ARTNeT Workshop ON Emerging trade issues in asia & The pacific
Meeting modern challenges

Does Protection Make Firms More Productive?

Evidence from Philippine Micro Data

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Motivation

- **Philippine case: substantial liberalization from late 1980s to mid-90s, policy reversal from late 90s onwards**
- **Impact of trade policy changes on productivity**
- **Melitz (2002): with firm heterogeneity, liberalization leads to productivity increases through firm exit & market share reallocation**
- **Pavcnik (’00), Fernandes (’03), Topalova (‘03), Chand&Sen (’00), Amiti&Konings (‘04), Muendler (’02), Schor (’03)**
- **Industries facing greatest tariff reduction & import competition have faster productivity growth than protected industries**
  - Resource allocation due to exit of inefficient plants & productivity improvements within plants

Presentation Outline

- **Trade Policy Reforms & Structure of Protection**
- **Manufacturing Performance, Growth, Structure**
- **Methodogy: adapted Pavcnik (2002)**
  - TFP estimation: Levinsohn & Petrin approach
  - TFP decomposition: within firm productivity & reallocation of market shares & resources from less to more efficient firms
  - Regression: determinants of productivity
- **Analysis of Results**
- **Summary & Policy Implications**

Part 1: Trade Policy & Protection

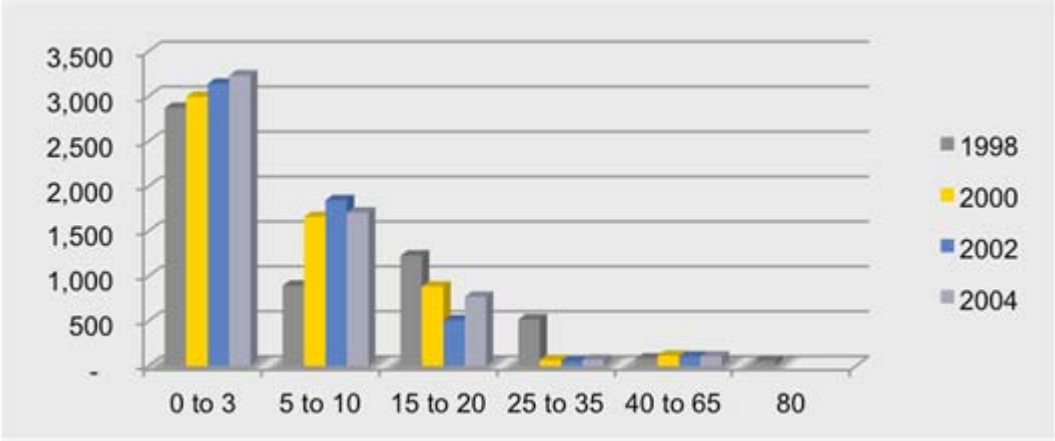
Year	Description
1980s-mid 1990s	removal tariff & non-tariff barriers (tariff reform programs 1 &2)
1995	tariff reform program (TRP) 3 as first step towards uniform 5% tariff by 2005
1996	tariffication of quantitative restrictions on agriculture & creation of tariff quotas
1998	mini reform packages not implemented, tariffs frozen at 2000 levels
2001	TRP 4 never implemented
2003	selective protection through Executive Orders 241 & 264

TariffS & frequency distribution

Average Tariff Rates (in %)

