How does OFDI affect domestic investment?
A difference-in-differences matching approach

Sourafel Girma   Ila Patnaik   Ajay Shah

March 8, 2010

Traditional questions of OECD countries

- When a firm becomes an MNC, what happens to local jobs and investment?
- The fear: the firm will shift production and jobs to low-wage locations worldwide
- Economic theory offers the possibility of both effects
- It could be that domestic and outward investment are complementary
- Or it could be that they are substitutes.
- OECD evidence generally favours complementarity.

Unique features of outbound FDI by Indian firms

Low domestic wage   +

OFDI as a means to acquire technology, build distribution for global exports based on home production.   +

Weak local debt market, coupled with capital controls which encourage OFDI when doing foreign borrowing   —

Institutional constraints in local investment : land acquisition, deficiencies of indirect taxation   —

When Indian firms do FDI, does this elevate or hinder their domestic investment?

Traditional regression approach

- Setup a panel data model where a group of regressors explain the growth of domestic assets
- Introduce an OFDI dummy
- We did this in the 3rd Research Meeting of the NIPFP DEA Program, October 2008.

Limitations of interpretation

The results of $y = a + bx$ could be interepreted in three ways:

1. Maybe x causes y
2. Maybe y causes x
3. Maybe z causes both x and y.

It is hard to place a causal interpretation upon the results.

The way forward

- Go closer to the statistical analysis of experiments
- Unit *i* and *j*, which are much like each other
- One is given a treatment, while the other is not
- The difference is attributable to the treatment.
- A big new field: e.g. *The Credibility Revolution in Empirical Economics: How Better Research Design is Taking the Con out of Econometrics* by Joshua Angrist and Jorn-Steffen Pischke, NBER WP, March 2010.
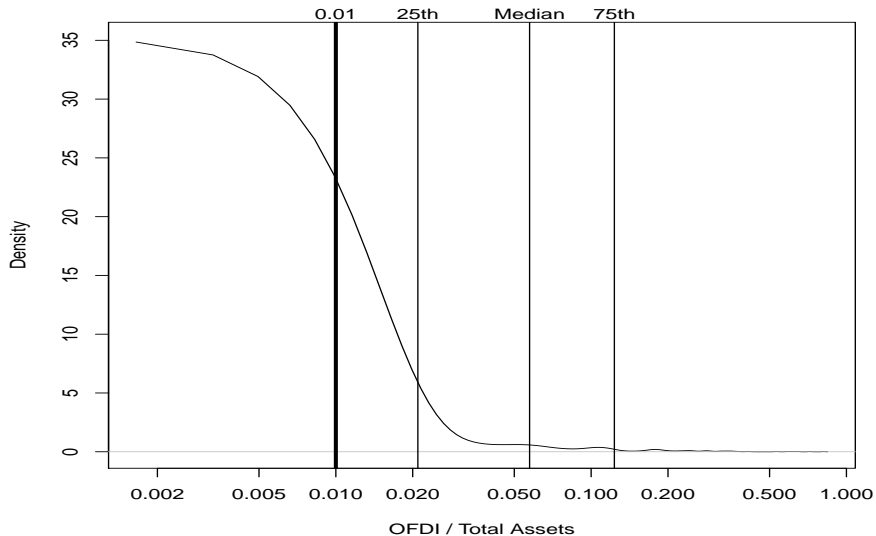
Empirical strategy

- In 2000, capital controls were eased to enable OFDI
- From 2001 to 2003, some firms self-selected themselves to invest abroad. This is 'the treatment' group.
- For each treatment firm, we try to find a matched firm with highly similar characteristics.
- Now this is like biostatistics: there is a treatment sample and a control sample, and a treatment has been administered.
- We ask: By 2005-06, what was the difference in domestic assets?
- The key foundation for this is: Good matching of characteristics between the treatment sample and the control sample.

Data Description

- Our dataset consists of non-financial firms in CMIE's COSPI index for the period 2000 to 2006.
- An OFDI firm is defined as one investing more that 1% of its total assets abroad.
- We define High and Low ODFI firms based on a cutoff which is the thrid quartile of OFDI.

