

Advanced Topics in Trade

Lectures 6 - Trade Reforms and Efficiency Gains in Developing Countries

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Today's Agenda

- ▶ Brief overview of firms in developing countries.
- ▶ Summary of Tybout (2000) about the major challenges facing developing countries.
- ▶ A more detailed examination of the impact of policy distortions on firm productivity and growth in China, India, and Mexico (Hsieh and Klenow, 2009, 2014).
- ▶ Three papers from Section 3: Trade Liberalization, Efficiency, Quality, and other Macroeconomic Consequences
 - ▶ Pavcnik on Chile (2002), Bustos on Argentina (2011), Khandelwal and Topalova on India (2011).

Tybout (2000 Journal of Economic Literature)

- ▶ “The Manufacturing sector is often the darling of policy makers in less developed countries (LDCs).”
 - ▶ Job creation, economic growth, technology transfer, all sort of positive externalities.
- ▶ Developing countries' government implemented policies to promote manufacturing exports.
- ▶ But oftentimes, it is the domestic policy distortion that hinders the development of manufacturing sectors.

Tybout (2000)

Benefits of Industrialization?

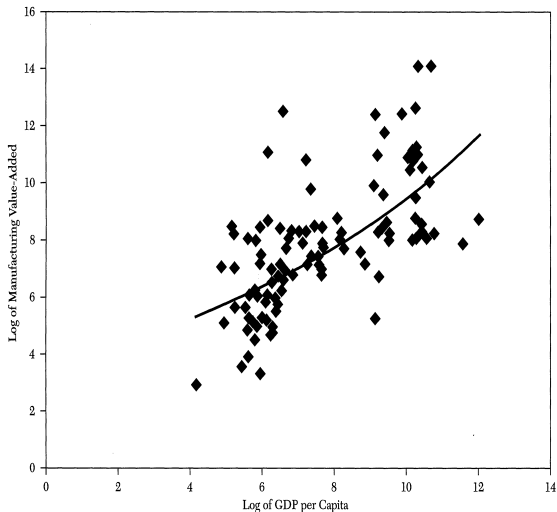


Figure 1. Size of the Manufacturing Sector and Level of Development

Source: Author's calculations based on the World Bank's World Development Indicators 1997.

Tybout (2000)

Common issues in LDCs

- ▶ Small market size
- ▶ Limited access to foreign inputs, capital, and technology
- ▶ Low rates of education
- ▶ Limited infrastructure
- ▶ Volatility/ policy uncertainty
- ▶ Bad governance

Tybout (2000)

Outcomes

- ▶ A lot of small firms (the “missing middle” phenomenon)
- ▶ A few large firms dominate policies, block entry, have special access to governments and banks.
- ▶ Small firms grow too slowly.
- ▶ Are small firms always more efficient? Not necessarily, but some of them are.
- ▶ Small firms account for a much larger employment share in LDCs.
- ▶ High productivity and firm size dispersion in LDCs. A symptom of inefficient policies?
- ▶ How can trade openness help solve some of these problems?

Hsieh and Klenow (2009)

Productivity Distribution

- ▶ Is it true that developing countries tend to have a more dispersed total factor productivity (TFP) distribution across firms?

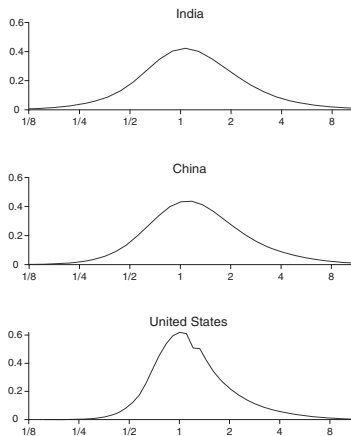


FIGURE II
Distribution of TFP

Hsieh and Klenow (2009)

