Trade Liberalisation and Manufacturing Productivity in Nepal: Examining A Small Open Developing Economy

Amrit Pathak[1] Dr Shawn Leu[2]
Prof Mahinda Siriwardana[3]

Australian Conference of Economists
ECONOMICS IN THE NEW NORMAL
10–13 JULY 2022
HOBART TASMANIA

ESA | The Economic Society of Australia | Tasmania

1 Doctoral Student, UNE Business School, University of New England

2 Senior Lecturer in Macroeconomics, UNE Business School, University of New England

3 Professor of Economics, UNE Business School, University of New England

Introduction

- Several studies on average productivity responses to lower trade protection through liberalisation polices (Pavcnik, 2002; Amiti and Konings, 2007; Fernandes, 2007; Topalova and Khandelwal, 2011; Yu et al., 2013; Ogu et al., 2016; Rijesh, 2020).
- Scant empirical evidence on distributional productivity responses.
- Focusing only on aggregate trade policy impacts on productivity ignores heterogenous responses exhibited by different industries.
- We investigate whether trade liberalisation is uniformly beneficial to all manufacturing industries in Nepal.
- We find effects of the common liberalisation shock vary across industries along the productivity distribution and are dependent on industry characteristics.

Overview of the Work

- Exploit Nepal's rapid trade reforms intensified in the early 1990s and study the trade-productivity nexus using manufacturing industry data.
- Go beyond popular mean productivity approach in the literature and examine the link by productivity quantiles.
- Two major contributions to the literature:

A. First, find considerable heterogeneity in how the fruits of productivity improvement are shared between different types of industries in a trade liberalising country.

B. Second, given the heterogenous industry responses, the results are informative to policymakers in formulating suitable policy packages in addressing the needs of different types of industries.

Nepal's Trade Liberalisation

Nepal started adopting economic reform measures in the mid-1980s under the condition of the Structural Adjustment Program (SAP) in cooperation with the IMF and the World Bank.

The reform process further intensified in 1992 when Nepal's new democratically elected government implemented a series of market-oriented policy reforms.

Reforms included the full convertibility of the rupee, elimination of quantitative restrictions and import licenses, rationalisation of the tariff structure, simplification of the tax system, and expansion of investment incentives (Biggs et al., 2000).

- The 2006 IMF Staff Country Report: unweighted average tariff fell from about 40% in 1990 to 14% in 2004/05.
- In 1996, Nepal signed a trade and transit agreement with India – a further boost to the economy – Nepalese domestic products have access to the large Indian market with domestic content requirements removed.

Methodology

- Empirical analysis starts with the estimation of an industry level production function using the Levinsohn and Petrin (2003, henceforth LP) and Ackerberg et al. (2015, henceforth ACF) methodologies.
- Based on the estimated coefficients, we construct industry total factor productivity (TFP).
- Next, industry productivity is regressed on tariffs to estimate trade liberalisation effects.

- We assume a Cobb-Douglas production function for an industry *i* at time *t*:

$$y_{it} = \alpha_l l_{it} + \alpha_k k_{it} + \alpha_m m_{it} + \alpha_f f_{it} + \alpha_e e_{it} + \omega_{it} + \upsilon_{it} \qquad \textit{Eq.1}$$

Where y_{it} is output, l_{it} is labor, k_{it} is capital, m_{it} is raw materials, f_{it} is fuel, and e_{it} is electricity. ω_{it} is an industry-specific and time-varying productivity shock and υ_{it} is an idiosyncratic error.

- LP propose a control function approach: a firm's intermediate input demand is a function of unobserved productivity, conditional on the capital stock.
- Form of the control function: nonparametric in capital and intermediate input.

- Ackerberg et al. (2015): a functional dependence problem may arise from using the LP methodology.
- An alternative: use of the ACF proposed value-added Cobb-Douglas production function.

$$va_{it} = \alpha_l l_{it} + \alpha_k k_{it} + \omega_{it} + \upsilon_{it} \qquad Eq.2$$

Where va_{it} is logged value-added output.

