Corporate Debt Restructuring, Bank Competition and Stability: Evidence from India

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Outline

Bankruptcy in India

No unified bankruptcy code in India

- On average, it takes 4.3 years (World Bank).
- Twice as in China
- Banks can only recover 25.7 cents/Dollar.
- Kingfisher grounded in 2012 with debts of $1.5 billion.

What is Corporate Debt Restructuring (CDR) Programme?

CDR

- CDR is an efficient out-of-court institutional mechanism for banks/FIs to restructure corporate debts of Rs.100 million and above in multiple-banking accounts.
- It is three-tiered mechanism with a standing forum, empowered group and the CDR cell.

Regulatory forbearance on asset classification and provisioning

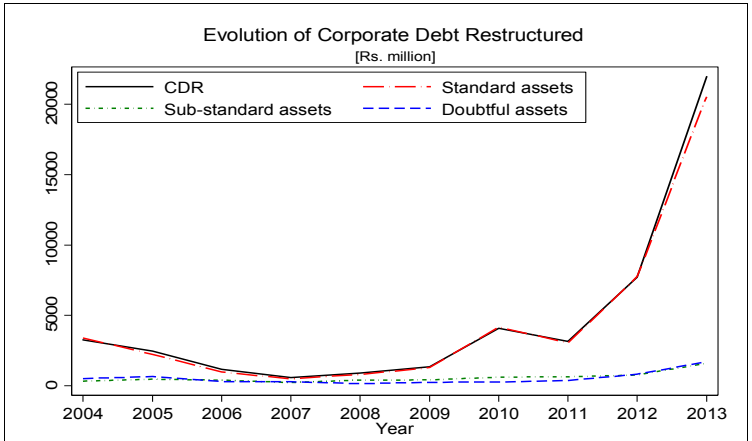
- Banks were allowed to make concessional provision of 2% on any restructured standard assets (Working Group, 2012).
- CDR is a conduit for bankers to hide NPLs to hike profitability.

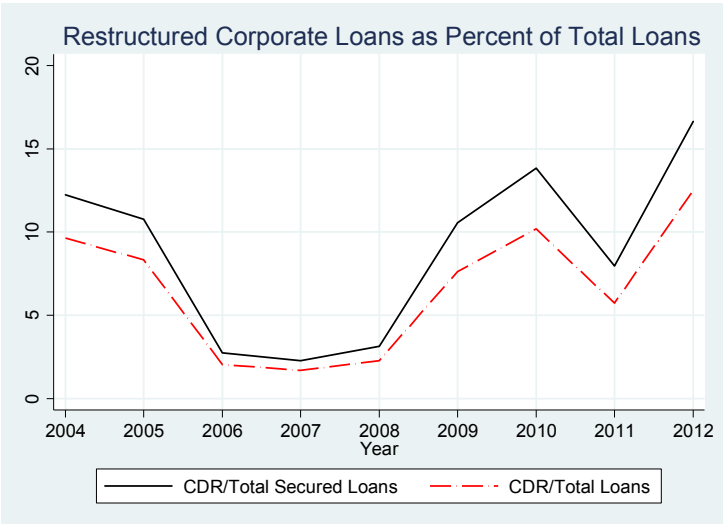
More on CDR

Evolution of restructured corporate debt

The taming of the restructuring

- On November 2012, RBI raised provision on restructured loans to 2.75% from just 2% previously.
- Provision on any new restructured standard loan is 5% from June 1, 2013.





Bank competition-stability relationship

Market power-stability hypothesis

- More concentrated and less competitive banking systems are more stable (Keeley, 1990; Casu, Girardone and Molyneux, 2012; Liu, Molyneux and Wilson, 2013; Fu, Lin and Molyneux, 2014)
- More profits provide a buffer against fragility and provide incentives against excessive risk taking.

Competition-stability hypothesis

- Greater competition contributes to sustain stability in the banking market (Boyd and De Nicolo, 2005)
- Higher market power of banks increases the borrowing cost of entrepreneurs, who eventually likely to default on their loan.

The existing studies on Indian banking sector

Bank ownership and efficiency studies

- Given the heterogeneous bank sizes and mixed ownership groups, most of the Indian studies explored either the link between ownership structure and performances (e.g., Sarkar et al., 1998; Bhaumik and Dimova, 2004) or the bank efficiency gap among the public, private and foreign banks (e.g., Das and Kumbhakar, 2012; Casu, Ferrari and Zhao, 2013)

Legal reforms and institutional mechanism to curtail credit risk

- Taking the Debt Recovery Tribunals Act of 1993, Visaria (2009) shows that the establishment of these tribunals led to a significant reduction in both delinquency rates and the cost of loans.
- Following a securitization reform in India, that is, the SARFAESI Act of 2002, Vig (2013) shows that strengthening of creditor rights led to a reduction in secured debt, total debt, debt maturity, and asset growth, and an increase in liquidity hoarding by firms.

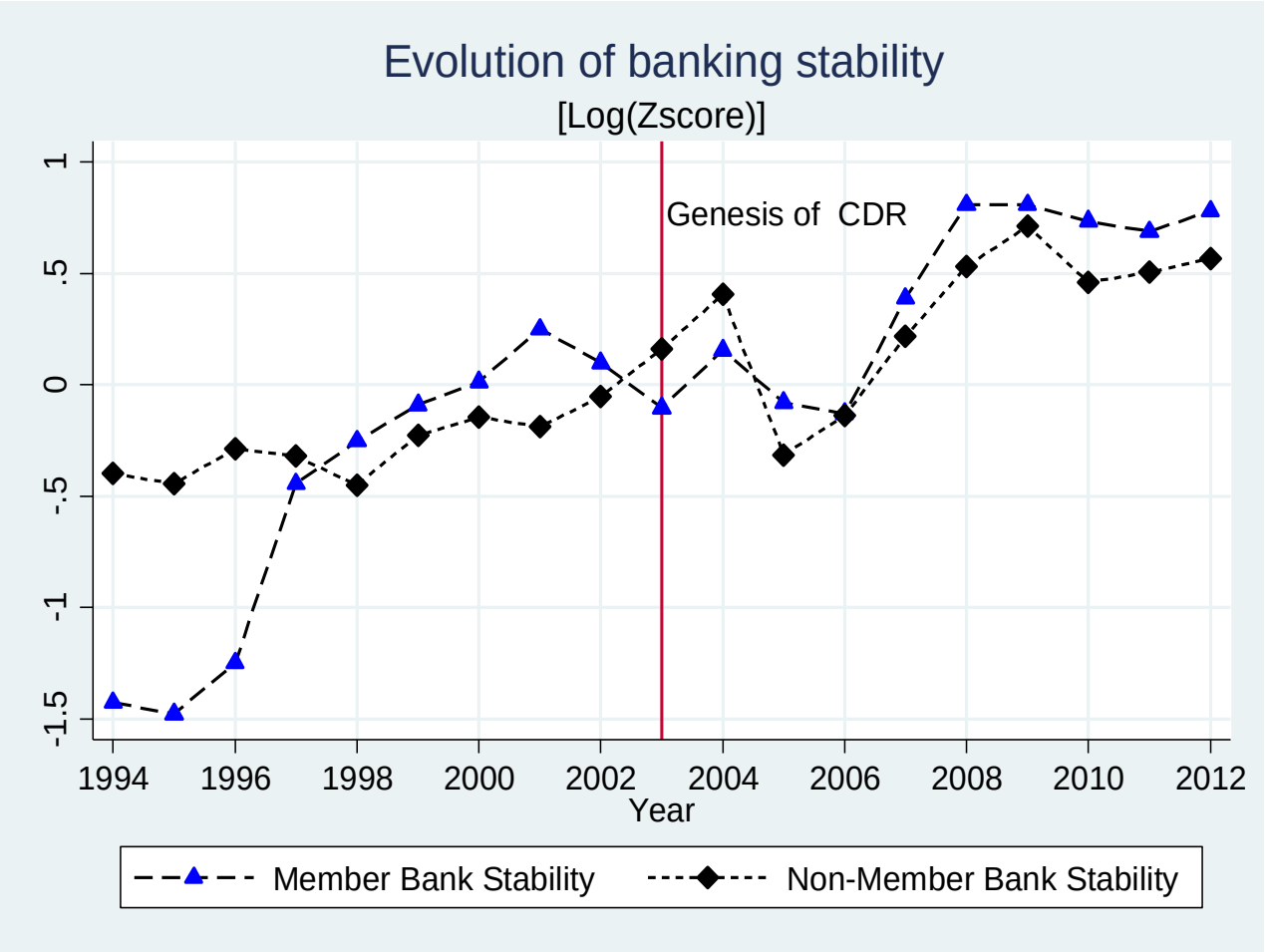
Measuring bank risk

Following Turk-Ariss (2010), we used assets returns, its volatility and leverage to calculate Z-Score:

$$Z - score_{it} = \frac{ROA_{it} + EQA_{it}}{\sigma_{it}^{ROA}}$$

- where ROA is the return on assets, EQA is the equity over assets and σ_{it}^{ROA} is the standard deviation of ROA.
- For example: Average $Z - Score$ of 3.3 means that ROA has to drop by 3.3 times of its Standard deviation to deplete bank equity.

