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Multiple import sourcing

First evidence for German enterprises from manufacturing industries

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Abstract:

This paper uses information on import transactions by German firms from 2009 to 2012 merged with information on characteristics of the importers taken from surveys by the Statistical Offices to document that a large share of importers engage in multiple import sourcing by importing the same good from more than one source country in a year and that a large share of total imports is due to multiple sourcing. It is shown that the probability of multiple import sourcing and the share of imports from multiple sourcing in total imports increase with firm productivity and firm size after controlling for detailed industry affiliation.

JEL Classification: F14

Keywords: Imports, Multiple import sourcing, Transaction level data, Germany

* I thank Horst Raff for making me curious about multiple import sourcing. All computations were done at the research data center of the Statistical Office Berlin-Brandenburg in Berlin. The transaction level data and firm level data used are strictly confidential but not exclusive, see www.forschungsdatenzentrum.de for access. To facilitate replication the Stata do-files used are available from the author on request.

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1. Motivation

Firms from manufacturing industries that import inputs can use different sourcing strategies. One alternative is to buy a certain good from one single supplier in one foreign country only and by doing so to engage in single sourcing. The other alternative is to buy a certain good from different suppliers in different countries and to engage in multiple import sourcing. While single import sourcing from the supplier who delivers a good of a given quality at the lowest price minimizes the costs paid for inputs, following this strategy may come at a high price. If the traded good is highly important for the importing firm and if it is difficult to find an alternative supplier in the short run the single foreign supplier is in a position to blackmail the importer by demanding a higher price that might increase the costs of the importer considerably. Furthermore, sometimes the foreign firm may not be able to supply a sufficient quantity of the input for reasons that the supplier is not responsible for – from strikes to natural disasters. A way out is to diversify and to engage in multiple import sourcing. However, this comes at a cost, too. Adding suppliers means, among others, that these further suppliers have to be searched, contracts have to be negotiated, details of the technical specification of the goods have to be fixed and the quality of these goods delivered by a new supplier have to be controlled. For an importing firm, therefore, the optimal sourcing strategy for an input might be either single sourcing or multiple sourcing.

The number of countries of origin a firm imports a good from in a year is an extensive margin of imports of a firm that has, to the best of my knowledge, not been investigated empirically before.[1] This paper contributes to the literature by using

[1] Two comprehensive reviews of the business economics literature on importing by Quintens et al. (2006) and Aykol et al. (2013) do not mention empirical studies on multiple import sourcing. In the economics literature extensive margins of imports of a firm that have been investigated empirically

information on import transactions by German firms from 2009 to 2012 merged with information on characteristics of the importers taken from surveys by the Statistical Offices to document the share of importers engaged in multiple import sourcing by importing the same good from more than one source country in a year[2] and the share of total imports that is due to multiple sourcing. Furthermore, the paper looks at the links between the probability of using multiple import sourcing and the share of imports from multiple sourcing in total imports on the one hand and two firm characteristics, namely firm productivity and firm size, on the other hand.

The rest of the paper is organized as follows. Section 2 outlines the empirical hypotheses investigated in this paper; section 3 describes the data used in the empirical investigation; section 4 informs on the extent of the use of a multiple sourcing strategy in a large sample of German firms from manufacturing industries and discusses the results of the econometric study on the links between multiple import sourcing and firm characteristics; section 5 concludes.

2. Empirical hypotheses

We build on the huge literature that discusses the links between firm characteristics and margins of foreign trade and test for the correlation between the adoption of a multiple sourcing strategy in imports and two firm characteristics, namely firm productivity and firm size.

include the number of goods imported, the number on countries imported from, and the number of times a firm-god-country combination in imports is recorded in a year; see Wagner (2016) for a comprehensive survey of this literature that includes studies with German data for imports of goods.

[2] It should be noted at the outset that the data used in this empirical investigation do not contain information on the foreign firm a German firm imports from. Therefore, importing the same good from more than one firm in one foreign country (e.g., buying tires from more than one manufacturer of tires from France) is not identified as multiple import sourcing in the data.