- After obtaining inputs parameters, we compute Hick's neutral TFP of an industry by subtracting predicted output from its actual output.

$$TFP_{it} = y_{it} - \hat{\alpha}_l l_{it} - \hat{\alpha}_k k_{it} - \hat{\alpha}_m m_{it} - \hat{\alpha}_f f_{it} - \hat{\alpha}_e e_{it} \quad Eq.3 \quad (\text{LP})$$
$$TFP_{it} = va_{it} - \hat{\alpha}_l l_{it} - \hat{\alpha}_k k_{it} \qquad Eq.4 \quad (\text{ACF})$$

- Next, use of the LP and ACF TFP measures to investigate the impact of trade policy on industry productivity.

$$TFP_{it} = \beta_0 + \beta_1 tariff_{it} + \beta_2' ind\_dum_{it} + \beta_3' (tariff * ind\_dum)_{it} + \eta_i + \lambda_{it} + \varepsilon_{it} \quad \textit{Eq. 5}$$

Where TFP_{it} is industry productivity, η_i captures time-invariant industry-specific characteristics, λ_{it} captures economy-wide shocks to all industries over time, $tariff_{it}$ represents a trade liberalisation measure, and ind_dum_{it} is a vector of indicator variables that contains industry characteristics.

Data Preparation

- Use of the National Census of Manufacturing Establishments (NCME) of Nepal.
- Censuses are quinquennial in nature.
- Data from the census year 1981/82 to 2011/12.
- Altogether seven time points for the panel dataset.
- Each census contains an average of 3,712 establishments.
- We categorise these establishments into 66 different industries according to the four-digit Nepal Standard Industrial Classification (NSIC), following international practices.

- Industries having one or two establishments are omitted from the dataset.
- Due consideration given in preparing the dataset: examining variable definitions across years, sorting through the data, resolving issues with industry identification codes, industrial classification revisions, and underreporting of data.
- Finally, we build a single panel dataset sorted by industry type and year.

Trade Liberalisation Measures

We employ industry-level import tariffs as proxy for trade liberalisation.

Use of the UNCTAD-TRAINS database to extract tariff data via the World Integrated Trade Solution (WITS) portal.

Extracted tariffs for each of the 4-digit 66 industries are effectively applied tariffs (AHS).

We also use most favored nations (MFN) tariffs as an alternative measure.

Tariff rates for each industry are matched to their respective census years.

Industry Characteristics

- We construct indicator variables for size and location based on the number of establishments.
- Reference category for the size variable is ‘Large’.
- Large industries include those that have more than 50% of establishments employing 50 workers or more, and vice versa for ‘Small’.
- For the location variable, the reference category is ‘Rural’.
- Rural industries have more than 50% of establishments located in rural areas, and vice versa for ‘Urban’.

