Quality Screening and Trade Intermediaries: Evidence from China

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Abstract

We examine the quality-screening role played by intermediaries in international trade, exploiting export data at the product level for Chinese exporters. We uncover substantial heterogeneity among intermediaries, and distinguish two types: generalized and specialized intermediaries. We find strong evidence of a quality-verification role for specialized intermediaries: they are more prevalent in products with greater quality dispersion among local exporters, and export goods of higher quality than do generalized intermediaries. Our results suggest that specialized intermediaries have the capacity to reduce the incidence of quality problems.

Keywords: Intermediaries, International Trade, Quality screening, Product differentiation, China.

JEL codes: F13, F14, O25, R11.

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1 Introduction

A considerable proportion of international trade is handled by so-called intermediaries. Intermediaries such as wholesalers, trading companies and import-export companies account for 22% of the exports of the world's largest trading nation, China (Ahn et al., 2011).[1] Understanding the factors that give rise to intermediaries in exporting is thus key. An extensive theoretical literature rationalizes the role of intermediaries in the economy,[2] and in particular in international trade. Three main roles have been put forward in this context: (1) helping to match sellers/exporters to foreign buyers;[3] (2) reducing trade costs;[4] and (3) mitigating adverse selection by checking quality.[5] There is now well-accepted empirical evidence that intermediaries alleviate difficulties in reaching less-accessible markets through the first two channels. However, there is much less consensus on the hypothesis of quality screening.

In this paper we use export data at the product level for Chinese exporters to investigate the quality-screening role of intermediaries. In theory, an intermediary is in a good position to alleviate quality problems due to prior investment in inspection technology or incentives

[1] This share is 10% of total exports in the US (Bernard et al., 2010a), 11% in Italy (Bernard et al., 2015), 20% in France (Crozet et al., 2013), and 35% in Chile (Blum et al., 2010).

[2] See Spulber (1996) for a review of the roles of middlemen in general.

[3] The initial models viewed intermediaries as agents who reduce the search costs of finding international buyers and sellers (Rauch and Watson, 2004; Petropoulou, 2008; Antras and Costinot, 2011).

[4] Various recent models extend Melitz (2003) to account for intermediary activity. These typically assume an intermediation technology that allows intermediaries to exploit some kind of export advantage (such as economies of scope or better knowledge) over small exporting producers (Ahn et al., 2011; Akerman, 2010; Blum et al., 2011; Bernard et al., 2010a; Crozet et al., 2013; Felbermayr and Jung, 2011).

[5] See Biglaiser (1993), Biglaiser and Friedman (1994), and Li (1998).

to protect their reputation as a quality seller (Biglaiser and Friedman, 1994). In the context of international trade, where information asymmetry is greater, intermediaries could be used to screen the quality of products and then reveal this quality to consumers (Dasgupta and Mondria, 2013). This quality-verification hypothesis suggests a greater prevalence of trade intermediation in the exports of goods that are more differentiated. However, when complete contracts are not possible, trade intermediation is prone to hold-up. Intermediaries may shirk from the costly investments in specialized physical and human capital required for quality inspection, and hence underinvest in quality-signaling from the perspective of their clients (Tang and Zhang, 2012). These two opposing views mirror the contrasting empirical results on the relationship between vertical product differentiation and the prevalence of trade intermediation (Feenstra and Hanson, 2004; Tang and Zhang, 2012; Bernard et al., 2015; Ahn et al., 2011). On the one hand, the quality-sorting role of intermediary firms has clearly been established for traders in Hong Kong (Feenstra and Hanson, 2004). Their role in intermediating trade between China and the rest of the world has been shown to be greater for differentiated products, which Feenstra and Hanson (2004) interpret as evidence that they are able to select Chinese producers that meet foreign quality standards. On the other hand, a negative relationship has been observed between the share of intermediaries in exports and the degree of product differentiation in two different countries: China (Tang and Zhang, 2012)[6] and Italy (Bernard et al., 2015).

Using Chinese firm-level export data we uncover substantial heterogeneity between intermediaries, and distinguish two types based on the concentration of their export bundles:

[6] Ahn et al. (2011) find that the relative price of intermediaries compared to that of direct exporters does not vary significantly with the product's scope for quality differentiation, suggesting little quality-sorting by intermediary firms.

generalized and specialized intermediaries.[7] We argue that the latter group is characterized by enhanced quality-verification activities. Our results suggest a selection into intermediary use based on the intrinsic features of the product being traded: products with a greater degree of differentiation and need for quality verification tend to be disproportionately handled by intermediaries that operate as quality-control agents, i.e. specialized intermediaries.

We do not model intermediaries of different types explicitly, and hence do not try to single out an underlying difference between the two types of intermediaries. These may for example differ in terms of investments in screening technology or long-term relationships with both customers and buyers. Compared to generalized intermediaries, whose product range can cover many different unrelated industries, specialized intermediaries focus on a narrower set of products with greater export value.[8] This larger scale likely allows specialized intermediaries to develop expertise on the particular production process of the products they cover and profitably invest in the costly quality screening process that applies to their product line. Also, as niche players they have greater incentives to protect their reputation as reliable suppliers of quality goods.

We propose two empirical results that emphasize the quality-verification role of specialized intermediaries. First, specialized intermediaries are more likely to be found in quality-differentiated products and, second, they export products of much higher quality than do generalized intermediaries.

Our first set of results refers back to the empirical findings in Tang and Zhang (2012).

[7] Intermediary heterogeneity also appears in some theoretical work: intermediaries vary in terms of their ability to screen product quality (Dasgupta and Mondria, 2011) or the size of their networks (Rauch and Watson, 2004).

[8] As indicated in Table 2, in our data the average export value per HS6 is eight times higher for specialized than for generalized intermediaries.

We use the same data set of Chinese exports in 2005,[9] and follow their approach of looking at the product-level relationship between the prevalence of trade intermediation and the dispersion of export quality.[10] Our approach differs in that we account for two existing types of intermediaries: generalized and specialized, the latter group having a quality-verification role. Shanghai Silk International Trade Company (SSTC) is a good illustration. This is an affiliate of Shanghai Silk Group Co. Ltd., whose business line is limited to garments. SSTC claims that the products it delivers are tested extensively in a certified textile-testing laboratory.[11] Their website announces that SSTC has established long-term stable trade relations with over a thousand customers around the world, such as Wal-Mart and ZARA, who chose SSTC for its excellence in the whole process from fashion design and product management to product testing and quality control.[12] Our results show that accounting for the heterogeneity of intermediaries substantially changes the findings in Tang and Zhang (2012). While we confirm that intermediaries overall focus on products that are less differentiated, we show that specialized and generalized intermediaries differ in that the former disproportionately handle exports of products with substantial variation in supplier quality, attesting to their quality-verification role.[13] We calculate the Herfindahl index of the firm-level distribution of export sales over products conditional on the effect of ownership and size in a regression

[9] We follow Ahn et al. (2011) and Tang and Zhang (2012) and define intermediaries as firms with certain Chinese characters suggesting a trading role in their name.

[10] We use the structural-based measure of quality proposed by Khandelwal et al. (2013). We hence do not use the dispersion in export prices to proxy for vertical differentiation (Feenstra and Hanson, 2004; Bernard et al., 2015; Ahn et al., 2011) as a result of the well-known drawbacks in using unit values to proxy for quality (Hallak and Schott, 2010).

[11] The certification is granted by the China National Accreditation Board for Laboratories (CNAL).

[12] The website (http://www.shsilk.com.cn/about/subcmp1.aspx) also claims that the price of each process is lower than that of third-party service suppliers.

[13] We check that the measured link between reliance on specialized intermediaries and quality dispersion does not only reflect the efficacy of specialized intermediaries in improving quality. We also ensure that our results are not driven by the activities of affiliates established by foreign and domestic groups, whose raison d'être differs from the independent quality-screening role suggested by our theory.

framework. Our baseline approach distinguishes specialized and generalized intermediaries according to the median of this conditional concentration index. Our results are robust to the use of alternative cut-offs and a number of sensitivity checks. Our exploration of the destination-country dimension further strengthens our argument. To the extent that specialized intermediaries can help screen product quality for buyers, this function should be more pronounced for more distant buyers, who tend to have less information about the sellers. We include interaction terms between country characteristics and product-quality differentiation and find greater support for quality-verification in more distant countries with fewer ethnic Chinese.

Our second set of results relates to the difference between intermediaries' and direct exporters' quality levels. Exports by generalized intermediaries are shown to be of lower quality than those of specialized intermediaries, with the latter's quality being close to, but less than, that of direct exporters. This is consistent with the price results in the growing literature on trade intermediation, suggesting that intermediaries help relatively less efficient (low-quality) firms to export (Akerman, 2012; Bernard et al., 2010a; Ahn et al., 2011; Crozet et al., 2013). We also find a monotonic relationship between the degree of specialization of specialized intermediaries and the quality of the products sold. The quality of the products exported by specialized intermediaries in the upper quartile of the distribution of product range is higher than that of direct exporters.

Our analysis of the association between the use of trade intermediaries and product quality exploits city-level data and calculates measures of vertical differentiation at the city-product level. We hence depart from the traditional use of cross-sectional data across products, which overlooks the spatial heterogeneity in quality dispersion. Our data reveal

substantial variation in quality dispersion across Chinese cities, even for fairly homogeneous goods. We uncover a rather intuitive spatial component of quality dispersion: more open and accessible cities tend to have greater product-quality dispersion. However, the quality differentiation across Chinese intermediaries within a product is not only geographical and differs across products. We find that cities with a reputation for being high-quality centers for particular products have higher average quality and lower quality dispersion in these products. We also consistently observe a smaller coefficient of variation of quality dispersion across exporting cities for homogeneous products compared to differentiated products. This suggests that the city-product (as opposed to product) level dimension is the most appropriate for the analysis of quality dispersion. Using city-product data also allows us to include product fixed effects to address any confounding factors in the link between product-level quality heterogeneity and intermediation. Average price and quality, as well as the scope for vertical differentiation at the product level, are likely to be correlated with many other unobserved characteristics of our HS6 products, which may in turn determine the relative importance of intermediaries in exports. Our empirical approach controls for unobserved product-specific and city-specific characteristics via product- and city-level fixed effects. In our robustness checks we estimate panel regressions and confirm the existence of selection into the use of intermediaries, whereby exports in (city-product) industries with greater differences in quality across suppliers are more likely to be handled by specialized intermediaries. Our results here reconcile the contrasting existing results on the quality-verification role of intermediaries. As specialized intermediaries account for only a minority of intermediated trade, it is unsurprising that their quality-verification role is masked in aggregate data. The contrasting finding of quality-screening for traders in Hong Kong who export Chinese

products is consistent with a greater proportion of these intermediaries being specialized (Feenstra and Hanson, 2004).

