Local Intermediate Inputs, Foreign Direct Investment and the Performance of Domestic Firms:
When Firms Share Common Local Input Suppliers

By

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March 2011

"*LSI* manufactures garment accessories in Bangladesh since 1999. Among other factors, serving FDI garment firms was an important reason for us to set up our plant in Dhaka, EPZ. At the beginning, the share of FDI garment firms in our total sales was about 20%. Now it is 35-40%. Many Bangladeshi garment firms benefitted from *LSI* working with FDI garments firms, and to comply to the standard of FDI garment firms … which requires *LSI* to upgrade and expand product range, capacity, efficiency, and to reduce our costs and lead time. Moreover, *LSI* always shares the market intelligence we learned from our FDI garment clients regarding the latest product requirements and fashion trend with our other clients. Thus, the domestic garment firms that buy from us can further improve themselves based on the information." -- Rachel Wu, Managing Director, *LSI LTD*, November 2010.

Introduction

- New intermediate inputs play a critical role in explaining productivity gains and growth in many endogenous growth models

- Macro evidence: Feenstra (AER, 1994), Broda and Weinstein (QJE, 2006)

- Micro evidence: Amiti and Konings (AER, 2007), Goldberg, Khandelwal, Pavcnik and Topalova (QJE, 2010)

- All based on *imports* when theories do not distinguish imported vs local intermediate inputs

Objective

- Study how the product scope and productivity of domestic firms may improve due to increased access to new and better varieties of *local* intermediate inputs, caused by the larger presence of foreign direct investment (FDI) firms in the same industry
- These FDI firms use local intermediate inputs and share these local suppliers with some domestic firms

Approach

- Firm level data of the Bangladeshi garment sector is specifically collected to study this issue

- consists of a stratified random sample of 10 percent of the domestic firms and 100 percent of the FDI firms

- Each of these firms is asked to identify its top three local input suppliers

Siblings

- Two firms are *siblings* if they share a common local input supplier

- For each firm, the presence of its FDI siblings in an industry is referred to as *sibling foreign presence*

Identification Strategy

- Relating product scope and productivity of domestic firms to their sibling foreign presence

Why?

- Quality improvement of local inputs
  - Javorcik (2004) and Javorcik and Spatareanu (2009) show that downstream FDI firms make local suppliers better
  - This paper assess whether better local suppliers will further benefit those downstream domestic firms that also buy from them
  - Anecdotal evidence based on interviews with local suppliers support this view
- Variety Expansion of local inputs

Figure 1
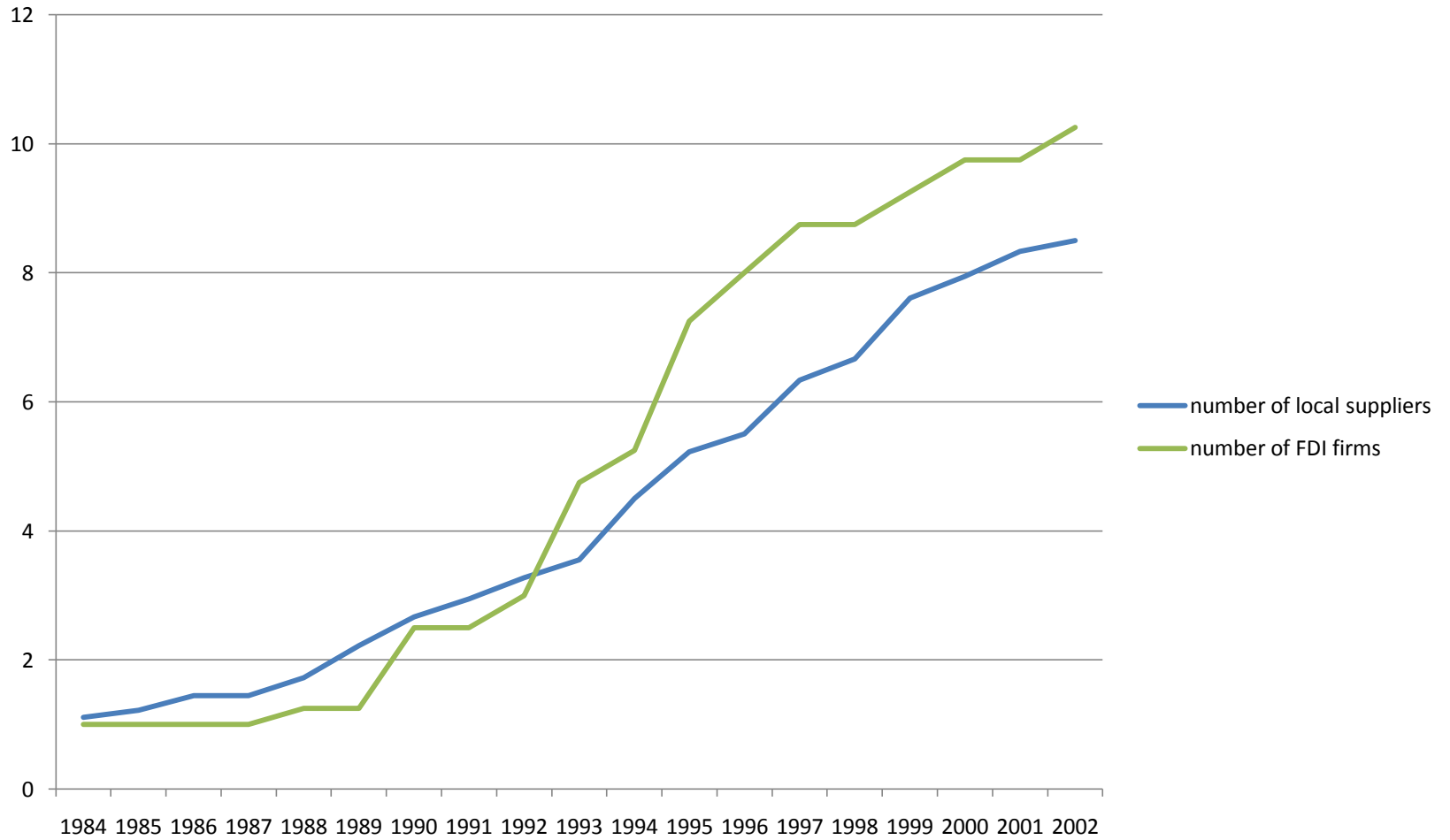
Aggregate Causality

- OLS:

