Customs-related Transaction Costs, Firm Size and International Trade Intensity

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ABSTRACT. The costs of paperwork and delays needed to clear international customs are generally perceived as a time-consuming impediment to international trade. However, few studies have empirically examined the determinants and the impact of this type of government-imposed transaction costs. This paper analyses the role of firm size as a determinant of customs-related transaction costs, as well as the effect of firm size on the relationship between these costs and the international trade intensity of firms. The results of this study indicate that customs-related transaction costs repress international trade activities of firms, even at low levels of these costs. The paper identifies transaction-related economies of scale, simplified customs procedures and advanced information and communication technology as main determinants of customs-related transaction costs. It is shown that when these factors are taken into account, firm size has no effect on customs-related transaction costs. Policy implications are considered for firm strategy and public policy.

KEY WORDS: firm size, international business strategy, international trade intensity, trade barriers

JEL CLASSIFICATION: F1, H3, K4

1. Introduction

Transaction costs are generally higher for international trade than for domestic transactions. Obvious differences are taxes and tariffs, but there are also higher transportation costs, as the goods have to be transported over longer distances. Another element of the costs of international transactions is the costs of dealing with the delays and the paperwork involved in customs clearance. Such government-imposed transaction costs can be an important determinant of international trade. In the last decades, visible trade barriers such as tariffs and import licensing systems have been reduced, but, at the same time, there has been an increase in the use of non-tariff trade barriers such as customs regulations as a hidden trade barrier (e.g., Krugman and Obstfeld, 2000; Biederman, 1999).

Recently, Obstfeld and Rogoff (2001) showed that even a small difference in transaction costs between home and foreign goods can be detrimental to international trade, resulting in a large home bias in trade. More importantly, their results indicate that the marginal effect of international trade costs increases with the level of these costs. Consequently, customs-related transaction costs might have a larger impact in a setting where there are substantial international trade costs, which is generally the case for international transactions. Therefore, customs-related transaction costs could be important, even though they are not the largest part of the transaction costs for international trade. Because of economies of scale in transaction costs and the limited availability of resources, customs-related transaction costs might be even more detrimental for the international trade activities of small firms than for those of larger firms.

The importance of international trade activities is clear, as they provide employment, create backward and forward linkages, and ultimately increase the standard of living. Furthermore, international trade can provide a competitive advantage, increase capacity utilisation and raise technological standards (e.g. Terpstra and Sarathy, 2000; Levy et al., 1999; Leonidou and Katsikeas, 1996). In addition, Wagner (1995) finds that international trade increases the growth of firms and

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Roper (1999) reports that the development of new export markets increases a firm's profitability and growth.

Although the impact of customs-related transaction costs on international trade is highly relevant for economic theory and policy, there is only little empirical work on this topic. An exception is the empirical analysis of Cecchini et al. (1988).[1] Using a survey of 500 companies, they quantify the customs-related transaction costs in the EU before the introduction of the Single European Market. They report that the total of customs-related transaction costs (including transit delays and excluding opportunity costs) was estimated at about 8 billion Euro.[2] At that time, this was equal to 2 per cent of the value of cross-border trade in the EU. The opportunity costs (costs in terms of trade not undertaken) of customs procedures were estimated between 4.5 and 15 billion Euro. Furthermore, the study reports that the costs of customs procedures are very unevenly distributed across firms. The costs of customs procedures were between 30 and 45 per cent higher for companies with fewer than 250 employees than for companies with more than 250 employees. Although the Cecchini Report was widely criticised for being written to justify the Single European Market programme (Harris, 1996, p. 70), the estimates nevertheless indicate that customs-related transaction costs impose a substantial burden on trade.

This paper identifies the determinants of customs-related transaction costs as well as the effect of these costs on the international trade intensity of firms. We start with an analysis of the relationship between firm characteristics and customs-related transaction costs. This information is also of strategic importance when firms decide on their import and export operations. We then continue with an analysis of the relationship between customs-related transaction costs, firm size and international trade intensity. To reduce the effects of other factors that influence international trade, we use information on firms from a single country, The Netherlands, so there is only one institutional setting. As The Netherlands is a member of the European Union (EU), we examine only international transactions with countries outside the EU. Customs regulations do not apply to cross-border transactions within the EU.