The Evolution of bank stability



Note: Figure A1. **Evolution of banking stability**. Following Vig (2013), de-meaning of Z-score is done for each groups (Member and Non-Member), and then we plot the time series of de-meaned values of Z-score. It clearly shows before entering into CDR, member banks had a declining trend from the year 2001 to 2003. From 2004 to 2012, stability of the member banks increased as compared to non-member banks given CDR fully operationalized in the year 2004.

Treatment and control group's before-after kernel density plot

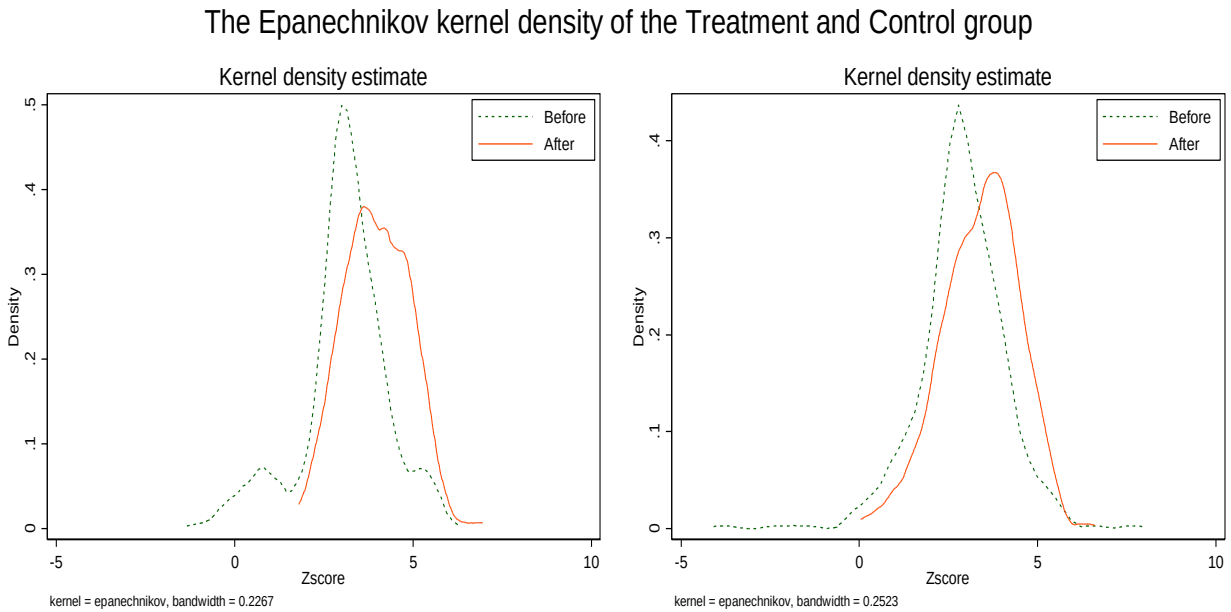
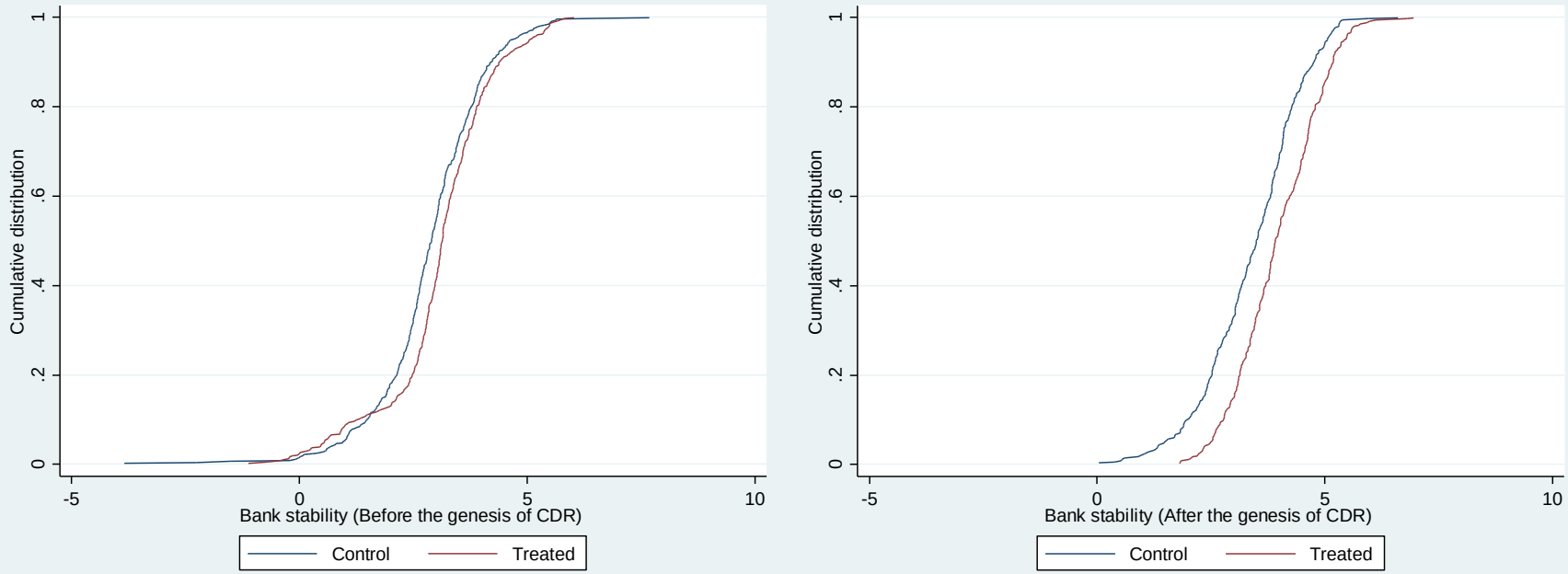


Figure A2: Kernel density of Indian banking stability

Note: Figure A2. **Kernel density of Indian banking stability (Zscore).** This figure depicts the Epanechnikov kernel density of the logarithm of Z-score for both the member banks ("treatment") group and non-member banks ("control") group. It shows that ***stability of the treated group has increased more (left graph) compared to control groups (right graph)***.