The remainder of the paper is structured as follows. Section 2 discusses intermediary heterogeneity and describes how we distinguish specialized from generalized intermediaries. Section 3 describes the construction of the quality variables and provides preliminary evidence of the quality-verification role of specialized intermediaries. Section 4 then presents the regression results linking trade intermediation to vertical differentiation, and Section 5 considers the difference in quality levels between our two types of intermediaries. Last, Section 6 concludes.

2 Heterogeneity among intermediaries in China

2.1 Data

Our main data comes from the Chinese Customs Trade Statistics (CCTS) database, as used by Ahn et al. (2011) and Tang and Zhang (2012). This is compiled by the General Administration of Customs of China, and includes firm-level export values and quantities at the 8-digit HS product-level by country of destination. For each individual export flow, we have both the quantity exported and the corresponding free on board (f.o.b.) value in US Dollars. We can then calculate the unit value of exports for each firm, product and destination. The database also records the destination of exports and contains firm-specific information such as ownership (foreign, state or private), name and address. We collapse the data to the annual level and aggregate product data to the 6-digit HS level.

We adopt the common practice in the literature of identifying intermediary firms based on the Chinese characters that have the English-equivalent meaning of "importer", "exporter", and/or "trading" in the firm's name (Ahn et al., 2011; Tang and Zhang, 2012). In particular, we follow the approach in Tang and Zhang (2012) and search for the following pinyin (Romanized Chinese) phrases: "jin4chu1kou3", "jing1mao4", "mao4yi4", "ke1mao4", "wai4jing1", "wai4mao4" and "gong1mao4".[14]

2.2 Measuring specialization

We would like to differentiate between intermediaries that export a variety of products spanning unrelated sectors and those with a core competence in a single line of business. The former correspond to the type of traders that appear in the recent empirical literature, where intermediaries have consistently been found to export more products to more destination markets and more varieties per country than direct firms (Ahn et al., 2011; Bernard et al., 2010a; Crozet et al., 2013). This aspect of trading firms suggests that part of intermediaries' role is to help firms send products to destination markets. On the contrary, intermediaries with a restricted core competence, which we will refer to as specialized traders, conform to the image of intermediaries in Dasgupta and Mondria (2011): they screen product quality and then reveal this to consumers.

We will distinguish between the two types of intermediaries according to their distribution of export sales over products: we calculate for each intermediary firm f the share of exports in each product p, s_f^p. We then compute the firm's Herfindahl index by aggregating the

[14]These last two terms, which mean "foreign trade" and "industry and trade" respectively, were not considered by Ahn et al. (2011). In the robustness tests in Table A-5 we check that our results continue to hold with this more conservative measure.

squares of the shares of all the products exported by firm f:[15]

$$HI_f = \sum_{p \in S_f} (s_f^p)^2, \tag{1}$$

where S_f is the set of (N_f) products that firm f exports, and s_f^p the export-value share of product p over the total export value of firm f. A higher value of HI_f means that the firm's export basket spans a narrower range of varieties. Firm-level product scope is expected to rise with firm size and productivity (Bernard et al., 2010a; Bernard et al., 2011). To control for those mechanical associations in our analysis of the heterogeneity of product concentration across intermediaries, we regress the HI measure on a quadratic polynomial in firm size (proxied by export value) with fixed effects for ownership,[16] and then take the residual, ϵHI_f.

Figure 1 shows the distribution of HI_f (left panel) and ϵHI_f (right panel) in our sample of intermediaries. The Herfindahl indices are calculated as the sums of product shares s_f^p defining the different products p at the HS6-, HS4- and HS2-levels. The twin peaks in the figure suggest a bimodal distribution.

[15] We do not normalize the Herfindahl index (using $1 - \frac{1}{N_f}$ in the denominator), as this would mechanically eliminate mono-product exporters.

[16] We use three ownership-type dummies (State-owned enterprises, private firms, and foreign-invested firms) to pick up the well-documented productivity differences between firms by ownership (Bloningen and Ma, 2010). The online Appendix shows that our results continue to hold when we distinguish specialized and generalized intermediaries using the ordinary Herfindahl index (without adjusting for size and ownership).

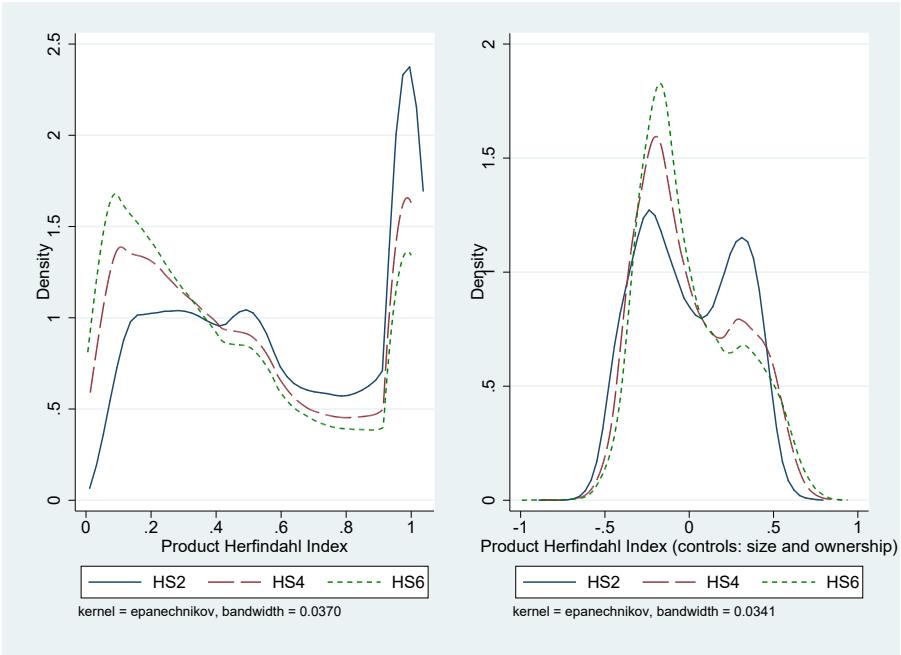

Figure 1: The Distribution of Firm-level Herfindahl Indices

The Herfindahl indices are calculated using Equation 1 with products p defined at the HS6-, HS4- and HS2 levels. The right-hand panel shows the distribution of the Herfindahl indices after conditioning on a quadratic in firm size and firm-ownership dummies. See the text. In the left-hand panel, the mean, median and standard deviation are 0.44, 0.36 and 0.33 respectively when products are defined at the HS6-level, 0.49, 0.43 and 0.33 at the HS4-level, and 0.60, 0.56 and 0.32 at the HS2-level. In the right-hand side panel, the mean, median and standard deviation are 0.01, -0.07 and 0.29 respectively when products are defined at the HS6-level, 0.01, -0.06 and 0.29 at the HS4-level, and 0.01, -0.02 and 0.29 at the HS2-level.

Two separate groups of intermediaries stand out: that to the right is characterized by a narrow range of products (i.e. specialized intermediaries) while that to the left covers a larger product range, which we refer to as generalized intermediaries.[17]

Our baseline distinction between specialized and generalized intermediaries is based on Figure 1, and in particular on the median value of ϵHI_f. The intermediaries with HS6-product concentration (conditional on size and ownership) above the median are defined as specialized; those below the median are generalized. We will later check that our results are robust to replacing the median cut-off of product concentration by the 60th percentile, excluding mono-exporters and defining the p products in Equation 1 at a more aggregate (HS4- or HS2-) level. It is important to point out that none of the criteria we use to delineate

[17]Figure OA-1 in the online Appendix shows that this bimodal distribution is robust to the exclusion of firms which export a single HS6 product.

specialized versus generalized intermediaries automatically imply a mechanical correlation with average quality.

2.3 Summary statistics

Table 1 shows the overall export values for direct exporters and the two types of intermediaries. In 2005, intermediaries accounted for 21.2% of Chinese exports, with 8.7% of exports being handled by specialized intermediaries. This proportion is the same regardless of the aggregation level used to define the p products in the firm-level concentration indices. While the share of exports accounted for by intermediaries has fallen over time, the share of exports accounted by specialized intermediaries has remained constant at 9%.

Table 1: Summary Statistics: The Role of Intermediaries

Year	Total export value ($ million)	Share in export value: Direct exporters	Indirect exporters	Specialized intermediaries: HS6	HS4	HS2
	(1)	(2)	(3)	(4)	(5)	(6)
2002	325,632	72.5	27.5	9	8.3	8.4
2003	417,548	75.7	24.3	8.2	7.6	7.6
2004	593,644	77.4	22.6	8.8	8.3	8.3
2005	761,484	78.8	21.2	8.7	8.1	8.1
2006	966,690	79.1	20.9	8.8	8.4	8.8

This table lists the summary statistics from China's export transaction data. Column 1 shows the values in millions of U.S. Dollars. Columns 2 to 6 show the share of column (1)'s total figure in %. See the text for the definition of intermediary firms. HS6, HS4 and HS2 refer to the level of aggregation used to define the products in the Herfindahl calculations (Equation 1) and to define specialized and generalized intermediaries: see the text.

Table 2 lists firm-level summary statistics in 2005 by firm type (direct exporters, generalized intermediaries and specialized intermediaries). As a small number of exceptionally large firms may dominate trade, we show both means and medians. The two intermediary types differ in a number of dimensions. With our differentiation between specialized and generalized intermediaries being based on the median, the two types account by construction for the same share of exporters (9.4%). However, as can be seen in row 2, generalized interme-

diaries are larger than specialized intermediaries, with median export sales of 864,283 and 598,946 USD respectively. Reflecting our use of product concentration to define generalized and specialized intermediaries, the median value of the number of HS6-products exported by the former is 25, more than six times that for the latter (4) and that of the median direct exporter (3). Generalized intermediaries also export to many more markets (8), as compared to the other two firm types (3). Row 3 follows Ahn et al. (2011) and classifies HS codes into one of 15 unrelated sectors[18] to identify the firm's core activity (e.g., animal products, wood products or textiles). The observation in Ahn et al. (2011) that intermediary firms (as a whole) handle products that span entirely unrelated sectors holds only for generalized intermediaries. The median generalized intermediary exports products in six sectors; on the contrary, the two other firm types, direct exporters and specialized intermediaries, only export products in one or two sectors. This is consistent with our description of specialized intermediaries as not only exporting fewer products, but also having a core competence.[19]

Table 2: Firm-level Summary Statistics for Exporting Firms, 2005.

Firm type	Direct firms		Generalized intermediaries		Specialized intermediaries	
Number	116,375		13,414		13,413	
	Mean	Median	Mean	Median	Mean	Median
Export value by firm (thousand $)	5,109	535	5,335	864	6,602	599
Export value by variety (HS6) by firm ($)	994,198	44,433	58,306	9,763	629,690	26,580
No. of markets	6.84	3	17.21	8	8.98	3
No. of industries (combined HS2)	1.99	1	6.78	6	3.03	2
No. of industries (HS2)	2.91	2	15.79	10	4.85	2
No. of industries (HS4)	5.68	2	44.26	18	9.63	3
No. of varieties (HS6)	8.66	3	70.83	25	14.21	4

Source: Authors' calculations from Chinese transactions data in 2005. See the text for the definition of intermediary firms. Specialized and generalized intermediaries are identified based on the residual of a regression of the Herfindahl index on a quadratic in firm exports and firm-ownership dummies (Equation 1), with products defined at the HS6-level.