Results and Discussions

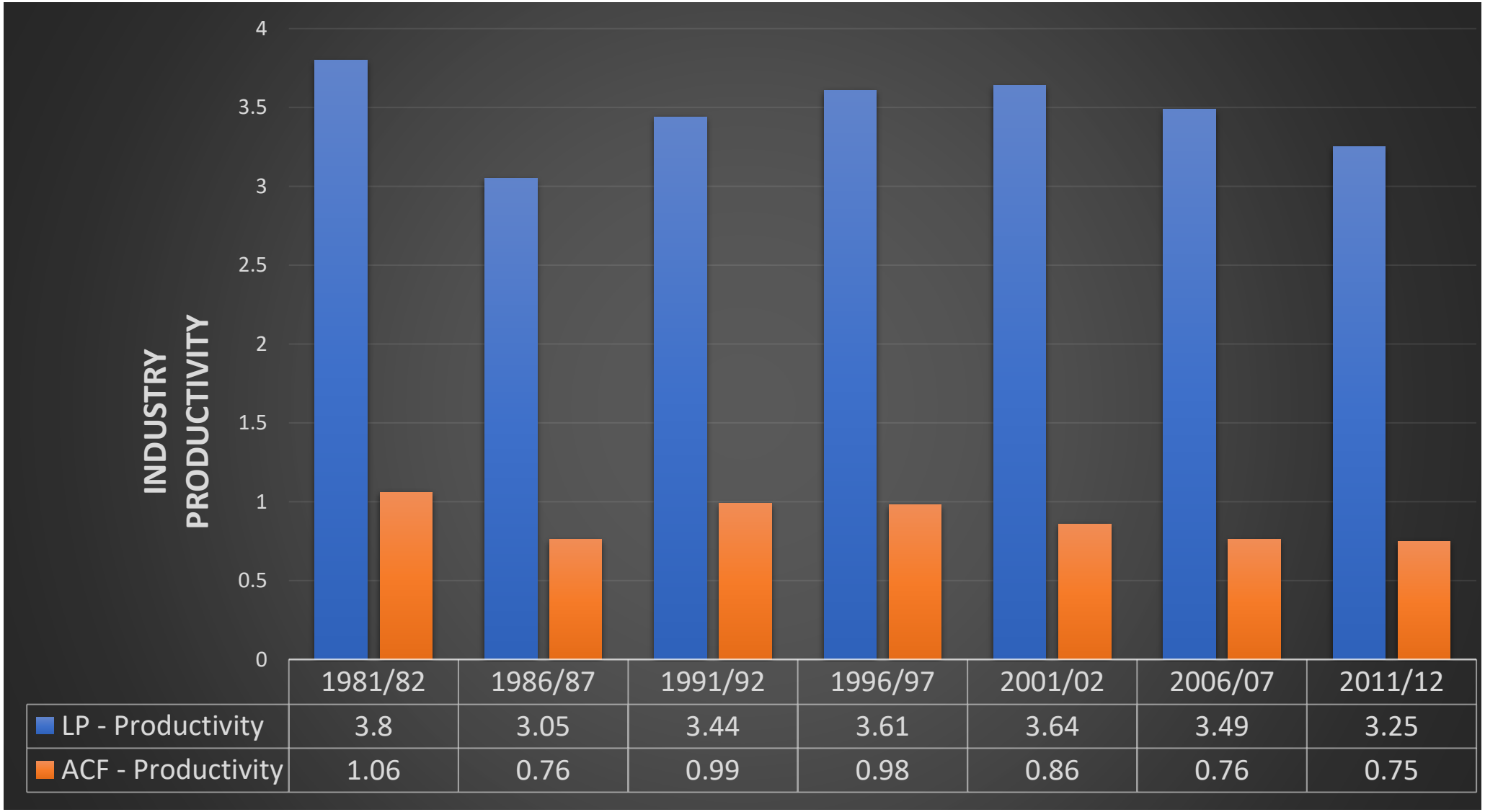
- Production function estimation: evidence the estimated magnitude for labor coefficient is greater than that of capital coefficient, suggesting the Nepalese manufacturing sector is relatively more labor-intensive.
- Looking at the LP productivity estimates, the productivity number drops initially, then increases gradually from 1986/87 to 2001/02, after which the trend is reversed.
- Results consistent with the various domestic shocks that the Nepalese economy experienced during the study period.

Table A Production Function Estimates

	Models	
Dependent variable: Output	LP	ACF (va)
Labor	0.1999***	0.6062**
	(0.0393)	(0.2502)
Capital	0.1200*	0.3885**
	(0.0620)	(0.1766)
Raw materials	0.6200***	
	(0.0844)	
Fuel	0.0784***	
	(0.0188)	
Electricity	0.0005	
	(0.0187)	
Returns to scale (RTS)	1.0187	0.9947
	$\chi^2(1) = 0.62$	$\chi^2(1) = 0.00$
	[0.4323]	[0.9482]
Observations (N)	365	294

Note: LP is Levinsohn and Petrin (2003), estimating the gross output production function (1); ACF is Ackerberg et al. (2015), estimating the value-added production function (2). In the LP column, bootstrapped standard errors are in parentheses; in the ACF column, robust standard errors are in parentheses; p-values are shown in square brackets. *p<0.10, **p<0.05, and ***p<0.01 denote the level of statistical significance at 10%, 5% and 1% respectively.