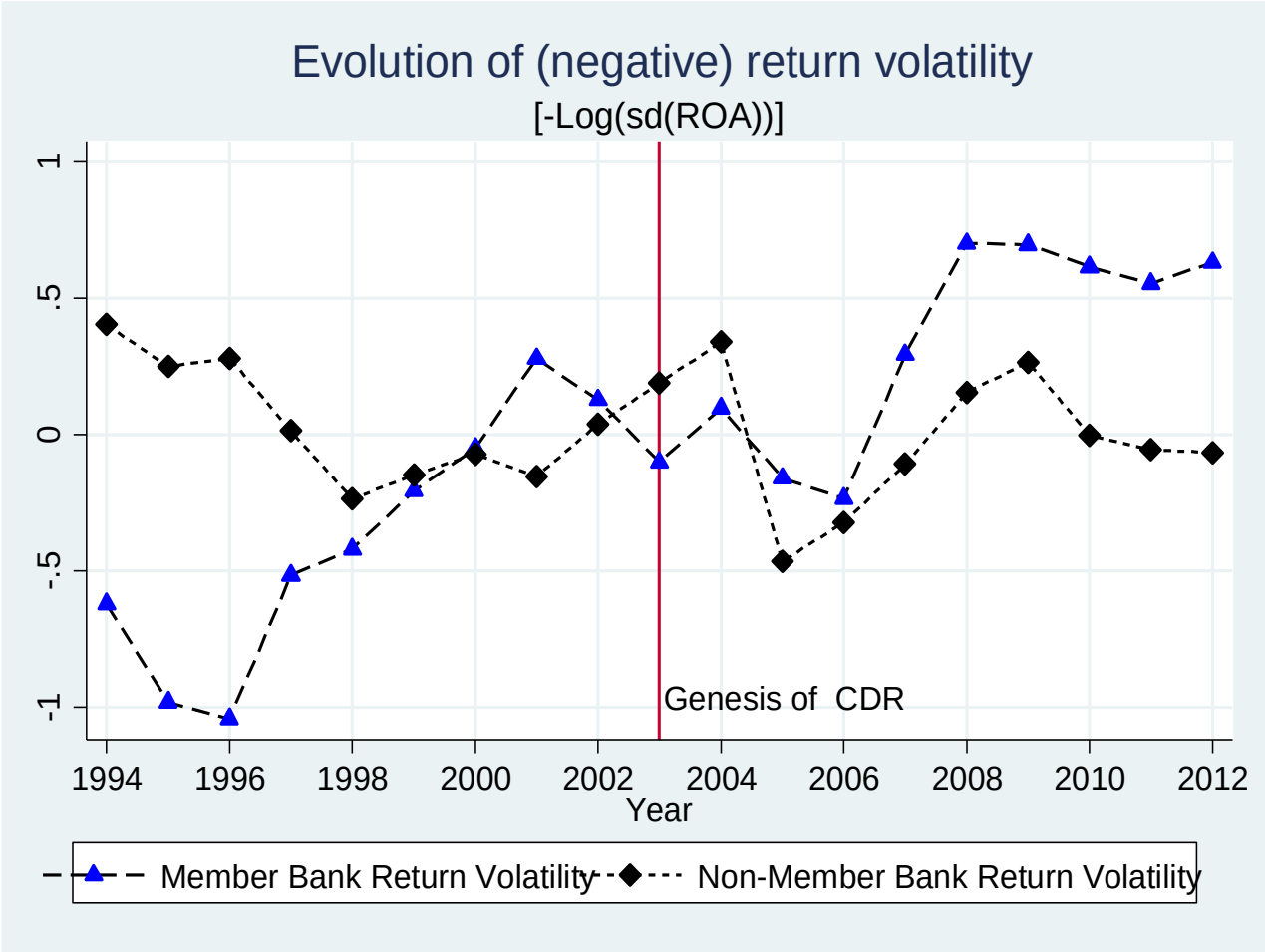
Cumulative density distribution plots

The cumulative density distribution of the treatment and control group



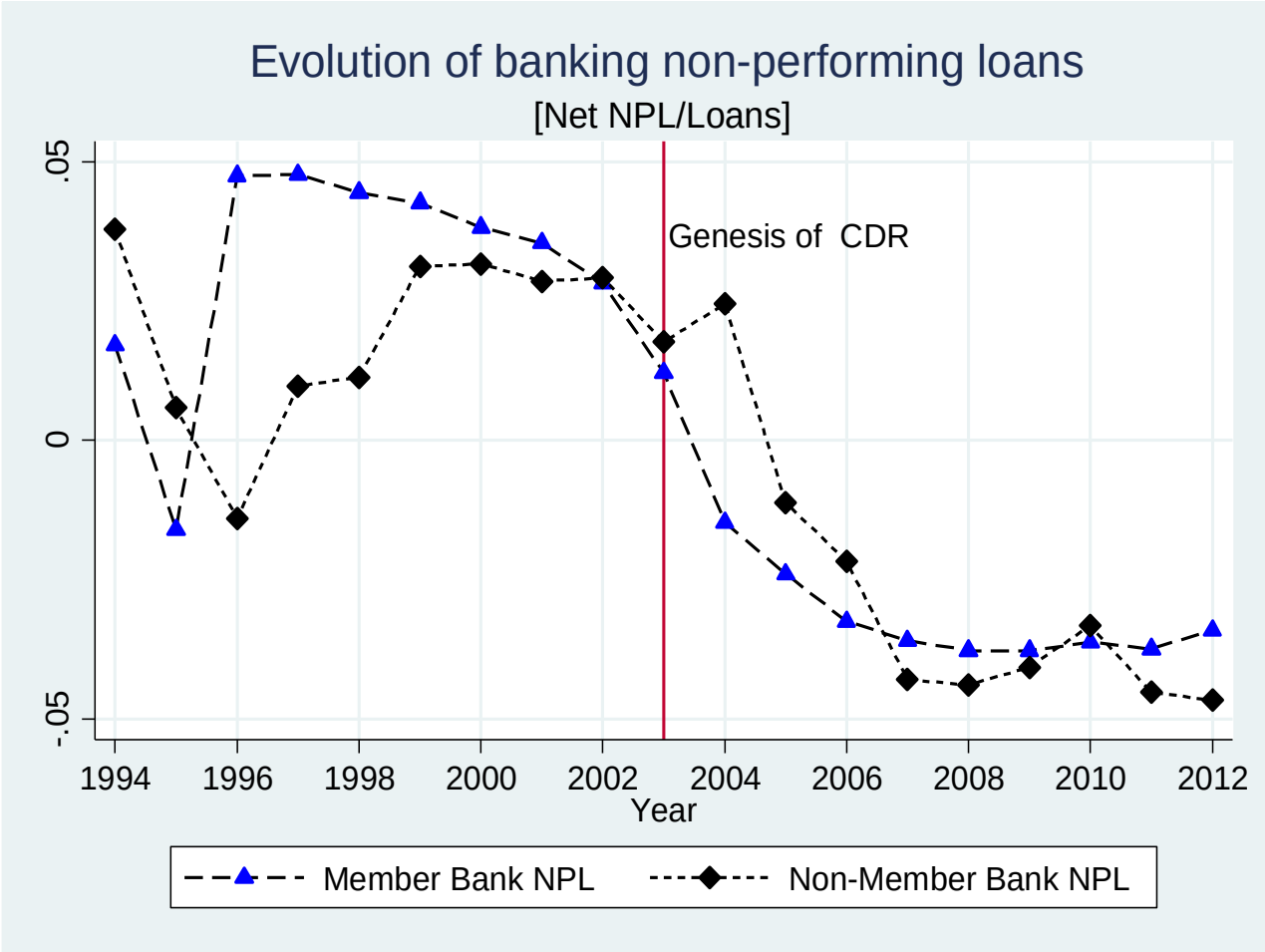
Banking stability of Indian banks

The Evolution of bank (negative) return volatility



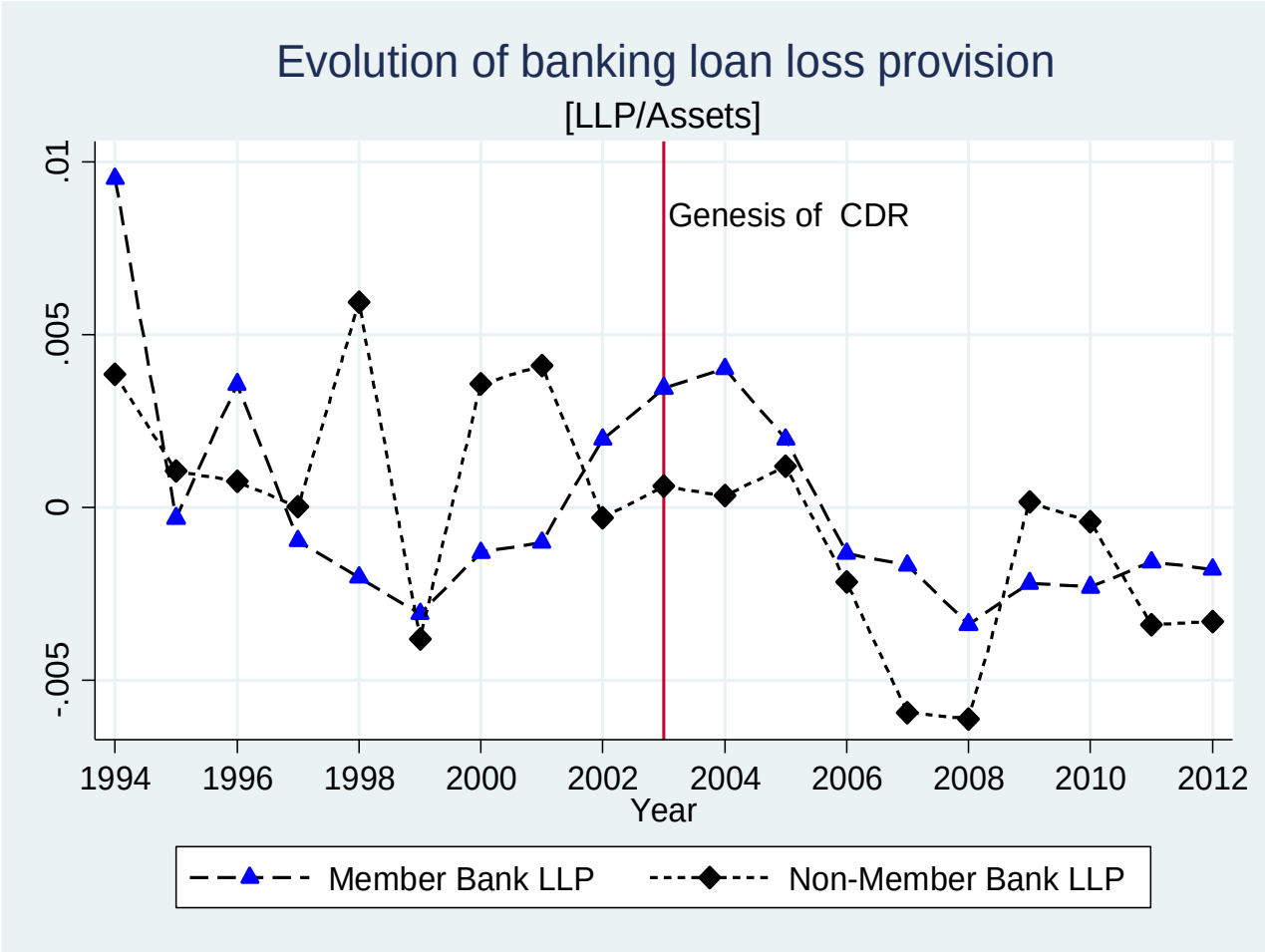
Note: Figure A3. **Evolution of banking (negative) return volatility**. Following Vig (2013), de-meaning of return volatility is done for each groups (Member and Non-Member), and then we plot the time series of de-meaned values of return volatility. Following Beck et al., (2013), we have transformed (logarithm) return volatility to make it proportional to bank stability.