  # FDI firms can explain # local input suppliers, controlling for # domestic firms and time trend.

- Granger causality tests (level and detrend):

  # FDI firms ➜ # local input suppliers

  # local input suppliers ➜ # FDI firms

Natural Experiment

- Trade policy shock in EU (EBA)

- Increased presence of FDI firms which demand more local intermediate inputs

- Increased product scope and productivity of domestic firms that use these local suppliers

Structural Estimation from Multi-Product Firm Model

- Exogenous increase in the number of FDI firms

  - number of local input variety to increase

    - statistically significant productivity and product scope gains for domestic firms

Unique Data Set

- Number of products of each firm in each year
- Use firm level price index for output and material to deflate sales and material cost ➜ better estimates on output, input, and productivity
- Use firm sales by products and export destinations to construct product linkage and market linkage to control for product and market specific demand shocks and spillovers
- Use industry-location-year fixed effects to control for government policies, aggregate productivity and demand shocks, and market competition

Other Related Literature

- Horizontal spillovers of FDI firms
  - Theoretical papers: Findlay (QJE, 1978), Rodriguez-Clare (AER, 1996), Markusen and Venables (EER, 1999)
  - Empirical papers (mixed results): Caves (1974), Blomstrom and Persson (1983), Blomstrom and Wolff (1994), Aitken and Harrison (1999), Haddad and Harrison (1993), Djankov and Hoekman (2000), Konings (2001) ➜ *none focus on FDI with backward linkages*

Policy Message:
FDI Induced Industry Development

- Trade liberalization ➜ greater variety of high quality imported intermediate inputs ➜product scope and productivity gains of domestic firms

- Larger presence of FDI firms ➜ greater variety of high quality local intermediate inputs ➜ product scope and productivity gains of domestic firms

Outline

- Definitions
- Data
- Reduced form regression results
  - Backward linkages: Do FDI firms increase the demand for local intermediate inputs?
  - Horizontal spillovers: Do FDI firms improve the productivity of their domestic siblings?
  - Robustness Checks
  - Evidence based on industry foreign presence
- Structural estimation
- Conclusion

Definitions

- *Foreign presence* -- the product of firm i foreign ownership share and its capital share in industry j in year t

- *Industry foreign presence* -- the sum of firm foreign presence across all firms in j in t

- *Sibling* – firms i and k are siblings in t if they share a common local input supplier

- *Sibling foreign presence* – the sum of the foreign influence of all siblings of i in t from all the local suppliers of i

An Example
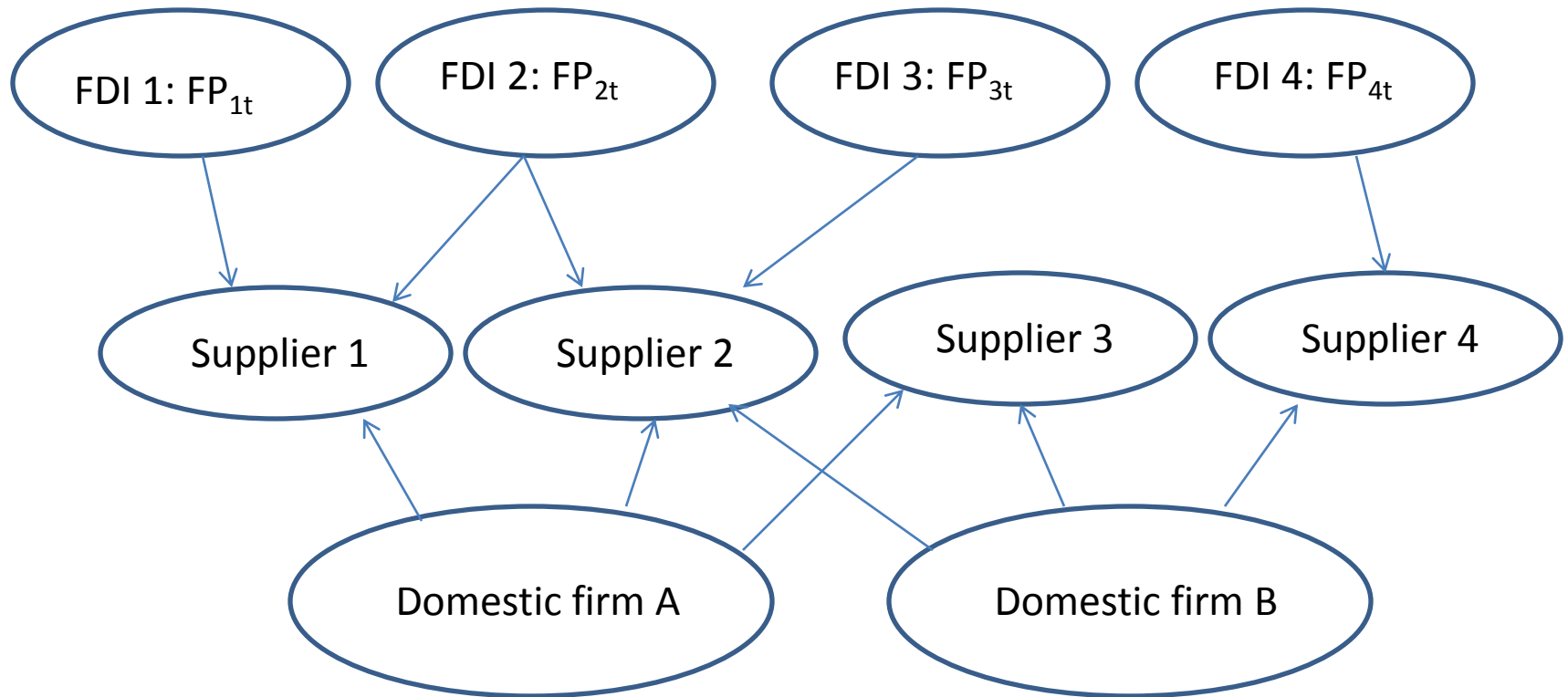
Industry foreign presence = $FP_{1t}+FP_{2t}+FP_{3t}+FP_{4t}$
Sibling foreign presence for A = $(FP_{1t}+FP_{2t})+(FP_{2t}+FP_{3t})$
Sibling foreign presence for B = $(FP_{2t}+FP_{3t})+FP_{4t}$