[18]HS 01-05 "Animal and Animal Products"; HS 06-15 "Vegetable Products"; HS 16-24 "Foodstuffs"; HS 25-27 "Mineral Products"; HS 28-38 "Plastics/Rubbers"; HS 41-43 "Raw Hides, Skins, Leathers & Furs"; HS 44-49 "Wood and Wood Products"; HS 50-63 "Textile"; HS 64-67 "Footwear/Headgear"; HS 68-71 "Stone/Glass"; HS 72-83 "Metals"; HS 84-5 "Machinery/Electrical"; HS 86-89 "Transportation"; HS 90-97 "Miscellaneous"; and HS 98-99 "Service".

[19]This echoes the emerging theoretical work that introduces core competencies in models of multiple-product firms (Eckel and Neary, 2010; Bernard et al., 2010b).

Table A-1 displays the list of the top-20 products by export value of the HS6 categories with specialized intermediary share of over 50%. Table A-2 carries out the same exercise for generalized intermediary shares. Intermediation by specialized intermediaries appears to be especially prevalent for tobacco products, maize, and coal and steel products where they can account for more than two-thirds of total exports. By contrast the share of generalized intermediaries never exceeds 67%. The largest shares are exhibited for a variety of textile fabrics. Table A-1 hence points to tobacco and cigarettes as outliers on the right-tail of the distribution of specialized intermediary export shares, possibly because trading these products through specialized intermediaries is less related to quality verification than to monopoly distribution rights. We will show that our empirical results are robust to dropping these two products.

3 Intermediaries and Quality

Our proposition is that the vertical differentiation of a product determines the prevalence of specialized intermediaries that operate as quality-control agents. We hence expect specialized intermediaries to effectively verify quality and export at higher qualities than generalized intermediaries.

3.1 Quality differences between firm types

We build on the strategy of Khandelwal et al. (2013) to estimate the quality of a variety, which is defined as a specific good sold by a firm in a given destination. The two main elements are that (1) quality is assumed to play the role of a demand shifter, and (2)

preferences are assumed to be CES across producers of imperfectly-substitutable varieties. Identification is based on the following demand equation:

$$q_{fpc} = p_{fpc}^{-\sigma_p} \Lambda_{fpc}^{\sigma_p - 1} P_{pc}^{\sigma_p - 1} Y_{pc} \tag{2}$$

where σ_p is the elasticity of substitution between varieties. Equation 2 shows the demand q_{fpc} addressed to each single producer f as a function of the price p_{fpc} relative to the price index P_{pc}, the quality of its variety Λ_{fpc} and the real demand in market c, Y_{pc}/P_{pc}.

After log-linearizing, the quality of each variety can be estimated as the residual from a demand equation, controlling for prices at the individual and aggregate level and the nominal demand in the market:

$$\ln q_{fpc} + \sigma_p \ln \; p_{fpc} = \underbrace{(\sigma_p - 1) \ln P_{pc} + \ln Y_{pc}}_{\text{Component specific to pc}} + \underbrace{(\sigma_p - 1) \ln \Lambda_{fpc}}_{\text{residual}} \tag{3}$$

Since price indices and demands are not observed at the product- and destination-level, the standard approach pioneered by Khandelwal et al. (2013) is to capture these variables by fixed effects. We thus use the prices p and quantities q observed at the variety (p, c) level and a calibration of the elasticity of substitution σ_p to measure the left-hand side of Equation 3. Our data for σ_p are taken from Broda and Weinstein (2006).[20] We then regress this variable on country-product level fixed effects. We rescale the estimated residual to reflect the heterogeneity in product-level elasticities of substitution to obtain an estimate of $\ln \Lambda_{fpc}$.

Figure 2 compares average product quality across firm types (direct exporters and gen-

[20] HS3 elasticities for China are taken from www.columbia.edu/ dew35/TradeElasticities/TradeElasticities.html.

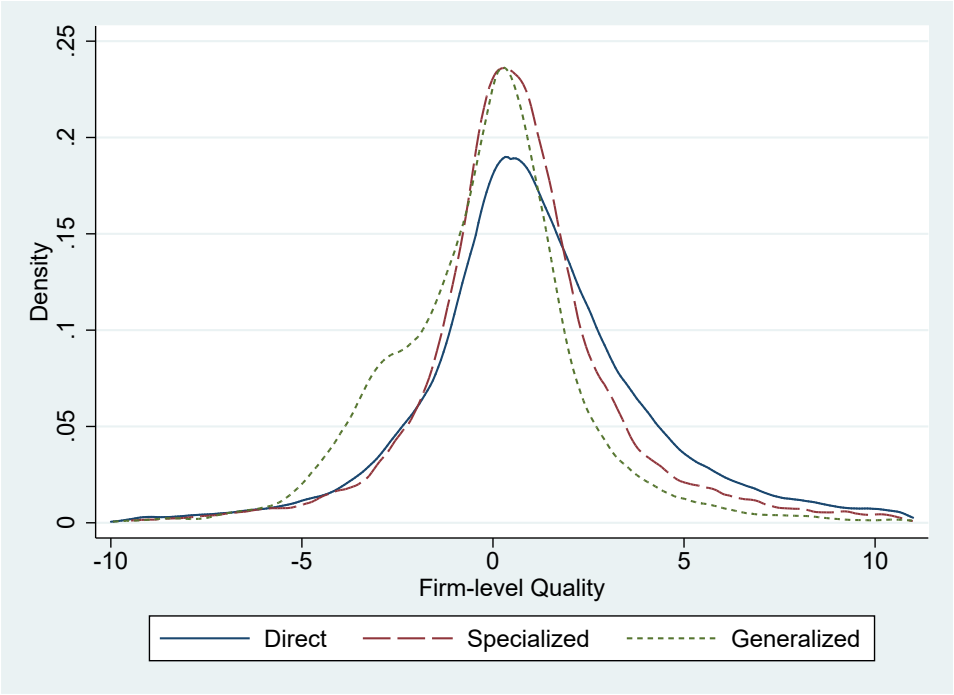

Figure 2: Distribution of Firm-level Quality (trimming 1%)
The firm average is calculated as a weighted average using the share of the transaction (product-country) in the firm's exports.

eralized and specialized intermediaries). Exports by generalized intermediaries are shown to be of lower quality than those of specialized intermediaries, with the latter's quality being closer to, but less than, that of direct exporters.

Table 3 provides additional statistics on quality differences by firm type. Column 6 shows weighted average export quality when the weights are the shares of firm exports in the total exports of the firm type. Average quality for direct exporters is six times that of intermediaries, which is consistent with intermediaries helping relatively inefficient firms, those with low-quality products to export (Akerman, 2012; Bernard et al., 2010a; Ahn et al., 2011; Crozet et al., 2013). Nevertheless, export quality is higher for specialized than generalized intermediaries, with weighted average figures of 0.42 and 0.28 respectively. These statistics clearly suggest that specialized intermediaries focus on higher-quality products.

Table 3: Summary Statistics on Export Quality by Firm Type, 2005

	Firm-level Quality					
	(1)	(2)	(3)	(4)	(5)	(6)
Firm type	Mean	Median	Bottom 25%	Top 25%	Standard deviation	Weighted average
Direct firms	1.37	0.90	-0.59	2.78	7.36	2.50
Specialized intermediaries	0.79	0.55	-0.60	1.85	4.86	0.42
Generalized intermediaries	-0.17	-0.01	-1.62	1.11	3.32	0.28

Source: Authors' calculations from Chinese transactions data in 2005. See the text for the definition of intermediary firms. Specialized and generalized intermediaries are identified based on the residual of a regression of the Herfindahl index on a quadratic in firm exports and firm-ownership dummies (Equation 1), with products defined at the HS6-level. Firm-level quality is calculated as a weighted average with the share of the firm-product-country exports in firm total exports as the weights. The weights used in column 6 are firm total exports as a percentage of the total exports for the corresponding firm type (direct exporter, generalized intermediary and specialized intermediary).

Table 4 shows the export share of high-tech products across different firm types (direct exporters and generalized and specialized intermediaries). Three complementary classifications are used to assess the technological content of the export basket of the three firm types. We report successively the simple share (using product lines) and the export weighted share of high-tech products. The first row uses the OECD classification, which provides a comprehensive and detailed list of the most technology-intensive products (Hatzichronoglou, 1997). The classification is based on the R&D intensity, whether direct or indirect, of each product. Row 2 relies on the UNCTAD Skill and Technology Content of Products[21] and row 3 turns to the Eurostat classification of High-tech manufacturing industries.[22] The technological content of the direct exporters' export basket is systematically higher than that of intermediaries. This is in line with the evidence in Ahn et al. (2011) that Chinese exports by intermediaries are more expensive than direct exporters.[23] Compared to generalized in-

[21]The data is available at http://www.tradesift.com/about-ts/productGroups/pg_unctadSkill.aspx.

[22]http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:High-tech.

[23]This finding is in line with Ahn et al.'s (2011) modelling of intermediation as producing higher marginal costs of foreign distribution. In their setting, firms with relatively higher unit costs endogenously select intermediation.

Table 4: Summary Statistics on Export Quality by Firm Type, 2005

	Share of high tech products in exported value		
Firm type	Direct firms	Intermediaries	
		Generalized	Specialized
High-tech products (OECD)	30.14	5.17	10.56
High-skill & technology products (Unctad)	27.52	3.15	7.90
High-tech products (Eurostat)	34.76	15.20	20.98

Source: Authors' calculations from Chinese transactions data in 2005. See the text for the definition of intermediary firms and the classification of technology-intensive products. Specialized and generalized intermediaries are identified based on the residual of a regression of the Herfindahl index on a quadratic in firm exports and firm-ownership dummies (Equation 1), with products defined at the HS6-level.

termediaries, specialized intermediaries export a slightly higher share of high-tech goods, which is consistent with the image of specialized intermediaries being niche players focused on upscale specialty products.

One concern with the positive correlation between specialized intermediaries and high-quality exports is that large firms may establish an affiliated trading company. These affiliated intermediaries are not the independent quality-screeners that our theory suggests. These arms of what are likely highly-productive firms may cluster in the specialized category, providing an alternate explanation of the positive correlation between specialized intermediaries and high-quality exports.[24] We exploit information from the firm names to identify firms belonging to a group and find that these subsidiaries are not clustered in a particular category of intermediates, which reassures that affiliates do not blur our distinction between specialized and generalized intermediaries.[25] In the empirical section we will show that our

[24] We thank an anonymous referee for pointing out this issue.