Number of firms doing OFDI

	No OFDI	OFDI firms	High OFDI	Low OFDI
2000	1731	27	4	23
2001	1726	93	22	71
2002	1707	150	41	109
2003	1750	174	44	130

Density plot of OFDI to total assets in 2003

	No OFDI	OFDI firms	High OFDI	Low OFDI
Chemicals	356	30	4	26
Diversified	23	4	0	4
Electricity	13	0	0	0
Food	138	6	1	5
Machinery	215	15	0	15
Metals	141	8	0	8
Mining	17	0	0	0
MiscManuf	81	1	0	1
NonMetalMin	82	5	0	5
Serv.Construction	91	1	0	1
Serv.IT	94	78	36	42
Serv.Other	215	19	3	16
Textiles	185	5	0	5
TransportEq	99	2	0	2

Methodology

- Propensity score matching is done for firms that 'self-selected' themselves into doing OFDI with those that did not using a logit model.
- Firms are matched by the following covariates
    - age
    - total assets
    - wages
    - sales
    - domestic assets
- The values of these covariates for the pre-treatment year 2000 are used.

Estimation

- We estimate the effect of investing abroad during 2001-2003 by firms on the growth in domestic assets by 2005/06.
- This is done using a Difference-in-Difference approach to look at the Average Treatment Effect (ATE) on a group of matched firms.
- The outcome variable is the difference between domestic assets in 2005/2006 and domestic assets in 2000.
- The ATE is the difference between growth of domestic assets of the treated and control firms.

Nearest neighbour matching : Sample Size

We perform Nearest neighbour matching taking care of the common support.

	Low OFDI	
	Control	Treated
All	1572	116
Matched	100	100
Unmatched	1472	0
Discarded	0	16
	High OFDI	
All	1650	38
Matched	28	28
Unmatched	1622	0
Discarded	0	10

Propensity score estimation

Panel A: Low OFDI

	Estimate	Standard Error	z-value	p-value
Intercept	-3.15	0.43	-7.40	0.00
Total assets	5.47	3.23	1.70	0.09
Age	-0.02	0.01	-3.68	0.00
Wages	0.45	0.12	3.78	0.00
Sales	-0.36	0.12	-2.93	0.00
Domestic assets	-5.08	3.22	-1.58	0.11

Panel B: High OFDI

	Estimate	Standard Error	z-value	p-value
Intercept	-0.42	0.64	-0.66	0.51
Total assets	8.86	5.12	1.73	0.08
Age	-0.10	0.02	-4.42	0.00
Wages	1.04	0.20	5.31	0.00
Sales	-0.69	0.18	-3.81	0.00
Domestic assets	-8.99	5.09	-1.77	0.08

Total assets, Wages, Sales and Domestic assets are measured in logs.

	Means Treated	Means Control	SD Control	Mean Diff
Before Matching				
Distance	0.12	0.07	0.06	0.05
Total assets	5.38	4.34	1.61	1.05
Age	22.29	22.90	19.88	-0.60
Wages	2.35	1.19	1.93	1.16
Sales	4.92	4.04	1.84	0.88
Domestic assets	5.38	4.34	1.61	1.04
After Matching				
Distance	0.11	0.11	0.07	0.00
Total assets	5.43	5.25	1.66	0.18
Age	23.42	20.95	15.44	2.47
Wages	2.30	2.21	1.95	0.10
Sales	4.99	4.74	1.94	0.25
Domestic assets	5.43	5.25	1.66	0.17

The means of treated and control units move closer after matching.

Summary Statistics: High OFDI

	Before Matching			
	Means Treated	Means Control	SD Control	Mean Diff
Distance	0.13	0.02	0.04	0.11
Total assets	4.05	4.42	1.64	-0.36
Age	10.71	23.14	19.92	-12.43
Wages	1.47	1.26	1.95	0.20
Sales	3.49	4.11	1.86	-0.62
Domestic assets	4.02	4.42	1.64	-0.40
	After Matching			
Distance	0.07	0.07	0.06	0.00
Total assets	4.62	3.83	1.59	0.79
Age	11.86	10.75	7.49	1.11
Wages	1.77	1.37	1.56	0.40
Sales	4.02	3.74	1.73	0.29
Domestic assets	4.62	3.83	1.58	0.79

Balance Improvement

Low OFDI	Mean Difference	eQQ Median	eQQ Mean	eQQ Max
Distance	99.93	99.88	99.17	98.03
Total assets	82.73	78.51	75.30	33.10
Age	-308.62	-100.00	-73.03	10.26
Wages	91.76	88.19	79.07	16.69
Sales	72.10	69.65	65.76	16.05
Domestic assets	83.28	80.26	75.52	33.59
High OFDI				
Distance	99.87	99.83	99.69	99.61
Total assets	-116.10	-109.47	-76.81	37.71
Age	91.09	57.14	81.62	87.88
Wages	-96.30	-53.60	-24.10	41.39
Sales	53.53	58.36	46.08	66.02
Domestic assets	-98.59	-91.76	-64.78	37.71

Balance improvement between the before and after matched units is defined as, $100((|a| - |b|)/|a|)$ where a is the balance before and b is the balance after matching.