Data

- Firm level survey was conducted from the period of November 2004 to April 2005, which covers a stratified random sample of 350 firms

- Cover all FDI firms and 10% domestic firms

- Sample is stratified to reflect the population distribution of firms by size, by industry (woven garments vs. non-woven garments) and by location (Chittagong, Chittagong-EPZ, Dhaka and Dhaka-EPZ)

Table 1: Sample Average

	Non-woven		Woven	
	Domestic	FDI	Domestic	FDI
Sales	2648.90	3894.15	2656.05	14200.00
Export	2538.41	3662.36	2620.61	14200.00
Material	1722.67	2527.50	1874.64	9665.94
Imported material	1013.16	2150.88	1494.03	8393.14
Employee (number)	639.55	946.57	571.81	1877.64
Investment	138.69	137.59	49.04	266.04
Capital	580.10	1582.38	734.65	4103.32
Age (year)	5.23	6.10	7.98	7.29
Number of firms	89	15	167	26

Note: All values are in US$000, except otherwise specified.

Table 2: Sample Average for Domestic Firms

	Non-woven	Woven
Industry foreign presence	28.68	36.43
FDI sibling	15.57	51.91
Sibling foreign presence	0.48	6.08
FDI product rival	89.52	92.93
Product rival foreign presence	13.48	36.61
FDI market rival	97.60	97.31
Market rival foreign presence	2.12	10.58

Note: All values are in percent.

Unique Natural Experiment

- In 2000, the EU announced the implementation of "Everything But Arm" initiative in 2001 which gave duty free quota free access to all goods from LDCs that meet ROOs

- Woven FDI firms that export to the EU expand their capacity to meet demand ➔ increased market presence (and local inputs demand)

- Use FDI siblings that export to the EU and the impact of EBA on these woven FDI firms as instruments

Figure 2: Share of FDI in Industry Capital

Legend: ■ Nonwoven EU Exporters ■ Nonwoven Non-EU Exporters ■ Woven EU Exporters ■ Woven Non-EU Exporters
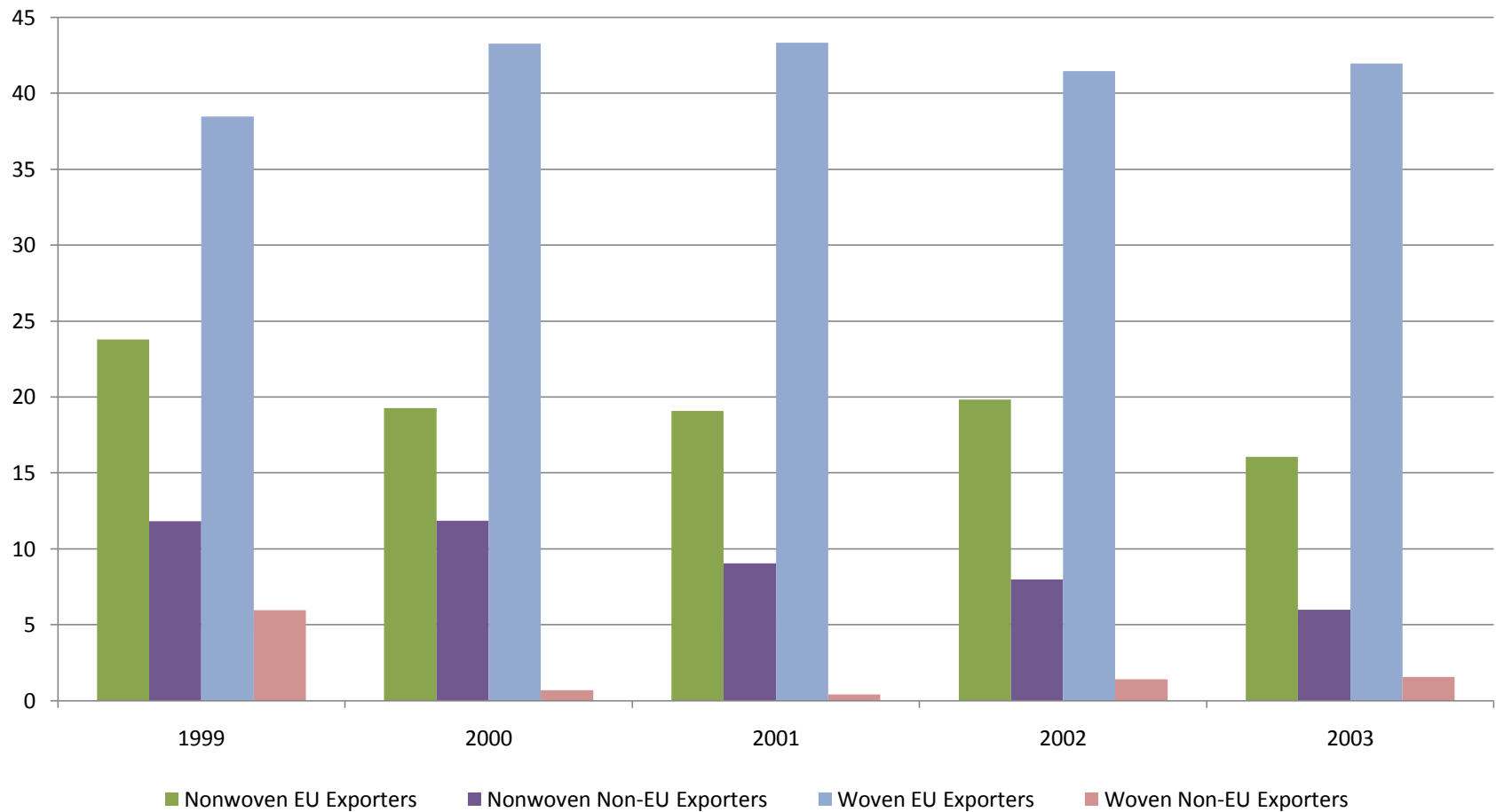
Exclusion Restriction