Productivity: The positive link between margins of foreign trade and productivity qualifies as a stylized fact. For exports this has been documented in hundreds of studies for countries from all over the world (see Wagner (2007b) for a survey). According to findings from this literature an important reason for the positive productivity differential between exporters and non-exporters is self-selection of more productive firms on export markets. The reason for this is that there exist additional costs of selling goods in foreign countries that can only be covered by more productive firms without making a loss. The range of extra costs include transportation costs, distribution or marketing costs, or production costs in modifying current domestic products for foreign consumption. This implies that firms that export to a larger number of foreign markets and a larger number of different goods have to be more productive, because at least some of the extra costs recur for each foreign market served and for each good exported. Vogel and Wagner (2010) show that similar arguments can be made with regard to imports and productivity. Empirical evidence for Germany reported in Wagner (2012b) is fully in line with this.

The adoption of a multiple sourcing strategy in imports implies that the firm has to cover extra costs, too, because further foreign suppliers have to be searched, new contracts have to be negotiated, all details of the technical specification of the goods have to be fixed and the quality of these goods delivered by a new supplier have to be controlled. At least some of these extra costs are fixed costs. Therefore, this strategy will only be adopted by more productive firms that can cover these extra costs, and the intensity of its use will increase with productivity.

Firm size: A positive link between firm size and margins of foreign trade qualifies as another stylized fact. This positive link is due to fixed costs of exporting and importing. Larger firms have efficiency advantages due to scale economies, advantages of specialization in management and better conditions on the markets for

inputs. Large firms can be expected to have cost advantages on credit markets while small firms often face higher restrictions on the capital market leading to a higher risk of insolvency and illiquidity. Furthermore, there might be disadvantages of small firms in the competition for highly qualified employees. For Germany empirical evidence in line with this positive link between firm size and margins of foreign trade is reported in a number of studies (see Wagner 2011a, 2012a, 2016).

These arguments hold for the adoption of a multiple sourcing strategy in imports and the intensity of its use, too. Therefore, a positive relationship between firm size and multiple import sourcing is expected.

This discussion of the links between firm characteristics and multiple import sourcing leads to the following two empirical hypotheses:

H1: The probability that a firm engages in multiple import sourcing (extensive margin) and the share of imports from multiple sourcing in all imports of a firm (intensive margin) increases with firm productivity.

H2: The probability that a firm engages in multiple import sourcing (extensive margin) and the share of imports from multiple sourcing in all imports of a firm (intensive margin) increases with firm size.

Note that both hypotheses are expected to hold after controlling for detailed industry affiliation at the 4-digit level that take care of industry specific effects like competitive pressure, policy measures, or demand shocks.

3. Data

In Germany information on goods traded across borders and on the countries traded with is available from the statistic on foreign trade (*Außenhandelsstatistik*). This statistic is based on two sources. One source is the reports by German firms on transactions with firms from countries that are members of the European Union (EU);

these reports are used to compile the so-called *Intrahandelsstatistik* on intra-EU trade. The other source is transaction-level data collected by the customs on trade with countries outside the EU (the so-called *Extrahandelsstatistik*). The raw data that is used to build the statistic on foreign trade are transaction level data, i.e. they relate to one transaction of a German firm with a firm located outside Germany at a time.

The record of the transaction usually includes a firm identifier (tax registration number) of the trading German firm. Using this identifier information at the transaction level was aggregated at the level of the trading firm for the reporting years 2009 – 2012. These data show which firm trades how much of which good with firms from which country. Products are distinguished according to very detailed classifications. In the data used for this paper, the Harmonized System at 6-digit level (HS6) is used as the product classification system. These data are used to identify firms that engage in multiple import sourcing, i.e. firms that import at least one HS6-good in a year from more than one country.[3] Furthermore, the data are used to the compute the share of imports from multiple sourcing in total imports of the firm.