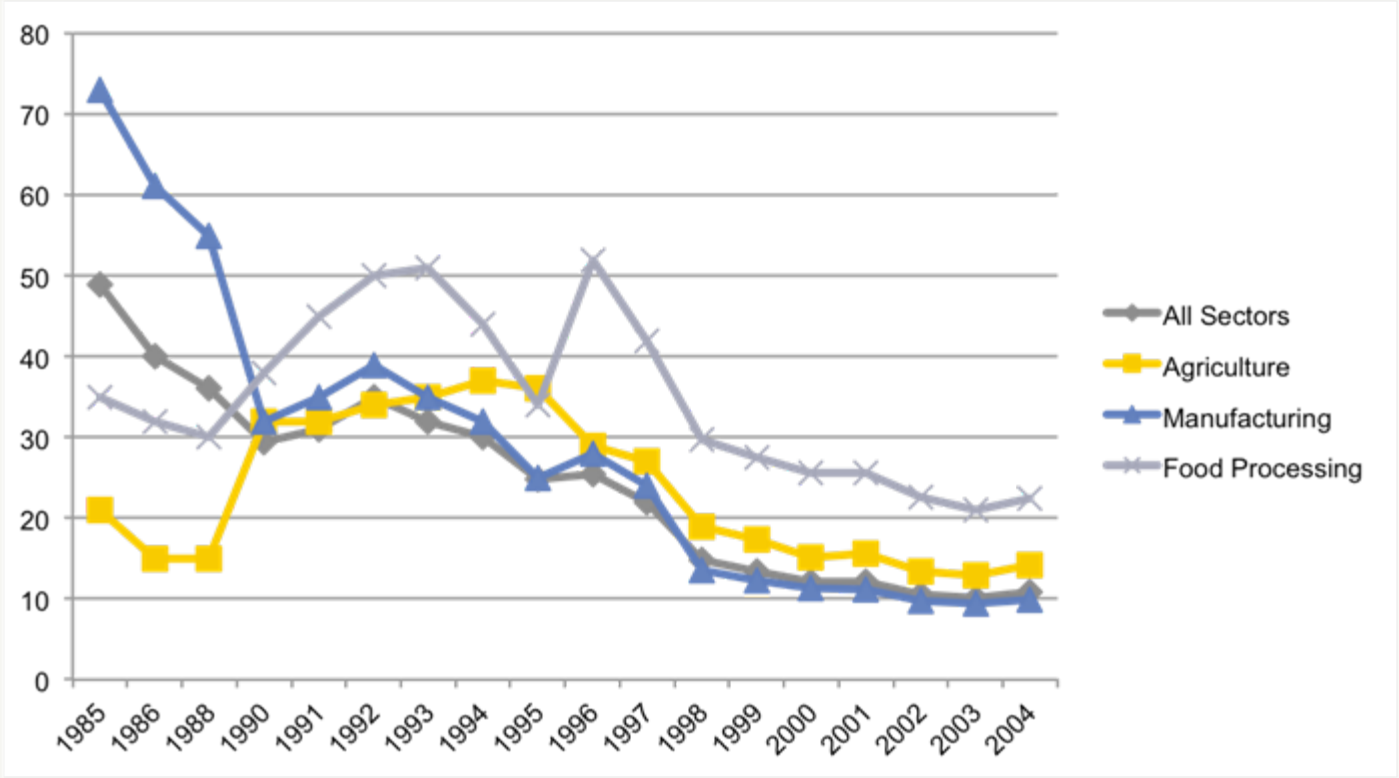
	1996	1998	2000	2002	2003	2004
Mfg CV	28.0 0.97	11.4 0.93	8.5 0.95	6.39 1.3	6.57 1.03	6.76 1.03
Agri CV	29.0 0.95	15.9 1.07	11.5 1.3	10.4 1.31	10.4 1.22	11.3 1.17
All CV	25.5 1.02	11.3 0.96	8.47 0.99	6.45 1.17	6.60 1.06	6.82 1.07

Frequency distribution of tariffs



- **Substantial trade reforms from 1980s-1990s**
- **In 2003-04, selective protection**
- **After ‘04, liberalization thru ASEAN CEPT Program**
- **Average tariffs already very low, except for selected products esp. sugar, petrochemicals, flat glass, iron & steel**

Effective Protection Rates (in % 1985-2004)



- **EPRs have declined**
- **Substantial differences in protection across sectors**
- **Food manufacturing receives highest protection**

EPR of Importables vs. Exportables

	1998	2000	2002	2004
All Sectors	**14.75**	**12.13**	**10.55**	**10.88**
Importable	25.64	21.21	18.82	19.09
Exportable	3.45	2.72	1.98	2.36
Agriculture	**18.98**	**15.12**	**13.38**	**14.15**
Importable	22.67	19.01	17.97	18.09
Exportable	15.36	11.31	8.89	10.30
Mfg	**13.61**	**11.37**	**9.79**	**9.96**
Importable	27.30	22.48	19.53	19.87
Exportable	-1.57	-0.96	-1.02	-1.04

- **Importables remained highly protected**
- **Exportables penalized esp. mfg (negative EPRs)**

EPR Dispersion: Coefficient of Variation (CV)

	1998	2000	2002	2004
All Sectors	2.82	3.21	2.13	2.27
Agriculture	0.75	0.77	0.88	0.77
Manufacturing	3.27	3.68	2.45	2.64

- **CV a measure of dispersion, indicator whether structure is distorting**
- **High levels of CV, esp in manufacturing**

Protection structure continues to discriminate

- **Bias in favor of agriculture & food manufacturing**
- **Bias in favor of importables & against exports, remained penalized**
- **Protection structure implies strong incentive to misallocate resources**