- EBA has no direct impact on the performance of domestic firms

- Clerides, Lach and Tybout (QJE, 1998), and Bernard and Jensen (JIE, 1999) show that better firms self select to be exporters and little evidence of further gains while exporting

- Cross check based on a subset of domestic firms that *do not* export to the EU

Foreign Investment Policy of Bangladesh

- Industrial Policy (1999) of Bangladesh: from 1999 to 2004, foreign investment was discouraged in the following areas: *garments*, banks, insurance companies, and other financial institutions

- For our sample period, while existing FDI firms were allowed to expand and invest with no restrictions, entry of new FDI garment firms was very rare, and were highly regulated by the government ➔ *number of FDI is exogenous*

Regression Results

- Backward linkages: Do FDI firms increase the demand for local intermediate inputs?
  - It is not a prerequisite that FDI firms are more productive for horizontal spillovers to take place
  - It is necessary for FDI firms to increase industry demand for local inputs (Rodriguez-Clare, 1996)
  - This is true if FDI firms are larger
  - Availability of local inputs may vary by industry-location-year ➔ cluster standard errors

Table 3: Dependent Variable – ln(domestic material)

	(1)
FDI dummy variable	0.479***
	(0.166)
EU exporter dummy	
US exporter dummy	
Productivity (TFP)	
Capital stock	
Age	
Output	
Industry-location-year fixed effects	No
R-squared	0.0120
Observations	1143

Table 3: Dependent Variable – ln(domestic material)

	(1)	(2)
FDI dummy variable	0.479***	0.336
	(0.166)	(0.205)
EU exporter dummy		
US exporter dummy		
Productivity (TFP)		
Capital stock		
Age		
Output		
Industry-location-year fixed effects	No	Yes
R-squared	0.0120	0.1026
Observations	1143	1143

Table 3: Dependent Variable – ln(domestic material)

	(1)	(2)	(3)
FDI dummy variable	0.479***	0.336	0.440**
	(0.166)	(0.205)	(0.196)
EU exporter dummy			0.363***
			(0.110)
US exporter dummy			-0.211***
			(0.071)
Productivity (TFP)			
Capital stock			
Age			
Output			
Industry-location-year fixed effects	No	Yes	Yes
R-squared	0.0120	0.1026	0.1135
Observations	1143	1143	1143

Table 3: Dependent Variable – ln(domestic material)

	(1)	(2)	(3)	(4)
FDI dummy variable	0.479***	0.336	0.440**	0.268
	(0.166)	(0.205)	(0.196)	(0.205)
EU exporter dummy			0.363***	0.295**
			(0.110)	(0.141)
US exporter dummy			-0.211***	-0.340***
			(0.071)	(0.060)
Productivity (TFP)				0.223***
				(0.045)
Capital stock				0.284***
				(0.045)
Age				0.163***
				(0.049)
Output				
Industry-location-year fixed effects	No	Yes	Yes	Yes
R-squared	0.0120	0.1026	0.1135	0.2028
Observations	1143	1143	1143	1106

Table 3: Dependent Variable – ln(domestic material)

	(1)	(2)	(3)	(4)	(5)
FDI dummy variable	0.479***	0.336	0.440**	0.268	0.044
	(0.166)	(0.205)	(0.196)	(0.205)	(0.201)
EU exporter dummy			0.363***	0.295**	0.194
			(0.110)	(0.141)	(0.143)
US exporter dummy			-0.211***	-0.340***	-0.313***
			(0.071)	(0.060)	(0.156)
Productivity (TFP)				0.223***	
				(0.045)	
Capital stock				0.284***	
				(0.045)	
Age				0.163***	
				(0.049)	
Output					0.479***
					(0.033)
Industry-location-year fixed effects	No	Yes	Yes	Yes	Yes
R-squared	0.0120	0.1026	0.1135	0.2028	0.2962
Observations	1143	1143	1143	1106	1143

Reduced Form Regression

- Do FDI firms improve the performance of their domestic siblings?

$$\ln y_{it} = \alpha_i + \alpha_{jkt} + \alpha_{SFP}SFP_{it} + \mathbf{X}_{it}\boldsymbol{\beta} + \beta_i Trend_{it} + v_{it}$$

- Need to control for firm fixed effect and only rely on within firm variations in performance and sibling foreign presence to identify coefficient
- Between firm differences due to entry/exit should not affect result
- Cluster standard errors by industry-year

Sibling Foreign Presence …

- Increase with the number of foreign siblings and the presence of each foreign sibling
- Decrease with the presence of domestic firms