The Evolution of non-performing loans



Note: Figure A4. **Evolution of non-performing loans**. Following Vig (2013), de-meaning of non-performing loan ratio is done for each groups (Member and Non-Member), and then we plot the time series of de-meaned values of non-performing loan. It clearly shows that before entering into CDR, member banks had higher non-performing loans, which was decreased in the treatment period. NPL is rising again may be because 20-25% of the restructured loans are assumed to be bad gradually.

The Evolution of loan loss provisions



Note: Figure A5. **Evolution of loan loss provisions**. Following Vig (2013), de-meaning of loan loss provision is done for each groups (Member and Non-Member), and then we plot the time series of de-meaned values of non-performing loan. It clearly shows that before entering into CDR, member banks had higher loan loss provision, which is decreased in the treatment period may be due to regulatory forbearance on asset classification and provisioning.

Measuring market power

Following Berger et al. (2009) and Koetter et al. (2012), we calculated market power at the bank-level as:

$$Lerner_{it} = \frac{P_{it} - MC_{it}}{P_{it}}$$

- where P is the ratio of total revenue to assets, MC is the marginal cost of producing an additional unit of output.
- MC is estimated using stochastic frontier analysis (SFA) where we employed three inputs (i.e. labour, capital and borrowed funds) and two outputs (i.e. loans and securities).

Stochastic frontier analysis (SFA)

$$lnTOC_{it} = \beta_0 + \sum_{j=1}^{3} \beta_j \ln W_{j,it} + \sum_{p=1}^{2} \gamma_p \ln Y_{p,it} + \delta \ln(Z_{it}) + \sum_{j=1}^{3} (\frac{\varsigma_j}{2}) (\ln W_{j,it})^2 + \sum_{j}^{3} \sum_{k}^{3} \eta_{jk} \ln W_{j,it} \ln W_{k,it}$$

$$+ \sum_{p=1}^{2} (\frac{\theta_p}{2}) (\ln Y_{p,it})^2 + (\frac{\kappa_{12}}{2}) \ln Y_{1,it} \ln Y_{2,it} + \sum_{j=1}^{3} \sum_{p=1}^{2} \lambda_{jp} lnW_{j,it} \ln Y_{p,it} + \sum_{k=1}^{2} \rho_k trend^k + \sum_{j=1}^{3} \varepsilon_j \ln W_{j,it} trend$$

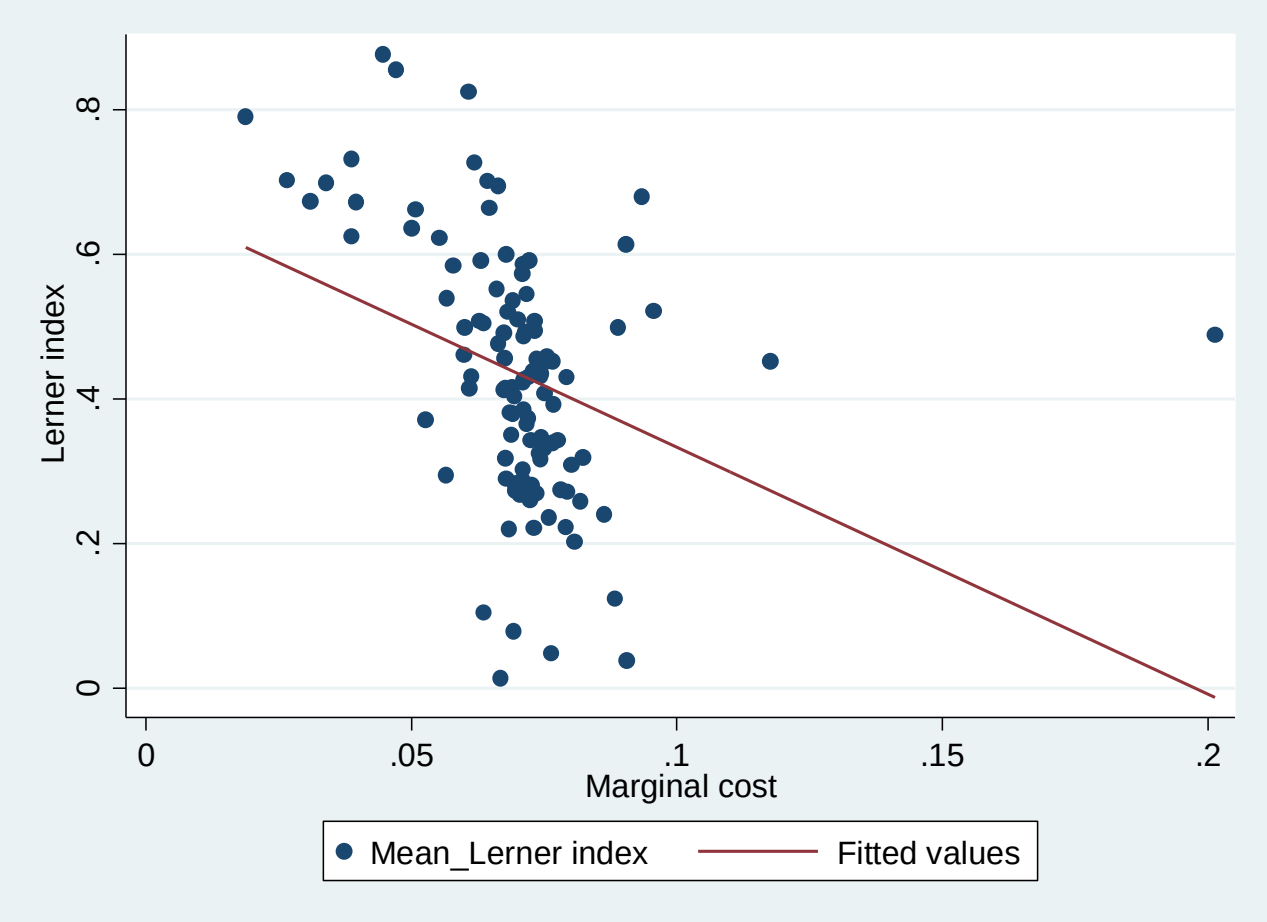
$$+ \sum_{p=1}^{2} \omega_p \ln Y_{p,it} trend + \varepsilon_{it}$$

- where *TOC* is the total costs including financial and operating cost.
- To estimate *MC* we take first derivative with respect to outputs.

$$MC_{it} = \frac{TOC_{it}}{Y_{1,it}} [\gamma_1 + \theta_1 \ln Y_{1,it} + (\frac{\kappa_{12}}{2}) \ln Y_{2,it} + \sum_{j=1}^{3} \lambda_{1j} lnW_{j,it} + \omega_1 trend]$$

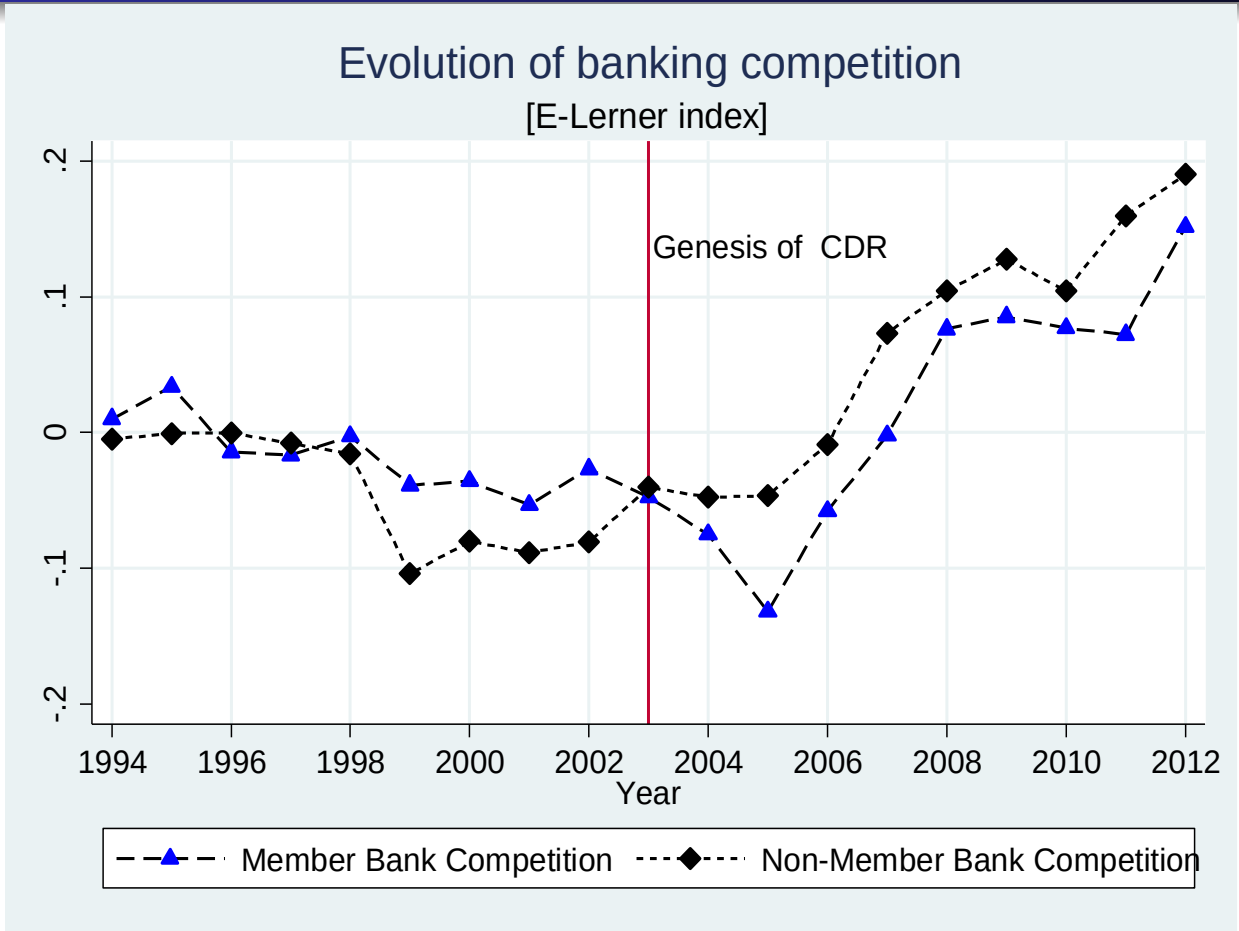
$$+ \frac{TOC_{it}}{Y_{2,it}} [\gamma_2 + \theta_2 \ln Y_{2,it} + (\frac{\kappa_{12}}{2}) \ln Y_{1,it} + \sum_{j=1}^{3} \lambda_{2j} lnW_{j,it} + \omega_2 trend]$$