Part 2: Performance, growth, structure

	average growth rate			average share		
	80s	90s	20s	80s	90s	20s
GDP	1.7	2.8	4.6	100	100	100
Agriculture	1.3	1.5	3.5	23.5	21.6	19.2
Industry	0.9	2.1	3.9	27.6	26.4	25.4
Manufacturing	0.9	2.3	3.4	25.9	25.1	23.8
Service	2.3	3.7	5.2	48.9	52	55.4

- **Mfg growth sluggish from 1980s-1990s**
- **With some modest gains posted in the 2000s**
- **very little movement of resources in manufacturing as share to total industrial output declined**

Employment CONTribution

Sector	average growth rate			average share		
	80s	90s	20s	80s	90s	20s
Agriculture	**1.2**	**0.7**	**1.4**	**49.6**	**42.8**	**36.6**
Industry	**2.5**	**1.7**	**0.8**	**10.6**	**10.6**	**9.6**
Manufacturing	**2.5**	**2.1**	**0.6**	**9.9**	**10.2**	**9.2**
Services	**4.8**	**4.2**	**3.6**	**39.8**	**46.6**	**53.8**

- **Growth rate of employment has been weak**
- **Share to total employment has remained stagnant**
- **Failure to create enough employment to absorb new entrants to labor force**

Manufacturing value added

	1981-89	1990-99	2000-09
Consumer Goods	**57.0**	**50.0**	**50.0**
Food manufactures	44	36	39
Beverage industries	4	4	4
Footwear & wearing apparel	5	6	5
Intermediate Goods	**31.0**	**35.0**	**27.0**
Chemical & chemical products	7	6	6
Products of petroleum & coal	12	17	14
Capital Goods	**10**	**13**	**19**
Basic metal industries	3	2	2
Electrical machinery	3	6	12

- **Consumer products dominated**
- **intermediate products followed, then capital goods**

Part 3: Methodology

- **Estimate TFP using Levinsohn&Petrin (2001)**

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \mu_{it} \; ; \; \mu_{it} = \omega_{it} + \eta_{it}$$

- **TFP Decomposition**

$$\Omega_t = \sum_i s_{it} prod_{it} = \overline{prod}_t + \sum_i (s_{it} - \bar{s})(prod_{it} - \overline{prod}_t)$$

"within firm productivity growth" ***"reallocation effect" or covariance effect***

- **Trade & Productivity Link : TFP Determinants**

$$prod_{it} = \alpha_0 + \alpha_1 trlib + \alpha_2 z_{it} + \varepsilon_{it}$$

Data

- **NSO's Annual Survey & Census of Establishments: 1996-98, 2000,2002-03, 2005-06**
- **Panel data created by linking the firms' ID codes**
- **Unbalanced dataset: all firms with 2 or more observations**
- **Exit: firm is present in a given year t but will not be present in subsequent year t+1**
- **firms no longer in the 2006 census**
- **Firms with missing, zero or negative values for the variables in TFP estimation were excluded (mostly firms with less than 10 workers)**

Descriptive Statistics

Variable	Definition	Obs	Mean	SD
Totworkers	Total number of workers	22500	259.4827	627.1911
Capital	Book value of assets	22500	1.57E+08	8.89E+08
Value added	Revenues –(raw materials+electricity& fuel)	22500	2.02E+08	1.26E+09
Fuelelect	Fuel and electricity	22500	3.31E+07	1.55E+09
Epr	Effective protection rate	22500	16.06315	20.0311

Year	No. of firms per year	No. of firms that exited
1996	2603	4
1997	2642	723
1998	2627	111
2000	2135	365
2002	2448	783
2003	2207	521
2005	3508	358
2006	4330	--
Total	22500	2865

Manufacturing sectors by trade orientation

- **Non-traded: export & import ratios are zero or less than 1%**
  - slaughtering and meat packing, ice cream, mineral water, and custom tailoring, dressmaking

Traded sectors

- **Purely Exportable: substantial exports or export ratio of at least 10% and 0 or minimal imports**
  - Tobacco leaf curing, crude coconut oil, rattan furniture
- **Purely Importable: substantial imports or import ratio of at least 10% and 0 or minimal exports**
  - Meat & meat products, coffee roasting, assembly motor vehicles
- **Mixed Sector: substantial imports & exports**
  - Motor vehicle parts & components, semi-conductor, appliances

