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Imported Intermediates, Innovation, and Product Scope: Firm-Level Evidence from Developing Countries

Ben Shepherd, Principal.

Susan Stone, OECD.

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developing trade consultants
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349 5th Avenue
New York, NY 10016
Ben@Developing-Trade.com

Imported Intermediates, Innovation, and Product Scope: Firm-Level Evidence from Developing Countries

Ben Shepherd and Susan Stone[1]

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Abstract: This paper generalizes recent work for India which shows that the use of imported intermediates is associated with the creation of new product varieties by domestic firms. It uses firm-level data for 17 developing countries and 13 sectors to show that firms that source their inputs internationally tend to introduce more new products than those that use domestic inputs only. In the preferred specification, a firm that imports all of its intermediates tends to produce 18% more new products than a firm that sources all of its inputs locally, after controlling for other factors.

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[1] *Shepherd (Corresponding Author)*: Principal, Developing Trade Consultants, Ltd., Ben@Developing-Trade.com, 260 W 52nd St. #22B, New York, NY 10019, USA, T. +1-646-845-9702, F. +1-646-350-0583. *Stone*: Senior Trade Policy Analyst, OECD, susan.stone@oecd.org.

1 Introduction

Goldberg et al. (2010) and Seker and Rodriguez-Delgado (2012) have recently used Indian data to show that access to imported intermediate goods is associated with increased product scope for domestic firms. By obtaining a wider range of inputs, domestic firms can innovate and produce new varieties. Concretely, Goldberg et al. (2010) estimate that about one-third of the observed rise in product scope in their data can be explained by access to foreign intermediate inputs. This mechanism is potentially an important one for developing countries looking to maximize their gains from trade in the context of endogenous growth. However, it has not been rigorously examined outside the Indian context, and so the question remains as to whether previous results can be generalized to other developing countries.

The present paper undertakes a similar analysis using firm-level data covering 17 developing countries[2] and 13 sectors, taken from the World Bank's Enterprise Surveys dataset. It confirms that previous results using Indian data are generalizable to other developing countries: even after controlling for a range of other factors, firms that import intermediate goods tend to introduce more new product varieties than other firms. Concretely, a firm that imports all of its inputs tends to produce 18% more new products than a firm that sources all of its inputs domestically.

Only Lederman (2010) uses similar data to examine the determinants of new product introduction. This paper differs from Lederman (2010) in two important ways, however. First, the dependent variable is a count of the number of new products introduced in the last three years, as opposed to a dummy variable equal to unity if a firm introduced a new product in the last two years. The analysis here is therefore at a finer level, and more closely resembles the approach of Goldberg et al. (2010). Second, the primary independent variable is also different. Lederman (2010) examines the influence of a wide range of factors and uses tariffs and non-tariff measures, at the country and sector levels as his proxy for

[2] "Developing countries" are taken to be all except the high income countries in the World Bank's classification scheme.

engagement in international markets. He goes on to find only weak evidence that tariff rates are negatively associated with the introduction of new products. This paper, by contrast, controls for country and sector specific factors like tariffs using fixed effects, and focuses on firm-level import behavior as the main independent variable of interest. The link between access to imported intermediates and product innovation is therefore much closer in the present paper.

The paper proceeds as follows. The next section presents the dataset and empirical model. It then discusses results, and shows that they are robust to a variety of specifications. Section 3 concludes by discussing the implications of these results.

2 Empirical Model and Results

2.1 Data

The World Bank's Enterprise Surveys dataset currently has data on over 120,000 firms in 125 mostly developing and transition economies. This paper uses a subset of the Enterprise Surveys data from 2002-2006. All high income countries are dropped from the analysis, so the sample is limited to developing countries only. Only manufacturing firms are kept in the sample, with services firms excluded. Taking into account this narrowing of the sample and data availability, a total of 17 countries and 13 industries remain in the estimation sample for the favored empirical model.

Each survey covers a cross-section of firms, but asks questions that produce up to three years' worth of data (i.e., firms are asked to provide information for one year ago, two years ago, and three years ago). The dataset is therefore a panel, although no entry or exit is observed. Some countries are included more than once in the dataset when they are surveyed over multiple years, but it is impossible to determine whether or not individual firms are included multiple times due to the way in which the

World Bank assigns anonymous identifiers to firms in each survey. However, due to the small number of repeated countries in the sample, this is not a major issue.

2.2 Empirical Model

Table 1 provides full information on the variables used in this paper, all of which are sourced from the Enterprise Surveys dataset. Variable definitions are largely standard and do not require further discussion. Labor productivity is used instead of TFP because sample size is greatly improved: not all firms report the more detailed data required to estimate TFP, but most report total sales and the number of permanent employees.[3]

The only variable that requires further discussion is the number of new products introduced by an establishment over the last three years. It is the key variable for the analysis, and is used as the dependent variable for the regressions. Clearly, what constitutes a "new" product is open to debate. In highly detailed data such as those used by Goldberg et al. (2010), it is possible to identify a firm's product scope in terms of standard international trade classifications, such as the Harmonized System. A "new" product is then a product within a Harmonized System category that has not been produced before. With the Enterprise Surveys data, it is necessary to take a different approach because individual products are not identified in this way. Instead, the Enterprise Surveys questionnaire specifies that a "new" product is one that "involved a significant change in the production process". This is probably a somewhat looser definition than the one based on the Harmonized System classification, but it has the advantage of being a more commercial one. In any case, it is possible to control for the fact that different firms might interpret "products" in different ways by including a count of the number of products produced by the firm three years ago (i.e., netting out recent innovations). That variable is

[3] Additional results available on request show that this paper's findings are robust to the use of TFP estimated using the Levinsohn and Petrin (2003) methodology rather than labor productivity, even though the estimation sample is much smaller.

included as a robustness check below, and results prove to be fully consistent when it is included in the model.

