TRADE FACILITATION AND INNOVATION: EVIDENCE FROM SOUTH ASIA SUBREGIONAL ECONOMIC COOPERATION COUNTRIES

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ABSTRACT

We use firm-level data from Bangladesh, India, and Nepal to show that trade times affect innovation behavior. Reducing export times as a proxy for improved trade facilitation brings added competitive pressure from world markets, which induces firms to innovate. Improving import times allows firms to access imported intermediates, which are equally associated with increased innovation. We find consistent evidence that shorter trade times are associated with the introduction of new products, and new management systems. In terms of mechanisms, shorter trade times are associated with greater spending on research and development, as well as additional time allocation to those activities. From a policy perspective, our results suggest that long-run growth in the South Asia Subregional Economic Cooperation countries can be supported in part by improving trade facilitation, where performance lags substantially behind the global frontier.

I. INTRODUCTION

1. Innovation is a key driver of long-term economic growth and development, and modern theories of growth emphasize the fact that it is endogenous to a wide range of influences in the economy (e.g., Romer 1990). Recent contributions in the trade literature have emphasized that engagement with the international economy can promote innovation at the firm level. Goldberg et al. (2010) and Seker and Rodriguez-Delgado (2012) used Indian data to show that access to imported intermediate goods is associated with increased product scope for domestic firms. Seker (2012) has shown that the same result holds in 43 developing countries in Eastern Europe and Central Asia, as well as Latin America and the Caribbean. Concretely, Goldberg et al. (2010) estimated that about one-third of the observed rise in product scope in their data can be explained by access to foreign intermediate inputs. Although the literature on imported intermediates has focused on tariff cuts as the mechanism leading to increased availability to local firms, there is evidence that trade facilitation can also play a role in expanding trade at the extensive (product) margin: see Dennis and Shepherd (2011), and Beverelli, Neumueller, and Teh (2015).

2. Expansion in product scope is readily equated to a particular type of innovation, namely the introduction of new products into the market. However, that is not the only way in which productivity-enhancing innovation can take place, and particularly in developing countries, may not even be the most important way. Process innovation also matters, as does innovation in management systems. At the same time, current work has not focused on the mechanisms that underlie innovation, such as allocating time or money to research and development (R&D) activities within firms.

3. Shepherd (2017) used Indian firm-level data to extend the existing literature. He focused on innovation by firms across three dimensions: new products, new processes, and new management systems. In addition, he looked at two mechanisms that underlie successful innovation, namely investment of financial resources in R&D, and allocation of time to that activity. He has shown that engagement with the international economy—proxied by exporter and importer status—is positively associated with the probability that a firm engages in innovation.

4. This paper builds on and extends that work in two ways. First, we expand the dataset to include firm-level data for Bangladesh and Nepal, in addition to India, thus ensuring greater relevance to South Asia Subregional Economic Cooperation (SASEC) countries as a whole. Second, we go beyond exporter and importer status to examine policy variables that could plausibly affect innovation activity by mediating the links between firms and the world economy. Concretely, we focus on trade facilitation performance, proxied by the average time taken for exports and imports to clear customs, as measured by individual firms. Policy makers have direct influence over these outcome variables, which have particular prominence currently in the context of the World Trade Organization's (WTO) Trade Facilitation Agreement (TFA). We find that halving the time taken to clear customs increases the probability that a firm engages in innovative activity by 10%–20%, depending on the type of activity considered. This magnitude is quantitatively important, in particular as SASEC countries are not world leaders in terms of trade facilitation. The implication, which we discuss further in the conclusion, is that SASEC countries could boost innovation—which supports long-run growth and development—by improving trade facilitation, as one of a cluster of actions.

II. DATA AND PRELIMINARY ANALYSIS

5. The primary data source for this paper is the World Bank's Enterprise Surveys dataset. It currently has data on over 120,000 firms in 125 mostly developing and transition economies. This paper uses a survey on innovation implemented in a subset of those countries. We take data for Bangladesh (2013), India (2014), and Nepal (2013) as these are the only SASEC countries for which the required data are available. After limiting the sample to manufacturing firms only, because trade facilitation data are not observed for firms that only sell services, and dropping observations in the top and bottom percentiles of firm-level productivity by country, the total sample consists of 17,783 observations across 36 sectors. After we take into account varying availability patterns across different variables of interest, we are left with an estimating sample of between 629 and 974 observations. The survey covers a single year of activity, although some questions contain a temporal dimension (e.g., by comparing the current year with 3 years prior).

6. The process for undertaking Enterprise Surveys is highly standardized. The World Bank works with local partners to develop a sampling frame based on the business register, or similar resource. Survey companies are then engaged to contact firms using stratified random sampling. Interviews are conducted face to face, typically with a senior manager. Topics covered include basic financial and performance information, business constraints, international integration, and relations with government. The breadth of the Enterprise Surveys makes them an incomparable resource for conducting policy relevant firm-level empirical work in developing countries.

7. This paper uses a selection of data points from recent surveys of Bangladesh, India, and Nepal. The reason for choosing a single survey is that the current version of the questionnaire—which provides important new details on innovation—has not yet been incorporated into the standardized multi-country dataset.[1] The interest of exploiting new data on innovation is strong and justifies limiting the sample to a restricted country sample.