Scatterplot: Lerner vs. Marginal cost



Note: Scatterplot of Lerner indices and marginal cost

The Evolution of bank competition (Efficiency-adjusted Lerner indices)



Note: Figure A6. **Evolution of bank competition**. Following Vig (2013), de-meaning of efficiency-adjusted Lerner indices is done for each groups (Member and Non-Member), and then we plot the time series of de-meaned values of Lerner indices. It clearly shows that during treatment period, member banks could increase market power substantially may be because member banks could exploit CDR mechanism to ***"hide NPLs and hike profitability"***, enhancing margins and subsequently market power.

The impact of bank competition on stability:

We used an instrumental variable technique with a GMM estimator to circumvent potential endogeneity issue. It is the heteroskedasticity and autocorrelation consistent (HAC) variance estimation of Newey and West (1987):

$$Bank\ risk_{it} = \alpha_i + \alpha_t + \beta_1 Lerner_{it} + \beta_2 rreg_t + \sum \gamma \cdot (Bank\ Controls)_{it} + \sum \delta \cdot (Macro)_{it} + \varepsilon_{it} \quad (1)$$

- *Bank risk* are either Z-Score or logarithm transformation of negative standard deviation of ROA. ▸ Measuring bank risk
- *Lerner* are either conventional or efficiency-adjusted Lerner indices. ▸ Measuring market power
- *rreg* is deregulation dummy. ▸ Control variables

Data

Our dataset comprises of an unbalanced panel of up to 110 commercial banks from 1992-2012. We draw data from a number of sources:

- The bank level dataset is compiled from the Reserve Bank of India.
- The macro data is compiled from the World Bank World Development Indicators (WDI).
- IV instruments are taken from the Heritage Foundation.
- We deflate all monetary values to 1994 (1993-94 = 100) prices using the wholesale price index (WPI). ▸ Summary statistics

Control variables

Variables	Notation	Definitions	Source
Frontier Arguments			
Costs of funds	w_1	Sum of interest expenses on deposits, interest expenses on RBI and inter-bank funds divided by sum of deposits and borrowings from RBI and others	RBI
Cost of labour	w_2	Payments to and provisions for employees divided by total assets	RBI
Cost of capital	w_3	Other operating expenses divided by fixed assets	RBI
Total loans	y_1	Total loans and advances	RBI
Other earning assets	y_2	Total investments	RBI
Equity	z	Sum of capital and reserves and surplus	RBI
Operating costs	TOC	Sum of Interest Expenses and Operating Expenses	RBI
Profit before tax	PBT	Operating income less TOC	RBI
Negative profit indicator	NPI	Takes 1 for the negative profit or else 0	Own
Bank risk measures			
Z-score	$Z-score$	Sum of return-on-assets (ROA), defined as net profit over assets, and equity ratio (EQA), defined as equity over assets, divided by standard deviation of (ROA) of each bank over past three years (calculated using a rolling window)	Own
Return Volatility	σ_{ROA}	Standard deviation of ROA for each bank, calculated over past 3 years	Own
Credit risk	NPL	Non-performing loans divided by total loans	RBI
Market Power			
C-Lerner	$C-Lerner$	A bank-level non-structural indicator of bank competition, measured by using fixed-effects method, with lower values indicating higher competition in the banking sector	Own
E-Lerner	$E-Lerner$	A bank-level non-structural indicator of bank competition, an efficiency-adjusted Lerner index, measured by using a stochastic frontier analysis approach, with lower values indicating higher competition in the banking sector	Own
Bank characteristics			RBI
Bank Size	$size$	Logarithm of total assets	RBI
Loan ratio		Total performing loans divided by total assets	RBI
Provision ratio	LLP	Total loan loss provision divided by total assets	RBI
Net interest margin	NIM	Net interest income to total earning assets	RBI
Income diversification	DIV	Non-interest income divided by total operating income	RBI
Equity ratio	EQA	Total equity divided by total assets	RBI
IV Instruments			
Merger	$merger$	Takes value equal to one for the year and thereafter if a bank enters into mergers and acquisitions activity or else zero	Own
Business Freedom	$bfree$	The business freedom is taken from Heritage Foundation, it is a number between 0 and 100, with 100 equaling the freest business environment	HF
Macroeconomic variables			
GDP per capita	$gdppc$	Logarithm of GDP per capita	WDI
Volatility of GDP	$\sigma_{5,gdp}$	Standard Deviation of real GDP growth rate calculated over past five years using a rolling window	WDI
Inflation	inf	Annual growth rate of consumer price index	WDI

Summary statistics

Variable	Mean	Median	SD	Min	Max	N
Frontier Arguments						
Costs of funds	0.07	0.06	0.15	0	6.3	1798
Costs of labour	0.01	0.01	0.01	0	0.13	1798
Costs of capital	0.64	0.33	1.18	0.01	15.58	1798
Total loans	73096	14129	193917	0.3	2967979	1798
Other earning assets	43712	11073	102235	3	1207346	1798
Operating costs	9875	2598	22804	6	305492	1798
Profits before tax	2775	556	7024	-4422	108013	1798
Equity	9067	2034	22475	5	287196	1798
Total revenue	12650	3369	29558	4	413505	1798
Dependent Variables						
Z-score	3.3	3.29	1.18	-3.84	7.68	1572
Volatility of ROA	0.01	0	0.01	0	0.16	1578
Credit risk	0.05	0.02	0.08	-0.45	1.22	1792
Market Power						
C-Lerner	0.32	0.3	0.18	-1.99	0.9	1798
E-Lerner	0.42	0.44	0.25	-2.21	0.97	1798
Bank-specific variables						
Total asset	140139	31628	342239	106	4568799	1798
Loan ratio	0.43	0.44	0.14	-0.03	0.82	1792
LLP ratio	0.02	0.01	0.02	-0.23	0.28	1786
NIM	0.04	0.04	0.04	-0.41	0.58	1798
Diversification	0.17	0.14	0.13	-1.66	0.87	1798
Equity ratio	0.12	0.07	0.15	0	0.98	1798
Reregulation	0.73	1	0.45	0	1	1798
CDR	0.24	0	0.43	0	1	1798
IV Instruments						
Merger	0.09	0	0.29	0	1	1798
Business Freedom	51.66	55	6.45	35.5	55	1650
Macroeconomic variables						
GDP per capita	61715	36189	61301	7093	236651	1798
Volatility of GDP	2.08	2.03	0.53	0.88	3.07	1798
Inflation	7.4	7.16	3.07	3.68	13.23	1798

