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## ETHNIC ENTREPRENEURSHIP AND INTERNATIONALISATION IN EAST AFRICA

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### ABSTRACT

*Using the World Bank Enterprise Surveys panel data for the East African Community, this paper analyses the influence of ethnic origin of entrepreneurs on internationalisation and firm performance. Using traditional probit and OLS estimation techniques in combination with matching strategies to account for selection and nonlinearity, we show that the African Indian background of the entrepreneur is a conditional predictor for international activity. In addition, we show that the effect of exporting in terms of innovation and growth is stronger for indigenous entrepreneurs when compared to African Indian entrepreneurs. Hence, we conclude that learning by exporting in recent times is larger for indigenous entrepreneurs.*

**Key Words:** *Internationalisation, Innovation, Diaspora, East Africa.*

### INTRODUCTION

Since the early 1990s, there has been an increasing interest in the performance of Africa's manufacturing sector as a potential engine of economic growth and productivity. Growth is most commonly studied in relationship to size and the age of the firm, but other enterprise characteristics have proven to matter for the performance of African firms as well (Bigsten & Söderbom, 2006). There is substantial evidence that firms owned by non-indigenous or ethnic minority entrepreneurs in sub-Saharan Africa generally perform better than those of indigenous or African-owned firms (Ramachandran & Shah, 1999). Not only do ethnic minority-owned firms often start out larger, they also tend to grow significantly faster, and produce a larger share of value added than African-owned firms (Ramachandran & Shah, 2007). A similar distinction is manifested when analysing the international orientation of sub-Saharan African firms (Rankin *et al.*, 2006). A large share of import- and export manufacturing firms in sub-Saharan Africa are owned by non-indigenous African entrepreneurs whereas indigenous African manufacturing firms in Africa traditionally focus on (small) domestic markets (Bakunda, 2003).

Explaining these differences in productivity and growth, most authors underscore the importance of tight, ethnically defined business networks that help non-indigenous entrepreneurs in sub-Saharan Africa overcome economic uncertainty, market imperfections, and weak formal institutions (Biggs & Shah, 2006). These business networks can provide superior access to information, technology, and finance, which most indigenous entrepreneurs lack (Ibeh *et al.*, 2012; McDade & Spring, 2005; Biggs *et al.*, 2002; Fafchamps, 2000). The differences in performance between ethnic minority-owned and African-owned firms can be further explained in terms of managerial resources and capabilities. Evidence shows that, in general, non-indigenous entrepreneurs in sub-Saharan Africa are more highly educated, possess more managerial experience and skills, and have a stronger international orientation than their indigenous African counterparts (Ramachandran & Shah, 2007; Bakunda, 2003; Grenier *et al.*, 1999).

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Although it is a common conclusion that efficient firms self-select into the export market (Bernard & Jensen, 1999), there is increasing evidence from developing countries of a reversed causality, whereby firms have been found to become more efficient as a result of exporting (Blalock & Gertler, 2004). Several studies indicate that African firms with experience in exporting improve their relative performance and are also more likely to continue exporting than similar firms without such experience, principally because of high entry barriers (Van Biesebroeck, 2005; Bigsten *et al.*, 2004).

This paper analyses the influence of ethnic origin of entrepreneurs for internationalisation and firm performance in East Africa, specifically Tanzania, Kenya, and Uganda. For historical reasons, a significant share of small and medium-sized enterprises (SMEs) in East Africa is owned by Africans of Indian origin. In Tanzania and Uganda this ethnic minority owns around a quarter of all SMEs in manufacturing, whereas in Kenya such ownership is around 60 percent of SME owners of Indian descent (Biggs & Shah, 2006). So far, there are no empirical papers using large scale firm level data that analyse the differences in export status and the effects thereof—in terms of innovation and sales growth—for ethnic minority entrepreneurs when compared to indigenous entrepreneurs.

We find that African Indian entrepreneurs are, indeed, more internationally active than indigenous entrepreneurs and that this has become consolidated over time. There is, however, little evidence in matched samples that the firm's performance of these ethnic minority entrepreneurs benefit from international networks. With regard to indigenous entrepreneurs, we find that, especially, large firms are internationally active, but here our results suggest that there is learning by exporting effect, as indigenous firms benefit more from internationalisation in terms of innovative capacity and sales growth.

The remainder of the paper is organised as follows. The second section presents a brief literature overview on the relationship between ethnic origin and firm performance in East Africa. The third section provides a description of the data and methodology. The fourth section presents the main results, and the fifth section concludes.