This paper continues as follows. The next section discusses the theory and develops hypotheses on the relationships between firm characteristics, customs-related transaction costs and international trade activities of firms. Section 3 describes the data and Section 4 presents the empirical results. We find that customs-related transaction costs repress the international trade intensity of firms. Furthermore, substantial differences in customs-related transaction costs among firms can be explained by transaction-related economies of scale, the use of simplified customs procedures and the use of advanced information and communication technology. It is shown that when these factors are taken into account, there is no effect of firm size on customs-related transaction costs. The final section discusses how international firms can effectively deal with customs-related transaction costs and what can be done by government authorities to minimise the detrimental effect of customs regulations on the international trade activities of firms.

2. Background and hypotheses (H)

In this section, we start with a description of the customs procedures for import and export transactions in the EU. Extra attention is paid to the simplified customs procedures, which can reduce customs-related transaction costs substantially, as the results in Section 4 indicate. Section 2.2 develops hypotheses concerning the relationship between firm characteristics and customs-related transaction costs. Section 2.3 concludes with the development of two hypotheses about the relationship between customs-related transaction costs, firm size and international trade intensity.

2.1. *Customs procedures in the EU*

Customs law of the EU is codified in the Community Customs Code and applies from 1 January 1994.[3] The Community Customs Code provides general customs rules and procedures to ensure consistent implementation of customs legislation in the EU. The system of customs procedures is highly consolidated in the EU, but considerable differences among the Member States still exist with regard to the completion of

declarations (European Commission, 1997, p. 117). There are "normal" customs procedures for entry and exit of goods, but there also exist simplified customs procedures.

Normal customs procedures for import and export. Goods brought into the territory of the EU are subject to control by the customs authority and must be conveyed without delay by a route specified by the customs authorities. At the customs office, a summary declaration must be lodged, once the goods have been presented to customs. With the completion of the Single European Market, the movement of goods within the EU has been removed from customs control, and therefore entry of goods takes place only at the outer borders of the EU. The declaration to release goods into free circulation in the EU market must be made on the standard EU customs document, the Single Administrative Document (SAD). The SAD brings together in one set of forms the control, country, transport, fiscal and statistical data required for customs procedures. If the documentation is free of irregularities, the customs official will sign the document and the goods will be released into free circulation. If goods are exported outside the territory of the EU, the goods are placed under an export procedure. The export declaration must be lodged at the customs office that is responsible for supervising the place where the exporter is established or where the goods are packed and loaded for export shipment. After approval of the customs authorities, the goods must leave the territory of the EU.

The data that has to be provided for import and export procedures are very similar. Thus, we may expect that there are no large differences in customs-related transaction costs between imports and exports. This is supported by the results reported by Cecchini et al. (1988, p. 13), which suggest that differences in the costs of import and export transactions largely reflect differences in the industrial composition and the presence of outliers. Therefore, we treat import and export transactions together in this study.[4]

Simplified customs procedures. The "normal" customs procedure is that a declaration is made for each transport. However, various procedures exist that can reduce the burden of customs procedures. Such procedures simplify declarations or facilitate the logistical planning of international shipments. As an example, firms in The Netherlands can obtain a licence to file electronic declarations 24 hours a day or a licence to declare on a monthly basis. In general, the conditions attached to such licences relate to the quality of the company's accounting and internal control systems. The availability of such procedures and the specific licence requirements differ across Member States of the EU.

2.2. *Determinants of customs-related transaction costs*

In this section, we develop hypotheses concerning a firm's characteristics and the customs-related transaction costs a firm faces. Every firm having international transactions is confronted with these costs in order to meet the requirements of customs regulations. Customs-related transaction costs are incurred to support international transactions, so they should be related to the value of these transactions. In the remainder of this paper we therefore consider customs-related transaction costs relative to the total value of international transactions.