The Effect of Competition on Bank Risk-Taking

	1	2	3	4
VARIABLES	**Z-score [log(ROA+EQA)/(sd(ROA)]**		**Return volatility [-log(sd(ROA))]**	
C-Lerner	**7.145*** [1.338]**	**-**	**5.371*** [1.271]**	**-**
E-Lerner	**-**	**2.783*** [0.640]**	**-**	**1.846*** [0.531]**
Reregulation	**3.652*** [1.083]**	**1.567 [1.109]**	**3.209*** [1.080]**	**1.662 [1.066]**
Size	0.170** [0.079]	0.162* [0.084]	0.215*** [0.075]	0.223*** [0.075]
Loan ratio	2.794*** [0.358]	1.050** [0.410]	2.472*** [0.324]	1.333*** [0.367]
LLP ratio	-21.546*** [3.708]	-12.256*** [2.935]	-17.346*** [3.882]	-10.930*** [1.903]
Diversification	-3.400*** [0.955]	0.238 [0.488]	-2.495*** [0.897]	0.355 [0.431]
NIM	-8.433*** [3.006]	0.185 [1.193]	-6.040** [2.678]	0.720 [1.025]
Equity ratio	0.891 [0.601]	-1.019 [0.755]	-1.989*** [0.574]	-3.201*** [0.673]
GDP Per Capita	-2.510*** [0.778]	-0.588 [0.790]	-2.174*** [0.777]	-0.769 [0.764]
Volatility of GDP	1.931*** [0.691]	0.085 [0.714]	1.578** [0.690]	0.231 [0.690]
Inflation	-0.035 [0.047]	-0.008 [0.047]	-0.038 [0.046]	-0.018 [0.045]
Diagnostic Test				
First Stage F-test	10.54***	35.81***	9.208***	38.60***
Hansen's J [p-value]	0.361	0.856	0.205	0.573
Second Stage F-test	15.31***	13.03***	9.428***	9.980***
Endogeneity [p-value]	0.0102	0.0137	0.0337	0.0319
No. of Obs.	1,561	1,561	1,566	1,566
No. of banks	106	106	106	106

Robustness check: Funding adjusted Lerner indices and Competition dummies

Competition-Fragility: Fund-adjusted Lerner with 1% outlier correction

	1	2	3	4	5	6	7	8	9
VARIABLES	**Z-score [(ROA+EQA)/(sd(ROA)]**			**Return volatility [-log(sd(ROA))]**			**NPL [log(NPL)]**		
C-Lerner	6.195***			4.247***			-2.276***		
	[0.735]			[0.663]			[0.517]		
E-Lerner		2.905***			1.663***			-0.384	
		[0.546]			[0.478]			[0.247]	
F-Lerner			**6.256*** **			**4.396*** **			**-1.836*** **
			[0.675]			**[0.621]**			**[0.478]**
Reregulation	3.571***	1.576	2.690***	3.075***	1.755*	2.490**	-1.685***	-1.567***	-1.590***
	[1.025]	[1.090]	[0.982]	[1.022]	[1.048]	[0.987]	[0.427]	[0.433]	[0.424]
No. of Obs.	1.561	1.561	1.561	1.566	1.566	1.566	1.567	1.567	1.567
No. of banks	106	106	106	106	106	106	105	105	105

The relationship between different level of competition and financial stability

	Z-score [(ROA+EQA)/(sd(ROA)]						Return volatility [-log(sd(ROA))]					
VARIABLES	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
High C-Lerner	1.064***						0.218**					
	[0.324]						[0.105]					
Average C-Lerner		0.990***						0.977***				
		[0.220]						[0.211]				
Low C-Lerner			**-1.626*** **						**-1.305*** **			
			[0.238]						**[0.217]**			
High E-Lerner				0.722**						0.074		
				[0.284]						[0.076]		
Average E-Lerner					0.451**						0.306*	
					[0.200]						[0.180]	
Low E-Lerner						**-1.068*** **						**-0.600*** **
						[0.250]						**[0.228]**
Reregulation	2.167**	3.006***	3.481***	1.312	2.676**	2.015*	2.066**	2.888**	3.124***	1.979*	2.390**	1.968*
	[1.029]	[1.150]	[1.247]	[1.113]	[1.081]	[1.089]	[1.025]	[1.149]	[1.184]	[1.034]	[1.050]	[1.043]
No. of Obs.	1,561	1,561	1,561	1,561	1,561	1,561	1,569	1,566	1,566	1,569	1,566	1,566
No. of banks	106	106	106	106	106	106	106	106	106	106	106	106

The effect of CDR on bank stability:

Following Bertrand and Mullainathan (2003), we examine the effect of CDR on bank risk-taking by using a difference-in-difference (DID) approach as follows:

$$Bank\ risk_{it} = \alpha_i + \alpha_t + \beta_1 \cdot CDR_{i,t-1} + \beta_2 Lerner_{i,t-1} + \sum \gamma \cdot (Bank\ Controls)_{it} + \sum \delta \cdot (Macro)_{it} + \varepsilon_{it} \quad (2)$$

- where, *CDR* is an indicator variable that takes a value equal to one if a bank signed inter-creditor agreement (ICA) and became a member of CDR programme in 2003 and thereafter or else zero.
- the coefficient β_1 captures the DID effect i.e., the treatment effects of CDR on financial stability.

The interactive effect of CDR with bank competition

We use following difference-in-difference-in-differences (DDD) approach (Long et al. 2010; Vig, 2013) to investigate interaction effect of CDR and bank competition on stability:

$$\begin{aligned} Bank\ risk_{it} = {} & \alpha_i + \alpha_t + \beta_1 \cdot (CDR)_{i,t-1} + \beta_2 Lerner_{i,t-1} \\ & + \beta_3 \cdot CDR_{i,t-1} \times Lerner_{i,t-1} \\ & + \sum \gamma \cdot (Bank\ Controls)_{it} + \sum \delta \cdot (Macro)_{it} + \varepsilon_{it} \end{aligned} \tag{3}$$

- where the coefficient β_3 captures the DDD effect.

Basic empirical strategy: difference-in-differences (DID)

Table 4a: This table provides basic empirical strategy.

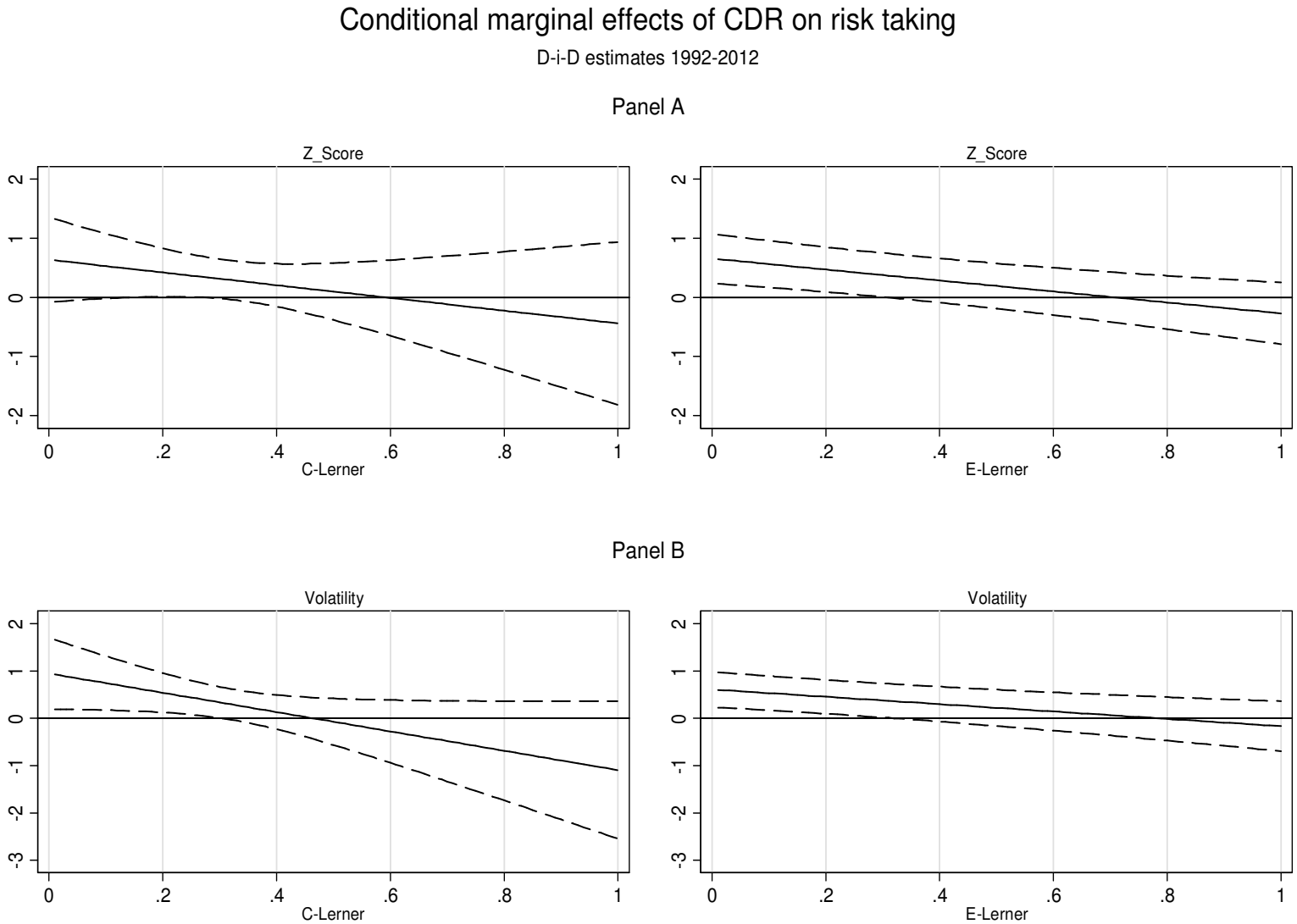
Member banks are those who participated and Non-member banks are those who did not participate in the CDR programme. 'Before' refers to 1992-20 'After' refers to period from 2004 to 2012. DD refers to Difference-in-Differences. Diff is interpreted as the percentage change form period before to aft is the percentage change in the member banks compared to non-member banks. ***, **, and * indicate statistical significance at the 1%, 5% and 10% respectively.