8. It is important to describe the five variables used to capture innovation activity at the firm level, as they represent a departure from the previous literature in terms of their richness. Table 1 provides detailed definitions of these variables as well as other variables taken from the survey for empirical analysis. A first feature of these new data is that it is possible to distinguish three sorts of innovation: product, process, and systems. The first refers to the introduction of a new product, the most well-known type of innovation. The second captures innovative changes to production systems—a particularly important type of innovation in the developing country context. The third covers innovation in management and organizational systems, again a source of incremental technical change. These three indicators are used sequentially in the empirical analysis to show the linkages between trade facilitation and innovation at the firm level, keeping the coverage as wide as possible. Summary statistics show that around 40% of firms for which data are available report introducing a new product, system, or process.

[1] Other countries for which data on innovation are available include Belarus, Bulgaria, Democratic Republic of the Congo, Ethiopia, Ghana, Kazakhstan, Kenya, Lithuania, Malawi, Namibia, Nigeria, Pakistan, Poland, Romania, Serbia, Tajikistan, Tanzania, Uganda, Ukraine, Uzbekistan, and Zambia. In additional results, we show that the paper's results are robust to the inclusion of additional countries for which data are available.

Table 1: Variables, Definitions, and Sources

Variable	Definition	Source
Foreign	Dummy variable equal to unity for establishments that are owned more than 50% by the foreign private sector	Enterprise Surveys question b2b
Log(Capacity Utilization)	Logarithm of the establishment's output produced as a proportion of the maximum output possible using all available resources	Enterprise Surveys question f1
Log(Capital Intensity)	Logarithm of the establishment's net book value of machinery, vehicles, and equipment, and land and buildings per permanent full-time employee	Enterprise Surveys questions l1, n6a, and n6b
Log(Employees)	Logarithm of the establishment's number of permanent full-time employees	Enterprise Surveys question l1
Log(Experience)	Logarithm of the number of years' experience in the sector of the firm's top manager	Enterprise Surveys question b7
Log(Export Time)	Logarithm of the number of days taken for exported goods to clear customs	Enterprise Surveys question d4
Log(Import Time)	Logarithm of the number of days taken for imported goods to clear customs	Enterprise Surveys question d14
Log(Productivity)	Logarithm of total sales less the cost of raw materials and intermediate goods used in production, per permanent full-time employee	Enterprise Surveys questions d2, l1, and n2e
New Process	Dummy variable equal to unity for establishments that have introduced new or significantly improved methods of manufacturing products or offering services in the last 3 years	Enterprise Surveys question h3
New Product	Dummy variable equal to unity for establishments that have introduced new or significantly improved products or services in the last 3 years	Enterprise Surveys question h1
New Systems	Dummy variable equal to unity for establishments that have introduced new or significantly improved organizational structures or management practices in the last 3 years	Enterprise Surveys question h5
R&D Spending	Dummy variable equal to unity for establishments that spent on formal R&D activities, either in-house or contracted with other companies, during the last 3 years	Enterprise Surveys question h7
R&D Time	Dummy variable equal to unity for establishments that gave employees some time to develop or try out a new approach or new idea about products or services, business process, firm management, or marketing, during the last 3 years	Enterprise Surveys question h8

R&D = research and development.

Sources: Enterprise Surveys; and Authors.

9. The last two innovation indicators focus on R&D, which is one important mechanism by which innovation can take place, and an important link to policy due to the incentives that exist in many countries. The first variable is an indicator of R&D spending by the firm, either in-house or through external contracts. It captures the most traditional type of R&D, but needs to be supplemented in the developing country context because firms are frequently resource constrained, and find it difficult to spend directly on R&D. That does not mean, however, that they do not engage in innovation. The second indicator is broader, and captures the allocation of time to employees to engage in incremental innovation activities. Again, this mechanism is likely to be particularly important in developing countries, and highlights the broad scope that even resource-constrained firms have to be innovative. Summary statistics show that around 32% of firms for which we have data have undertaken R&D spending, but a much higher proportion, around 42%, have allocated time to R&D. This finding is significant, because it

shows that finance-constrained firms in developing countries may innovate principally by allocating in-kind resources to product, process, and system development, rather than by direct spending on R&D.

10 Shepherd (2017) previously studied the innovation aspect of this dataset for the case of India (but not the other SASEC countries). He looked at the determinants of innovation behavior at the firm-level using all indicators discussed above, and found that engagement with the international economy is a key determinant of innovation. Concretely, firms that export are 22% more likely to introduce a new product compared with nonexporters, and the corresponding difference is 66% for importers. Clearly, access to imported intermediates, as well as competitive pressures from the world market, can provide a powerful incentive to firms to innovate. However, Shepherd (2017) did not look at variables that are amenable to policy action. That is the main value added of the present paper, which looks at the time taken to clear customs as one factor that mediates firm relationships with the global economy, and could potentially affect innovation behavior.