FIGURE 1 LP and ACF Total Factor Productivity



	1981/82	1986/87	1991/92	1996/97	2001/02	2006/07	2011/12
LP - Productivity	3.8	3.05	3.44	3.61	3.64	3.49	3.25
ACF - Productivity	1.06	0.76	0.99	0.98	0.86	0.76	0.75

A. Trade Policy Impact on Industry Productivity

We estimate *Eq.5* in four specifications M1 to M4 with industry- and year-fixed effects.

Model M1 regresses TFP on tariffs only. Expected negative sign, i.e., lower tariffs increase industry productivity, however the tariff coefficient is statistically insignificant.

In model M2, we add the two industry characteristic variables. Although the coefficients are not significant, the estimated sign suggests that large industries benefit from efficiency scale in lifting productivity.

In model M3, we add two more regressors where tariffs interact respectively with size (‘Large’) and location (‘Rural’) variables.

Interestingly, while tariffs do not affect productivity directly, its interactive term with size (large industries) is negative and significant at 1%.

This means the productivity enhancement from lower tariffs is concentrated in large industries than diffused across the entire manufacturing sector in Nepal.

In model M4, both size and location interact with tariffs together, and we find further productivity enhancement for rural-based large industries.

Switching to MFN tariffs, the results are consistent with those of AHS tariffs

Table B Tariffs and Industry Productivity

	AHS Tariffs				MFN Tariffs			
Dependent variable: LP TFP	M1	M2	M3	M4	M1	M2	M3	M4
Tariffs	-0.0213	-0.0208	-0.0006	-0.0032	-0.0189	-0.0175	-0.0004	-0.0034
	(0.0159)	(0.0156)	(0.0085)	(0.0079)	(0.025)	(0.025)	(0.0124)	(0.0113)
Large Ind.		0.1575	1.2079*	1.2738**		0.1566	1.2509*	1.3016**
		(0.346)	(0.6323)	(0.6362)		(0.3378)	(0.6925)	(0.626)
Rural Ind.		-0.1804	0.0787	0.0923		-0.1639	-0.0332	-0.0259
		(0.1342)	(0.3757)	(0.3672)		(0.1155)	(0.4748)	(0.4482)
Tariffs*Large Ind.			-0.0635***	-0.0504**			-0.0633**	-0.0493*
			(0.0224)	(0.0246)			(0.0296)	(0.0286)
Tariffs*Rural Ind.			-0.0214	-0.0174			-0.0118	-0.0074
			(0.0191)	(0.0196)			(0.0254)	(0.024)
Tariffs*Large Ind.*Rural Ind.				-0.0309*				-0.0301
				(0.0158)				(0.0272)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Squared (R^2)	0.046	0.049	0.091	0.097	0.034	0.037	0.071	0.077
Observations (N)	283	283	283	283	298	298	298	298

Note: Robust standard errors clustered by industry are in parentheses. LP TFP is Levinsohn-Petrin total factor productivity; AHS is effectively applied tariff; MFN is most favoured nations tariff. *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$ denote statistical significance at 10%, 5%, and 1% respectively.

Robustness Check

- Now we estimate *Eq. 5* using ACF productivity.
- Starting with AHS tariffs, we obtain the consistent result that large industries reap the benefit of higher productivity when tariffs are lowered.
- Additional productivity gains accrue to large industries operating in rural areas.
- Using MFN tariffs, the story is qualitatively consistent.