[25] In the online Appendix we set out our method to identify a total of 3,182 affiliated firms, of which 27% are intermediaries: 418 are specialized intermediaries and 439 are generalized intermediaries. We use two complementary approaches. The first corresponds to the presence of the term "group" in the company type, reflecting that the exporter belongs to a group. During the commercial registration process a company will be allowed to include "group" in its name if it can provide evidence of at least three affiliated companies established by its parent company. The second consists in identifying group-related firms based on the fact that they share the same "Chosen name" as another firm, which can be their parent or another affiliate of

results are robust to dropping the group-related firms for our two sets of findings, the association between quality dispersion and specialized-intermediaries prevalence and the quality difference between intermediaries and direct exporters.

3.2 Quality dispersion in China

We exploit the variation in the scope for quality differentiation across products and space to see whether intermediaries, or a subset of them, mitigate adverse-selection problems by guaranteeing product quality. We will show that there is substantial heterogeneity in terms of quality differentiation (i.e. the dispersion of qualities) across Chinese cities for a given product. This heterogeneity determines the prevalence of export intermediaries and, more importantly, the importance of the role that specialized intermediaries play in overall intermediation.

Our estimates of quality differentiation follow Khandelwal (2010) by calculating quality dispersion for each city-product pair as the standard deviation of the estimated $\ln \Lambda_{fpc}$ across all (firm-product-destination) flows.[26] We use data for 2004, as our empirical strategy relates 2005 intermediary prevalence to the one-year lagged quality dispersion at the city-product level.

Our concentration on product-city (as opposed to product-) level variation in quality dispersion reflects that quality dispersion varies across both space and products in our data. Table OA-11 in the online Appendix reveals substantial variation in quality dispersion across Chinese cities, even for fairly homogeneous goods (garlic and silicon). Following Khandelwal

the same parent. We also report summary statistics that show the same main differences between the two intermediary types and the direct exporters when excluding or focusing on these group-related firms.

[26] In Section 4.2 we show that the results are robust to defining dispersion using the trimmed or untrimmed standard deviation, the full range (maximum minus minimum) and the inter-quartile range of qualities.

(2010), we treat quality dispersion as an exogenous product characteristic. Our work however differs in that we also measure quality dispersion at the city-level. What we call cities here correspond to the first administrative division of the 31 Chinese provinces.[27] Given China's large population and area, the 321 cities in our sample are anything but small. We further only retain city-product pairs with over ten (firm-product-destination) export flows to ensure that there are enough observations for a reliable measure of quality dispersion. Considering the link between product-quality differentiation and the share of intermediary exports at this level of spatial disaggregation, we may worry about the endogeneity of exporting-firm location across cities. While the diversity of firms in terms of export share may affect the measure of quality dispersion, which is calculated within product across existing firms, it is unlikely to affect our measure of intermediary specialization, which is calculated across products within an exporting firm. Our empirical specification in any case controls for the number and diversity (as measured by the Herfindahl index) of intermediaries and direct exporters at the city-product level.

Figure 3 shows the dispersion of average quality separately for coastal and non-coastal cities. This figure highlights the spatial dispersion of quality, which varies across locations intuitively: more open and accessible cities tend to exhibit greater product-quality dispersion.

In the online Appendix we find a similar pattern with a more refined proxy of intrinsic openness: we calculate foreign-market access for each Chinese city in 2004 using the results from a gravity-trade regression, as in Redding and Venables (2004).[28] However, quality

[27] China is divided into four municipalities (Beijing, Tianjin, Shanghai and Chongqing) and 27 provinces, which are further divided into (4-digit) prefectures. As is common in the literature, we use the term city to refer to the whole prefecture, even though it includes both an urban and a rural part.

[28] In the online Appendix we single out eight award-winning locations which were rewarded in 2002 by the China National Textile Industry Council for their unique development of industrial agglomeration bases. We consistently find that they have higher average quality and lower quality dispersion in the product in which

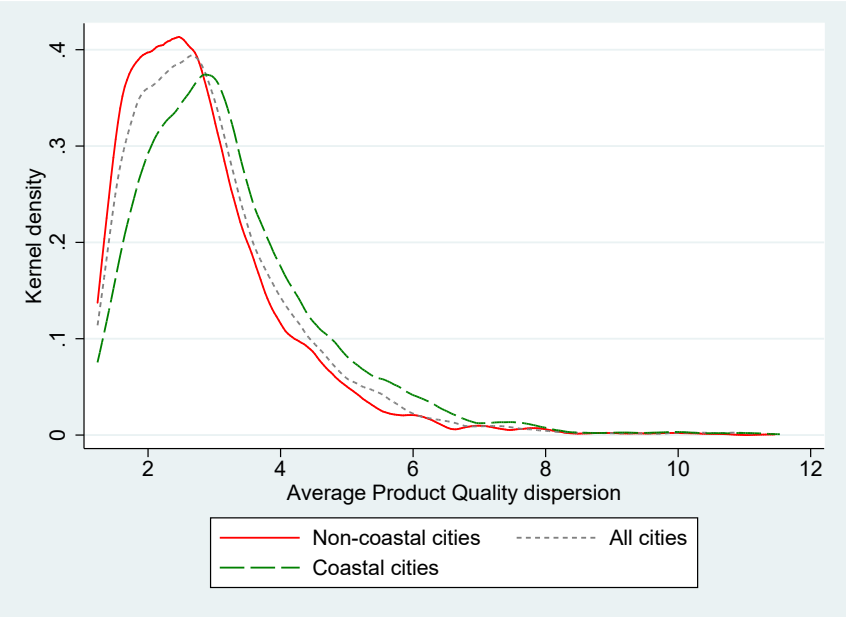

Figure 3: The distribution of average product quality dispersion, coastal vs. non-coastal cities

Product quality dispersion is defined as the standard deviation of quality in 2004. Average product quality dispersion is the mean of city-product quality dispersions across cities.

differentiation across Chinese intermediaries within a product is not only geographical, but also differs across products. For each product, we calculate the coefficient of variation (i.e., standard deviation divided by the mean) of quality dispersion across exporting cities. In Table OA-12 in the online Appendix we show the cross-product average and range of the coefficient of variation separately for homogeneous and differentiated products, following the definition in Rauch (1999). We obtain a smaller coefficient of variation for homogeneous than for differentiated products, suggesting that the product-city (as opposed to product-level) dimension is the most appropriate for the analysis of quality dispersion.

they specialize.

4 The empirical analysis of intermediation

Our regression estimates the share of intermediary exports in city-HS6 observations, which is correlated with a proxy for the scope of vertical differentiation.

While firm-level customs data is available for 2000-6, the Chinese system of trading licenses was not entirely dismantled until 2005. Following the literature, we consider the single year 2005 as the baseline as export licenses had been removed by 2005, and any firm that wished to trade directly with foreign partners was free to do so (Ahn et al., 2011). We show in the robustness checks in Section 4.2.2 that our results continue to hold in a panel specification appealing to variation over time in a given city-product pair of the relationship between quality dispersion and intermediary prevalence.

4.1 Empirical specification

We now formally examine how the prevalence of the two types of intermediary is related to vertical differentiation. Our specification is:

$$\text{Intermediary share}_{lp} = \beta \text{ Quality Dispersion}_{lp} + \gamma Z_{lp} + \mu_l + \nu_p + \epsilon_{lp} \tag{4}$$

where Intermediary share$_{lp}$ is the share of intermediary exports from Chinese city l in HS6 code p in 2005, and Quality Dispersion is quality heterogeneity across exports for that city-product pair. To address potential endogeneity problems, we lag our proxy for quality differentiation by one year. Intermediary share will be further decomposed into those emanating from specialized and generalized intermediaries.

The regressions include both city fixed effects, μ_l, and HS6 fixed effects, ν_p. Product fixed effects capture inherent differences in the degree of intermediation that products require. These fixed effects also account for all of the intrinsic product factors, common to all Chinese locations, that may be correlated with both the scope for quality differences between firms and the prevalence of intermediaries. These include any repercussions from national-level trade protection of imports and exports, and the degrees of horizontal differentiation and contract dependence.[29]

City fixed effects control for location-specific characteristics that determine overall supply capacity, such as infrastructure, the technological level and factor endowments. Our empirical approach hence exploits both within-city variation across products and within-product variation across cities. For a given product we compare the prevalence of trade intermediation between cities where there is a relatively large quality heterogeneity among exporters to that in cities where there is less (after controlling for the city average via city fixed effects).

We further control for city-product characteristics. Chinese export performance varies considerably by firm ownership (Amiti and Freund, 2010). The inclusion of the share of exports by foreign firms and the share of State-owned firms defined at the city-product level is crucial to account for the ability of different cities to export different products without requiring intermediation, as a result of differences in firm-level productivity and quality reflecting different ownership structures.[30] Moreover the ownership structure of exporters is

[29]Intermediaries have been shown to be less prevalent for freely-traded products, contract-dependent products and complex products (Ahn et al., 2011; Crozet et al., 2013; Tang and Zhang, 2012). The proxies used in these contributions such as the well-known Rauch (1999) classification for simple and complex goods or the measure of contract dependence in Nunn (2007) are calculated at the product level and will be reflected in the product fixed effects in our empirical model.

[30]Foreign firms have higher productivity and product quality than do domestic firms in China (Ge et al., 2015). The superior performance of foreign affiliates typically derives from international technology spillovers (Keller and Yeaple, 2009) and fewer financial constraints (Arnold and Javorcik, 2009; Manova et al., 2015).

likely to have direct repercussions on the relative role of intermediaries and their specific type (specialized versus generalized). State firms are generally less restricted in exporting directly than are private firms, since most of them have their own affiliated State-owned intermediaries to help them export. Foreign firms may also rely less on intermediaries, as they have better knowledge of export markets and may benefit from their parent company's distribution networks abroad. Meanwhile, foreign-invested enterprises do not require intermediaries to guarantee the quality of their products, as they primarily export for their parent companies in the destination countries.

Our set of controls Z_{lp} picks up the cost of using intermediaries and buyers' search costs. We include the Herfindahl index of intermediaries to control for inherent differences in the local monopoly power of intermediaries for a given product. This may relate to intangible assets such as an established reputation prior to trade liberalization. Following a similar logic we also include the Herfindahl index of direct exporters. We furthermore include the number of direct exporters and the number of intermediaries (in logs) to proxy for buyers' costs of searching for a producer and an intermediary respectively.

The standard errors in all of the regressions are clustered at the city level to account for the correlation in the error terms across products for a given location (Moulton, 1990).[31]

Our final sample consists of 51,233 observations spanning 3,042 HS6 products and 321 cities.

[31] Clustering standard errors at the product level does not change the significance of the coefficient.