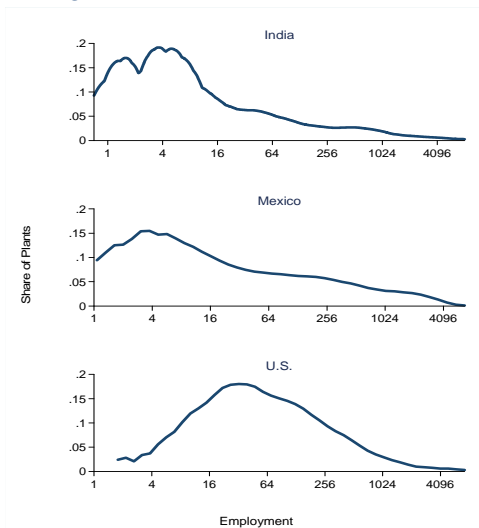
The gains from removing policy distortion

- ▶ What is the aggregate TFP gain if all policy distortion is removed so that marginal products of capital and labor, respectively, are equalized across firms within sectors?

TFP GAINS FROM EQUALIZING TFPR WITHIN INDUSTRIES

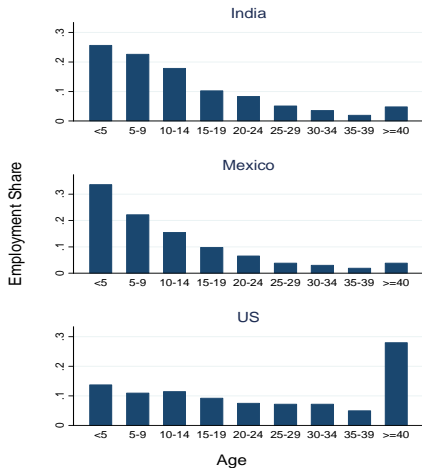
	1998	2001	2005
China			
%	115.1	95.8	86.6
India	1987	1991	1994
%	100.4	102.1	127.5
United States	1977	1987	1997
%	36.1	30.7	42.9

Figure 14: Distribution of Establishment Size



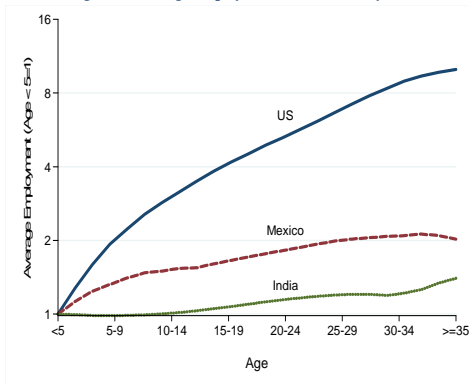
Sources: 2010-2011 ASI-NSS (India), 1998 Economic Census (Mexico), and 1997 Manufacturing Census (U.S.). Plants are weighted by the per-plant value-added share of each four digit industry.

Figure 3: Employment Share by Age in the Cross-Section



Notes: 2010-2011 ASI-NSS (India), 2003 Economic Census (Mexico), and 2002 Manufacturing Census (U.S.). For India, employment includes paid, unpaid, and contract workers. In Mexico employment includes paid and unpaid workers at fixed-location establishments. For the U.S. employment covers all manufacturing establishments with at least one employee.

Figure 4: Average Employment over the Life-Cycle



Notes: Employment growth imputed from the 1992 and 1997 U.S. Manufacturing Censuses, the 1998 and 2003 Mexican Economic Censuses, and the 1994-1995 and 2010-2011 Indian ASI-NSS. Employment of the youngest age group is normalized to 1 in each country. We compare average employment per surviving plant in a later year to average employment per operating plant in the same cohort in the earlier year. See text for details.

Hsieh and Klenow (2009)

Letting go the State-owned Enterprises in China

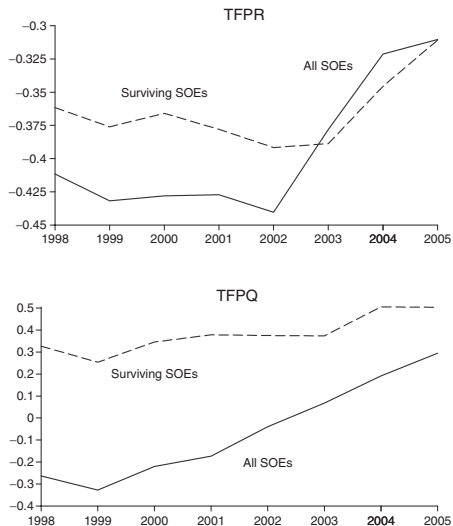


FIGURE IV
TFPR and TFPQ of Chinese State-Owned Firms

Hsieh and Klenow (2009)