Table C Tariffs and Industry Productivity

Dependent variable: ACF TFP	AHS Tariffs				MFN Tariffs			
	M1	M2	M3	M4	M1	M2	M3	M4
Tariffs	-0.0048	-0.0048	0.0022	0.0012	-0.0013	-0.0011	0.0026	0.0019
	(0.0046)	(0.0046)	(0.0044)	(0.0046)	(0.0062)	(0.0061)	(0.0056)	(0.0057)
Large Ind.		0.0136	0.0754	0.1016		0.0061	-0.0132	-0.0011
		(0.0999)	(0.1378)	(0.1318)		(0.0907)	(0.1701)	(0.1658)
Rural Ind.		-0.0370	0.1441	0.1495		-0.0344	0.0881	0.0898
		(0.0833)	(0.1517)	(0.1513)		(0.0734)	(0.1572)	(0.1550)
Tariffs*Large Ind.			-0.0055	-0.0003			-0.0001	0.0032
			(0.0048)	(0.0047)			(0.0062)	(0.0068)
Tariffs*Rural Ind.			-0.0107*	-0.0091			-0.0071	-0.006
			(0.0062)	(0.0063)			(0.0072)	(0.0075)
Tariffs*Large Ind.*Rural Ind.				-0.0123*				-0.0072
				(0.0064)				(0.0061)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Squared (R^2)	0.067	0.068	0.078	0.084	0.059	0.059	0.062	0.064
Observations (N)	283	283	283	283	298	298	298	298

Note: Robust standard errors clustered by industry are in parentheses. ACF TFP is Ackerberg-Caves-Frazer total factor productivity; AHS is effectively applied tariff; MFN is most favoured nations tariff. *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$ denote statistical significance at 10%, 5%, and 1% respectively.

B. Trade Policy Impact by Productivity Quantiles

- To uncover variations in responses depending on industries' productivity distribution.
- Results: most of the coefficient estimates are negative for both tariffs with respect to LP and ACF productivity, confirming lower tariffs lead to higher productivity.
- Also, there is an increasingly negative association between industry productivity and tariff reductions when moving from lower to upper quantiles of productivity distribution.
- Only the most efficient industries enjoy productivity gains when trade protection is lowered.

Table D Impacts of Tariffs by Industry Productivity Quantiles

TFP	LP		ACF	
	AHS	MFN	AHS	MFN
q10	0.0032	0.0057	-0.0016	-0.0067
	(0.0048)	(0.0092)	(0.0067)	(0.0208)
q25	-0.0065	-0.0060	-0.0057	-0.0040
	(0.0076)	(0.0082)	(0.0076)	(0.011)
q50	-0.0082	-0.0151	-0.0056	-0.0034
	(0.0094)	(0.0162)	(0.0043)	(0.0069)
q75	-0.0101	-0.0088	-0.0019	0.0024
	(0.0074)	(0.0076)	(0.0077)	(0.0083)
q90	-0.0587***	-0.0289*	-0.0140	-0.0164
	(0.0136)	(0.0154)	(0.2700)	(0.0230)
q95			-0.1568***	0.0073
			(0.0459)	(0.0074)

Note: Standard errors are in parentheses. TFP is total factor productivity; LP stands for Levinsohn and Petrin (2003); ACF stands for Ackerberg et al. (2015); AHS is effectively applied tariff; MFN is most favoured nations tariff. *p<0.10, **p< 0.05, and ***p<0.01 denote statistical significance at 10%, 5%, and 1% respectively. q10 to q95 denote productivity distribution at different quantiles. All specifications of quantile regressions include both year- and industry-fixed effects.

Conclusion

- Trade liberalisation impacts are industry-specific depending on industry characteristics and productivity distribution.
- First set of results: only large industries derive productivity gains with lowered trade protection as part of the liberalisation process in Nepal.
- Second set of results: only the most efficient producers can take advantage of tariffs reductions in generating significant productivity increases.

Policy Implications

Government should be cognisant of the uneven distribution of productivity improvement between different types of industries when domestic markets open to new economic opportunities but also external competition.

Policymakers need to design additional domestic policies to assist smaller and less efficient industries to optimise liberalisation benefits, especially in least developed countries.

Small industries would need time and require policy assistance to increase productivity in the face of new foreign competition introduced by trade liberalisation.

The End