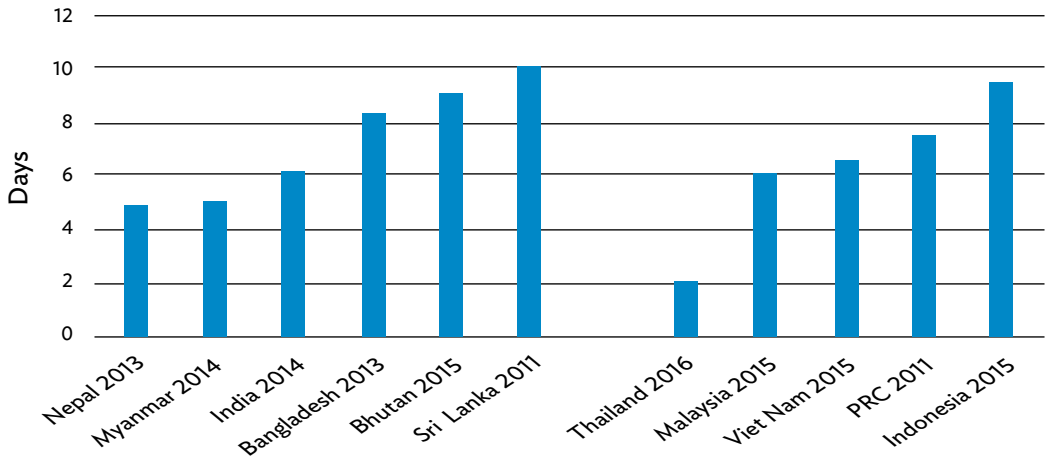
11. To introduce trade facilitation performance, we use firm-level measures of the time taken for exports and imports respectively to clear customs. The Enterprise Surveys ask firms for the average time taken for these operations. Lower times are indicative of better trade facilitation, which means that firms can be in closer contact with international markets. These data have previously been used by Shepherd (2013), who showed that longer export and import times are associated with lower trade participation at the firm level, across a wide range of developing countries. Hoekman and Shepherd (2015) used the same data to show that firm-level trade times affect export participation for all types of firms, i.e., regardless of size. The intuition behind these results has subsequently been confirmed using transaction-level data and a rigorous quasi-experimental identification strategy by Volpe Martincus, Carballo, and Graziano (2015).

12. Volpe Martincus, Carballo, and Graziano (2015) used the universe of Uruguay's exports at the transaction level, over the 2002–2011 period. The dataset included detailed information on the time taken for each transaction to go through customs. Their research design exploited the fact that risk-based control procedures can be used to establish random allocation of shipments to different channels, which helps establish a causal effect between customs performance and exports at this highly detailed level of analysis.

13. Figure 1 presents data on export times as recorded by the Enterprise Surveys, for SASEC countries and comparators in East Asia and Southeast Asia. Performance varies widely, but on average, clearing exports takes about 1 day longer in SASEC compared with the other Asian countries. The difference is significant in the context of global value chain expansion, where speed and reliability of delivery are important determinants of lead firms' decisions to invest in manufacturing capacity offshore.

14. As set out above, we expect trade facilitation performance to be positively associated with innovation. Firms that are more closely linked to world markets are more likely to import intermediates, and also to experience competitive pressures in other markets. Both factors are associated with innovation. Figure 2 presents an initial analysis of the data using kernel densities of the time taken for exports to clear customs. Innovators—defined as firms that have introduced a new product within the last 3 years—clearly face shorter export times than non-innovators. This first glance at the data therefore confirms our hypothesis that better trade facilitation performance can help spur innovation. However, it is important to control for other factors that influence firm-level innovation, and we turn to that in the next section by using a fully specified econometric model.

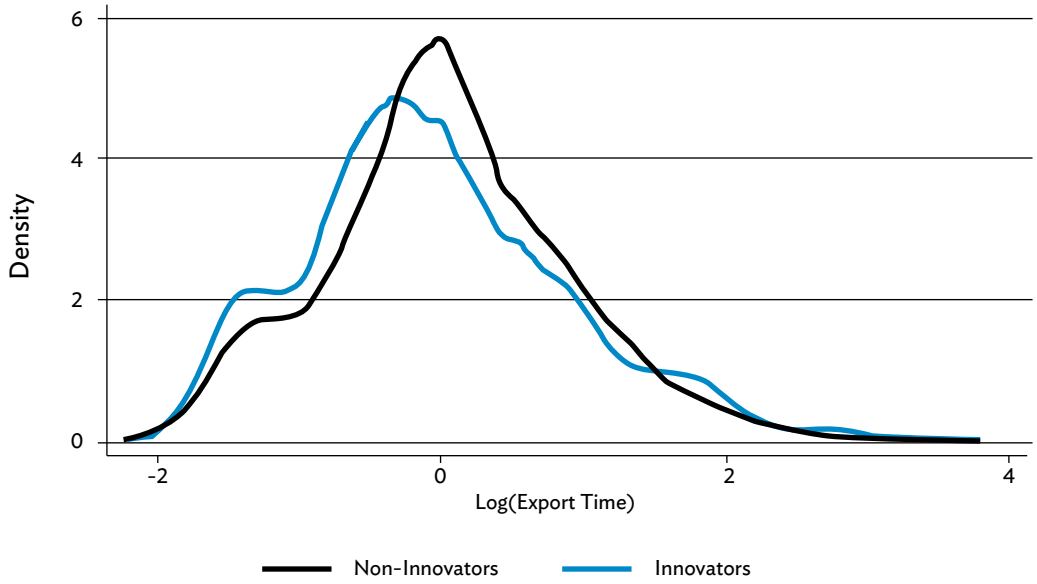
Figure 1: Average Export Clearance Times, South Asia Subregional Economic Cooperation and Comparator Countries, latest available year



PRC = People's Republic of China.