Reducing the licensing costs in India

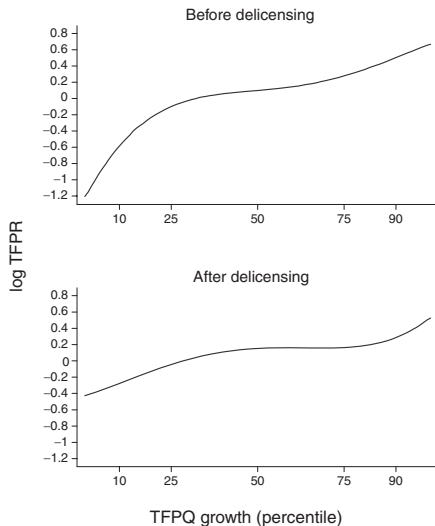


FIGURE V
TFPR and TFPQ Growth in Delicensed Sectors in India

Pavcnik on Chile (2002)

- ▶ Estimate the effects of a decrease in domestic tariffs (increased import competition) on firm productivity.
- ▶ Hypothesize that the increased import competition after liberalization may have the following consequences:
 - ▶ Inefficient producers may be forced out of the market (the extensive margin emphasized by Melitz (2003)).
 - ▶ Lower output prices cause domestic producers to increase output, and move down their average cost curve (due to increasing returns to scale).
 - ▶ Increase competition causes plants to "trim their fat" (reduce X-inefficiencies.)
 - ▶ May import "better" inputs.

Chile's Trade Policy

- ▶ Between 1974 and 1979 Chile underwent significant trade liberalization.
- ▶ Tariffs were reduced to 10% across the board by 1979.
- ▶ From 1983 to 1984 tariffs increased to 35%.
- ▶ By 1985, tariffs were reduced to 20%.
- ▶ Pavcnik's analysis examines 1979 to 1986.

Estimating Plant-Level Productivity

A challenging task

- ▶ Production function of a plant (in log):

$$y_{it} = \beta_0 + \beta x_{it} + \beta_k k_{it} + \omega_{it} + \mu_{it}$$

- ▶ x_{it} are variable factors of production.
- ▶ k_{it} is the plant's stock of capital.
- ▶ ω_{it} is plant-specific productivity, which is known to the plant, but not to the econometrician.
- ▶ μ_{it} is a productivity shock unknown to the plant or the econometrician.

Estimation Biases

- ▶ The first and foremost fundamental issue: How to tackle price and quality differences across firms?
- ▶ Simultaneity bias:
 - ▶ ω_{it} will affect a firm's choice of inputs (materials, labor, and capital) as well as output.
 - ▶ Therefore, β and β_k will be biased upward.
- ▶ Selection bias:
 - ▶ All else equal, given a low realization of productivity, firms with more capital are more likely to continue to operate.
 - ▶ The expected productivity of an operating firm is decreasing in its capital stock and β_k will be biased downward.

Solutions?

- ▶ There are a lot of technical details in the paper, which we will skip.
- ▶ The basic idea is to find an exogenous variable to serve as an instrument (that affects productivity but not output).
- ▶ Pavcnik (2002) argue that investment will affect capital stock next period but not this period, which appears to satisfy the exogeneity criteria of an instrument.
- ▶ In particular, Pavcnik estimates the following equation

$$y_{it} = \beta_0 + \beta x_{it} + \beta_k k_{it} + \omega_{it} + \mu_{it}$$

$$y_{it} = \beta_0 + \beta x_{it} + \beta_k k_{it} + \theta_{it}(k_{it-1}, i_{it-1}) + \mu_{it},$$

- ▶ where the productivity term ω_{it} is now replaced by $\theta_{it}(k_{it-1}, i_{it-1})$ is a polynomial of both k_{it-1} and i_{it-1}
- ▶ e.g., $\delta_2 k_{it-1}^2 + \delta_3 k_{it-1}^3 + \delta_4 k_{it-1}^4 + \gamma_2 i_{it-1}^2 + \gamma_3 i_{it-1}^3 + \gamma_4 i_{it-1}^4$

Estimation Procedures

- ▶ She estimates the production function in two stages:
 - ▶ The first stage is to obtain β (the elasticity on labor and material).
 - ▶ The second stage is to obtain β_k , with the probability of survival taken into account.
 - ▶ With β , β_k , and the polynomial formula, firm productivity can be calculated.