- Upward selection bias – up and rising domestic firms may choose to work with new local suppliers which increases the number of FDI siblings
- Downward simultaneity bias – up and rising domestic firms may expand capital and cause the market share of FDI firms to decrease
- Upward omitted variable bias – productive local suppliers make domestic and FDI firms better off

Table 4: First Stage Regressions

	(1)	(2)	(3)	(4)
FDI siblings that export to EU	0.07***	0.09***	0.04***	0.04***
	(0.01)	(0.01)	(0.01)	(0.01)
FDI siblings that export to EU*	0.02***	0.04***	0.01*	0.01***
Woven*EBA	(0.00)	(0.01)	(0.00)	(0.00)
Observations	104	104	1000	1000
F-stat	127.71***	202.79***	14.84***	13.46***

Notes: All columns include firm fixed effects, industry-region-year

fixed effects, firm age, share of imported materials and

share of material in sales. Columns (2) and (4) also include

firm specific time trend.

Robust standard errors in parentheses are clustered by industry-year.

*, **, *** indicate statistical significance at 90%, 95% and 99% confidence levels.

Table 5: Restricted Sample

Dependent Variables	(1) Product Scope	(2) Product Scope	(3) Sales per Worker	(4) Sales per Worker	(5) Output per Worker	(6) Output per Worker	(7) TFP_OLS	(8) TFP_OLS	(9) TFP_AOP	(10) TFP_AOP
Estimation Methods	LS	IV	LS	IV	LS	IV	LS	IV	LS	IV
Sibling Foreign Presence	3.01***	14.51***	6.17***	24.42***	5.42***	24.53***	2.02**	12.04***	1.90*	10.86***
	(0.41)	(1.50)	(1.14)	(1.85)	(1.36)	(1.79)	(0.84)	(0.92)	(0.92)	(0.69)
Age	0.20	-0.13	0.68	0.15	0.60	0.05	0.30	0.01	0.19	-0.07
	(0.28)	(0.08)	(0.41)	(0.16)	(0.42)	(0.16)	(0.18)	(0.09)	(0.17)	(0.11)
Imp Materials/Materials	-0.70	-0.74**	-1.42*	-1.49**	-1.57*	-1.64**	-0.84*	-0.88*	-0.89**	-0.92***
	(0.52)	(0.36)	(0.75)	(0.64)	(0.83)	(0.72)	(0.42)	(0.39)	(0.37)	(0.32)
Material/Sales	-0.06	0.68	0.10	1.28	0.21	1.45	-0.34	0.30	-0.33	0.24
	(1.03)	(0.64)	(1.73)	(1.15)	(1.81)	(1.25)	(1.14)	(0.85)	(1.03)	(0.78)
Observations	116	113	116	113	116	113	108	104	104	100

Notes: All dependent variables are in log. TFP_OLS is from (1) and (4) of Table 12; TFP_AOP is from (3) and (6) of the same table.

Firm fixed effects and industry-region-year fixed effects are included in all columns.

Robust standard errors in parentheses are clustered by industry-year.

*, **, *** indicate statistical significance at 90%, 95% and 99% confidence levels.

Sample only consists of Bangladeshi firms that do not export to the EU.

Table 6: Restricted Sample with Firm Specific Time Trend

Dependent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Product Scope		Sales per Worker		Output per Worker		TFP_OLS		TFP_AOP	
	LS	IV	LS	IV	LS	IV	LS	IV	LS	IV
Sibling Foreign Presence	2.21*	7.30***	4.85*	18.43***	4.92*	18.40***	2.47**	9.05***	2.53**	8.33***
	(1.07)	(0.52)	(2.23)	(1.68)	(2.27)	(1.79)	(1.03)	(0.83)	(1.00)	(0.84)
Age	1.52	0.59***	1.43	-1.06	1.51	-0.96	0.57	-0.63	0.45	-0.62
	(1.08)	(0.23)	(3.28)	(1.04)	(3.23)	(2.43)	(1.45)	(0.43)	(1.43)	(0.52)
Imp Materials/Materials	0.17	-0.06	-0.21	-0.81***	-0.22	-0.81***	-0.21	-0.50	-0.19	-0.45**
	(0.36)	(0.16)	(0.85)	(0.23)	(0.84)	(0.24)	(0.43)	(0.15)	(0.43)	(0.16)
Material/Sales	-0.17	-0.01	0.92	1.34***	0.73	1.14***	-0.41	-0.21	-0.44	-0.29
	(0.64)	(0.31)	(0.59)	(0.35)	(0.56)	(0.29)	(0.36)	(0.27)	(0.28)	(0.25)
Observations	116	113	116	113	116	113	108	104	104	100

Notes: All dependent variables are in log. TFP_OLS is from (1) and (4) of Table 8; TFP_AOP is from (3) and (6) of the same table.

Firm fixed effects and industry-region-year fixed effects are included in all columns.

Robust standard errors in parentheses are clustered by industry-year.

*, **, *** indicate statistical significance at 90%, 95% and 99% confidence levels.

Sample only consists of Bangladeshi firms that do not export to the EU.

All columns include firm specific time trend.