Hotelling's T-squared test

We perform a two sample Hotelling's T^2 test on the control and treated groups.

	T-squared stat	p-value
Low OFDI		
Matched sample	1.91	0.10
High OFDI		
Matched sample	1.93	0.11

The null hypothesis tests that there is no difference between the two group's means of all covariates.

QQ Plots
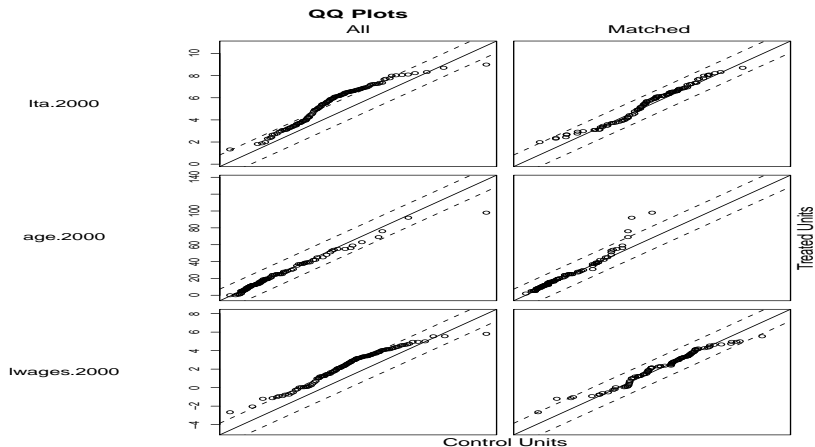
Histogram of Propensity Scores : *Low OFDI*

Raw Treated
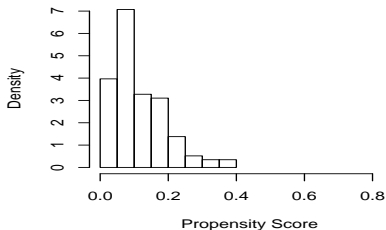
Matched Treated
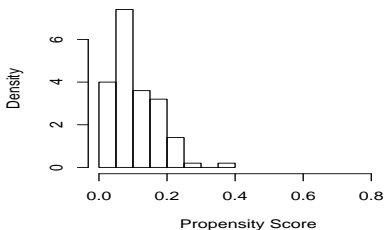
Raw Control
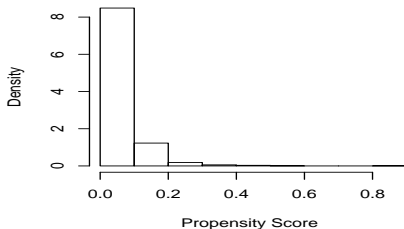
Matched Control
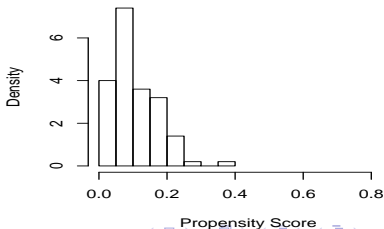
Distribution of Propensity Scores

Unmatched Treatment Units

Matched Treatment Units

Matched Control Units
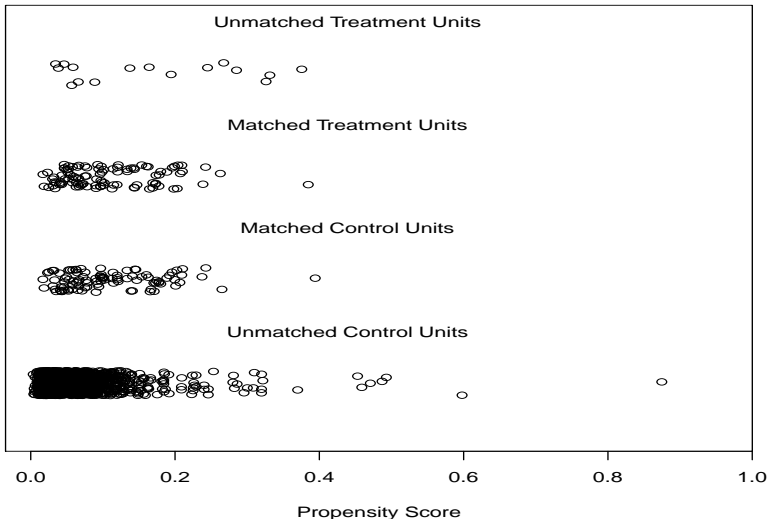
Unmatched Control Units