## LITERATURE REVIEW

Previous studies have emphasised how most successful manufacturing firms in East Africa, as well as those engaged in the import and export trade, are owned by ethnic minority entrepreneurs, in particular of Indian descent (Biggs & Shah, 2006; Ramachandran & Shah, 1999; Himbara, 1994). The strong economic, political, social and cultural links between East Africa and India are predominantly a result of a shared history under British colonial rule as the British East Africa Protectorate was originally administered from Bombay, with thousands of Indians sent as contract labourers to work on the Kenya-Uganda railway. Many Indians eventually settled down with their families in East Africa to embrace the new available opportunities, mostly as traders, but later on also as professionals such as doctors, lawyers, teachers and engineers (Bhattacharya, 2009).

Today, there are about 200,000 Africans of Indian origin in East Africa (HLC, 2004), often characterised as a close-knit, mostly self-reliant community, which maintains much of its strong Indian ties and traditions.<sup>1</sup> As Collier (2013) argues in his seminal work on the evolution and persistence of cultural preferences, migration from high income to low income countries often results in a settler culture of low levels of integration. He uses the Incentive Theory to show under which conditions generation of migrants adopt the culture of the home country. If the economic benefits of integration are low, parents shield their siblings from connecting to the indigenous population and maintain their settler mentality (Collier, 2013).

Diasporas are an important magnet for international trade (Beine *et al.*, 2011). In his classic work on the creation of institutions, Greif (2006) uses Magrabi Arab trading ethnic groups as a main example of kinship driven early long distance networks. East Africa is no exception. Early generations of African Indians originated mostly from Gujarati ethnic groups, which upheld close trading relations with mainland India across the Indian Ocean (Mehta, 2001). Such historical ties and global networks constitute a main driver of the internationalisation of firms.

Early theories on firm internationalisation focus on the gradual leverage of ownership advantages, for example, scaling domestic market power and innovation capabilities in stages by utilising locational advantages abroad (Dunning, 1988; Johanson & Vahlne, 1977). For many international firms from India and China, ownership advantages in efficient production make consumers in low income countries natural buyers of their products. As a matter of fact, internationally-active firms in Africa, however, often are larger SMEs with limited ownership advantages. Such firms trade because they experience low costs in doing so, and often in terms of low psychic distance to the export market.

Ethnic ties provide firms with access to business network as well as landing platforms for gaining managerial capabilities, which are of crucial importance in theories of small firm internationalisation (Oviatt & McDougall, 1994). The connection between capabilities and innovation in SMEs is well-recognised (Knight & Cavusgil, 2004), and recent econometric studies show a close connection between managerial capabilities and firm performance in developed and emerging economies (Bloom & Van Reenen, 2010). In addition, migrant settler communities often have a strong transmission of entrepreneurial culture, which in modern theory is regarded as a main driver of SME internationalization dynamics (Knight & Liesch, 2016).

Our paper is also connected to recent new international economics theories that analyse the (within) sectoral effects of increased internationalisation (Melitz, 2003). The main conclusion of this literature is that a fall in trade costs—in this context tends to lower the costs because of Diaspora advantages—increases the profitability of exporting firms. The effect is that trade liberalisation stimulates labour mobility towards exporting firms and makes them grow relative to low productivity (indigenous) non-exporters. In turn, the demand and higher wages in the exporting sectors in turn increase the production costs for indigenous firms, causing a selection effect and higher exit rates. In addition, in the emerging market context, internationalisation of high productivity SMEs may over time result in learning by exporting, causing deeper productivity gains for ethnic entrepreneurial firms (De Loecker, 2007).

## **DATA AND METHODOLOGY**

### **Data**

The Regional Programme on Enterprise Development (RPED), launched by the World Bank in the early 1990s, was the first major research arm that collected large-scale survey data on African enterprises. Such data collection has subsequently become a regular exercise in at least some African countries (Bigsten & Söderbom, 2006). Today, the World Bank Enterprise Surveys (WBES) provide the most comprehensive company-level data on African manufacturing firms available. The WBES has panel data from 2006/2007 and 2013 for the East African Community (EAC). However, the firms of both years only partly overlap, with many more firms added in 2013. For the sample, we only use manufacturing firms that are present in both 2006/2007 and 2013, as we are interested in firms' performance over time. The most important restriction is that all the firms had to be present in 2006/2007, as the question on ethnic origin was posed only in 2006/2007. Since quite a few firms did not survive the period between the questionnaires of 2006/2007 and 2013, we are left with 331 potential firms. As there are some missing observations for some of the variables, in the regressions we lose on average another 20 observations.