PART 4: Total factor productivity growth, 2006

Industry	TFP	Industry	TFP
All manufacturing	-3.37	coke, petroleum, chemicals & rubber	-4.76
food, beverages, tobacco	-1.44	non-metallic products	-0.65
Textile	2.35	basic metal & fabricated metal	1.32
garments	0.99	machinery & equipment vehicles & other transport	-0.86
leather	9.54	furniture	1.86
wood, paper, publishing	-3.85	Other manufacturing	0.63

- Normalized growth figures interpreted relative to 1996; aggregate TFP declined by 3.37% between 1996 & 2006
- failure to invest in state of the art technology, lack of investment in human capital

TFP Decomposition Manufacturing

Year	Aggregate productivity	Unweighted productivity	Covariance
1997	-0.2289	0.52691	-0.75581
1998	-1.5939	0.94821	-2.54213
2000	-0.4444	0.04361	-0.48812
2002	-4.8621	-0.20471	-4.65744
2003	-1.0019	0.61681	-1.61874
2005	-2.5331	-0.62714	-1.90597
2006	-3.3701	-1.47782	-1.89236

$$\Omega_t = \sum_i s_{it} prod_{it} = \overline{prod}_t + \sum_i (s_{it} - \bar{s})(prod_{it} - \overline{prod}_t)$$

- covariance: reshuffling of resources
- unweighted productivity: within firm productivity
- TFP declined, negative unweighted productivity & covariance

TFP decomposition by sector, 2006

Sector	Aggregate productivity	Unweighted productivity	Covariance
Textile	2.3518	-2.26561	4.61733
Leather	9.5435	-7.69629	17.23975
Basic metal & fabricated prods	1.3205	-0.70002	2.02053
Furniture	1.864	0.20054	1.66347
Other manufacturing	2.8653	-3.44865	6.31391
Food, beverages, tobacco	-1.4387	-1.93472	0.49602
Garments	-0.9928	-2.5954	1.60258
Wood, paper, publishing	-5.3884	-1.40469	-3.98371
Petroleum, chemical, rubber	-4.7642	-2.13054	-2.63366
Non-metallic	-0.6473	-2.37125	1.72388
Machiner, equipment, vehicles	-0.858	0.82884	-1.68693

- 5 out of 11 subsectors had + aggregate productivity growth
- Productivity growth driven mainly by growth in covariance (reshuffling of resources from less productive to more productive firms)

Non-Traded (NT) Sector

Year	Aggregate productivity	Unweighted productivity	Covariance
1997	1.0615	1.0713	-0.0099
1998	-2.0268	0.6031	-2.63
2000	1.7744	1.9616	-0.1872
2002	1.2714	1.8996	-0.6282
2003	3.7791	3.1779	0.6012
2005	12.8997	3.8971	9.0026
2006	3.9191	0.7626	3.1564

$$\Omega_t = \sum_i s_{it} prod_{it} = \overline{prod}_t + \sum_i (s_{it} - \bar{s})(prod_{it} - \overline{prod}_t)$$

- From 1996 to 2006, aggregate productivity grew by 3.9%, of which 3.2% was due to the reallocation of resources & 0.8 due to within firm productivity growth

Purely Exportable (PX) Sector

Year	Aggregate productivity	Unweighted productivity	Covariance
1997	4.7958	1.0313	3.7645
1998	12.0972	2.7059	9.3914
2000	4.2568	0.1134	4.1434
2002	9.1702	0.0232	9.147
2003	4.2675	0.0232	4.2443
2005	3.479	-0.5855	4.0645
2006	3.7554	-1.2888	5.0442

$$\Omega_t = \sum_i s_{it} prod_{it} = \overline{prod}_t + \sum_i (s_{it} - \bar{s})(prod_{it} - \overline{prod}_t)$$

- From 1996 to 2006, aggregate productivity grew by 3.8%, of which 5% was contributed by the reshuffling of market shares towards more efficient firms.

Purely Importable (PM) Sector

Year	Aggregate productivity	Unweighted productivity	Covariance
1997	0.9131	0.6038	0.3093
1998	2.1644	2.3049	-0.1404
2000	-2.8248	0.0552	-2.8799
2002	-4.4221	0.65	-5.072
2003	-1.7409	2.3334	-4.0742
2005	-1.5688	0.0233	-1.592
2006	-0.9943	-0.9624	-0.0318

$$\Omega_t = \sum_i s_{it} prod_{it} = \overline{prod}_t + \sum_i (s_{it} - \bar{s})(prod_{it} - \overline{prod}_t)$$

- From 1996 to 2006, TFP declined by 0.99% due to falling unweighted productivity growth and covariance growth rates

Mixed Sector (MX)