Outcome variable	**Before**			**After**			
	Non-Member	Member	Diff	Non-Member	Member	Diff	**DD**
Z-Score	2.881	3.079	0.197***	3.407	3.973	0.566***	**0.369*** **
Std. Error	0.051	0.057	0.076	0.059	0.058	0.083	**0.113**
Return volatility	5.218	5.984	0.766***	5.156	6.671	1.516***	**0.75*** **
Std. Error	0.05	0.056	0.075	0.058	0.058	0.082	**0.111**

The effect of CDR on bank stability

	Z-score [log(ROA+EQA)/(sd(ROA)]					Return volatility [-log(sd(ROA))]				
VARIABLES	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
CDR	**0.436****	**0.322***	**0.312***	**0.638***	**0.657*****	**0.682*****	**0.346****	**0.318***	**0.947****	**0.608*****
	[0.183]	**[0.170]**	**[0.188]**	**[0.365]**	**[0.213]**	**[0.172]**	**[0.171]**	**[0.186]**	**[0.384]**	**[0.191]**
C-Lerner		2.647***		2.723***			1.687***		1.797***	
		[0.305]		[0.314]			[0.222]		[0.240]	
E-Lerner			1.085***		1.307***			0.709***		0.888***
			[0.214]		[0.181]			[0.167]		[0.162]
CDR x C-Lerner				**-1.077**					**-2.043***	
				[1.006]					**[1.067]**	
CDR x E-Lerner					**-0.926*****					**-0.776*****
					[0.285]					**[0.254]**
Size		0.094	0.126	0.092	0.123		0.154	0.182*	0.150	0.178*
		[0.087]	[0.090]	[0.086]	[0.091]		[0.093]	[0.097]	[0.093]	[0.097]
Loan ratio		1.853***	1.504***	1.826***	1.462***		1.714***	1.563***	1.657***	1.522***
		[0.367]	[0.377]	[0.368]	[0.379]		[0.346]	[0.365]	[0.343]	[0.363]
Loan Loss Provision		-10.176*	-8.429	-10.226*	-8.595		-10.218**	-9.205*	-10.273**	-9.291**
		[5.522]	[6.172]	[5.519]	[6.106]		[4.272]	[4.712]	[4.249]	[4.636]
Diversification		0.059	0.753	0.070	0.686		0.306	0.728	0.337	0.672
		[0.410]	[0.490]	[0.405]	[0.492]		[0.425]	[0.469]	[0.422]	[0.470]
Net interest margin		-0.131	1.307	-0.096	1.157		0.517	1.552	0.600	1.413
		[1.137]	[1.627]	[1.134]	[1.555]		[1.167]	[1.462]	[1.171]	[1.398]
Equity ratio		1.111*	0.846	1.100*	0.771		-1.821***	-1.968***	-1.840***	-2.030***
		[0.623]	[0.717]	[0.628]	[0.704]		[0.589]	[0.655]	[0.588]	[0.649]
GDP per capita		-0.066	0.010	-0.072	0.008		-0.174	-0.131	-0.184	-0.130
		[0.133]	[0.134]	[0.134]	[0.133]		[0.119]	[0.119]	[0.119]	[0.118]
Volatility of GDP		0.146*	0.081	0.141*	0.102		0.191**	0.149**	0.180**	0.166**
		[0.077]	[0.075]	[0.077]	[0.074]		[0.073]	[0.072]	[0.073]	[0.071]
Inflation		-0.015	-0.024*	-0.016	-0.025*		-0.028**	-0.034**	-0.029**	-0.034**
		[0.014]	[0.014]	[0.014]	[0.014]		[0.013]	[0.013]	[0.013]	[0.013]
Constant	3.730***	1.244	0.651	1.333	0.629	5.779***	4.828***	4.394***	4.992***	4.375***
	[0.143]	[1.099]	[1.205]	[1.111]	[1.208]	[0.120]	[1.015]	[1.102]	[1.018]	[1.107]
Diagnostic Test										
Observations	1,569	1,564	1,564	1,564	1,564	1,574	1,569	1,569	1,569	1,569
No. of banks	110	109	109	109	109	110	109	109	109	109
Bank fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adj. R^2	0.188	0.281	0.246	0.282	0.251	0.121	0.218	0.191	0.221	0.195
Rmse	0.912	0.858	0.879	0.858	0.876	0.872	0.822	0.836	0.820	0.834
F	14.15***	22.03***	18.12***	23.56***	19.03***	9.487***	12.52***	10.50***	14.44***	10.98***

Marginal effect of CDR on banking stability



Sensitivity analysis: The impact of CDR on stability controlling for SARFAESI Act

	1	2	3	4
VARIABLES	**Z-score [(ROA+EQA)/(sd(ROA)]**		**Return volatility [-log(sd(ROA))]**	
CDR	**0.638***	**0.657*****	**0.947****	**0.608*****
	[0.365]	[0.213]	[0.384]	[0.191]
C-Lerner	2.723***		1.797***	
	[0.314]		[0.240]	
E-Lerner		1.307***		0.888***
		[0.181]		[0.162]
CDR x C-Lerner	-1.077		-2.043*	
	[1.006]		[1.067]	
CDR x E-Lerner		-0.926***		-0.776***
		[0.285]		[0.254]
SARFAESI	**-0.178**	**-0.128**	**-0.156**	**-0.128**
	[0.146]	[0.145]	[0.146]	[0.145]
Diagnostic Test				
Observations	1,564	1,564	1,569	1,569
Bank FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Bank controls	YES	YES	YES	YES
Macro controls	YES	YES	YES	YES
No. of bank	109	109	109	109
Adj. R^2	0.282	0.251	0.221	0.195
rmse	0.858	0.876	0.820	0.834
F	23.56	19.03	14.44	10.98

Sensitivity analysis: Matching estimators

Table 6: Sensitivity analysis of the impact of CDR using matching techniques

VARIABLES	Z-score [(ROA+EQA)/(sd(ROA)]			Return volatility [-log(sd(ROA))]		
Matching estimators	Kernel matching	Stratified Matching	Abadie and Imbens	Kernel matching	Stratified Matching	Abadie and Imbens
ATT	0.58***	0.48***	0.84***	0.57***	0.45***	0.70***
SE	[0.08]	[0.09]	[0.13]	[0.09]	[0.09]	[0.13]
t-statistics	7.04	5.13	6.59	6.18	4.94	5.19
Observations	1,403	1,403	1,240	1,403	1,403	1,241
Common support condition	√	√	√	√	√	√

Note: Three matching methods are used include Kernel matching, Stratified matching and the nearest-neighbour bias-corrected matching estimators proposed by Abadie and Imbens (2006). Abadie and Imbens method adjusts the differences within the matches for the differences in covariate values. Following Abadie et al. (2004), we use four matches per observation. The variables that are used for the matching (or bias-adjusted variables) include the age of the bank, listed bank dummy (equal to one if a bank is listed in the stock market, or else zero), the number of employee, the number of branches and the logarithm of total assets. ATT is the average treatment effect for the treated. The standard errors in Abadie and Imbens are heteroskedasticity-consistent, and *Z*-stats are reported. For the rest, we report absolute values of bootstrapped *t*-stats in bracket. Observation size is reduced as we do not have information on the number of employee for all banks prior to 1997. The number of observation also differs due to the difference in the underlying matching approaches. We run balancing test on all the independent variables included in the logit regression, which has been satisfied. Hosmer–Lemeshow test confirmed goodness-of-fit of logit model (unreported but available upon request).

Logit model, descriptive statistics and distribution of matched sample

Table A3: Propensity to participate into CDR- Logit model and descriptive statistics

Panel A: Logit model			Panel B: Descriptive statistics of matched sample			
Dependent variable: CDR	**Coefficient**	**S.E.**	**Member banks**	**Non-member banks**	**p-value**	**t-stats**
Log of Age	0.887***	[0.343]	4.23	4.16	0.28	1.08
Log of number of employee	-2.434***	[0.713]	9.18	9.28	0.50	-0.67
Log of number of branches	1.272**	[0.519]	6.54	6.65	0.42	-0.80
Listed bank dummy	1.879*	[0.963]	0.89	0.92	0.35	-0.94
Bank size (log total assets)	2.265***	[0.368]	12.10	12.15	0.65	-0.46
Observation	1,340					

Note: In Panel A, the dependent variable CDR is an indicator variable that takes value 1 for banks which participate into Corporate Debt Restructuring Mechanism in 2003 and thereafter or else zero. We use the logarithm of total age of individual banks, the number of employees, branches, listed dummy and banks size of each banks in the Logit model in order to measure the propensity score where standard errors are clustered at the bank level and reported on brackets. Since information on bank employees are missing prior to 1997, our total number of observations is reduced to 1340. The Hosmer–Lemeshow test (p-value = 0.62) confirms the goodness-of fit of Logit model. In Panel B, we shows the descriptive statistics of the matched sample for which p-values are reported.