Table 1 provides an overall snapshot of our sample for number of firms and export status for Tanzania, Kenya and Uganda. The first observation is that the sample distribution is in line with common priors on the distribution of economic activity across these three countries. Kenya and Uganda have many indigenous entrepreneurs who mostly serve the domestic market. Tanzania, by contrast, has many African Indian entrepreneurs who are internationally active. The second observation is that on average indigenous entrepreneurs are much less internationally active than African Indian entrepreneurs and other ethnic entrepreneurs such as those of European and Asian descent. The third observation is that of sample selection bias. In contrast to what we know about the true distribution, a large percentage of firms in our sample is internationally-active. One overall conclusion is that including country dummies is important when pooling the observations for statistical analysis.

**Table 1: Exporters and Non-Exporters in the East African Region**

	<b>Indigenous</b>	<b>African Indian</b>	<b>Other Ethnic</b>	<b>Total</b>
<b>Non-Exporter</b>				
Tanzania	14	39	5	58
Kenya	89	10	8	107
Uganda	38	12	6	56
Total	141	61	19	221
<b>Exporter</b>				
Tanzania	4	27	5	36
Kenya	7	9	2	18
Uganda	8	12	6	26
Total	19	48	13	80

Table 2 shows the most relevant sample descriptive statistics. As could already be observed in Table 1, the probability of drawing an exporter is substantially lower for indigenous firms than for ethnic firms. Surprisingly, the distribution of innovative activity—we provide a full description of the variables below—is very different across countries. In Tanzania, innovation activity is higher for indigenous entrepreneurs than for ethnic entrepreneurs, whereas this is the opposite for Kenya and Uganda. More significantly, indigenous firms especially in Kenya are substantially smaller than African Indian firms. This implies that we have to be careful with non-linear effects when analysing the effects of ethnicity on firm level outcomes such as internationalisation. The reason is the potential selection of ethnicity in exporting through firm size. A last observation in Table 2 is that on average there is not much difference in growth rates between indigenous and ethnic firms.

**Table 2: Descriptive Firm Statistics**

	<b>Indigenous</b>	<b>African Indian</b>	<b>Other</b>
<b>Tanzania</b>			
% Export 2007	28	47	55
% Export 2013	22	41	50
% Innovative	78	68	82
Sales (mean log)	13.3	14.2	14.9
Growth (mean)	5.94	4.93	5.23
Productivity (mean)	0.32	0.28	0.15
<b>Kenya</b>			
% Export 2007	7	53	30
% Export 2013	7	47	20
% Innovative	59	89	100
Sales (mean log)	11.2	14.6	13.8
Growth (mean)	5.22	5.67	4.86
Productivity (mean)	0.73	0.36	0.16
<b>Uganda</b>			
% Export 2007	13	33	33
% Export 2013	17	50	50
% Innovative	81	96	83

Sales (mean log)	12.8	13.9	14.3
Growth (mean)	6.17	5.73	5.44
Productivity (mean)	0.74	0.33	0.18

The key variables in Table 2 are related to ethnicity and exporting. For ethnicity, the WBES 2006/2007 asks for ethnic origin of the firm’s owner. We have reduced the potential answers to three categories: *Indigenous*, *African Indian*, and *Other Ethnic*.<sup>2</sup> For *Exports* we use the share of exports in total sales as a continuous variable, and when it is larger than zero as binary value one for *Exporter*. For *Innovation* we use the WBES binary variable for new product introductions. *Growth* is measured as the change in sales between 2006/2007 and 2013, where we convert sales in local currency in dollars using the World Development Indicators. As controls, we concentrate on (the logs of) firm size in terms of total employment and labour productivity measured as sales per employee in full-time equivalent.<sup>3</sup> Lastly, we have regrouped the detailed industry classification into four categories. All estimations include dummies for these four groupings as well as country dummies.

## Methodology

In this paper, we concentrate on how the incidence of exporting correlates with the ethnic origin of the firm’s owners. In addition, we investigate the effects of ethnicity, exporting—and the connection between these two—on innovation and firm performance. For the binary export status, we use a probit model, whereas for the continuous export share model we rely on a standard OLS model. In these models, we include dummies for countries (mostly significant) and industries; however, we do not report on them. As the connection with the exogenous ethnicity status is our main interest, we refrain from addressing endogeneity concerns in the probit and OLS specifications for checking reverse causality.