Table 7: Full Sample

Dependent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Product Scope		Sales per Worker		Output per Worker		TFP_OLS		TFP_AOP	
	LS	IV	LS	IV	LS	IV	LS	IV	LS	IV
Sibling Foreign Presence	0.13	1.18	3.37***	5.16***	3.46***	4.61***	1.87**	2.52***	1.61***	1.84**
	(0.72)	(0.76)	(0.73)	(0.42)	(0.77)	(0.38)	(0.73)	(0.78)	(0.47)	(0.27)
Age	0.02**	0.01	0.28***	0.27***	0.29***	0.28***	0.24***	0.24***	0.19***	0.19***
	(0.01)	(0.01)	(0.03)	(0.04)	(0.03)	(0.03)	(0.06)	(0.05)	(0.05)	(0.05)
Imp Materials/Materials	-0.11***	-0.10***	0.17	0.18	0.15	0.15	0.20	0.20	0.16	0.16
	(0.02)	(0.01)	(0.15)	(0.15)	(0.18)	(0.17)	(0.13)	(0.13)	(0.14)	(0.14)
Material/Sales	0.04	0.04	1.00***	1.01***	0.81**	0.81**	-0.61	-0.61	-0.90	-0.90
	(0.09)	(0.07)	(0.31)	(0.31)	(0.33)	(0.32)	(0.54)	(0.53)	(0.57)	(0.56)
Observations	1034	1034	1034	1034	1034	1034	1013	1013	1000	1000

Notes: All dependent variables are in log. TFP_OLS is from (1) and (4) of Table 8; TFP_AOP is from (3) and (6) of the same table.

Firm fixed effects and industry-region-year fixed effects are included in all columns.

Robust standard errors in parentheses are clustered by industry-year.

*, **, *** indicate statistical significance at 90%, 95% and 99% confidence levels.

Sample includes Bangladeshi firms that may or may not export to the EU.

Table 8: Full Sample with Firm Specific Time Trend

Dependent Variables	(1) Product Scope	(2) Product Scope	(3) Sales per Worker	(4) Sales per Worker	(5) Output per Worker	(6) Output per Worker	(7) TFP_OLS	(8) TFP_OLS	(9) TFP_AOP	(10) TFP_AOP
	LS	IV	LS	IV	LS	IV	LS	IV	LS	IV
Sibling Foreign Presence	0.94**	1.19***	2.15***	5.30***	1.97***	5.32***	1.08***	2.76***	1.09***	2.64***
	(0.32)	(0.20)	(0.20)	(0.56)	(0.17)	(0.54)	(0.09)	(0.17)	(0.09)	(0.12)
Age	0.06	0.06*	0.52***	0.49***	0.61***	0.58***	0.44***	0.42***	0.27**	0.26**
	(0.05)	(0.03)	(0.15)	(0.14)	(0.13)	(0.13)	(0.11)	(0.10)	(0.11)	(0.10)
Imp Materials/Materials	-0.07**	-0.07***	0.39	0.39*	0.33	0.33	0.16	0.16	0.06	0.06
	(0.03)	(0.02)	(0.21)	(0.20)	(0.21)	(0.20)	(0.11)	(0.11)	(0.08)	(0.08)
Material/Sales	-0.00	-0.00	0.43	0.43	0.23	0.23	-0.78**	-0.79**	-1.00**	-1.01**
	(0.08)	(0.05)	(0.26)	(0.25)	(0.24)	(0.23)	(0.30)	(0.29)	(0.34)	(0.33)
Observations	1034	1034	1034	1034	1034	1034	1013	1013	1000	1000

Notes: All dependent variables are in log. TFP_OLS is from (1) and (4) of Table 8; TFP_AOP is from (3) and (6) of the same table.

Firm fixed effects and industry-region-year fixed effects are included in all columns.

Robust standard errors in parentheses are clustered by industry-year.

*, **, *** indicate statistical significance at 90%, 95% and 99% confidence levels.

Sample includes Bangladeshi firms that may or may not export to the EU.

All columns include firm specific time trend.

Inference

- a one percentage point increase in sibling foreign presence is associated with a 1% gain in product scope and 3% gain in productivity
- On average, within firm product scope and productivity gain is 4% and 8%, while the change in sibling foreign presence is 1%
- sibling foreign presence can explain ¼ of within firm product scope expansion and 1/3 of productivity gain

Robustness Checks

- Other possible channels of spillovers
  - Product linkages
  - Market linkages
  - Domestic siblings
- Placebo exercise -- randomized sibling foreign presence
- Evidence based on industry foreign presence

$$\ln TFP_{it} = \alpha_i + \alpha_t + \alpha_{IFP} IFP_{jt} + \mathbf{X}_{jt}\boldsymbol{\beta} + \nu_{it}$$

Table 9: Robustness Checks

Dependent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Product Scope				TFP_AOP			
Product Foreign Presence	0.61				0.26			
	(1.03)				(0.46)			
Market Foreign Presence		-0.06				-0.58		
		(0.76)				(0.42)		
Domestic Sibling Presence			-0.89				-0.93	
			(0.68)				(1.35)	
Randomized Sibling Foreign Presence				1.51**				-0.74
				(0.64)				(0.80)
Age	-0.21*	-0.20*	-0.18	-0.20*	0.28**	0.28**	0.31**	0.28**
	(0.10)	(0.10)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
Imported Materials/Materials	-0.04	-0.04	-0.05	-0.04	-0.06	0.07	0.06	0.06
	(0.12)	(0.12)	(0.11)	(0.12)	(0.09)	(0.09)	(0.07)	(0.09)
Material/Sales	-0.21	-0.20	-0.21	-0.20	-1.00**	-0.99**	-1.01**	-1.00**
	(0.18)	(0.18)	(0.18)	(0.18)	(0.35)	(0.35)	(0.35)	(0.35)
Observations	1034	1034	1034	1034	1000	1000	1000	1000

Notes: All dependent variables are in logs. TFP_AOP is from (ref: eq: non-woven) and (ref: eq: woven).

Firm fixed effects and industry-region-year fixed effects are included in all columns.

Robust standard errors in parentheses are clustered by industry-year, with degree of freedom adjustment for small sample.

*, **, *** indicate statistical significance at 90%, 95%, and 99% confidence levels.

Sample consists of Bangladeshi firms that may or may not export to the EU. All columns include firm specific time trends.