Source: Enterprise Surveys.

Figure 2: Export Times Facing Innovators and Non-Innovators, South Asia Subregional Economic Cooperation Countries



Notes: Innovators are defined as firms that have introduced a new product in the last 3 years. Non-innovators have not introduced a new product over the same time period. Log(export time) is adjusted by regressing it on a full set of country-sector fixed effects and taking the residuals. The sample is trimmed by dropping the top and bottom percentiles of the productivity distribution.

Source: Authors' estimates.

III. EMPIRICAL MODEL AND RESULTS

15. Following Shepherd (2017), our empirical model takes the following general form:

$$\Pr\left(Innovation_{csf} = 1\right) = \sum_{c}\sum_{s} d_{cs} + b_0 \log(trade\ time_{csf}) + \sum_{i} b_i Controls_{csf} + e_{csf}$$

where *c* indexes countries, *s* indexes sectors, and *f* indexes firms. We limit consideration to manufacturers only, and exclude service providers. The *d* terms represent a complete set of country-sector fixed effects, to control for influences that are common across firms within country-sector pairs. For trade time, we use alternately export and import times, as discussed above. Controls are standard determinants of productivity and trade from the firm-level trade literature, which we believe are also relevant to innovation. They include labor productivity, size (number of employees), capital intensity, proxies for management competence (the lead manager's level of experience, and the rate of capacity utilization), and a dummy for firms that are foreign invested. Our dependent variables are the innovation indicators discussed above. Estimation is by fixed effects logit with robust standard errors corrected for clustering by country-sector. Table 2 provides the descriptive statistics.

Table 2: Descriptive Statistics

Variable	Number of Observations	Mean	Standard Deviation	Minimum	Maximum
Foreign	17,430	0.033	0.178	0.000	1.000
Log(Capacity Utilization)	13,904	4.291	0.395	0.000	4.605
Log(Capital Intensity)	8,516	12.642	2.248	–3.324	25.820
Log(Employees)	17,562	3.349	1.373	0.000	9.616
Log(Experience)	17,362	2.464	0.768	0.000	4.277
Log(Export Time)	2,351	1.305	1.021	0.000	5.193
Log(Import Time)	2,286	1.747	1.154	0.000	5.438
Log(Productivity)	11,665	13.050	1.909	5.481	25.289
New Process	17,758	0.434	0.496	0.000	1.000
New Product	17,758	0.443	0.497	0.000	1.000
New Systems	17,758	0.434	0.496	0.000	1.000
R&D Spending	17,758	0.256	0.437	0.000	1.000
R&D Time	15,365	0.427	0.495	0.000	1.000

R&D = research and development.

Notes: All descriptive statistics are unweighted. Statistics are based on a trimmed sample, excluding the top and bottom percentiles of firm productivity by country.

Source: Authors' estimates.

16. Table 3 presents the regression results for export time. Each column represents an alternative dependent variable, but the model specification is the same across all columns. Control variables typically have the expected signs and economically sensible magnitudes. Size, capital intensity, foreign

ownership, and capacity utilization—all typically have a positive and statistically significant impact on innovation. Surprisingly, labor productivity does not have a statistically significant coefficient in any of the regressions. The reason is likely that it is a noisy measure of productivity, inferior to total factor productivity (TFP) but more readily available. Also, it is correlated with firm size (number of employees), so estimates are necessarily more imprecise due to this factor.[2]

Table 3: Regression Results—Time to Export
(South Asia Subregional Economic Cooperation countries)

	(1) Product	(2) Process	(3) Systems	(4) R&D Spending	(5) R&D Time
Log(Productivity)	−0.035	−0.086	0.009	0.087	−0.087
	(0.598)	(0.241)	(0.914)	(0.345)	(0.363)
Log(Size)	0.155**	0.212***	0.180***	0.285***	0.274***
	(0.016)	(0.001)	(0.000)	(0.000)	(0.000)
Log(Capital Intensity)	0.174***	0.136**	0.174***	0.052	0.104*
	(0.003)	(0.015)	(0.000)	(0.204)	(0.076)
Foreign	1.807**	0.918*	−0.047	0.931***	−0.090
	(0.039)	(0.080)	(0.889)	(0.004)	(0.838)
Log(Capacity Utilization)	0.541**	0.540**	0.561**	0.287	0.969**
	(0.021)	(0.026)	(0.017)	(0.278)	(0.012)
Log(Experience)	−0.033	0.163**	−0.136	−0.400***	−0.042
	(0.799)	(0.042)	(0.146)	(0.001)	(0.787)
Log(Time to Export)	−0.135**	−0.098	−0.187*	−0.352***	−0.335***
	(0.036)	(0.258)	(0.069)	(0.000)	(0.000)
Observations	972	978	973	968	974
Pseudo-R^2	0.033	0.028	0.030	0.050	0.046
Increase in innovation probability for a 50% reduction in time to export	9.81%	NA	13.84%	27.63%	26.14%

NA = not applicable, R&D = research and development.