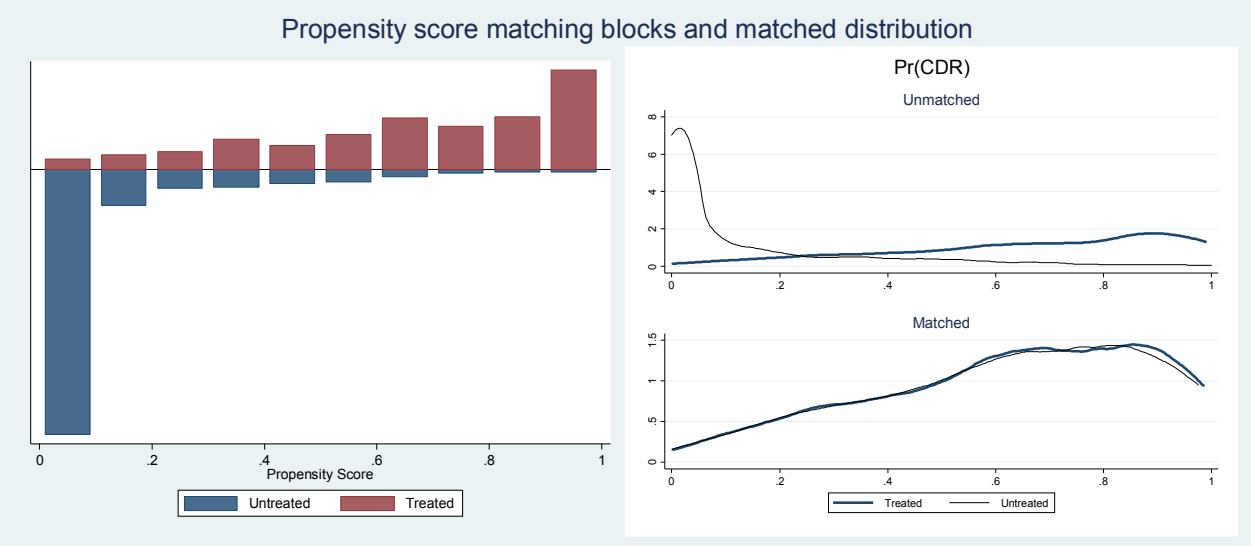


Figure A2: Graph on the left shows how several blocks where member and non-member banks were matched. Graphs on the right shows the Kernel distribution of the matched and unmatched banks.

Sensitivity analysis: Heckman two-step selection model

VARIABLES	First-state regressions	Z-score		(Negative) Return volatility	
	Dep. Var. = Regulatory intervention indicator	1	2	3	4
Listed dummy	0.542***				
	[0.192]				
Logarithm of # bank branches	0.192*				
	[0.111]				
Private-owned bank dummy	9.158***				
	[1.138]				
State-owned bank dummy	8.986***				
	[1.203]				
Regulatory intervention (-1)		**0.520***	**0.664****	**0.423***	**0.918*****
		[0.266]	**[0.281]**	**[0.232]**	**[0.339]**
Market power (-1)	-1.560***	0.850**	0.674***	0.331	1.420***
	[0.384]	[0.375]	[0.249]	[0.243]	[0.300]
Regulatory intervention*Market			-0.653**		-1.079**
			[0.325]		[0.415]
Logarithm of total assets	0.524***	0.156	0.199*	0.223*	0.115
	[0.101]	[0.123]	[0.119]	[0.121]	[0.118]
Loan ratio	12.153***	2.509*	1.292	1.668	1.852
	[1.006]	[1.381]	[1.256]	[1.225]	[1.399]
Loan loss provision ratio	10.379	-	-	-	-
	[6.966]	[4.894]	[3.846]	[3.929]	[4.916]
Income diversification	6.671***	2.027*	1.069	1.273	1.681
	[1.494]	[1.201]	[1.181]	[1.164]	[1.211]
Net interest margin	-1.346	25.224***	22.517***	23.613***	23.407***
	[6.507]	[6.749]	[5.821]	[5.743]	[6.837]
Equity ratio	4.835**	-3.745*	-	-	-3.912**
	[2.066]	[1.913]	[1.837]	[1.884]	[1.916]
Logarithm of GDP per capita		-0.251	-0.121	-0.153	-0.191
		[0.322]	[0.273]	[0.275]	[0.319]
Volatility of GDP		0.243*	0.194	0.188	0.249*
		[0.136]	[0.118]	[0.120]	[0.133]
Consumer price index (annual		-0.004	-0.004	-0.004	-0.005
		[0.022]	[0.021]	[0.021]	[0.022]
Inverse Mills ratio (λ)		**-0.062**	**-0.095**	**-0.074**	**-0.099**
		[0.126]	**[0.119]**	**[0.119]**	**[0.122]**
Constant	-23.613***	2.061	4.296	4.225	2.141
	[1.709]	[3.056]	[2.753]	[2.779]	[3.006]
Observations	1,755	994	997	997	994
Bank fixed effect	No	Yes	Yes	Yes	Yes
Year fixed effect	No	Yes	Yes	Yes	Yes
Adjusted R-squared	0.678	0.41	0.37	0.37	0.42

Summary

- Greater pricing power is positively associated with banking stability.
- After second phase of deregulation, stability of Indian banking sector improved substantially.
- The *CDR* programme mitigated *debt overhang* of corporates and *NPLs overhang* of banks.
- The difference-in-difference approach shows that member banks of CDR system experience a significant improvement in banking stability.
- However, the positive effect of CDR on banking stability diminishes for the member banks at the higher market power level.

Policy implications

- To ensure no scope for ever-greening (Peek and Rosengren, 2005), the RBI should tighten the macro-prudential norms and emphasise on international best practice in asset classification and provisioning of restructured corporate loans.
- Member banks should increase provisioning on existing restructured loans gradually; otherwise any substantial loss might lead them to exhaust capital base at a point where insolvency or illiquidity would be inevitable.

Thank You

Thank You!

Measuring bank risk

Following Turk-Ariss (2010), we used assets returns, its volatility and leverage to calculate Z-Score:

$$Z - score_{it} = \frac{ROA_{it} + EQA_{it}}{\sigma_{it}^{ROA}}$$

- where ROA is the return on assets, EQA is the equity over assets and σ_{it}^{ROA} is the standard deviation of ROA.
- For example: Average $Z - Score$ of 3.3 means that ROA has to drop by 3.3 times of its Standard deviation to deplete bank equity.

Return

Measuring market power

Following Berger et al. (2009) and Koetter et al. (2012), we calculated market power at the bank-level as:

$$Lerner_{it} = \frac{P_{it} - MC_{it}}{P_{it}}$$

- where P is the ratio of total revenue to assets, MC is the marginal cost of producing an additional unit of output.
- MC is estimated using stochastic frontier analysis (SFA) where we employed three inputs (i.e. labour, capital and borrowed funds) and two outputs (i.e. loans and securities).

Return

Stochastic frontier analysis (SFA)

$$lnTOC_{it} = \beta_0 + \sum_{j=1}^{3} \beta_j \ln W_{j,it} + \sum_{p=1}^{2} \gamma_p \ln Y_{p,it} + \delta \ln(Z_{it}) + \sum_{j=1}^{3} \left(\frac{\varsigma_j}{2}\right)(\ln W_{j,it})^2 + \sum_{j}^{3}\sum_{k}^{3} \eta_{jk} \ln W_{j,it} \ln W_{k,it}$$

$$+ \sum_{p=1}^{2} \left(\frac{\theta_p}{2}\right)(\ln Y_{p,it})^2 + \left(\frac{\kappa_{12}}{2}\right) \ln Y_{1,it} \ln Y_{2,it} + \sum_{j=1}^{3}\sum_{p=1}^{2} \lambda_{jp} lnW_{j,it} \ln Y_{p,it} + \sum_{k=1}^{2} \rho_k trend^k + \sum_{j=1}^{3} \varepsilon_j \ln W_{j,it} trend$$

$$+ \sum_{p=1}^{2} \omega_p \ln Y_{p,it} trend + \varepsilon_{it}$$

- where TOC is the total costs including financial and operating cost.
- To estimate MC we take first derivative with respect to outputs.

$$MC_{it} = \frac{TOC_{it}}{Y_{1,it}}\left[\gamma_1 + \theta_1 \ln Y_{1,it} + \left(\frac{\kappa_{12}}{2}\right) \ln Y_{2,it} + \sum_{j=1}^{3} \lambda_{1j} lnW_{j,it} + \omega_1 trend\right]$$

$$+ \frac{TOC_{it}}{Y_{2,it}}\left[\gamma_2 + \theta_2 \ln Y_{2,it} + \left(\frac{\kappa_{12}}{2}\right) \ln Y_{1,it} + \sum_{j=1}^{3} \lambda_{2j} lnW_{j,it} + \omega_2 trend\right]$$