Structural Model

- Two sector economy motivated by Ethier (1982), Rodriguez-Clare (1996), Feenstra and Kee (2008):

$$Y_i = \phi_i \left[\sum_{n=1}^{N} m_{ni}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}\alpha_M} L_i^{\alpha_L} K_i^{\alpha_K}$$

- Symmetric equilibrium:

$$Y_i = \phi_i N^{\frac{\alpha_M}{\sigma-1}} M_i^{\alpha_M} L_i^{\alpha_L} K_i^{\alpha_K}$$

Decomposing TFP

- Define firm's TFP as:

$$\ln TFP_i \equiv \ln Y_i - \alpha_M \ln M_i - \alpha_L \ln L_i - \alpha_K \ln K_i$$

- Firm's TFP increases with the number of intermediate inputs:

$$\ln TFP_i = \ln \phi_i + \frac{\alpha_M}{\sigma - 1} \ln N$$

$$N \equiv N^D + N^I$$

$$N^D = f(FDI)$$

Table 11: Structural Regressions

	(1)	(2)	(3)	(4)
Dependent Variables		TFP_AOP		
Estimation Methods	LS	LS	IV	IV
Number of local input suppliers	0.27*		0.36***	
	(0.12)		(0.14)	
Number of total intermediate inputs		0.10*		0.12***
		(0.05)		(0.05)
TFP				
Price of output				
Price of intermediate inputs				
Wages				
F-Statistics			29.27	13.48
Observations	1041	1041	1041	1041

Decomposing TFP

- At the sample mean, the number of intermediate inputs can explain about 20% of the firm's TFP

Multi-Product Firm Model

- Each firm has a PPF:

$$Y_i = \left[\sum_{v_i=1}^{V_i} y_{v_i}^{\frac{\lambda-1}{\lambda}} \right]^{\frac{\lambda}{\lambda-1}}, \lambda < 0.$$

- Symmetric equilibrium:

$$p_{v_i} = p_i, \text{ and } y_{v_i} = y_i$$

$$Y_i = V_i^{\frac{\lambda}{\lambda-1}} y_i$$

$$y_i = V_i^{\frac{-\lambda}{\lambda-1}} \phi_i N^{\frac{\alpha_M}{\sigma-1}} M_i^{\alpha_M} L_i^{\alpha_L} K_i^{\alpha_K}$$

- Given prices, cost minimization implies unit cost function
  - increases with product scope (V)
  - decreases with the number of input variety (N)

$$c_i = \kappa V_i^{\frac{\lambda}{\lambda-1}} \left[\phi_i N^{\frac{\alpha_M}{\sigma-1}} \right]^{-1} P_M^{\alpha_M} P_L^{\alpha_L} P_K^{\alpha_K}$$

- Profit maximization implies

$$p_i = \mu c_i = \mu \kappa V_i^{\frac{\lambda}{\lambda-1}} \left[\phi_i N^{\frac{\alpha_M}{\sigma-1}} \right]^{-1} P_M^{\alpha_M} P_L^{\alpha_L} P_K^{\alpha_K}$$

Structural Regression for Product Scope

- Product scope of a firm
  - increases with the number of input variety
  - increases with firm productivity
  - increases with output price
  - decreases with input prices

$$\ln V_i = \frac{\lambda-1}{\lambda}\left[\theta + \ln\phi_i + \frac{\alpha_M}{\sigma-1}\ln N + \ln p_i - \sum_{j=\{M,L,K\}} \alpha_j \ln P_j \right]$$

$$\ln V_{it} = \beta_i + \beta_N \ln N_t + \beta_{TFP}\ln\phi_{it} + \beta_p \ln p_{it} + \beta_M \ln P_{Mt} + \beta_L \ln P_{Lt} + u_{it},$$

Figure 4: Output variety increases as PPF shifts out due to an increase in input variety
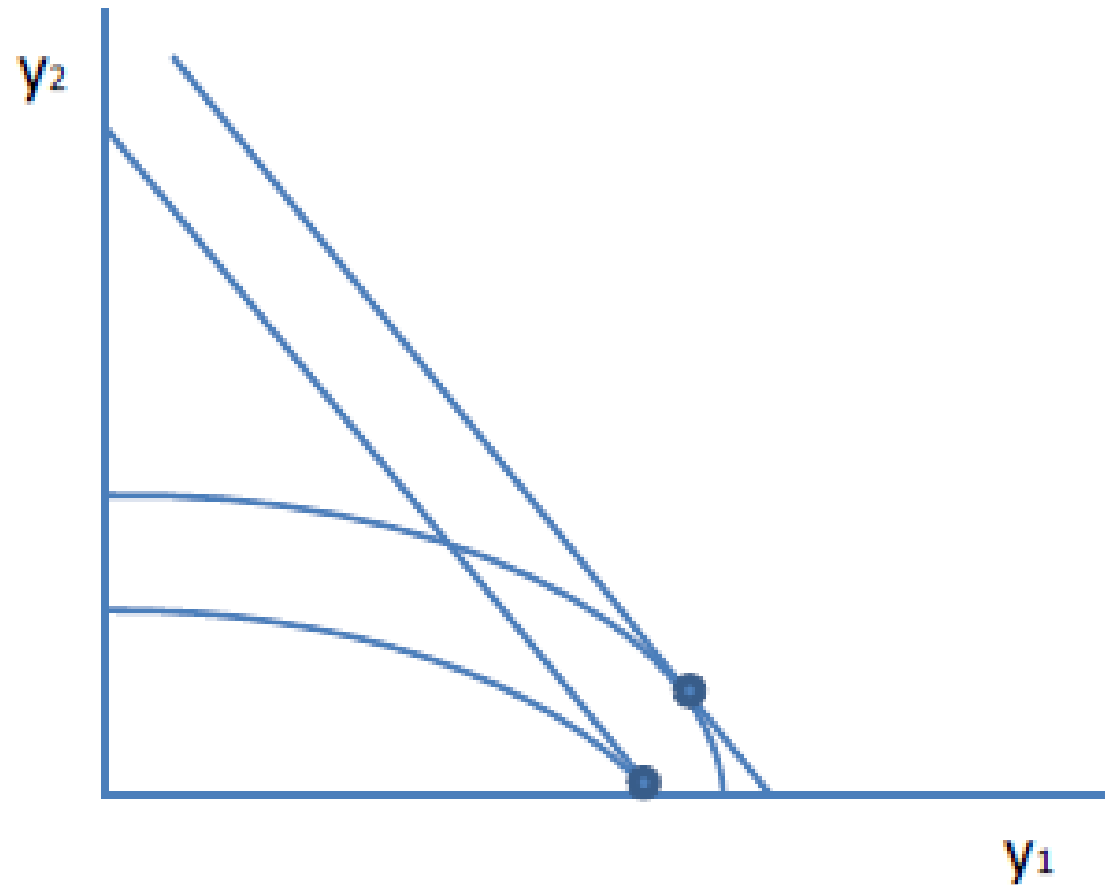
Table 11: Structural Regressions