A recurrent finding in studies on compliance costs (costs incurred by companies and individuals in meeting legal requirements) is that these costs are higher for smaller firms (e.g. Hudson and Godwin, 2000; Sandford and Hasseldine, 1992; Sandford et al., 1981). Sandford et al. (1981, p. 53) provide a theoretical basis for this observed relationship by referring to Adam Smith's classical division-of-labour argument. Large companies can hire specialists who devote their time entirely to compliance activities. Other sources of economies of scale are indivisibilities of people and facilities and laws of mathematics and physics (Nooteboom, 1993). Indivisibilities result in what are called "threshold costs": no matter how small output may be, there is a minimum capacity of people or facilities. Such threshold costs are prominent in international trade where firms have to set up contacts, contracts and governance schemes in a distant and unfamiliar environment. As many of the costs of engaging in international trade are fixed by nature, economies of scale should play an important role.

According to transaction costs theory, the size and frequency of transactions determine the economies of scale of transactions. The idea is that the costs of transaction-specific investments will be easier to recover for large transactions of a recurring kind (Williamson, 1985, p. 60). Therefore, we hypothesise that customs-related transaction costs decrease with the frequency and the average size of international transactions.

In the above reasoning, the implicit assumption is made that when transaction frequency is increased, the average size of international transactions does not decrease. A firm that increases its transaction frequency without increasing its total international trade is likely to incur higher transaction costs. We therefore hypothesise that the effect of a relative change in transaction frequency should be smaller than the effect of a change in average transaction size of the same magnitude.[5] The above discussion is summarised in the following hypotheses, which will be tested in our empirical application.

H1a: A higher frequency of international transactions results in lower customs-related transaction costs.

H1b: Larger transaction sizes in international transactions result in lower customs-related transaction costs.

H1c: The effect of a relative change in the average transaction size is larger than the effect of the same relative change in the frequency of international transactions.

So far, we have argued that economies of scale are the main determinants of customs-related transaction costs. However, these economies of scale are related to the size of the business activities a firm is specialised in, and not directly linked to the size of a firm. Levy et al. (1999) argue that the effects of scale in international trade activities are reduced by the declining costs of information and communication technology. As a consequence, the minimum capacity required to realise significant economies of scale in customs compliance activities may well be within the reach of small firms that specialise in international trade. Larger firms that are not specialised in international trade may not necessarily realise these scale economies.

Following this line of reasoning, we argue that there is no effect of firm size on customs-related transaction costs, once transaction size and transaction frequency are taken into account. In a study on compliance costs of tax credits for research and development costs, Guntz et al. (1995) report that larger firms have lower compliance costs. However, this effect disappears when they control for the amount of research and development costs, showing that, although firm size is *associated* with research and development, economies of scale are related to the size of the activity and not to the size of the firm. Therefore, we hypothesise that

H2: Firm size has no independent effect on customs-related transaction costs.

Besides realising economies of scale to reduce customs-related transaction costs, firms can also try to increase efficiency in the business processes that deal with customs. One can think of the frequency with which the company exchanges information with the customs authorities, the way in which this information is exchanged and the way in which the necessary information is gathered inside the company. This section continues with a description of some of the possible efficiency gains and their influence on the level of customs-related transaction costs.

In the EU, the normal customs procedure is to file a declaration for each export or import transaction. However, the filing frequency of declarations can be reduced by using simplified customs procedures. The simplified procedures provide the opportunity to combine several transactions into a single declaration. When certain conditions are met, firms can declare import and export transactions together on a monthly basis, thereby lowering the filing frequency of customs declarations to once every month. With a lower filing frequency, a firm needs less time to collect the data, prepare the customs documentation and process the declarations in the business information system. Empirical support for a negative relation between filing frequency and compliance costs has been reported by Cléroux (1992) in a study of the Canadian goods and services tax.

H3: Reduced filing frequency decreases customs-related transaction costs.