Notes: Dependent variables (different measures of innovation) are indicated at the top of each column. Regression is by logit with fixed effects by country-sector. Sample covers South Asia Subregional Economic Cooperation countries, and drops the 1st and 99th percentiles of productivity. Probability Values (P-values) based on robust standard errors adjusted for clustering by country-sector are indicated in parentheses beneath the parameter estimates. Statistical significance is indicated by * (10%), ** (5%), and *** (1%).

Source: Authors' estimates.

17. Export time has the expected negative coefficient in all regressions, and it is statistically significant in four out of five. We conclude that, in line with our hypothesis, better trade facilitation is associated with a greater propensity to innovate, after controlling for other factors that impact firm-level innovation behavior. The magnitude of the effect is quantitatively important. Reasoning in terms of odds ratios, we see that halving average time to export is associated with an increase in the probability of innovation of 10%–20% depending on the specification used. (Full results on innovation probabilities for a halving of export time are reported in the bottom line of Table 3.) Clearly, there is real scope for improved trade facilitation to help promote innovation in SASEC countries.

[2] The correlation coefficient is 0.1127.

18. The results for import time are in Table 4. They are generally quite comparable to those in Table 3, although control variables are not always signed in accordance with expectations or statistically significant. By contrast, the import time variable has a negative coefficient in four out of five regressions, as was the case for export time. Magnitudes are quite stable across specifications, and suggest a similar quantitative impact as was found for export times. Again, we conclude that improving trade facilitation performance has significant potential to boost innovation activity among SASEC firms. Again, the last line of the table reports full results in terms of innovation probabilities for a halving of import time.[3]

Table 4: Regression Results—Time to Import (South Asia Subregional Economic Cooperation countries)

	(1) Product	(2) Process	(3) Systems	(4) R&D Spending	(5) R&D Time
Log(Productivity)	−0.056	−0.065	0.066	0.038	−0.116
	(0.645)	(0.602)	(0.530)	(0.739)	(0.224)
Log(Size)	0.249***	0.189**	0.229***	0.316***	0.319***
	(0.001)	(0.018)	(0.003)	(0.000)	(0.000)
Log(Capital Intensity)	0.124**	0.080	0.121**	0.039	−0.023
	(0.025)	(0.155)	(0.019)	(0.628)	(0.765)
Foreign	1.274**	0.817	−0.307	1.052**	−0.183
	(0.047)	(0.170)	(0.482)	(0.024)	(0.605)
Log(Capacity Utilization)	−0.250	0.713**	0.219	0.312	0.590*
	(0.360)	(0.048)	(0.491)	(0.393)	(0.059)
Log(Experience)	−0.185	0.032	0.370***	−0.188	−0.096
	(0.105)	(0.738)	(0.001)	(0.304)	(0.511)
Log(Time to Import)	−0.203*	−0.119	-0.282**	−0.210**	−0.193*
	(0.067)	(0.353)	(0.018)	(0.029)	(0.055)
Observations	665	673	663	629	672
Pseudo-R^2	0.040	0.028	0.049	0.048	0.046
Increase in innovation probability for a 50% reduction in time to import	15.11%	NA	21.59%	15.67%	14.31%

NA = not applicable, R&D = research and development.

Notes: Dependent variables (different measures of innovation) are indicated at the top of each column. Regression is by logit with fixed effects by country-sector. Sample covers South Asia Subregional Economic Cooperation countries, and drops the 1st and 99th percentiles of productivity. P-values based on robust standard errors adjusted for clustering by country-sector are indicated in parentheses beneath the parameter estimates. Statistical significance is indicated by * (10%), ** (5%), and *** (1%).

Source: Authors' estimates.

[3] In additional results, shown in Appendix Tables A.1 and A.2, we expand the sample to include all other countries for which data on innovation is available. However, the estimation sample is restricted to only those countries with at least 20 observations. These differ by specification within the two Appendix tables as well as across. Furthermore, observations in the top and bottom percentiles of firm-level productivity by country are dropped. Coefficient estimates for our variable of interest—time to export and time to import—are largely similar to those obtained for SASEC countries in Tables 3 and 4. Finally, Nepal is one of the countries with fewer than 20 observations. We repeat the estimation for SASEC countries by dropping Nepal from the sample. The estimation results are reported in Appendix Tables A.3 and A.4. Except for the coefficient on log of time to import using R&D time as measure of innovation, which is now statistically insignificant, all other coefficient estimates are largely similar.

IV. CONCLUSION AND POLICY IMPLICATIONS

19. This paper has shown that trade facilitation performance, as measured by the time taken for goods to clear customs, has a significant impact on firm-level innovation. Given the importance of innovation for long-run growth and development, this finding suggests that SASEC policy makers would do well to consider ways in which they could improve trade facilitation performance as one way of promoting innovation. Of course, many other policies are also relevant to innovation—from human capital development and education, to financial sector development and macroeconomic stability. We are not suggesting that trade facilitation is the most important way of promoting innovation, but our results do support the view that facilitating engagement with the global economy is one way in which countries can boost innovation. In this, our findings agree with a growing literature on firm product scope that has shown, in particular, that liberalization of input markets can help firms produce new varieties. The focus of that work has been on tariff reductions, but in an environment where tariffs around the world are relatively low—albeit that the SASEC countries have moderately high tariffs relative to other countries—the focus naturally turns to nontariff policies, like trade facilitation, that mediate firm interactions with world markets.