Production Function Estimates

TABLE 2(a)
Comparison of the semiparametric estimates of production functions

		(1)		(2)	
		Coef.	S.E.	Coef.	S.E.
Food processing	Unskilled labour	0-153	0-007	0-081	0-012
	Skilled labour	0-098	0-009	0-119	0-011
	Materials	0-735	0-008	0-723	0-011
	Capital	0-079	0-034	0-070	0-030
	<i>N</i>	7085		2806	
Textiles	Unskilled labour	0-215	0-012	0-183	0-020
	Skilled labour	0-177	0-011	0-166	0-015
	Materials	0-637	0-097	0-626	0-014
	Capital	0-052	0-034	0-056	0-032
	<i>N</i>	4265		1591	
Wood	Unskilled labour	0-195	0-015	0-149	0-023
	Skilled labour	0-130	0-014	0-134	0-023
	Materials	0-679	0-010	0-654	0-019
	Capital	0-101	0-051	0-107	0-020
	<i>N</i>	2154		692	
Paper	Unskilled labour	0-193	0-024	0-120	0-032
	Skilled labour	0-203	0-018	0-224	0-025
	Materials	0-601	0-014	0-594	0-023
	Capital	0-068	0-018	0-138	0-046
	<i>N</i>	1145		494	

The Effects of Trade Liberalization (Import Competition)

- ▶ Regression specification:

$$pr_{it} = \alpha_0 + \alpha_1 (Time)_{it} + \alpha_2 (Trade)_{it} + \alpha_3 (Trade \times Time)_{it} + \alpha_4 Z_{it} + \nu_{it}$$

- ▶ pr_{it} is the productivity of plant i in year t .
- ▶ $Time_{it}$ is a vector of year indicators.
- ▶ 1979 is the omitted (baseline) category.
- ▶ $Trade_{it}$ is a vector of trade-orientation indicators.
- ▶ Non-traded industries is the omitted category.

TABLE 4
Estimates of equation 12

	(1)		(2)		(3)		(4)		(5)		(6)	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Export-oriented	0.106	0.030**	0.106	0.030**	0.112	0.031**	0.098	0.048**	0.095	0.048**	0.100	0.046**
Import-competing	0.105	0.021**	0.105	0.021**	0.103	0.021**	-0.024	0.040	-0.025	0.040	-0.007	0.039
ex_80	-0.054	0.025**	-0.053	0.025**	-0.055	0.025**	-0.071	0.026**	-0.068	0.026**	-0.071	0.026**
ex_81	-0.099	0.028**	-0.097	0.028**	-0.100	0.028**	-0.117	0.027**	-0.110	0.027**	-0.119	0.027**
ex_82	0.005	0.032	0.007	0.032	0.003	0.032	-0.054	0.028*	-0.042	0.028	-0.055	0.028*
ex_83	0.021	0.032	0.023	0.032	0.021	0.032	-0.036	0.029	-0.025	0.030	-0.038	0.029
ex_84	0.050	0.031	0.051	0.031	0.050	0.031	0.007	0.028	0.017	0.028	0.007	0.028
ex_85	0.030	0.030	0.032	0.031	0.028	0.030	-0.001	0.029	0.013	0.030	-0.003	0.029
ex_86					0.043	0.036					-0.008	0.034
im_80	0.011	0.014	0.011	0.014	0.010	0.014	0.013	0.014	0.013	0.014	0.013	0.014
im_81	0.047	0.015**	0.047	0.015**	0.046	0.015**	0.044	0.014**	0.044	0.014**	0.044	0.014**
im_82	0.033	0.016**	0.034	0.017**	0.030	0.016*	0.024	0.015*	0.024	0.015*	0.025	0.015*
im_83	0.042	0.017**	0.043	0.017**	0.043	0.017**	0.040	0.015**	0.041	0.015**	0.042	0.015**
im_84	0.062	0.017**	0.062	0.017**	0.063	0.017**	0.059	0.015**	0.059	0.015**	0.061	0.015**
im_85	0.103	0.017**	0.104	0.017**	0.104	0.017**	0.101	0.015**	0.102	0.016**	0.101	0.015**
im_86					0.071	0.019**					0.073	0.017**
Exit indicator	-0.081	0.011**	-0.076	0.014**			-0.019	0.010**	-0.010	0.013		
Exit_export indicator			-0.021	0.036					-0.069	0.035*		
Exit_import indicator			-0.007	0.023					-0.005	0.021		
Industry indicators	yes		yes		yes		yes		yes		yes	
Plant indicators	no		no		no		yes		yes		yes	
Year indicators	yes		yes		yes		yes		yes		yes	
R ² (adjusted)	0.057		0.058		0.062		0.498		0.498		0.488	
N	22983		22983		25491		22983		22983		25491	