The transaction level data on exports and imports does not include any information on the characteristics of the trading firms. However, the firm identifier that comes with this data can be used to merge the information on foreign trade activities at the firm level with information collected on these firms in other surveys. Here we make use of the cost structure survey for enterprises in the manufacturing sector. This survey is carried out annually as a representative random sample survey in about 15,000 firms. The sample is stratified according to the number of employees and the industries; all firms with 500 and more employees are covered by the cost

[3] As said the data do not contain information on the foreign firm a German firm imports from. Therefore, importing the same good from more than one firm in one foreign is not identified as multiple import sourcing here.

structure survey (see Fritsch et al. 2004). These data are used to measure the productivity of the firm by value added per employee[4] and the size of the firm by the number of employees.

For each year from 2009 to 2012 information from the transaction data on imports and from the cost structure survey were linked for some 6,000 firms. With these linked data it is possible to investigate empirically the two hypotheses stated in section 2 – that he probability that a firm engages in multiple import sourcing and the share of imports from multiple sourcing in all imports of a firm increases with firm productivity **(H1)** and firm size **(H2)**.

4. Empirical investigation

In the empirical investigation data for the years 2009 to 2012 for samples of enterprises from manufacturing industries are used. The sourcing strategy of firms and the firm characteristics are rather stable over the four year period. Furthermore, in 2012 a new sample has been drawn for the cost structure survey that is the source of information on firm characteristics. Therefore, the data are not used as a panel data set here.[5] Instead, all empirical models are estimated with cross-section data for each year separately.

Descriptive statistics for the samples of importing firms are documented in Table 1. In each year about three in four firms engaged in multiple import sourcing by importing at least one HS6-good from more than one foreign country. The share of imports from multiple sourcing in total imports of these firms was about 50 percent on

[4] Note that the data has no information on the capital stock of the firms, so more elaborate measures of productivity like total factor productivity cannot be computed.

[5] See Wagner (2011b, section 5) for a discussion of this issue.

average. Multiple import sourcing is a widely but not universally used strategy among importers from manufacturing industries in Germany.

[Table 1 near here]

To test the two hypotheses H1 and H2 on the links between the import sourcing strategy of a firm and firm characteristics empirical models are estimated that use data for one year from 2009 to 2012 at a time. The dependent variable in the models either measures the adoption of a multiple sourcing strategy in imports by a firm or the intensity with which multiple import sourcing is used by a firm.

Adoption of a multiple sourcing strategy is measured by a dummy variable that takes the value one if a firm uses multiple import sourcing in the respective year (and zero otherwise). The estimation method applied is probit to take care of the dichotomous character of the dependent variable.

The intensity with which multiple import sourcing is used by a firm is measured by the share of imports from multiple import sourcing in total imports of the firm. This is a fractional variable that by definition can only take on values between zero and one (or between zero and 100 percent), and that has a probability mass at zero because some 25 percent of all firms in the sample do not engage in multiple export sourcing. To take care of this fractional character of the dependent variable the empirical models are estimated by fractional logit.[6]

To test the two hypotheses H1 and H2 on the links between the import sourcing strategy of a firm and firm characteristics all empirical models include an

[6] The fractional logit estimator was developed by Papke and Wooldridge (1996) and introduced into the literature on the microeconometrics of international trade in Wagner (2001) where details of its use are discussed.

identical set of independent variables: productivity (measured as value added per employee), firm size (measured as the number of employees, and also included in squares to take care of a non-linear relationship) and detailed 4-digit industry controls.

Note that these models cannot reveal any causal relationships, because the data at hand are not rich enough to estimate structural empirical models. Results, therefore, do only indicate correlations between the import sourcing strategy and firm characteristics while controlling for industry affiliation.

Results are reported in Table 2. All results are very similar for the four years. These results are fully in line with the theoretical hypotheses. The probability of using a multiple sourcing strategy in importing and the intensity of its use increases with productivity and firm size.

