

Determinants of Financial Crises 1880-1913

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Model Uncertainty

Model uncertainty present in much empirical economic research

- ▶ theory uncertainty: “open-endedness”
- ▶ specification uncertainty
- ▶ data issues

Ignore model uncertainty?

- ▶ biased estimation, misleading inference and prediction

Goal: robust inference, prediction and policy evaluation

Benchmark Model Averaging

1. Linear regression model with K candidate regressors:

$$\mathbf{y} = \mathbf{x}_1\beta_1 + \mathbf{x}_2\beta_2 + \dots + \mathbf{x}_k\beta_k + \varepsilon \quad (1)$$

2. Posterior (unconditional) distribution of parameter β

$$p(\beta|\mathbf{y}) = \sum_{j=1}^{2^K} p(\beta|\mathbf{y}, M_j) \cdot p(M_j|\mathbf{y}) \quad (2)$$

3. Posterior model probability proportional to marginal likelihood \times prior model probability:

$$p(M_j|\mathbf{y}) \propto l(\mathbf{y}|M_j) \cdot p(M_j)$$

Prior Structure

- ▶ Assume diffuse priors for parameters common across models (intercept, error variance σ)
- ▶ For slope parameter β assume “sample-dominated” prior information with proper Normal-Gamma prior (Leamer 1978, SDM 2004)
- ▶ Posterior model weight of M_j relative to all 2^K possible models

$$p(M_j|\mathbf{D}) = \frac{p(M_j) \cdot T^{-k_j/2} \cdot SSE_j^{-T/2}}{\sum_{i=1}^{2^K} p(M_i) \cdot T^{-k_i/2} \cdot SSE_i^{-T/2}} \quad (3)$$

- ▶ Prior \times Schwarz model selection criterion (BIC)
- ▶ intuition: penalize adding regressors k_j and large sum of squared errors $SSE_j \equiv (\mathbf{y} - \mathbf{X}\beta)'(\mathbf{y} - \mathbf{X}\beta)$ in model M_j .

Posterior Objects of Interest

Posterior mean, variance and inclusion probability for \mathbf{x}_i :

$$E(\beta_i|\mathbf{y}) = \sum_{j=1}^{2^K} p(M_j|\mathbf{y}) \cdot \hat{\beta}_{ij} \quad (4)$$

$$V(\beta_i|\mathbf{y}) = \sum_{j=1}^{2^K} p(M_j|\mathbf{y}) \cdot V(\beta_i|\mathbf{y}, M_j) + \sum_{j=1}^{2^K} p(M_j|\mathbf{y}) \cdot \left[\hat{\beta}_{ij} - E(\beta_i|\mathbf{y}) \right]^2 \quad (5)$$

$$p(i|\mathbf{y}) = \sum_{j=1}^{2^K} \mathbf{1}(\gamma_i = 1|\mathbf{y}, M_j) \cdot p(M_j|\mathbf{y}) \quad (6)$$

Historical Data

Bordo and Meissner database:

- ▶ 1880-1913 period: nearly 30 countries (both advanced and emerging)
- ▶ 1972-1997 period: over 40 countries for post-Bretton Woods
- ▶ dependent variables are measures of financial crisis (definition next slide)
- ▶ candidate determinants of financial crises $K = 23$

Definition of Financial Crises

Episodes of financial-market volatility marked by significant problems of illiquidity and insolvency of financial market participants and/or by official intervention to contain such consequences.

1. **Debt crises**: identify periods of six months or more with all or part of interest/principal payments were suspended, reduced or rescheduled
2. **Currency crises**: observe forced change in parity, abandonment of exchange rate peg, exchange rate exceeding critical value of exchange market pressure or international rescue
3. **Banking crises**: observe financial distress resulting in erosion of most or all of aggregate banking system capital
4. **Twin crises**: combination of currency and banking crises

Candidate Determinants of Financial Crises

1880-1913

Original Sin =

$(\text{gold} + \text{for. curr. debt}) / \text{Tot. Public debt}$

Market spread over UK consols

Gold Standard dummy

Trade balance / GDP

Money supply growth

Central Bank indicator

Periphery indicator

Market portfolio spread

War dummy

Debt / Revenue

Debt / Revenue \times Periphery indicator

Mismatch =

$(\text{Intl. reserves} - \text{for. curr. debt}) / \text{Exports}$

Gold reserves / Notes outstanding

Terms of trade growth

Original sin squared

Default history (0-7)