Note: ** and * indicate significance at a 5% and 10% level, respectively. Standard errors are corrected for heteroscedasticity. Standard errors in columns 1–3 are also adjusted for repeated observations on the same plant. Columns 1, 2, 4, and 5 do not include observations in 1986 because one cannot define exit for the last year of a panel.

Findings and Concerns

- ▶ Core result: large productivity improvements for import competing plants, but not for exporting plants.
- ▶ Issues:
 - ▶ Chiles currency appreciated significantly in 1980 and 1981, and then depreciated in 1982.
 - ▶ Because the price of exports rise, this will decrease the demand of exporting plants (relative to non-traded goods plants).
 - ▶ Because imported goods are now cheaper, this will also decrease the demand of import competing plants.
 - ▶ Lower demand may result in lower productivity.

Khandelwal and Topalova (2011)

- ▶ Explore the 1991 IMF-imposed trade liberalization in India.
- ▶ Before 1991, India's trade regime was among the most restrictive.
- ▶ By end of 1980s, only 12% of manufactured products could be imported under general licenses.
- ▶ Balanced-of-Payment crisis (rising current account deficits) in 1990-91.
- ▶ Turned to the IMF for conditional loans, which required macro stabilization policies and structural reforms.
- ▶ From 1990 to 1996, the average tariffs dropped from 87% to 43%. Standard deviation of tariffs dropped by 30%.

3 Different Tariff Measures

1. Output tariffs: simple or weighted averages of official tariff rates, at the industry level.
2. Input tariffs:

$$input_tariff_{jt} = \sum_s \alpha_{js} \times output_tariff_{st}$$

3. Effective rate of protection (ERP) proposed by Max Corden (1966):

$$erp_{jt} = \frac{output_tariff_{jt} - input_tariff_{jt}}{1 - \alpha_{js}}$$

α_{js} = share of input s in the value of output j .

Output Tariffs, Input Tariffs, and Effective Rates of Protection

TABLE 1.—INDIA'S OUTPUT TARIFFS, EFFECTIVE RATES OF PROTECTION, AND INPUT TARIFFS

Year	Output Tariff (1)	S.D. Tariff (2)	ERP (3)	S.D. ERP (4)	Input Tariff (5)	S.D. Input Tariff (6)
1989	0.97	0.41	0.93	0.43	0.36	0.09
1990	0.87	0.40	0.86	0.42	0.31	0.08
1991	0.89	0.39	0.89	0.41	0.31	0.08
1992	0.63	0.36	0.60	0.17	0.22	0.06
1993	0.82	0.42	0.77	0.22	0.30	0.08
1994	0.62	0.43	0.59	0.19	0.21	0.06
1995	0.47	0.30	0.44	0.16	0.17	0.05
1996	0.43	0.29	0.42	0.19	0.14	0.04
1997	0.35	0.25	0.34	0.15	0.11	0.03
1998	0.35	0.24	0.35	0.14	0.11	0.03
1999	0.34	0.16	0.34	0.14	0.12	0.03
2000	0.34	0.19	0.33	0.12	0.12	0.03
2001	0.35	0.20	0.33	0.12	0.12	0.03
1989–1996	0.70	0.42	0.68	0.35	0.25	0.10

Table reports the mean and standard deviation of tariffs across industries. Columns 1–2 report statistics for tariffs. Columns 3–4 report statistics for the effective rate of protection; see equation (3). Columns 5–6 report statistics for input tariffs; see equation (4). Input tariffs are constructed using the 1993–1994 Input-Output Transactions Matrix for India. Authors' calculations from data.