Year	Aggregate productivity	Unweighted productivity	Covariance
1997	-0.4724	0.437	-0.9094
1998	-2.524	0.7156	-3.2397
2000	0.0477	-0.0164	0.0641
2002	-5.3206	-0.3946	-4.9259
2003	-1.099	0.3881	-1.4871
2005	-3.0772	-0.8372	-2.24
2006	-3.9225	-1.5295	-2.3931

$$\Omega_t = \sum_i s_{it} prod_{it} = \overline{prod}_t + \sum_i (s_{it} - \bar{s})(prod_{it} - \overline{prod}_t)$$

- From 1996 to 2006, TFP declined by 3.9% due to negative unweighted productivity growth and covariance growth rates

Does trade liberalization affect productivity?
OLS Results

Explanatory Variable	Non-traded	Purely-importable	Purely-exportable	Mixed sector
lnepr	-0.122***	-0.076***	0.065***	-0.057***
	(0.036)	(0.015)	(0.028)	(0.009)
lnworkers	0.051***	0.064***	0.041***	0.044***
	(0.002)	(0.002)	(0.002)	(0.001)
exit indicator	0.004	-0.003	-0.001***	-0.1***
	(0.008)	(0.007)	(0.006)	(0.002)
sector indicators	yes	yes	yes	yes
year indicators	yes	yes	yes	yes
R-squared	0.4117	0.3787	0.267	0.2887
N	1024	2296	1738	17442

$$prod_{it} = \alpha_0 + \alpha_1 trlib + \alpha_2 z_{it} + \varepsilon_{it}$$

Random Effects

Explanatory Variable	Non-traded	Purely-importable	Purely-exportable	Mixed sector
lnepr	-0.049***	-0.073***	0.037	-0.031***
	(0.043)	(0.017)	(0.027)	(0.009)
lnworkers	0.046**	0.047***	0.033***	0.036***
	(0.003)	(0.003)	(0.003)	(0.001)
exit indicator	0.001	0.006	-0.0005	-0.006***
	(0.006)	(0.006)	(0.005)	(0.002)
sector indicators	yes		yes	
year indicators	yes		yes	
R-squared within	0.0721	0.0009	0.0004	0.0026
between	0.3971	0.4028	0.2956	0.3451
overall	0.407	0.3728	0.2652	0.2809
N	1024	2296	1738	17442
Breusch-Pagan Test	chi2(1) = 10314.56 Prob> chi2 = 0.0000			

Fixed Effects

Explanatory Variable	Non-Traded	Purely-Importable	Purely-Exportable	Mixed sector
lnepr	0.059	-0.052**	0.036	0.007
	(0.067)	(0.03)	(0.042)	(0.014)
lnworkers	0.034***	0.002	-0.015***	0.005***
	(0.009)	(0.007)	(0.008)	(0.002)
exit indicator	0.001	0.007	-0.003	-0.004**
	(0.007)	(0.006)	(0.007)	(0.002)
sector indicators	yes	yes	yes	
year indicators	yes	yes	yes	
R-squared within	0.0768	0.0186	0.0319	0.0107
between	0.3399	0.0034	0.1396	0.0342
overall	0.3564	0.0038	0.1555	0.0229
N	1024	2296	1738	17442
Hausman Test	chi2=788.23 Prob> chi2 = 0.0000			

$$prod_{it} = \alpha_0 + \alpha_1 trlib + \alpha_2 z_{it} + \varepsilon_{it}$$

Part 5: Summary & Implications

- **With firm heterogeneity, trade liberalization forces least productive firms to exit & reallocates market shares leading to aggregate productivity increases (Melitz 2003)**
- **Decomposition showed that in leather, textile, furniture, basic metals & other manufacturing, growth was driven mainly by the reallocation of market shares & resources from less productive to more productive firms**
- **Regression results showed that productivity increases due to the exit of inefficient firms & market share reallocation, negative & significant coefficient on *exit* indicator for mixed sector**
- **Results showed some evidence that protection leads to productivity losses & trade liberalization leads to productivity gains, negative & significant coefficient on *lnepr* for purely importable sector**

Summary & implications (conT'd)

- **Review selective protection to address distortions & inefficient resource allocation; not only shielded favored sectors (sugar, petrochemicals, glass, iron & steel) from competition but led to tariff disparities particularly among finished products that make use of these as inputs.**
  - Since tariffs on inputs are greater than tariffs on final goods, cost of production remained high affecting productivity
- **Reduce tariffs, simplify structure by adopting a more uniform tariff policy**