The selection on observables as well as on unobservables, indeed, is a main area of concern. With respect to unobservables, this concerns ethnic origin proxies for culture and networks, for which we do not have direct measures in the data. For observables, from the literature review we know that larger and more productive firms select into exporting. Controlling for firm size and productivity may not be enough when ethnic origin is correlated with these two variables. Shifting the ethnicity variable would immediately imply one’s move to a different distribution of firm size. In simple words: African Indian firms on average are different firms from indigenous firms.

To account for this worry, we use propensity score matching as pioneered by Rosenbaum and Rubin (1983) and widely put to work in social sciences. The idea is that observations are matched on their probability of being an exporter in a probit model that includes firm size, productivity, and the dummy structure. The observations with closest probability of being an exporter are matched, of which one of the pair is indeed an exporter and the other is not. This then produces a treatment effect for firms which are equal in their probability of being an exporting entity. In simple words, when we only switch the ownership ethnic status with firms of equal probability of exporting, does this, indeed, affect the probability of exporting?

## FINDINGS

### Exporting

In Table 3 we have combined the probit and OLS results for exporting. Column (1) presents the probit results for export status for 2006/2007 and Column (2) for 2013, controlling for size, productivity of 2006/2007, as well as the country and industry dummies. We observe as expected that African Indian firms significantly have a higher probability of exporting when controlled for other firm characteristics. With respect to the controls, firm size takes up most of the remaining variation in export status. Columns (4) and (5) do the same for the export share of firms. Here we observe that the correlation between the African Indian dummy and exporting only becomes significant for the year 2013 and the shift in the size of the coefficient is significant. Column (3) and (6) include an interaction term for large African Indian firms, which makes indigenous small firms the base control group. Although the interaction term itself is not significant, the key effect is that the African Indian dummy loses significance in both estimations, indicating that small African Indian firms are not more internationally-oriented than their indigenous counterparts.

**Table 3: Ethnic Origin and Export Status**

	(1)	(2)	(3)	(4)	(5)	(6)
African Indian	0.67***	0.71***	0.87	0.04	0.18***	0.08
	(2.73)	(2.97)	(1.26)	(0.67)	(2.67)	(0.41)
Firm Size	1.18***	1.34***	1.41***	0.60***	0.54***	0.49***
	(3.08)	(3.71)	(3.09)	(5.92)	(5.29)	(3.71)
Afri_Ind* Size			-0.18			0.12
			(0.25)			(0.56)
Productivity	-0.09	0.24	0.25	0.24**	0.24**	0.23**
	(0.19)	(0.61)	(0.64)	(2.55)	(2.57)	(2.29)
Firm Age	0.28	0.09	0.09	-0.03	-0.01	-0.01
	-1.29	-0.43	-0.4	(-0.43)	(-0.21)	(-0.12)
Observations	279	276	276	280	277	277

Note: Columns (1)-(3) Probit export status; (4)-(6) OLS export shares. All regressions include industry dummies as controls. Standardized beta coefficients; t statistics in parentheses;  
\* p<0.10, \*\* p<0.05, \*\*\* p<0.01.

The conclusion is that African Indian firms are, indeed, also more internationally-oriented than indigenous firms when we control for firm size and productivity. The more interesting conclusion is the change in importance of exporting for African Indian firms over time. Although African Indian firms are exporters in 2006/2007 and 2013, when we look at the share of exports in total sales, the ethnicity dummy is only significant in 2013. The conclusion is that between 2006/2007 and 2013 exporting has become more important for African Indian firms than for indigenous ones.

Introducing the interaction with firm size produces interesting effects. It shows that large firms are especially exporters. Since *Firm Size* now takes up large indigenous firms, we observe that, in this group especially they are exporters when compared to their small indigenous counterparts. Small African Indian firms are not more export-oriented than small indigenous firms, and large African Indian firms are not more export-oriented than large indigenous firms.

As explained in the data and method section, the selection and non-linearity constitute a serious concern in assessing the effects of ethnicity on exporting. The significant changes in the estimation in Table 3 when introducing the non-linear size interaction term, strengthens this concern even more. Table 4 analyses the causal effect of exporting by using propensity score matching. We match observation on predicted African Indian (a dummy) using a probit regression that includes firm size, productivity, age, and the country and industry dummies. The African Indian dummy is then used as the treatment effect, so that it compares firms with the same probability of being African Indian where in practice 1 is and the other is not. We use a 10 percent cut-off and common support at tails, so as to leave out the firms for which we have difficulty to establish credible pairs. The results are presented in Table 4.