4.2 Results: intermediation and vertical differentiation

4.2.1 Baseline results

Table 5 shows the estimates from Equation 4. In columns 1 and 2 the dependent variable is the share of intermediary exports. The coefficient on quality dispersion is negative and significant here, and is robust to the inclusion of the control variables discussed in Section 4.1. The results hence suggest that more vertically-differentiated goods in China are less likely to be exported via intermediaries. Columns 3 and 4 reproduce column 2, with the dependent variable being respectively the share of specialized and generalized intermediaries in the exports of a city-product pair. Specialized and generalized intermediaries are distinguished as described in Section 2 using the median export Herfindahl (HS6-product concentration) indices.[32]

The estimated coefficients on the share of specialized and generalized intermediaries are positive and significant and negative and significant respectively. The overall negative association between prevalence and the heterogeneity of export qualities is thus driven by generalized intermediaries. The positive coefficient for specialized intermediaries suggests that their role is the exact reverse: the greater the heterogeneity of varieties produced, the more specialized intermediaries are used. This is consistent with the latter playing a quality-screening role, as product-quality verification becomes more important with greater supplier heterogeneity. From the baseline estimates in column 3 of Table 5, a one standard-deviation rise in quality dispersion translates into a 0.6 percentage point specialized intermediaries'

[32] In robustness checks in the online Appendix, we show that our results hold when differentiating specialized and generalized intermediaries based on the ordinary Herfindahl index (Equation 1) instead of the size-ownership adjusted Herfindahl residual, with the average firm size in the city-HS6 pair as an additional regressor.

Table 5: Intermediation and Quality Differentiation: Baseline Results

Dependent variable	Share in city-HS6 exports of					
	All intermediaries		Specialized intermediaries	Generalized intermediaries	Specialized intermediaries	
	(1)	(2)	(3)	(4)	(5)	(6)
Quality Dispersion	-0.0016[a]	-0.0006[b]	0.0007[a]	-0.0013[a]	0.0006[b]	0.0005[b]
	(0.0005)	(0.0003)	(0.0002)	(0.0003)	(0.0002)	(0.0002)
Foreign-export share		-0.2688[a]	-0.0684[a]	-0.2005[a]	-0.0684[a]	-0.0803[a]
		(0.0109)	(0.0091)	(0.0079)	(0.0090)	(0.0097)
State-export share		-0.2710[a]	-0.1029[a]	-0.1681[a]	-0.1028[a]	-0.1091[a]
		(0.0121)	(0.0081)	(0.0097)	(0.0081)	(0.0100)
Herfindahl of intermediaries		0.2486[a]	0.2217[a]	0.0269[c]	0.2217[a]	0.2117[a]
		(0.0091)	(0.0212)	(0.0162)	(0.0213)	(0.0214)
Herfindahl of direct exporters		-0.2503[a]	-0.0666[a]	-0.1837[a]	-0.0667[a]	-0.0644[a]
		(0.0100)	(0.0068)	(0.0102)	(0.0067)	(0.0063)
Ln Number of intermediaries		0.1781[a]	0.0815[a]	0.0966[a]	0.0815[a]	0.0772[a]
		(0.0029)	(0.0042)	(0.0041)	(0.0041)	(0.0040)
Ln Number of direct exporters		-0.1996[a]	-0.0538[a]	-0.1457[a]	-0.0539[a]	-0.0535[a]
		(0.0032)	(0.0031)	(0.0038)	(0.0030)	(0.0031)
Ln Average export quality					0.0002	0.0001
					(0.0002)	(0.0002)
HS6-product Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
City Fixed effects	Yes	Yes	Yes	Yes	Yes	n.a.
City-HS2 Fixed effects	No	No	No	No	No	Yes
Observations	51,233	51,233	51,233	51,233	51,233	51,233
R-squared	0.29	0.74	0.35	0.57	0.35	0.46

Notes: Heteroskedasticity-robust standard errors clustered at the city level appear in parentheses. [a], [b] and [c] indicate significance at the 1%, 5% and 10% confidence levels. See the text for the definition of intermediary firms. Specialized and generalized intermediaries are identified based on the residual of a regression of the Herfindahl index on a quadratic in firm exports and firm-ownership dummies (Equation 1), with products defined at the HS6-level.

export share, which is a significant compared to the mean and median export figures of 12.3 and 2.3 percentage points respectively.

Columns 5 and 6 check that the negative correlation between specialized intermediation and quality dispersion is robust to controlling for other potential confounders. We could worry about reverse causality from the presence of specialized intermediaries and our quality-dispersion measure, resulting from the successful control of quality of the former.[33] If the specialized intermediaries in a location-product bin successfully screen quality, we should have lower quality dispersion for this location-product pair in the data than the underlying dispersion in the absence of specialized intermediaries. Any such negative relationship would however counter a positive association between quality dispersion and the prevalence of specialized intermediaries. Our estimates thus represent a lower bound for the quality verification role of specialized intermediaries.

As an additional check we add the average quality of exports at the city-product level to the benchmark results to control for any correlation between the quality dispersion of local producers and its mean. Our hypothesis (which will be confirmed in Section 5) is that specialized intermediaries export higher quality products than do generalized intermediaries. We should thus control for the quality of product-p exports in the city[34] when looking at the relationship between specialized intermediaries and local quality heterogeneity.

As shown in column 5 the quality level attracts a positive (albeit insignificant) coefficient, which is in line with our prior that specialized intermediaries focus on higher-quality products. Controlling for the resulting higher quality of exported products does not however

[33] We thank an anonymous referee for raising this issue.

[34] This is calculated as the weighted average of variety (firm-product-country) quality estimated in Equation 3 using the export share of the corresponding variety (firm-country) in city-product-level exports to calculate a weighted average quality figure for a city-product pair.

change the estimated effect of quality differentiation on the use of specialized intermediaries. In column 6 we further include city-HS2 fixed effects, so that we identify off of HS6-product variation within a given (HS2) industry within a city. This helps to ward off the criticism that certain cities might develop reputations for being high quality exporters in certain product groups (and that this is subsequently correlated with both the observed quality dispersion and the share of exports through specialized intermediaries).

Our overall finding is that separating by intermediary type suggests a role for quality screening by intermediates.[35] While intermediaries are overall found for less-differentiated products, the evidence suggests a quality-checking role for specialized intermediaries, who are more likely to be present in exports with greater local quality differentiation. Our results are then consistent with selection into intermediary use, whereby exports in industries with substantial differences in quality across suppliers are disproportionately handled by specialized intermediaries. In absence of an IV or a quasi-natural experiment, we cannot cannot entirely dispel the possibility of reverse causality but the body of evidence nevertheless is consistent with the "selection into intermediary use" view.

Specialized intermediaries do not then seem to be subject to the hold-up problems in trade intermediation described in the literature (Felbermayr and Jung, 2011; Tang and Zhang, 2012): they instead appear to be an effective way for high-quality good producers to signal their quality to consumers.

One should probably add the disclaimer here that you cannot entirely dispel the possibility of reverse causality, since you do not have an IV or a quasi-natural experiment. But

[35] In Table OA-7 in the online Appendix we check that the results continue to hold when using a fractional probit model to account for the 0-1 range of our dependent variable.

the body of evidence nevertheless is consistent with the selection into intermediary use view.

4.2.2 Robustness checks

Table A-3 in the Appendix checks that our main finding is robust to alternative ways of differentiating between the two intermediary types. In the first two columns the Herfindahl indices used to separate specialized from generalized intermediaries are calculated using HS4 and HS2 products respectively. The resulting point estimates are not statistically different from those in our baseline results (column 3 in Table 5). In column 3, the median cut-off of product concentration is replaced by the 60th percentile, so that specialized intermediaries are a more elite group. The positive association between specialized intermediary export share and vertical differentiation continues to hold. In columns 4 to 6, we change the way in which quality dispersion is calculated. We first calculate the standard deviation of qualities after excluding extreme values. Column 4 uses the 1% trimmed standard deviation of qualities within a city-product pair, column 5 the inter-decile range, and column 6 a measure of quality dispersion defined as the difference between the maximum and minimum quality of varieties within a city-product. We continue to find that Chinese cities with greater quality dispersion rely more on specialized intermediaries for their exports.

Table A-4 considers other types of outliers.[36] Column 1 excludes processing trade.[37] A growing literature has underscored the many ways in which processing and ordinary trade regimes differ. Processing exports are characterized by greater value-added (Koopman et

[36]In results in the online Appendix, we check that all of the results contained in Table A-4 continue to hold when measuring quality dispersion using the inter-decile range. This is the measure used in Khandelwal (2010), as it is argued to be more robust to outliers.

[37]Processing trade refers to the operations of firms, most often foreign, which obtain raw materials or intermediate inputs from abroad and, after assembling them in China, re-export the value-added final products (Feenstra and Hanson, 2005). Operations in the assembly sector that import inputs to process them in China and re-export the final products accounted for 41% of China's trade between 2002 and 2012.

al., 2012), more technological content and higher-quality varieties than are ordinary exports (Wang and Wei, 2010). We thus check that our finding of quality verification by specialized intermediaries in China does not simply reflect the particularities of processing exports. Foreign firms are excluded in Column 2, so that all of the indicators are calculated using information only from domestic firms. Hong Kong plays a very specific role in intermediating trade between China and the rest of the world (Feenstra and Hanson, 2004). In column 3, the data set excludes exports to Hong Kong: our main result is robust to this exclusion. In column 4 we exclude the activities of firms belonging to a group to ensure that subsidiaries established by foreign and domestic groups do not affect our distinction between specialized and generalized intermediaries. Column 5 shows that our findings are robust to excluding tobacco and cigarettes, which Table A-1 identified as outliers on the right-tail of the distribution of specialized intermediary export shares. The point estimates are virtually unchanged.[38]

Table 6 turns to a panel specification, which controls for all time-invariant differences between HS6-city pairs, as well as a number of time-varying characteristics that may be correlated with both quality dispersion and intermediary use. We here use Chinese customs data from 2002 to 2006,[39] and hence appeal to the variation (over time) within a given city-

[38]We propose other robustness checks in results in the online Appendix. We exclude the top and bottom five percent of city-product pairs in terms of quality differentiation. We exclude mono-product firms: this helps to address the concern that the bi-modal distribution of intermediaries observed in Section 2 is only picking up the difference between mono- and multi-product exporters. We also consider specific product features by dropping observations on products that are known to be clearly different from others. We exclude products for which some restrictions (mostly licenses and quotas) remained in place after China's entry to the WTO. The list is taken from https://www.wto.org/english/thewto_e/acc_e/completeacc_e.htm. Although all restrictions had been removed by 2005, we may suspect that these products are different from the others. Last we exclude homogeneous products (defined using the classification in Rauch, 1999), for which producers are more likely to resort to intermediaries (Ahn et al., 2011; Crozet et al., 2013). None of these changes has any impact on our results.