The Effects of Trade Liberalization (Import Competition)

- ▶ Unit of observation: firm i in industry j , year t
- ▶ Main specification:

$$y_{ijt} = \alpha + \beta_l l_{ijt} + \beta_p p_{ijt} + \beta_m m_{ijt} + \beta_k k_{ijt} + \omega_{ijt} + \varepsilon_{ijt}$$

- ▶ l_{ijt} stands for labor, p_{ijt} = power and electricity expenditure, m_{ijt} = materials; k_{ijt} = capital

Main Results

TABLE 3.—TRADE POLICY ENDOGENEITY: CURRENT PRODUCTIVITY AND SUBSEQUENT TRADE POLICY

Period	1989–2001 (1)	1989–1996 (2)	1997–2001 (3)
A: Output Tariffs			
Productivity	-0.133** [0.054]	-0.033 [0.070]	-0.177*** [0.067]
Observations	1,413	913	500
B: Input Tariffs			
Productivity	-0.032** [0.016]	-0.025 [0.024]	-0.047** [0.019]
Observations	1,359	878	481
C: Effective Rates of Protection			
Productivity	-0.211** [0.097]	-0.068 [0.138]	-0.235** [0.093]
Observations	1,347	870	477

The table regresses industry-level output tariffs (panel A), input tariffs (panel B), and effective rates of protection (panel C) in period t on industry-level productivity in period $t + 1$. Industry-level productivity is calculated as a real sales-weighted average of firm-level TFP. All regressions include industry and year fixed effects and are weighted by the number of firms in each industry for each particular year. Standard errors are clustered at the industry level. Significant at *10%, **5%, ***1%.

Robustness Checks

TABLE 5.—OUTPUT AND INPUT TARIFFS ON TOTAL FACTOR PRODUCTIVITY

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	8
					Lagged Dependent Variable	AB1	AB2	Direct Approach
Lagged output tariff	-0.011 [0.022]	-0.066*** [0.018]	-0.032* [0.017]	-0.046** [0.018]	-0.020 [0.014]	-0.036** [0.014]	-0.059*** [0.016]	-0.157*** [0.040]
Lagged input tariff	0.060 [0.075]	-0.508*** [0.107]	-0.480*** [0.098]	-0.276** [0.108]	-0.464*** [0.090]	-0.257** [0.107]	-0.278** [0.117]	-0.292 [0.201]
Lagged TFP					0.307*** [0.045]	0.455*** [0.068]	0.384*** [0.073]	
Private group firm	-0.022* [0.012]	-0.026** [0.011]						
Government owned	-0.121*** [0.030]	-0.135*** [0.032]						
Foreign	0.034* [0.020]	-0.008 [0.019]						
Medium	-0.026* [0.014]	-0.031** [0.015]						
Small	-0.056*** [0.017]	-0.089*** [0.018]						
Industry FEs		Yes						Yes
Firm FEs			Yes	Yes	Yes	Yes	Yes	
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Balanced panel				Yes				
AR1						-5.087	-5.048	
AR2						-0.729	0.413	
Observations	14,648	14,648	14,648	7,958	11,399	8,539	6,279	11,928

Table reports regressions of firm productivity on lagged output and input tariffs. All regressions include firm age and age squared, and the “private stand alone” and large are the omitted firm characteristics. In columns 6–7, the Arellano-Bond estimator is presented using one and two lags, respectively. Column 8 uses the direct method for estimating the productivity impact of tariffs, as explained in the main text. Robust standard errors are in parentheses. Standard errors are clustered at the firm level in columns 1–5. Standard errors in column 8 are bootstrapped using the block-bootstrapping method described in Efron and Tibshirani (1994), which takes into account the serial correlation in the data by keeping all observations that belong to the same firm together. Significance: *10%, **5%, ***1%.