20. The baseline for trade facilitation performance around the world is now the WTO's TFA. All of the SASEC countries (except Bhutan) are WTO members, and of those, all (except Maldives) have ratified the TFA. However, as developing countries, they do not necessarily have to apply all articles of the agreement immediately. Each country is free to notify obligations as falling into Categories A, B, and C. Only those in the first category have to be implemented in the short term. Category B obligations have extended transition periods, and those in Category C do not have to be implemented until technical and/or financial assistance from developed countries are forthcoming.

21. Thus far, only India, Nepal, and Sri Lanka have made notifications under the TFA.[4] Nepal has only included around 2% of the agreement's provisions in Category A, dealing with preshipment inspection and use of customs brokers, so it is essentially deferring application of the entire agreement in the short term. Sri Lanka has been more ambitious, with around one quarter of the agreement's provisions in Category A, covering a variety of subjects. India, by contrast, has signaled a clear intention to move forward on trade facilitation by including just over 70% of the agreement's provisions in Category A, across a wide range of issues. World leaders such as Singapore implemented the TFA's disciplines many years ago, and are pursuing advanced digital and paperless trade solutions to make customs processes even more rapid. Performance in SASEC lies far behind global best practice.

22. The point comes out well from Table 5, which reports scores on the Organisation for Economic Co-operation and Development's Trade Facilitation Indicators (TFI) for those SASEC countries for which data are available. The indicators range from 0 (no implementation of the considered measures) to 2 (full implementation). Average scores on the TFI pillars range from 0.667 to 1.700. However, there are significant divergences in country-level scores. India, the regional leader, has an average TFI score of 1.495, compared with only 0.813 for Bhutan. Moreover, a number of indicators for individual countries are scored at 0, but at 2 for other countries. A key feature of SASEC's trade facilitation performance is, therefore, its heterogeneity. As a point of comparison, the average TFI score of the People's Republic of China (PRC) is 1.483, which is very close to that of India. However, the world leader in this dataset is a developing country that has significant links with SASEC: Mauritius, with a score of 1.933. This result reinforces the view that there is considerable scope for SASEC countries to boost performance.

[4] The source for all information in this paragraph is the WTO (www.tfadatabase.org).

Table 5: Trade Facilitation Indicators for South Asia Subregional Economic Cooperation Countries

	Bangladesh	Bhutan	India	Nepal	Sri Lanka
Information availability (A)	1.875	...	1.889	1.333	1.375
Involvement of trade community (B)	1	...	1.333	1	1.667
Advance rulings (C)	0	0	2	...	...
Appeal procedures (D)	0.875	...	1.714	1.714	1.833
Fees and charges (E)	1.5	...	0.5	0.5	1.333
Formalities - documents (F)	1	0.4	1.4	0.8	1.6
Formalities - automation (G)	1	0	1.5	0.5	0.75
Formalities - procedures (H)	0.867	...	0.867	0.846	1.231
Border agency cooperation - internal (I)	1.5	2	2	2	1
Border agency cooperation - external (J)	1.667	...	...	...	...
Governance and impartiality (K)	1.286	1.667	1.75	1.5	1.667

... = not available.

Note: Data not available for Maldives and Myanmar.

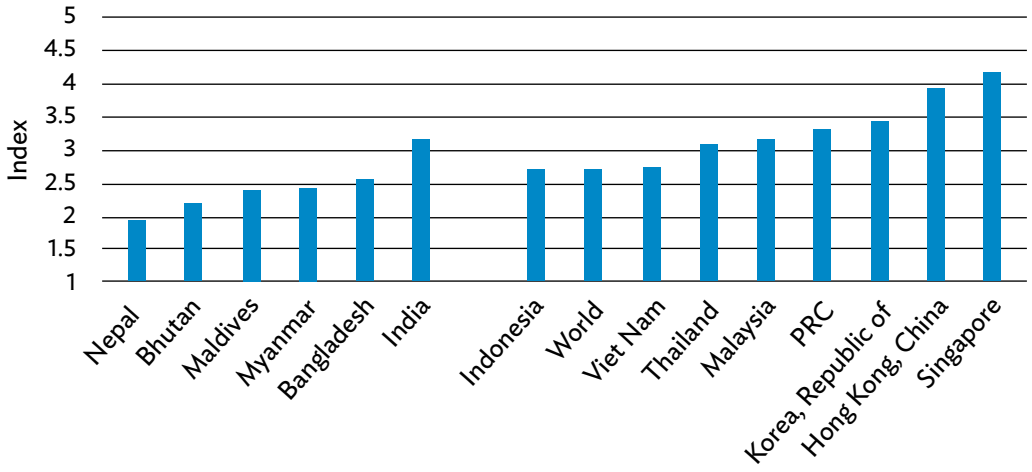
Source: Organisation for Economic Co-operation and Development.