[39]The rationale for starting in 2002 relates to the change in trade restrictions following China's WTO accession and the change in product nomenclature between 2001 and 2002. 2006 is the last year for which

product pair of the relationship between quality dispersion and intermediary prevalence. The use of pre-2005 is subject to caution, as the pre-2005 Chinese system of trading licenses de facto impeded some firms that wished to trade directly with foreign partners from doing so.

Table 6: Specialized Intermediaries and Quality Differentiation: Panel Estimates

Dependent variable	Share in city-HS6 exports of specialized-intermediaries Years 2002-2006			
	(1)	(2)	(3)	(4)
Quality Dispersion	0.00041[b]	0.00040[c]	0.00035[c]	0.00035[c]
	(0.00020)	(0.00021)	(0.00018)	(0.00018)
Foreign-export share	-0.084[a]	-0.084[a]	-0.084[a]	-0.084[a]
	(0.007)	(0.007)	(0.007)	(0.007)
State-export share	-0.113[a]	-0.113[a]	-0.111[a]	-0.111[a]
	(0.011)	(0.011)	(0.012)	(0.012)
Herfindahl of intermediaries	0.081[a]	0.081[a]	0.078[a]	0.078[a]
	(0.006)	(0.006)	(0.006)	(0.006)
Herfindahl of direct exporters	-0.041[a]	-0.041[a]	-0.040[a]	-0.040[a]
	(0.004)	(0.004)	(0.004)	(0.004)
Ln Number of intermediaries	0.041[a]	0.041[a]	0.039[a]	0.039[a]
	(0.002)	(0.002)	(0.002)	(0.002)
Ln Number of direct exporters	-0.033[a]	-0.033[a]	-0.030[a]	-0.030[a]
	(0.002)	(0.002)	(0.002)	(0.002)
Ln Average export quality		0.00031[c]		0.00025
		(0.00018)		(0.00018)
City-HS6 product Fixed effects	Yes	Yes	Yes	Yes
HS6 product-year Fixed effects	Yes	Yes	Yes	Yes
City-year Fixed effects	Yes	Yes	n.a.	n.a.
City-HS2-year Fixed effects	No	No	Yes	Yes
Observations	162,350	162,350	162,350	162,350
R-squared	0.79	0.79	0.82	0.82

Notes: Heteroskedasticity-robust standard errors clustered at the city level appear in parentheses. [a], [b] and [c] indicate significance at the 1%, 5% and 10% confidence levels. Source: Authors' calculations from Chinese transactions data in 2002-06. See the text for the definition of intermediary firms. Specialized and generalized intermediaries are identified based on the residual of a regression of the Herfindahl index on a quadratic in firm exports and firm-ownership dummies (Equation 1), with products defined at the HS6-level.

Our regressions include the three pairwise combinations of fixed effects: city-product, city-year and product-year. Besides city-product fixed effects, we include time-varying city-level dummies to account for demand and supply shocks that are common to all products

firm-level customs data is available.

in a given city and year as well as product-year dummies to account for all factors that affect product-level exports irrespective of the city of origin in a given year. In the last two columns 3 and 4 we add city-HS2-year fixed effects, and so consider variation between HS6 products within a given (HS2) industry for a given city-year. Columns 2 and 4 further include the average quality of exports at the city-product-year level to control for any correlation between the quality dispersion of local producers and its mean in that year. The quality level typically attracts a positive (albeit insignificant in column 4) coefficient, which is in line with our prior that specialized intermediaries focus on higher-quality products. Controlling for the resulting higher quality of exported products however does not change the estimated effect of quality differentiation on the use of specialized intermediaries. Our results using the panel dataset are hence fully consistent with our baseline results for 2005. Intermediation is more prevalent for less vertically-differentiated products, with the opposite pattern for a subset of intermediaries, specialized traders: they are more present in exports with greater differences in quality across local suppliers, suggesting that they help to check or screen product quality for buyers.

4.2.3 Accounting for the destination country

Our empirical strategy has so far mostly exploited variations in the need to screen quality by the source of the exports. The capacity of buyers to deal with information asymmetry and identify the quality of Chinese exports also depends on their nationality. Buyers may better be able to verify the quality of their imports if they are not too far away from and share linguistic and cultural ties with China. By way of contrast fixed export costs or import tariffs imposed by the destination country are not expected to affect the difficulty of quality

assessment. Table 7 shows the moderating role of country characteristics in the correlation between the intermediation export share and vertical differentiation. The dependent variable is the share of intermediary exports in city-product-country observations in 2005. The key parameter of interest is the interaction between our quality-dispersion measure for a city-product pair and proxies for information asymmetries between China and the destination country. Fixed effects at the city-product, city-country and product-country levels are introduced.

Table 7: Specialized Intermediaries and Quality Differentiation: the country-dimension

Dependent variable	Share in city-HS6-country exports of specialized-intermediaries				
	(1)	(2)	(3)	(4)	(5)
Quality Dispersion × Ln distance	0.00037[c]				
	(0.00019)				
Quality Dispersion × Ln (share ethnic Chinese 1990)		-0.00018[a]			
		(0.000068)			
Quality Dispersion × Ln (share ethnic Chinese 1980)			-0.00020[b]		
			(0.000075)		
Quality Dispersion × # of importing documents				0.00004	
				(0.00006)	
Quality Dispersion × Tariff rate					0.00002
					(0.00002)
City-HS6 product Fixed effects	Yes	Yes	Yes	Yes	Yes
Country-HS6 product Fixed effects	Yes	Yes	Yes	Yes	Yes
City-Country Fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	1,109,593	773,139	761,584	1,052,115	943,522
R-squared	0.43	0.42	0.42	0.43	0.42

Notes: Heteroskedasticity-robust standard errors clustered at the country level appear in parentheses. [a], [b] and [c] indicate significance at the 1%, 5% and 10% confidence levels. Source: Authors' calculations from Chinese transactions data in 2005. See the text for the definition of intermediary firms. Specialized and generalized intermediaries are identified based on the residual of a regression of the Herfindahl index on a quadratic in firm exports and firm-ownership dummies (Equation 1), with products defined at the HS6-level.

The first three columns introduce bilateral variables to capture the particular links between China and its partner countries: distance[40] and the share of ethnic Chinese population

[40]We use GeoDist dataset (Mayer and Zignago, 2011), available at http://www.cepii.fr/francgraph/bdd/distances.htm.

in 1990 and 1980 respectively.[41] Column 4 considers the sunk cost of exporting to a partner as measured by the number of import procedures in the World Bank's Doing Business Report (Djankov et al., 2006), while column 5 uses the tariff imposed by the partner.[42] Our findings are fairly intuitive. The link between specialized-intermediary prevalence and quality differentiation is stronger for more distant exports and falls when the destination country has more ethnic Chinese. By way of contrast, our proxies of fixed trade costs and the tariffs imposed on Chinese exports at destination do not affect the quality-verification role. This is consistent with a need for quality-checking that falls with mutual understanding and rises with information dissonance.

5 Empirical results: intermediation and quality

We now ask whether there is a "quality premium" for specialized relative to generalized intermediaries. We compare the qualities of the products exported by generalized and specialized intermediaries and direct exporters on each market. If specialized intermediaries do indeed screen quality and select the best goods, we expect their measured quality to be higher than that of generalized intermediaries, although this quality could be lower than that of direct exporters. Furthermore if the specialization of intermediaries in a restricted core competence produces greater incentives to be a reliable supplier of quality goods, there should be a monotonic relationship between the percentile cutoff used to discriminate specialized intermediaries and the quality of the products sold. We anticipate that the quality

[41] See Poston et al. (1994) and Poston and Yu (1990), available at http://data.worldbank.org/indicator/IC.IMP.DOCS?page=2.

[42] The product-level tariff applied to Chinese goods in 2004 is taken from http://wits.worldbank.org/.

of goods exported will rise with the cutoff of the product-scope distribution used to identify specialized intermediaries.

Our empirical approach is to regress our estimates of firm export quality in 2005, $\ln \Lambda_{fpc}$, at the product and country level on dummies for specialized and generalized intermediaries, as described in Section 2. The omitted category is direct exporters.

Our regressions include product-country fixed effects and city-product fixed effects to account for unobserved factors, including any systematic differences related to the homogeneity, relationship-specificity and non-contractibility of products which may help determine intermediary use. We include firm export value (in logs) and its square to control for firm size (Ahn et al., 2011) as well as three ownership-type dummies (State-owned enterprises, private firms, and foreign-invested firms). Moulton (1990) shows that regressing individual variables on aggregate variables can produce downward-biased standard errors. We therefore cluster standard errors at the firm level in all regressions.

The results appear in Table 8. Column 1 considers the overall effect of intermediaries on quality, and column 2 splits the intermediary dummy into specialized and generalized dummies. Column 3 reproduces Column 2 excluding the product-country pairs for which intermediaries make up under 1% or over 99% of exports, while column 4 excludes product-country pairs for which intermediaries make up under 5% or over 95% of exports. Export quality is significantly lower for goods that are handled by intermediaries. This is consistent with the growing literature suggesting that intermediaries systematically handle the exports of less-efficient firms; those with lower-quality products (Akerman, 2012; Bernard et al., 2010a; Ahn et al., 2011; Crozet et al., 2013). Column 2 suggests that this quality discount is mainly found for generalized intermediaries. The coefficient on quality for specialized

intermediaries is insignificant. This hierarchy continues to hold when the sample is restricted to product-country pairs for which the intermediary share is strictly above 1% and below 99% (column 3) and for which the intermediary share is strictly above 5% and below 95%. The F-test at the foot of each column indicates that we can reject (at the 1% confidence level) the null hypothesis that the specialized and generalized intermediary coefficients are equal. Overall, our findings suggest a significant quality gap between specialized and generalized intermediaries. While the products handled by generalized intermediaries are of lower quality than those of direct exporters, the difference between specialized intermediaries and direct exporters is insignificant. This suggests quality screening by specialized intermediaries that enables them to select products of the same quality as those of direct exporters.