Propensity Score

QQ Plots
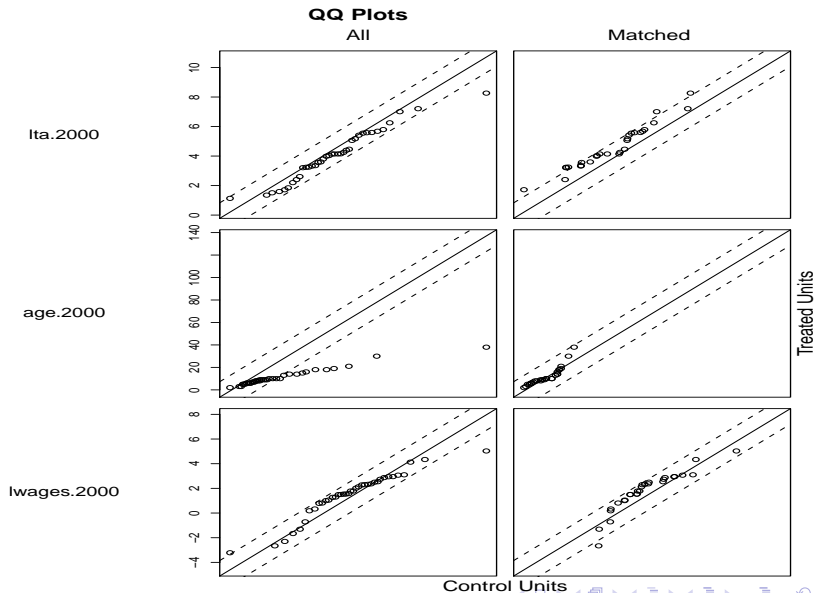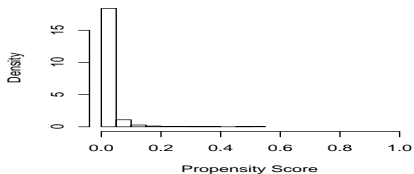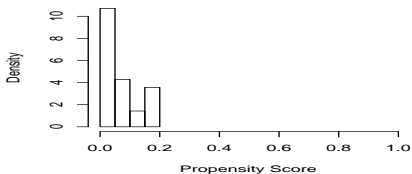
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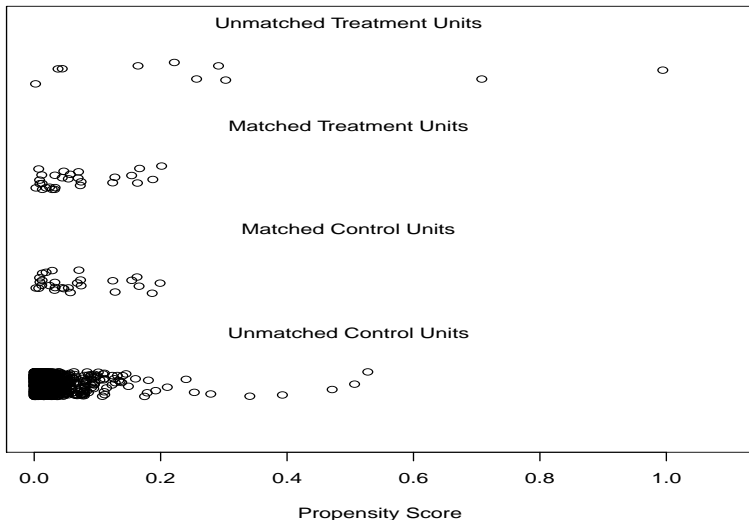
ATE using various Matching Methods

	ATE (2 years)	t-stat (2 years)	ATE (3 years)	t-stat (3 years)
Low OFDI				
Nearest	-0.03	-0.10	0.02	0.06
Optimal	0.07	1.93	0.14	3.04
Full	0.13	5.37	0.19	6.82
Subclassification	0.04	1.69	0.11	3.79
High OFDI				
Nearest	-0.57	-3.14	-0.59	-2.48
Optimal	-0.26	-2.12	-0.40	-2.67
Full	-0.19	-2.73	-0.29	-3.51
Subclassification	-0.38	-14.97	-0.48	-15.14

Summary of results

- There is a distinct difference between the results for low and high OFDI firms.
- For the High OFDI firms both the two and three year lag suggest substitutability between foreign and domestic investment.
- For the Low OFDI firms results support no immediate impact of OFDI and a small complimentarity affect.

Thank you