The upper plane of Table 4 presents the Average Treatment of the Treated (ATT) effect and its significance. We can observe that the results are broadly in line with regression analysis above. The treatment effect on export status is significant for both 2006/2007 as well as for 2013. By contrast, using the continuous variable for share of exporting only returns a significant treatment effect for 2013. The lower part of Table 4 shows the balancing properties, which indicates that the sample is rebalanced and that the mean difference between treated and non-treated is insignificant.

**Table 4: Propensity Score Matching for African Indian Treatment**

<b>Average Treatment Effect</b>			
	Exports 2007		Exports 2013
African Indian	-0.12		0.24***
	(-0.03)		-2.14
<b>Probit First Stage</b>			
	Coefficient	% Bias reduction	t-value means
Size	0.26***	77	-1.62
Productivity	-0.11	79	1.36
Age	-0.01	78	0.62
Kenya	-1.43***		
Uganda	-0.93***		

The lower panel shows the probit probabilities used to generate the propensity scores, in which we observe that size and industry are particularly important.<sup>4</sup> We observe that there is a substantial bias reduction, so matching has a substantial effect of ‘correcting’ the distribution, especially for differences in size, and that after matching the difference in means for the treated and untreated in matched sample are insignificant. For the upper panel, we observe that the African Indian treatment is insignificant in 2006/2007; however, it is significant in 2013. This confirms the findings in the OLS estimations.<sup>5</sup>

### Firm performance

Now that we have established that internationalisation is conditionally higher in African Indian firms, we ask how export status affects firm performance. Table 5 shows probit estimates for innovation (Columns 1, 2, and 3) and OLS regressions for sales growth between 2006/2007 and 2013 (Columns 4, 5, and 6).<sup>6</sup> In all estimations, we control for firm size, age, industry, country, and productivity. As indicated in the Data and Methodology section, innovation is measured as new product launches, and growth is sales growth between 2006/2007 and 2013.

**Table 5: Probit regressions for Innovation and Growth**

	-1	-2	-3	-4	-5	-6
African Indian	0.34	0.57**	0.47	0.15	0.35	0.3
	[1.37]	[2.07]	[1.54]	[0.67]	[1.42]	[1.03]
Exports 13	0.18	1.68*	0.18	1.01***	1.96***	1.00***
	[0.77]	[1.87]	[0.78]	[3.77]	[3.02]	[3.72]
Afr_Ind* Exports		-1.55*			-1.10*	
		[-1.83]			[-1.74]	
Imports 13	0.24	0.14	0.36	-0.37**	-0.44**	-0.25
	[1.15]	[0.66]	[1.36]	[-2.00]	[-2.31]	[-1.07]
Afri_Ind* Imports			-0.24			-0.23
			[-0.75]			[-0.81]
Observations	276	276	276	271	271	271

Column (1) indicates that overall there is no connection between ethnic origin of the entrepreneur and the level of exports to innovation –although the African Indian dummy is positive as well as the variable that measures the share of imports.<sup>7</sup> The dramatic effect is in Column (2) that includes the interaction term that captures large African Indian firms. All three coefficients for exporting become significant and deserve individual qualitative discussion. To begin with, although judging interaction regression coefficients is complex, basically they split the sample in four where in the base-group there are low- and non-exporting indigenous firms.<sup>8</sup> The African Indian dummy shows that small African Indian firms are slightly but significantly more innovative than their indigenous counterparts. The *Exports13* coefficient now takes up the exporting indigenous firms. We observe that this group is highly innovative—note that we are including country dummies, so we control for a ‘vibrant Kenya’ effect. Most dramatic, the interaction coefficient for large African Indian firms is significantly *negative*, indicating that exporting African Indian firms are *less* innovative than non-exporting indigenous firms. Finally, we observe that exporting is much more closely connected to innovation than importing.

Using the same kind of reasoning, Columns (4-6) analyse the effects of internationalisation on sales growth. In Column (4), the share of exporting and importing both has a positive correlation with sales growth, hence confirming the prior. By including the interaction term in Column (5), an interesting pattern emerges. Although the *Exports13* term is not in itself significant, the t-value of 1.63 already signals joint significance for the group of indigenous exporting firms. Again, especially for indigenous exporters, they are fast growers. By contrast, the interaction effect for exporting African Indian firms is non-significant. Lastly, imports highly correlate with sales growth. Column (6) includes the interaction term with imports, an indication that indigenous firms that import are particularly also fast growers.