Table A-5 checks that our results are robust to different ways of defining specialized and generalized intermediaries. In column 1 we calculate Herfindahl indices at the HS4- instead of the HS6-level; in column 2 we use the even more aggregated HS2-level. Our result of lower quality for products being handled by generalized intermediaries does not change, while the difference between specialized intermediaries and direct exporters turns positive and significant. In column 3 we adopt the more conservative approach in Ahn et al. (2011) of identifying intermediary firms based on Chinese characters. Compared to our baseline measure we drop firms whose names include "foreign trade" or "industry and trade" as intermediaries. In column 4, we exclude firms that export a single HS6 product from our analysis to see whether the quality gap between specialized and generalized intermediaries is just reflecting a general difference between mono- and multi-product exporters. We continue to find lower quality for intermediaries that is entirely driven by generalized intermediaries: specialized intermediaries handle significantly higher-quality goods than do generalized in-

Table 8: Intermediation and Export Quality: Baseline Results

Dependent variable	Firm quality of exports (product-country) in 2005: $\ln \Lambda_{fpc}$			
Sample restriction			Intermediary share >1% & <99%	>5% & <95%
	(1)	(2)	(3)	(4)
Intermediary	-0.623[a]			
	(0.046)			
Specialized intermediary		0.030	0.066	0.086
		(0.071)	(0.070)	(0.067)
Generalized intermediary		-0.778[a]	-0.763[a]	-0.733[a]
		(0.044)	(0.044)	(0.043)
Ln Firm export value	-0.135	-0.038	-0.018	-0.006
	(0.193)	(0.175)	(0.164)	(0.153)
Ln^2 (Firm export value)	0.012[c]	0.009	0.008	0.007
	(0.007)	(0.006)	(0.006)	(0.005)
Firm ownership dummies	Yes	Yes	Yes	Yes
HS6 product-Country Fixed effects	Yes	Yes	Yes	Yes
City-HS6 product Fixed effects	Yes	Yes	Yes	Yes
Observations	4,102,589	4,102,589	3,982,977	3,811,140
R-squared	0.23	0.23	0.23	0.23
F-Test $\beta_{spec} = \beta_{gen}$		184.6	198	205.5
Proba>F		0.001	0.001	0.001

Notes: Heteroskedasticity-robust standard errors clustered at the firm level appear in parentheses. [a], [b] and [c] indicate significance at the 1%, 5% and 10% confidence levels. Firm quality, $\ln \Lambda_{fpc}$, is calculated using Equation 3. Three ownership-type dummies (State-owned enterprises, private firms, and foreign-invested firms) are included. See the text for the definition of intermediary firms. Specialized and generalized intermediaries are identified based on the residual of a regression of the Herfindahl index on a quadratic in firm exports and firm-ownership dummies (Equation 1), with products defined at the HS6-level. Column 3 excludes product-country pairs for which intermediaries make up under 1% or over 99% of exports. Column 4 excludes product-country pairs for which intermediaries make up under 5% or over 95% of exports. The F-test shown at the foot of each column tests the equality of the estimated coefficients on the two intermediary types. The probabilities (below 0.01) indicate that this equality is rejected at the 1% confidence level.

termediaries. The export quality of specialized intermediaries is not statistically different from that of direct exporters.

Table A-6 repeats our analysis for some specific samples. We repeat the regression of column 2 in Table 8 excluding foreign firms (column 1) and then group-related firms (column 2). In column 3 we remove products which obtained their trade license after 2001, and in column 4 homogeneous goods traded on an organized exchange, as defined by Rauch (1999). In column 5 we exclude tobacco and cigarettes, for which the specialized intermediary export shares are abnormally high, possibly due to monopoly distribution rights. The negative quality premium for intermediaries, which is fully driven by generalized intermediaries, compared to direct exporters continues to hold.

In results available in the online appendix we further ensure that our results are robust to a variety of tests related to the origin and destination of exports. We exclude the four cities with province status (Beijing, Tianjin, Shanghai, and Chongqing), which stand out by their greater political autonomy and smaller surface area. We also tackle China's interior-coast divide. Coastal locations are significantly different from the rest of the country: they have more outward-oriented economies and have had great success in attracting foreign investment. The exclusion of export flows from coastal locations or inland locations does not affect our results. We also drop export flows to Hong Kong and to less-developed countries, as these may differ from the bulk of Chinese exports. In all cases, generalized intermediaries handle the lowest qualities with the export quality of specialized intermediaries being not statistically different from that of direct exporters.

As a final check on the robustness and consistency of our results based on the distinction between specialized and generalized intermediaries, Table 9 investigates the link between the

degree of specialization of specialized intermediaries and the quality of their products. In the first two columns our baseline specialized-intermediary dummy (based on the median) is split into various dummies depending on the range of varieties handled by the specialized intermediary. In column 1 we use a set of dummies to denote whether the specialized intermediary's Herfindahl (HS6-product concentration) index is in the 50th-75th percentiles, in the 75th-90th percentiles, or above the 90th percentile of the distribution of product concentration. The omitted category is the case where the Herfindahl is below the 50th percentile. In column 2, we use five dummies corresponding to the five above-median deciles of the distribution of export sales over products. We find that export quality is higher when the specialized intermediary's export basket spans a narrower range of varieties. The results in column 2 suggests a monotonic relationship between the distribution of product-scope and the quality of the products sold, which is consistent with our prior that a restricted core competence produces greater incentives to be a reliable supplier of quality goods.

The remaining columns confirm this systematic link between the percentile cutoff used to identify specialized intermediaries and the quality of the products sold. The various columns reproduce column 2 of Table 8 using different product (Herfindahl) concentration cut-offs presented in increasing order. Column 3 relies on the 60th percentile, a stricter threshold than the baseline that turns some intermediaries previously identified as specialized into generalized. This cut-off rises progressively from the 70th percentile in column 4 to the 90th percentile in column 6. The positive and significant coefficients on the dummies for intermediaries in the four top deciles of product concentration indicate that intermediaries with core competence in a single line of business export higher-quality (price) products compared to direct exporters. This sub-set of intermediaries hence does not conform to the

Table 9: Intermediation and Export Quality: the relationship between cut-off and quality

Dependent variable	Firm quality of exports (product-country) in 2005: $\ln \Lambda_{fpc}$					
	Herfindahl cut-off $\bar{c}$					
	50th	50th	60th	70th	80th	90th
	(1)	(2)	(3)	(4)	(5)	(6)
Specialized intermediary (50th-75th)	-0.058					
	(0.079)					
Specialized intermediary (75th-90th)	0.390^a					
	(0.100)					
Specialized intermediary (50th-60th)		-0.215^a				
		(0.080)				
Specialized intermediary (60th-70th)		0.132				
		(0.111)				
Specialized intermediary (70th-80th)		0.409^a				
		(0.122)				
Specialized intermediary (80th-90th)		0.418^a				
		(0.106)				
Specialized intermediary ($>90^{th}$)	0.533^a	0.539^a				
	(0.144)	(0.144)				
Specialized intermediary ($>$ cutoff $\bar{c}$)			0.261^a	0.417^a	0.422^a	0.464^a
			(0.080)	(0.081)	(0.094)	(0.145)
Generalized intermediary ($\leq$ cutoff $\bar{c}$)	-0.781^a	-0.784^a	-0.724^a	-0.678^a	-0.652^a	-0.638^a
	(0.044)	(0.044)	(0.045)	(0.046)	(0.046)	(0.046)
Ln Firm export value	-0.046	-0.033	-0.045	-0.126	-0.132	-0.136
	(0.179)	(0.179)	(0.180)	(0.195)	(0.195)	(0.194)
Ln^2 (Firm export value)	0.009	0.009	0.009	0.012^c	0.012^c	0.012^c
	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)
Firm ownership dummies	Yes	Yes	Yes	Yes	Yes	Yes
HS6-Country Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
City-HS6 product Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,102,589	4,102,589	4,102,589	4,102,589	4,102,589	4,102,589
R-squared	0.23	0.23	0.23	0.23	0.23	0.23
F-Test $\beta_{spec} = \beta_{gen}$	91.82	67.41	218.7	198.5	135.4	58.47
Proba>F	0.01	0.01	0.01	0.01	0.01	0.01

Notes: Heteroskedasticity-robust standard errors clustered at the firm level appear in parentheses. ^{a}, ^{b} and ^{c} indicate significance at the 1%, 5% and 10% confidence levels. Three ownership-type dummies (State-owned enterprises, private firms, and foreign-invested firms) are included. See the text for the definition of intermediary firms. Specialized and generalized intermediaries are identified based on the residual of a regression of the Herfindahl index on a quadratic in firm exports and firm-ownership dummies (Equation 1), with products defined at the HS6-level using the cut-off $\bar{c}$ indicated at the top of each column. The F-test shown at the foot of each column tests the equality of the estimated coefficients on the two intermediary types. The probabilities (below 0.01) indicate that this equality is rejected at the 1% confidence level.

traditional conception of intermediaries systematically handling the exports of less-efficient, low-quality firms.

6 Conclusion

This paper has contributed to the analysis of export intermediary firms. We use Chinese firm-level customs data to show that separating generalized from specialized intermediaries is key to understanding the quality-screening role played by intermediaries in international trade. We show that specialized and generalized intermediaries differ in that the former are more prevalent when there is a greater degree of quality differentiation, i.e. where quality verification would seem to be the most needed. Our results suggest selection into intermediary use based on the intrinsic features of the product being traded. Consistent with specialized intermediaries reducing quality problems, we find that their export quality is higher than that of generalized intermediaries. Our results suggest a consistent sorting into export markets, whereby higher quality-producers export directly and specialized intermediaries help buyers to screen quality and avoid quality problems among the remaining varieties.

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Table A-1: Top 20 HS6 products by export values with highest specialized intermediary shares, 2005

HS6 code	Product description	Specialized intermediary export share (%)	Intermediary export share (%)	Share in total exports (%)
240120	Tobacco, partly/wholly stemmed/stripped	98.62	99.76	0.03
240220	Cigarettes cont. tobacco	97.84	98.53	0.03
100590	Maize (corn), other than seed	74.46	75.03	0.15
720838	Flat-rolled prods. of iron/non-alloy steel,	71.02	71.11	0.08
270111	Anthracite coal, whether or not pulverised	70.11	70.2	0.06
720837	Flat-rolled prods. of iron/non-alloy steel	68.79	68.89	0.06
030192	Live eels (Anguilla spp.)	67.59	73.09	0.02
261310	Molybdenum ores & concs., roasted	64.42	64.43	0.15
720230	Ferro-silico-manganese, in granular/powder form	63	65.96	0.03
270112	Bituminous coal, whether or not pulverised	62.6	62.6	0.48
252310	Cement clinkers	59.32	60.5	0.04
640590	Footwear other than with uppers of leather	58.24	70	0.09
283620	Disodium carbonate	57.02	57.52	0.04
282530	Vanadium oxides & hydroxides	56.1	57.7	0.03
851632	Electro-thermic hair-dressing app.	55.16	67.23	0.03
360410	Fireworks	53.6	63.73	0.05
721933	Flat-rolled prods. of stainless steel	53.23	53.83	0.03
310530	Diammonium phosphate	51.07	51.7	0.03
720836	Flat-rolled prods. of iron/non-alloy steel	50.88	50.91	0.03
902830	Electricity meters	50.03	61.92	0.03

Source: Authors' calculations from Chinese transactions data in 2005.