23. To corroborate this interpretation, Figure 3 reports scores on the efficiency of border clearance component of the Logistics Performance Index for SASEC countries compared with the world average, and countries in East Asia and Southeast Asia, which perform relatively well in logistics and trade facilitation. Only India scores above the world average, and its strong rating likely reflects performance at key international gateways rather than the general state of trade facilitation in the country. The performance of the leading country in SASEC (India) is about on par with that of Malaysia, which itself performs well inside the frontier set by countries such as the Republic of Korea and Singapore, and is even significantly below the PRC. Again, there is clear evidence that SASEC countries are lagging somewhat in terms of trade facilitation performance, a factor that is likely holding back their efforts to promote trade integration.

24. Finally, we can use Enterprise Surveys to provide an indication of the scope for SASEC countries to improve import and export times, which, as we have shown in this paper, could help boost innovation. Our benchmark is Thailand, where export clearance time is measured at 2.07 days. To improve SASEC's performance to this level would require reductions of 79% in Sri Lanka, 77% in Bhutan, 75% in Bangladesh, 66% in India, 60% in Myanmar, and 58% in Nepal. Taking the estimates from Table 3 (column 1), this means that improving export times in SASEC to match those observed today in the PRC would boost the probability of new product introduction by firms by 23% in Sri Lanka, 22% in Bhutan, 21% in Bangladesh, 16% in India, and 13% in Myanmar. In making these calculations, we assume that the model parameters apply equally well outside the sample, i.e., to countries for which sufficient data were not available at the estimation stage, but for which we have export time data.

25. These findings suggest that there is clear scope for SASEC countries to boost trade facilitation performance, and the work presented here suggests that not only will that lead to greater trade integration—which supports income growth and job creation—but it could also help spur innovation, which is the key to attaining long-run growth and development that relies on endogenous productivity improvements rather than catching up to the global technology frontier.

Figure 3: Logistics Performance Index Efficiency of Border Clearance Index, Index Score 1-5, South Asia Subregional Economic Cooperation and Comparator Economies, 2016



PRC = People's Republic of China.

Source: World Bank. Logistics Performance Index.

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APPENDIXES

Appendix Table A.1: Regression Results—Time to Export (global sample)

	(1)	(2)	(3)	(4)	(5)
	Product	**Process**	**Systems**	**R&D Spending**	**R&D Time**
Log(Productivity)	0.033	0.026	0.043	0.064	−0.060
	(0.623)	(0.693)	(0.544)	(0.430)	(0.478)
Log(Size)	0.164***	0.218***	0.194***	0.338***	0.303***
	(0.005)	(0.000)	(0.000)	(0.000)	(0.000)
Log(Capital Intensity)	0.173***	0.096*	0.131***	0.053	0.092*
	(0.002)	(0.050)	(0.002)	(0.155)	(0.095)
Foreign	0.890	0.418	-0.405	0.665**	0.185
	(0.183)	(0.306)	(0.220)	(0.029)	(0.689)
Log(Capacity Utilization)	0.561***	0.366*	0.474**	0.055	0.672**
	(0.008)	(0.094)	(0.011)	(0.832)	(0.042)
Log(Experience)	−0.071	0.136*	−0.152*	−0.379***	−0.111
	(0.522)	(0.073)	(0.081)	(0.000)	(0.441)
Log(Time to Export)	−0.121*	−0.112	−0.262***	−0.373***	−0.340***
	(0.050)	(0.132)	(0.004)	(0.000)	(0.000)
Observations	1,105	1,106	1,109	1,095	1,045
Pseudo-R^2	0.030	0.023	0.032	0.057	0.045

R&D = research and development.

Notes: Dependent variables (different measures of innovation) are indicated at the top of each column. Regression is by logit with fixed effects by country-sector. Sample covers all countries with innovation data and at least 20 countries, and drops the 1st and 99th percentiles of productivity. Composition of countries differs across columns. P-values based on robust standard errors adjusted for clustering by country-sector are indicated in parentheses beneath the parameter estimates. Statistical significance is indicated by * (10%), ** (5%), and *** (1%).

Source: Authors' estimates.

Appendix Table A.2: Regression Results—Time to Import (global sample)

	(1)	(2)	(3)	(4)	(5)
	Product	**Process**	**Systems**	**R&D Spending**	**R&D Time**
Log(Productivity)	−0.030	−0.053	0.103	0.081	−0.109
	(0.713)	(0.504)	(0.176)	(0.343)	(0.195)
Log(Size)	0.260***	0.199***	0.210***	0.333***	0.358***
	(0.000)	(0.002)	(0.001)	(0.000)	(0.000)
Log(Capital Intensity)	0.087*	0.057	0.033	−0.026	0.022
	(0.077)	(0.258)	(0.519)	(0.631)	(0.744)
Foreign	0.364	0.421	−0.075	0.071	−0.159
	(0.314)	(0.119)	(0.785)	(0.816)	(0.572)
Log(Capacity Utilization)	−0.112	0.517**	0.158	−0.212	0.449
	(0.588)	(0.025)	(0.486)	(0.450)	(0.104)
Log(Experience)	−0.166*	0.006	−0.265***	−0.265*	−0.099
	(0.093)	(0.944)	(0.009)	(0.051)	(0.483)
Log(Time to import)	−0.165**	−0.143	−0.273***	−0.157*	−0.183**
	(0.048)	(0.123)	(0.004)	(0.059)	(0.047)
Observations	947	985	964	895	793
Pseudo-R^2	0.032	0.027	0.039	0.044	0.049

R&D = research and development.