	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent Variables	Product Scope							
Estimation Methods	LS	LS	IV	IV	LS	LS	IV	IV
Number of local input suppliers	0.20***		0.20**		0.26***		0.09**	
	(0.01)		(0.01)		(0.01)		(0.04)	
Number of total intermediate inputs		0.11***		0.11**		0.15***		0.04*
		(0.01)		(0.02)		(0.01)		(0.02)
TFP					0.06	0.06	0.47***	0.64**
					(0.03)	(0.03)	(0.16)	(0.30)
Price of output					0.16**	0.16**	0.04	0.36
					(0.05)	(0.05)	(0.70)	(1.06)
Price of intermediate inputs					0.02	0.14	-0.18***	-0.19***
					(0 .04)	(0.07)	(0.04)	(0.05)
Wages					0.04	0.04	-0.14***	-0.20***
					(0.05)	(0.05)	(0.05)	(0.07)
F-Statistics			29.11	13.01			158.66	158.66
Observations	1165	1165	1165	1165	1041	1041	1041	1041

Conclusions

- Results of this paper provide support to endogenous growth models which emphasize the importance of new intermediate inputs in explaining productivity growth

- Reduced form and structural regressions both are consistent with the hypothesis that larger presence of FDI firms causes product scope and productivity improvement of domestic firms due to better access to better and new local intermediate inputs

- Why others fail to identify horizontal spillovers could be because the lack of backward linkages of the FDI firms
- Policy recommendation may focus on attracting FDI firms that have sufficient backward linkages and can share local suppliers with domestic firms

Dependent Variable – ln(output)

	(1)	(2)	(3)	(4)	(5)	(6)
Industry	Non-woven	Non-woven	Non-woven	Woven	Woven	Woven
Dependent Variable	y_{it}	y_{it}	$y_{it+1}-0.156m_{it+1}-0.283l_{it+1}$	y_{ijt}	y_{it}	$y_{it+1}-0.549m_{it+1}-0.357l_{it+1}$
Materials	0.177***	0.156***	-0.004	0.524***	0.549***	0.013
	(0.051)	(0.046)	(0.040)	(0.044)	(0.045)	(0.028)
Labor	0.416***	0.283***	-0.019	0.396***	0.357***	-0.012
	(0.086)	(0.099)	(0.085)	(0.076)	(0.085)	(0.056)
Capital	0.121***		0.303***	-0.013		0.122***
	(0.048)		(0.081)	(0.032)		(0.053)
Age			-0.085			-0.226
			(0.281)			(0.162)
FDI			-0.370			-0.421
			(0.555)			(0.305)
Endogeneity correction[1]	No	Yes	Yes	No	Yes	Yes
Selectivity correction[2]	No	No	Yes	No	No	Yes
Year fixed effects	No	Yes	Yes	No	Yes	Yes
Observations	387	346	254	826	729	558

Fixed Effects Results

- Sibling foreign presence is positively correlated with better performance of domestic firms

- Robust to firm specific time trend, industry-location-year fixed effects, year varying firm controls (age, imported materials in total materials, materials in total sales)

IV Results

- The exogenous increase in sibling foreign presence due to EBA causes product scope, sales, output and productivity of domestic firms to increase, particular for firms that do not export to the EU
- Controlling for firm specific time trend gives similar results

Economically Significant?

- At sample mean, sibling foreign presence can explain about a third of the productivity gain within firms over the 5 year period

Industry Spillovers?

- Can we find positive horizontal spillovers using industry foreign presence?

- Caution – industry foreign presence is common across firms within industry-year, may be driven by industry demand shocks, trade policies and market competition

- Evidence of horizontal spillovers only significant for domestic firms that have foreign siblings

Structural Regressions

- Simple multi-product firm model with differentiated intermediate inputs

- Firm TFP depends on input variety

- Firm product scope depends on input variety, productivity and prices of inputs

So What?

- The absence of horizontal spillovers in other developing countries could be because those FDI firms have limited backward linkages

- Possible policy recommendation is to attract foreign investments that may have significant backward linkages and may share common local suppliers with domestic firms

- FDI as a catalyst for industrial development

Instrumental Variable

- EBA exogenously caused FDI woven firms that export to the EU to expand

⬇

- Domestic firms that have sibling foreign presence increases exogenously have better performance
- True even for domestic firms that do not export to the EU

Product Rivals and Market Rivals

- *Product rivals* – firms *i* and *k* are product rivals in *t* if they produce a same HS 6 digit product

- *Market rivals* – firms *i* and *k* are market rivals in *t* if they export to the same market