Table A-2: Top 20 HS6 products by export values with highest generalized intermediary shares, 2005

HS6 code	Product description	Generalized intermediary export share (%)	Intermediary export share (%)	Share in total exports (%)
551522	Woven fabrics of acrylic staple fibres	66.87	72.68	0.01
520526	Cotton yarn, single (excl. sewing thread)	66.6	69.83	0.01
521119	Woven fabrics of cotton	63.91	69.85	0.01
844900	Machinery for the mfr of felt/nonwovens	63.13	80.16	0.01
262190	Slag & ash, incl. seaweed ash (kelp)	62.25	71.13	0.01
410621	Tanned/crust hides & skins of goats/kids	61.41	88.52	0.01
630319	Curtains (incl. drapes) & interior blinds	59.33	65.99	0.01
400700	Vulcanised rubber thread & cord	59.18	67.66	0.01
580230	Tufted textile fabrics	59.16	67.06	0.01
847930	Presses for the mfr. of board of wood	57.07	71.94	0.01
845320	Machinery for making/repairing footwear	56.2	64.7	0.01
551599	Woven fabrics of synth. staple fibres	55.97	69.04	0.01
521159	Woven fabrics of cotton	53.14	62.89	0.01
580123	Weft pile fabrics other than uncut of cotton	52.57	57.4	0.01
820540	Screwdrivers	52.21	60.06	0.02
020732	Meat of ducks/geese/guinea fowls, not cut	51.79	66.1	0.01
620323	Men's/boys' ensembles of synth. fibres	51.52	57.11	0.01
551693	Woven fabrics of art. staple fibres	51.48	65.68	0.01
300410	Medicaments cont. penicillins/derivs.	51.4	66.51	0.01
551322	Woven fabrics of polyester staple fibres	50.57	57.58	0.01

Source: Authors' calculations from Chinese transactions data in 2005.

Table A-3: Specialized Intermediaries and Quality Differentiation: Indicator Checks

Dependent variable	Share in city-HS6 exports of specialized-intermediaries					
	Herfindahl cut-off			Dispersion measure		
	Median HS4	Median HS2	60th HS6	Standard deviation 1st-99th	Inter-decile range	Max-Min range
	(1)	(2)	(3)	(4)	(5)	(6)
Quality Dispersion	0.0006^b	0.0005^b	0.0006^b	0.0007^a	0.0002^b	0.0001^c
	(0.0003)	(0.0003)	(0.0003)	(0.0002)	(0.0001)	(0.00005)
Foreign-export share	-0.0586^a	-0.0525^a	-0.0322^a	-0.0684^a	-0.0682^a	-0.0682^a
	(0.0077)	(0.0066)	(0.0072)	(0.0091)	(0.0091)	(0.0091)
State-export share	-0.0873^a	-0.0907^a	-0.0596^a	-0.1029^a	-0.1029^a	-0.1028^a
	(0.0081)	(0.0069)	(0.0082)	(0.0081)	(0.0081)	(0.0081)
Herfindahl of intermediaries	0.1787^a	0.1552^a	0.1385^a	0.2218^a	0.2217^a	0.2216^a
	(0.0226)	(0.0163)	(0.0241)	(0.0212)	(0.0212)	(0.0212)
Herfindahl of direct exporters	-0.0494^a	-0.0507^a	-0.0339^a	-0.0666^a	-0.0666^a	-0.0667^a
	(0.0067)	(0.0065)	(0.0057)	(0.0068)	(0.0068)	(0.0068)
Ln Number of intermediaries	0.0672^a	0.0678^a	0.0480^a	0.0815^a	0.0814^a	0.0813^a
	(0.0038)	(0.0035)	(0.0040)	(0.0042)	(0.0042)	(0.0042)
Ln Number of direct exporters	-0.0412^a	-0.0453^a	-0.0261^a	-0.0538^a	-0.0539^a	-0.0540^a
	(0.0024)	(0.0027)	(0.0020)	(0.0031)	(0.0031)	(0.0030)
HS6-product Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
City Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	51,233	51,233	51,233	51,233	51,233	51,233
R-squared	0.30	0.32	0.30	0.35	0.35	0.35

Notes: Heteroskedasticity-robust standard errors clustered at the city level appear in parentheses. ^{a}, ^{b} and ^{c} indicate significance at the 1%, 5% and 10% confidence levels. See the text for the definition of intermediary firms. Specialized and generalized intermediaries are identified based on the residual of a regression of the Herfindahl index on a quadratic in firm exports and firm-ownership dummies (Equation 1) using the median in all columns, except in column 3 where the 60th percentile is used. The products in the Herfindahl calculations are defined at the HS6-level, except in columns 1 and 2 which use the HS4- and HS2-levels respectively.

Table A-4: Specialized Intermediaries and Quality Differentiation: Sample Checks

Dependent variable Sample	Share in city-HS6 exports of specialized-intermediaries				
Restriction	No processing exports (1)	No foreign exports (2)	No Hong Kong destination (3)	No group-related firms (4)	No tobacco & cigarettes
Quality Dispersion	0.0008[a]	0.0005[c]	0.0005[b]	0.0005[c]	0.0007[a]
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0002)
Foreign-export share	-0.0631[a]		-0.0667[a]	-0.0649[a]	-0.0684[a]
	(0.0086)		(0.0094)	(0.0079)	(0.0091)
State-export share	-0.0963[a]	-0.0938[a]	-0.1046[a]	-0.1077[a]	-0.1029[a]
	(0.0102)	(0.0093)	(0.0084)	(0.0107)	(0.0081)
Herfindahl of intermediaries	0.2106[a]	0.2522[a]	0.2172[a]	0.2145[a]	0.2217[a]
	(0.0123)	(0.0300)	(0.0203)	(0.0217)	(0.0212)
Herfindahl of direct exporters	-0.0663[a]	-0.0754[a]	-0.0648[a]	-0.0641[a]	-0.0666[a]
	(0.0059)	(0.0081)	(0.0062)	(0.0068)	(0.0068)
Ln Number of direct exporters	-0.0555[a]	-0.0609[a]	-0.0540[a]	-0.0530[a]	-0.0538[a]
	(0.0030)	(0.0031)	(0.0030)	(0.0031)	(0.0031)
Ln Number of intermediaries	0.0816[a]	0.0947[a]	0.0830[a]	0.0804[a]	0.0815[a]
	(0.0042)	(0.0055)	(0.0044)	(0.0044)	(0.0042)
HS6-product Fixed effects	Yes	Yes	Yes	Yes	Yes
City Fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	50,685	50,143	50,231	50,276	51,231
R-squared	0.33	0.33	0.34	0.34	0.35

Notes: Heteroskedasticity-robust standard errors clustered at the city level appear in parentheses. [a], [b] and [c] indicate significance at the 1%, 5% and 10% confidence levels. See the text for the definition of intermediary firms. Specialized and generalized intermediaries are identified based on the residual of a regression of the Herfindahl index on a quadratic in firm exports and firm-ownership dummies (Equation 1), with products defined at the HS6-level.

Table A-5: Intermediation and Export Quality: Robustness Checks (1)

Dependent variable	Firm quality of exports (product-country) in 2005: $\ln \Lambda_{fpc}$			
Restriction on intermediary identification	Herfindahl cut-off median HS4 (1)	Herfindahl cut-off median HS2 (2)	Conservative definition of intermediaries (3)	No mono-product (4)
Specialized intermediary	0.232[a]	0.239[a]	0.056	0.067
	(0.064)	(0.059)	(0.070)	(0.071)
Generalized intermediary	-0.794[a]	-0.802[a]	-0.755[a]	-0.717[a]
	(0.045)	(0.046)	(0.043)	(0.043)
Ln Firm export value	-0.046	-0.079	-0.042	0.010
	(0.179)	(0.184)	(0.173)	(0.192)
Ln^2 (Firm export value)	0.009	0.010[c]	0.009	0.008
	(0.006)	(0.006)	(0.006)	(0.006)
Firm-ownership dummies	Yes	Yes	Yes	Yes
HS6-Country Fixed effects	Yes	Yes	Yes	Yes
City-HS6 product Fixed effects	Yes	Yes	Yes	Yes
Observations	4,102,589	4,102,589	4,102,589	4,017,598
R-squared	0.23	0.23	0.23	0.23
F-Test $\beta_{spec} = \beta_{gen}$	395	473.5	166.3	151.5
Proba>F	0.001	0.001	0.001	0.001

Notes: Heteroskedasticity-robust standard errors clustered at the firm level appear in parentheses. [a], [b] and [c] indicate significance at the 1%, 5% and 10% confidence levels. Three ownership-type dummies (State-owned enterprises, private firms, and foreign-invested firms) are included. Intermediary firms are defined following the procedure in Tang and Zhang (2012), except in column 3 where we use the conservative definition in Ahn et al. (2011). See the text. Specialized and generalized intermediaries are identified based on the residual of a regression of the Herfindahl index on a quadratic in firm exports and firm-ownership dummies (Equation 1), with products defined at the HS6-level, except in columns 1 and 2 where the HS4- and HS2-levels are used. The F-test shown at the foot of each column tests the equality of the estimated coefficients on the two intermediary types. The probabilities (below 0.01) indicate that this equality is rejected at the 1% confidence level.

Table A-6: Intermediation and Export Quality: Robustness Checks (2)

Dependent variable	Firm quality of exports (product-country) in 2005: $\ln \Lambda_{fpc}$				
Sample restriction	No Foreign firms (1)	No group related firms (2)	No restricted products (3)	No homogeneous products (4)	No tobacco & cigarettes (5)
Specialized intermediary	-0.032	0.052	0.031	0.045	0.031
	(0.067)	(0.079)	(0.071)	(0.073)	(0.071)
Generalized intermediary	-0.774^a	-0.821^a	-0.778^a	-0.780^a	-0.778^a
	(0.043)	(0.047)	(0.044)	(0.045)	(0.044)
Ln Firm export value	-0.305^b	-0.076	-0.038	-0.031	-0.038
	(0.152)	(0.191)	(0.175)	(0.181)	(0.175)
Ln^2 (Firm export value)	0.015^a	0.010	0.009	0.009	0.009
	(0.102)	(0.007)	(0.106)	(0.110)	(0.106)
Firm-ownership dummies	Yes	Yes	Yes	Yes	Yes
HS6 product-Country Fixed effects	Yes	Yes	Yes	Yes	Yes
City-HS6 product Fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	3,555,104	3,769,867	4,097,714	3,906,788	4,102,309
R-squared	0.26	0.24	0.23	0.23	0.23
F-Test $\beta_{spec} = \beta_{gen}$	166.6	175.1	184.5	179.7	184.8
Proba>F	0.001	0.001	0.001	0.001	0.001

Notes: Heteroskedasticity-robust standard errors clustered at the firm level appear in parentheses. ^{a}, ^{b} and ^{c} indicate significance at the 1%, 5% and 10% confidence levels. Three ownership-type dummies (State-owned enterprises, private firms, and foreign-invested firms) are included. See the text for the definition of intermediary firms. Specialized and generalized intermediaries are identified based on the residual of a regression of the Herfindahl index on a quadratic in firm exports and firm-ownership dummies (Equation 1), with products defined at the HS6-level. The F-test shown at the foot of each column tests the equality of the estimated coefficients on the two intermediary types. The probabilities (below 0.01) indicate that this equality is rejected at the 1% confidence level.