Default indicator pre 1880

$(\text{Debt} / \text{Revenue}) \times \text{pre-1880 default}$

RER Deviation from Country Average

Original Sin \times RER

Latin America dummy

Europe core dummy

Europe periphery dummy

Robust Determinants of Debt Crises (FE)

Variable	$\rho(i \mathbf{y})$	$E(\beta_i \mathbf{y})$	$s.d(\beta_i \mathbf{y})$	$\beta_i/s_i \mathbf{y}$
UK consol spread	1.00	0.334	0.044	7.64
Periphery	1.00	0.370	0.044	8.35
Gold standard	0.86	-0.154	0.043	-3.59
Central Bank	0.85	-0.175	0.047	-3.73
Market spread	0.83	0.171	0.048	3.57
Original sin*	<i>0.10</i>	-0.092	0.047	-1.96

(*) not robust with OLS estimation.

Robust Determinants of Currency Crises (FE)

Variable	$\rho(i \mathbf{y})$	$E(\beta_i \mathbf{y})$	$s.d(\beta_i \mathbf{y})$	$\beta_i/s_i \mathbf{y}$
Trade balance / GDP	1.00	0.372	0.051	7.29
Original sin	1.00	0.235	0.048	4.87
UK consol spread	0.84	-0.160	0.047	-3.41
Gold standard	0.83	-0.161	0.048	-3.37
Central bank	0.44	0.136	0.050	2.71
Money growth	0.37	0.118	0.044	2.69
Gold reserves	0.19	-0.148	0.064	-2.30
Periphery	0.11	0.095	0.048	2.00

Robust Determinants of Currency Crises (OLS)

Variable	$\rho(i \mathbf{y})$	$E(\beta_i \mathbf{y})$	$s.d(\beta_i \mathbf{y})$	$\beta_i/s_i \mathbf{y}$
Money growth	1.00	0.372	0.053	7.03
Original sin	0.96	-0.197	0.050	-3.96
Trade balance / GDP	0.65	-0.180	0.060	-3.00
Central bank	0.32	0.158	0.057	2.76
Terms of trade growth	0.17	-0.185	0.079	-2.36
UK consol spread	0.14	0.118	0.052	2.26
Periphery	0.13	0.137	0.063	2.18
Mismatch	0.11	-0.150	0.071	-2.11

Robust Determinants of Banking Crises (FE)

Variable	$\rho(i \mathbf{y})$	$E(\beta_i \mathbf{y})$	$s.d(\beta_i \mathbf{y})$	$\beta_i/s_i \mathbf{y}$
Trade balance / GDP	1.00	0.372	0.051	7.29
Original sin*	1.00	0.235	0.048	4.87
UK consol spread*	0.84	-0.160	0.047	-3.41
Gold standard	0.83	-0.161	0.048	-3.37
Central bank	0.44	0.136	0.050	2.71
Money growth*	0.37	0.118	0.044	2.69
Gold reserves*	0.19	-0.148	0.064	-2.30
Periphery*	0.11	0.095	0.048	2.00
Debt/Revenue \times Per.**	0.11	-0.169	0.071	-2.38

(*) not robust with OLS estimation (**) robust with OLS, but not robust with FE estimation

Robust Determinants of Twin Crises (FE)

Variable	$\rho(i \mathbf{y})$	$E(\beta_i \mathbf{y})$	$s.d(\beta_i \mathbf{y})$	$\beta_i/s_i \mathbf{y}$
Original sin	1.00	0.389	0.039	9.88
Central bank	1.00	0.333	0.040	8.41
UK consol spread	1.00	-0.217	0.042	-5.19
Money growth	0.99	-0.179	0.040	-4.46
Periphery	0.99	0.189	0.044	4.26
Original sin squared	0.15	-0.129	0.059	-2.19
Trade balance**	0.19	0.109	0.049	2.23

(**) robust with OLS, but not robust with FE estimation

Next Steps

- ▶ Extend list of explanatory variables and time periods (post Bretton-Woods)
- ▶ Probit estimation of determinants of financial crises incidence
- ▶ Tobit estimation of determinants of subsequent crises severity
- ▶ Predictive likelihood to assess predictive performance