[Table 2 near here]

To put the estimation results into perspective the estimated average marginal effects of productivity and firm size are reported in Table 2, too. Taking the results for 2012 these estimates indicate that an increase in productivity by one standard deviation increases the probability that a firm uses a multiple sourcing strategy by nearly 12 percent and the share of imports from multiple sourcing in total imports by six percent; the respective estimated effects of an increase in employment by one standard deviation are 41 percent and 20 percent. All these estimated effects can be considered to be of a relevant order of magnitude from an economic point of view.

5. Concluding remarks

This paper looks at the prevalence of multiple sourcing strategies in import activities of German firms from manufacturing industries. Based on information on import transactions by German firms from 2009 to 2012 merged with information on characteristics of the importers taken from surveys by the Statistical Offices it documents that a large share of importers engage in multiple import sourcing by importing the same good from more than one source country in a year and that a large share of total imports is due to multiple sourcing. It is shown that, in line with theoretical hypotheses, the probability of multiple import sourcing and the share of imports from multiple sourcing in total imports increase with firm productivity and firm size after controlling for detailed industry affiliation. These effects are statistically significant and of an order of magnitude that are relevant from an economic point of view.

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Table 1: Descriptive statistics

Year	2009	2010	2011	2012
Number of enterprises	5,963	6,075	6,134	6,238
Share of enterprises with multiple import sourcing (%)	74.79	74.27	75.20	74.83
Share of imports from multiple sourcing in total imports (%)				
mean	50.83	50.66	50.99	50.38
std. dev.	39.46	39.82	39.79	39.72
p1	0.00	0.00	0.00	0.00
p50	60.41	59.82	60.81	58.98
p99	100.00	100.00	100.00	100.00
Labor productivity (value added per employee; Euro)				
mean	57,630	63,417	65,055	64,534
std. dev.	83,337	79,060	72,177	76,415
p1	6,759	13,618	15,027	8,947
p50	47,954	54,131	56,460	55,794
p99	200,962	212,846	204,356	194,050
Number of employees				
Mean	152.84	150.76	156.10	154.98
std. dev.	243.19	220.17	226.77	227.73
p1	22	23	22	21
p50	86	85	88	86
p99	1,050	1,028	1,079	1,063

Note: The minimum and maximum values are confidential; p1, p50 and p99 refer to the 1st, 50th and 99th percentile.

Table 2: Results from empirical models

	Year	2009	2010	2011	2012
Number of enterprises		5,963	6,075	6,134	6,238
Dependent variable: Multiple sourcing (yes/no) *Estimation method: Probit*					
Labor productivity	ß	4.73e-6	4.73e-6	4.08e-6	6.09e-6
	p	0.000	0.000	0.002	0.000
Average marginal effect		1.19e-6	1.19e-6	9.91e-7	1.52e-6
(p)		0.000	0.000	0.001	0.000
Number of employees	ß	0.0070	0.0075	0.0079	0.0074
	p	0.000	0.000	0.000	0.000
Number of employees (squared)	ß	-9.25e-7	-1.26e-6	-1.31e-6	-1.20e-6
	p	0.000	0.000	0.000	0.000
Average marginal effect		0.0017	0.0018	0.0019	0.0018
(p)		0.000	0.000	0.000	0.000
Dependent variable: Share of imports from multiple sourcing in total imports *Estimation method: Fractional logit*					
Labor productivity	ß	1.45e-6	3.49e-6	3.41e-6	3.69e-6
	p	0.082	0.000	0.001	0.001
Average marginal effect		3.24e-7	7.68e-7	7.47e-7	8.10e-7
(p)		0.081	0.000	0.001	0.001
Number of employees	ß	0.0036	0.0040	0.0039	0.0040
	p	0.000	0.000	0.000	0.000
Number of employees (squared)	ß	-4.90e-7	-7.24e-7	-7.64e-7	-7.45e-7
	p	0.000	0.000	0.317	0.139
Average marginal effect		0.00077	0.00084	0.00082	0.00083
(p)		0.000	0.000	0.000	0.000

Note: ß is the estimated regression coefficient, p is the prob-value. All models include a constant plus dummy-variables for detailed industries at the 4-digit level.

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