Differential Effects across Industries

TABLE 6.—TRADE LIBERALIZATION AND INDUSTRY CHARACTERISTICS

	Basic, Intermediate and Capital Goods		Consumer Durables and Consumer Nondurables		Highly Regulated Pre-1991		Less Regulated Pre-1991		Export Oriented		Non-Export Oriented	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
A: Output Tariffs												
Lagged tariff	-0.092*** [0.020]	-0.089*** [0.017]	-0.004 [0.040]	-0.005 [0.027]	0.016 [0.075]	-0.009 [0.038]	-0.058*** [0.018]	-0.071*** [0.015]	0.096 [0.147]	-0.152 [0.144]	-0.066*** [0.017]	-0.060*** [0.015]
Observations	7,050	3,135	4,796	1,949	1,024	451	12,689	5,431	891	367	10,632	4,603
B: Output and Input Tariffs												
Lagged tariff	-0.082*** [0.020]	-0.104*** [0.019]	0.026 [0.049]	0.050 [0.037]	-0.020 [0.160]	-0.011 [0.062]	-0.028 [0.018]	-0.055*** [0.017]	0.097 [0.147]	-0.146 [0.140]	-0.054*** [0.017]	-0.066*** [0.017]
Lagged input tariff	-0.202 [0.155]	0.303** [0.145]	-0.511*** [0.183]	-0.608*** [0.175]	-0.593* [0.328]	-0.370 [0.318]	-0.499*** [0.116]	-0.233** [0.113]	-1.109** [0.561]	-0.356 [0.582]	-0.331*** [0.118]	-0.026 [0.114]
Observations	7,011	3,114	4,681	1,894	957	418	12,602	5,388	852	346	10,517	4,548

Table reports regressions of firm productivity on lagged output and input tariffs by industry characteristics. All regressions include firm age, age squared, and firm and year fixed effects. Even-numbered columns present the Arellano-Bond estimator with two lags. Robust standard errors in parentheses. Standard errors are clustered at the firm level in odd-numbered columns. Significance: *10%, **5%, ***1%.

Differential Effects across Firms

TABLE 7.—TRADE LIBERALIZATION AND FIRM CHARACTERISTICS

	Domestic		Foreign		Large		Medium		Small	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A: Output Tariffs										
Lagged tariff	-0.062*** [0.018]	-0.068*** [0.016]	0.041 [0.037]	-0.039 [0.034]	-0.096*** [0.033]	-0.045** [0.018]	-0.033 [0.021]	-0.093*** [0.021]	-0.065* [0.036]	-0.031 [0.047]
Observations	13,618	5,718	1,190	637	2,673	1,538	7,474	3,572	4,661	1,245
B: Output and Input Tariffs										
Lagged tariff	-0.041** [0.019]	-0.061*** [0.018]	0.047 [0.041]	-0.028 [0.039]	-0.078** [0.034]	-0.016 [0.019]	-0.012 [0.022]	-0.087*** [0.025]	-0.034 [0.036]	-0.053 [0.049]
Lagged input tariff	-0.508*** [0.102]	-0.301** [0.123]	-0.058 [0.351]	-0.134 [0.227]	-0.289* [0.158]	-0.452*** [0.112]	-0.449*** [0.134]	-0.345* [0.195]	-0.802*** [0.245]	0.119 [0.242]
Observations	13,485	5,657	1,163	622	2,649	1,523	7,394	3,531	4,605	1,225

Table reports regressions of firm productivity on lagged output and input tariffs by firm characteristics. All regressions include firm age, age squared, and firm and year fixed effects. Even-numbered columns present the Arellano-Bond estimator with two lags. Firm sizes are classified as follows: small if average sales over the sample are less than the median, medium if sales are larger than median but less than the first percentile, and large if sales in the first percentile. Robust standard errors are in parentheses. Standard errors are clustered at the firm level in odd-numbered columns. Significance: *10%, **5%, ***1%.