In Table 6, we use propensity score matching to gain a deeper understanding of some of these results. We focus on the effects of exporting for indigenous and African Indian entrepreneurs by splitting the sample for these two groups –we can only include one treatment at the time. As we can observe in the table, within the group of African Indian firms exporters when matched to firms which have the same propensity to be exporters are neither significantly more innovative nor do they grow faster. In sharp contrast, matched indigenous exporters are significantly more innovative and grow faster.

**Table 6: Average Treatment Effect of Exporting on Innovation and Growth**

<b>ATT Second Stage</b>				
	Innovation	Innovation	Growth	Growth
Exporter	0.09	0.11***	0.20	0.24**
	African Indian	Indigenous	African Indian	Indigenous
<b>Probit First Stage</b>				
	Coefficient	% Bias reduction	t-value means	
Size	0.36***	97	-0.01	
Productivity	-0.06	97	0.08	
Age	0.01	88	0.2	



## CONCLUSIONS

In this paper we have analysed the connection between the ethnic origin of firm owners, internationalisation, and firm performance in East Africa. The main conclusions are that African Indian entrepreneurs are more internationally-active than indigenous entrepreneurs, and that this split has become more prominent over time. However, there is little evidence that such international activities result in better firms' performance indicated by innovative capacity and sales growth. Using the propensity score matching techniques as robustness checks, we account for the selection effects into exporting. With respect to indigenous entrepreneurs, in contrast, our findings support the learning by exporting effect, where firms do benefit from internationalisation in terms of innovation and growth.

There are several limitations to this study, which hamper the drawing of greater general conclusions. First, with 331 firms, the sample is far from representative of the wider economy, especially taking into account the selection effects of formal and larger foreign owned companies to participate in the survey. In addition, the WBES data are self-reported and not checked against official sources, hence creating a lot of measurement noise. Lastly, potentially there is reverse causality from performance to internationalisation for which we have not controlled. Taking this all in, we still believe the results in this paper are a fair first shot at data driven analysis of the effects of ethnic entrepreneurship in East Africa.

Diaspora entrepreneurship is at the heart of policy discussions in many developing countries, often—as a very sensitive topic—below the surface. In developed economies, diaspora entrepreneurship is regarded as one of the main benefits of migration, although also this notion is slowly shifting, especially in the European Union. A recent change, for instance, is the active involvement of diasporas in foreign policy by the home countries (Ragazzi, 2014). After decades of slow development in the post-colonial era, at the dawn of reaping the benefits of recent advances of economic development, diaspora entrepreneurship poses a challenge to policy makers across sub-Saharan Africa.

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<sup>1</sup>The economic power of the Indian population in East Africa was not seldom regarded with resentment by indigenous Africans, which, after independence resulted in numerous conflicts of legal representation of African Indians in Kenya, and even (temporary) expulsion of people of Asian descent from Uganda. Many African Indians migrated to the United Kingdom, Canada or the United States during this period, some of which later returned.

<sup>2</sup>Interestingly, a small subset of respondents mark both options 'African' and 'Indian' in the questionnaire. These firms we have classified in the African Indian category.

<sup>3</sup>The data provides information on the balance sheet so that we could use TFP estimation using the residual as a predictor of productivity. However, this proxy for capital has many missing values and would reduce the sample substantially. As nearly all firms report sales and employment, we use labour productivity as a control.

<sup>4</sup>Not all are significant, but one has to keep in mind that perfect prediction would result in limited options for matching. The key in this paper is to build a matching model that reduces the bias in the explanatory variables.

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<sup>5</sup>We have also run the PS model with the export status dummy as dependent in the second stage. For both years the treatment effects are weakly significant.

<sup>6</sup>The sales growth data have a very large standard deviation and in several cases highly implausible. To not reduce the sample, we make a dummy with value 1 for positive growth and 0 otherwise. Only 60 percent of the firms show positive growth rates.

<sup>7</sup>The estimates included imports, as there is a large economic development literature on the role of imports on innovation, although most of it focusses on the role of import competition on innovation (see Bloom, N., M. Draca, and J. Van Reenen [2016], “Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity”, *The Review of Economic Studies*, Vol. 83, No. 1, 87-117). Relatively little attention has been paid to the connection between imports and *within* firm innovation.

<sup>8</sup>The simplest way to see this is when both variables are dummy variables. The interaction term then is the case where ‘both dummies are 1’. Importantly, the coefficient that is not reported is the one where both dummies are zero. The coefficients are then in relation with this double zero control group.