Notes: Dependent variables (different measures of innovation) are indicated at the top of each column. Regression is by logit with fixed effects by country-sector. Sample covers all countries with innovation data and at least 20 countries, and drops the 1st and 99th percentiles of productivity. Composition of countries differs across columns. P-values based on robust standard errors adjusted for clustering by country-sector are indicated in parentheses beneath the parameter estimates. Statistical significance is indicated by * (10%), ** (5%), and *** (1%).

Source: Authors' estimates.

Appendix Table A.3: Regression Results—Time to Export (South Asia Subregional Economic Cooperation Countries except Nepal)

	(1)	(2)	(3)	(4)	(5)
	Product	**Process**	**Systems**	**R&D Spending**	**R&D Time**
Log(Productivity)	−0.025	−0.071	0.005	0.076	−0.075
	(0.709)	(0.325)	(0.952)	(0.420)	(0.443)
Log(Size)	0.171***	0.221***	0.181***	0.276***	0.292***
	(0.008)	(0.001)	(0.000)	(0.000)	(0.000)
Log(Capital Intensity)	0.184***	0.135**	0.173***	0.051	0.109*
	(0.002)	(0.016)	(0.000)	(0.211)	(0.064)
Foreign	1.681*	0.749	−0.226	0.753**	−0.265
	(0.064)	(0.167)	(0.503)	(0.029)	(0.510)
Log(Capacity Utilization)	0.503**	0.489**	0.553**	0.303	0.968**
	(0.032)	(0.044)	(0.019)	(0.252)	(0.014)
Log(Experience)	−0.044	0.144*	−0.145	−0.386***	−0.054
	(0.733)	(0.072)	(0.120)	(0.001)	(0.736)
Log(Time to Export)	−0.152**	−0.093	−0.194*	−0.356***	−0.355***
	(0.018)	(0.251)	(0.063)	(0.000)	(0.000)
Observations	960	964	963	958	960
Pseudo-R^2	0.033	0.026	0.03	0.046	0.049

R&D = research and development.

Notes: Dependent variables (different measures of innovation) are indicated at the top of each column. Regression is by logit with fixed effects by country-sector. Sample covers Bangladesh and India, and drops the 1st and 99th percentiles of productivity. P-values based on robust standard errors adjusted for clustering by country-sector are indicated in parentheses beneath the parameter estimates. Statistical significance is indicated by * (10%), ** (5%), and *** (1%).

Source: Authors' estimates.

Appendix Table A.4: Regression Results—Time to Import
(South Asia Subregional Economic Cooperation Countries except Nepal)

	(1)	(2)	(3)	(4)	(5)
	Product	**Process**	**Systems**	**R&D Spending**	**R&D Time**
Log(Productivity)	0.020	0.008	−0.002	0.026	−0.067
	(0.876)	(0.956)	(0.984)	(0.829)	(0.508)
Log(Size)	0.276***	0.209**	0.174**	0.311***	0.349***
	(0.001)	(0.013)	(0.023)	(0.000)	(0.000)
Log(Capital Intensity)	0.115**	0.073	0.130**	0.045	−0.055
	(0.037)	(0.207)	(0.011)	(0.564)	(0.467)
Foreign	1.077	0.629	-0.461	0.632	−0.292
	(0.118)	(0.318)	(0.293)	(0.122)	(0.414)
Log(Capacity Utilization)	−0.210	0.795**	0.263	0.328	0.756**
	(0.467)	(0.045)	(0.419)	(0.378)	(0.036)
Log(Experience)	−0.171	0.019	−0.359***	−0.177	−0.124
	(0.141)	(0.847)	(0.001)	(0.334)	(0.422)
Log(Time to import)	−0.230*	−0.119	−0.299**	−0.226**	−0.156
	(0.063)	(0.418)	(0.018)	(0.014)	(0.167)
Observations	614	613	609	602	616
Pseudo-R^2	0.043	0.031	0.041	0.042	0.053

R&D = research and development.

Notes: Dependent variables (different measures of innovation) are indicated at the top of each column. Regression is by logit with fixed effects by country-sector. Sample covers Bangladesh and India, and drops the 1st and 99th percentiles of productivity. P-values based on robust standard errors adjusted for clustering by country-sector are indicated in parentheses beneath the parameter estimates. Statistical significance is indicated by * (10%), ** (5%), and *** (1%).

Source: Authors' estimates.

Trade Facilitation and Innovation: Evidence from South Asia Subregional Economic Cooperation Countries

This paper examines how trade times affect innovation behavior. Analysis in the paper shows that shorter trade times are associated with the introduction of new products and new management systems. From a policy perspective, results suggest that long-run growth in the South Asia Subregional Economic Cooperation countries can be supported in part by improving trade facilitation, where performance lags substantially behind the global frontier.

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