Table 1: Variables, definitions, and sources.

Variable	Definition	Year	Source
Exporter	Dummy variable equal to unity for establishments that export a non-zero percentage of their sales either directly or indirectly (through a distributor)	Various	Enterprise Surveys questions c211a2 and c211a3
Foreign	Dummy variable equal to unity for establishments that are owned more than 50% by the foreign private sector	Various	Enterprise Surveys question c203b
Importer	Dummy variable equal to unity for establishments that import a non-zero percentage of their material inputs and supplies either directly or indirectly (through a distributor)	Various	Enterprise Surveys questions c2122 and c2123
Log(Capacity Utilization)	Logarithm of the establishment's average capacity utilization over the last year	Various	Enterprise Surveys question c250
Log(Capital Intensity)	Logarithm of the net book value of total assets per permanent employee one year ago	Various	Enterprise Surveys questions c262a1y and c281f1y
Log(Sales)	Logarithm of the establishment's total sales one year ago	Various	Enterprise Surveys question c262a1y
Log(Labor Productivity)	Logarithm of total sales per permanent employee one year ago	Various	Enterprise Surveys questions and c262a1y and c274a1y
Log(New Products)	Logarithm of the number of new products introduced by an establishment in the last three years	Various	Enterprise Surveys question c253b
Log(Old Products)	Logarithm of the number of products the establishment produced three years ago	Various	Enterprise Surveys questions c253a and c253b

Using these data, the empirical model takes the following form:

$$\log(New\ Products_{fcst}) = \sum_{c}\sum_{s}\sum_{t} d_{cst} + b_0 Importer_{fcst} + \sum_{i} b_i Controls_{fcst} + e_{fcst}$$

where d indicates a full set of fixed effects by country-sector-year, e is a standard error term, and controls refers to a set of firm-level control variables introduced progressively. (Due to the structure of

the dataset—the new products variable is only observed once per firm, as is importer status—it is impossible to include firm-level fixed effects as in Goldberg et al., 2010). The fixed effects account for factors that are common to all firms within a given country-sector-year combination, such as tariffs and other sectoral regulations.

2.3 Discussion of Results

Results from estimation by OLS appear in Table 2. The baseline regression is in column 1, and does not include any additional firm-level controls. In line with expectations and the results of Goldberg et al. (2010), importing intermediate goods is positively associated with the number of new products introduced, and the association is statistically significant at the 1% level.

Columns 2 through 4 of Table 2 progressively introduce additional firm-level controls. The importer dummy variable consistently has a positive and 1% statistically significant coefficient when controls are added for foreign ownership and exporter status (column 2), and size, productivity, and capacity utilization as a proxy for management competence (column 3).

As noted above, the definition of "new product" used in the Enterprise Surveys is somewhat open to interpretation by firms. Column 4 therefore includes an additional variable to control for the way in which each firm counts products, namely a tally of the number of products produced three years ago. The importer dummy remains positively signed and 1% statistically significant.

An additional data issue is that use of a log linear model drops all firms that report having introduced zero new products over the last three years. This factor is a potential source of bias. Column 5 deals with it by replacing the dependent variable with log(0.001+new products). The importer dummy remains positively signed and statistically significant, and it even increases substantially in value, which indicates that the link between imported intermediates and product innovation is stronger when non-innovators are included in the sample.

The finding that importer status is associated with introduction of more new products is not only statistically significant, but also economically meaningful. Taking the column 4 results as a benchmark, a firm that imports all of its intermediate goods tends to produce on average 18% more new products than a firm that sources all of its inputs domestically (exp(0.168)-1=0.18).

Table 2: Regression results.

	(1)	(2)	(3)	(4)	(5)
Importer	0.255***	0.213***	0.166***	0.168***	0.458***
	(0.000)	(0.000)	(0.005)	(0.000)	(0.001)
Foreign		-0.002	-0.083	0.026	-0.239
		(0.981)	(0.493)	(0.740)	(0.140)
Exporter		0.160**	0.085	-0.023	0.301*
		(0.014)	(0.248)	(0.638)	(0.061)
Log(Sales)			0.103***	0.032*	0.137***
			(0.000)	(0.051)	(0.000)
Log(Labor Productivity)			-0.138***	-0.063**	-0.117*
			(0.002)	(0.016)	(0.057)
Log(Capacity Utilization)			-0.061	-0.001	0.263*
			(0.416)	(0.993)	(0.051)
Log(Old Products)				0.534***	1.109***
				(0.000)	(0.000)
N	3561	3538	2865	2186	5375
R2	0.008	0.010	0.019	0.442	0.175

*Note: The dependent variable is log(new products) in columns 1-4, and log(0.001+new products) in column 5. Estimation is by OLS with fixed effects by country-sector-year. P-values based on robust standard errors clustered by country-sector-year appear in parentheses below the parameter estimates. Statistical significance is indicated by * (10%), ** (5%), and *** (1%).*

3 Conclusion

This paper has shown that firms that import intermediate goods tend to develop more new products than those that source their inputs from the domestic market. Its findings can be interpreted as a generalization of Goldberg et al. (2010) using data for a range of developing countries. By including a

measure of imports at the firm-level, rather than sector-level tariffs as in Lederman (2010), it is possible to more precisely identify the link between intermediate goods trade and product innovation. The effect of importing intermediates is both economically and statistically significant. Given the importance of product innovation in endogenous growth models, this paper suggests that trade in intermediate inputs can be an important vector of growth in the developing world.

4 References

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