP	Post Mean	Post SD
<b>Log GDP</b>	1.00	8.65329	2.88759
Area	0.97	0.00001	0.00000
Size of the labour force	0.92	-0.00000	0.00000
Tertiary education	0.89	2.06473	1.23959
Non-equipment investment	0.77	2.31148	1.78380
Number of war years	0.49	-0.77511	1.02352

# Financial Stability

## The Determinants of Bank Z-Score

	PIP	Post Mean	Post SD
French colony dummy	1.00	5.92283	2.40671
Ratio of workers to population	1.00	-0.20721	0.08193
Population growth	0.98	2.79672	1.14880
Size of the labour force	0.97	0.00000	0.00000
Fin. conglomerates restrictiveness	0.93	-0.95709	0.57221
Sub-Sahara dummy	0.71	-3.15695	3.01853
British colony dummy	0.69	1.87665	1.85436
Fraction Orthodox	0.66	-0.04122	0.04377
Rule of Law	0.62	1.22561	1.34357
Fraction Jewish	0.58	0.06279	0.07729
Non-equipment investment	0.55	0.21560	0.26716

# Access and Stability - Results summary

- Economic development matters for access to finance
- ATMs - access to finance, technological advancement or quality of financial services
- Greater restrictiveness on forming financial conglomerates conducive for efficiency but not for financial stability
- Rule of law relevant for financial stability

# Robustness checks

- Different prior structure
  - UIP prior
  - Collinear dilution prior
  - Strong heredity principle when interaction and quadratic terms of regressors included
  - Random beta-binomial model prior
- Different sampler: birth-death, reverse jump



# Conclusions

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# Conclusions

Thank you for your attention!

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