Most international firms in the EU use more or less advanced computer information systems. Customs procedures require logistical, financial, fiscal and statistical data, which may be stored in different databases. Integration of the information system can reduce the labour time needed to produce the required information. For instance, the integration of the statistical and customs databases makes entry of transaction data into each database separately redundant. In addition, the integration of the inventory and financial administration will make it easier to identify the relation between physical and financial flows in the firm, which is required for customs declarations. Furthermore, external integration by electronic data interchange (EDI) between buyers, suppliers and customs authorities may reduce customs-related transaction costs. Senders of electronic messages do not have to record messages on paper and receivers do not have to enter the data into their database manually. EDI might also reduce the probability of mistakes. For instance, if firms submit declarations electronically, details in the declaration can be checked immediately by the receiving program. Therefore, we hypothesise that, in general,

H4: Integration of computerised business information systems reduces customs-related transaction costs.

Knowing which factors determine the level of customs-related transaction costs is in itself interesting, but it might not deserve such a thorough investigation if it did not substantially influence the level of international trade activities firms are engaged in. We therefore continue with a discussion of the relationship between the level of customs-related transaction costs and the intensity of a firm's international trade activities.

2.3. *Customs-related transaction costs and international trade intensity*

Economic theory suggests that differential transaction costs of international trade may cause a home bias in international trade. Obstfeld and Rogoff (2001) suggest that even small differences in differential transaction costs can induce a significant bias for domestic trade. The argument is based on the interaction between the differential costs of international trade and the elasticity of substitution between home and foreign goods. Empirical estimates of the average size of this substitution elasticity are rather high (between 5 and 6) and are most likely biased downwards, since data on goods that are not traded are not included (Hummels, 1999). Therefore, we expect that customs-related transaction costs, as differential transaction costs of international trade, reduce the intensity of international trade of firms, even at relatively low levels of these costs.

H5: Customs-related transaction costs have a negative effect on international trade intensity.

As the available resources of small firms are more constrained than those of larger firms (Barnett and Amburgey, 1990), they may be more vulnerable to the detrimental effect of customs-related transaction costs on their international trade activities than larger firms. Furthermore, Leonidou (1995) reports that the imposition of non-tariff barriers, such as customs procedures, was systematically perceived as more inhibiting by smaller firms. In addition, the availability of resources offers substantive support for the first phases of a firm's internationalisation (Gomes and Ramaswamy, 1999). Thus, we expect that the impact of customs-related transaction costs on international trade intensity is smaller for larger firms, so:

H6: Increased firm size reduces the impact of customs-related transaction costs on international trade intensity.

3. Data

Our main interest is in the determinants of customs-related transaction costs and the effect of these costs on international trade activities. For a proper analysis, it is important to have an institutional setting that is similar for all observations, but, at the same time, there should also be a substantial amount of variation in customs-related transaction costs. To make sure that the institutional setting is the same, we focus on a single country, The Netherlands. As a centre of European distribution networks, it has attracted a large variety of businesses with international trading activities, resulting in a substantial amount of

variation in the level of customs-related transaction costs. Moreover, the companies and authorities in The Netherlands are experienced in the use of simplified and computerised customs procedures, and the customs authorities in The Netherlands are considered relatively efficient (European Commission, 1997; Cecchini et al., 1988). Therefore, the size of customs-related transaction costs found for The Netherlands will generally be a conservative estimate of these costs in the EU.

The data we use consist of a sample of international traders drawn from the database of the Dutch tax and customs authorities. The database was constructed from a sample of 2,988 firms involved in cross-border trade (including firms with intra-EU transactions and logistical services). The number of firms that responded to the survey and are included in the database is 642 (21.5 per cent). The response was tested for representativeness with respect to the size and economic activity of respondents. A comparison did not indicate significant differences, except that firms with more than 100 employees had a higher response rate than smaller firms. As response rates and customs-related transaction costs might be related to the efficiency of the firm's administration, representativeness of the sample with respect to customs-related transaction costs was also tested using the test of Armstrong and Overton (1977). No significant deviations were found (p-value = 0.72).

The questionnaire was developed with the assistance of customs agents, customs officials, employer organisations and accountants. The first part of the questionnaire was concerned with the general characteristics of the firm, its information system and international transactions. The last part requested detailed information on activities that firms need to perform in order to meet the requirements of customs procedures. These activities include (1) the filing of customs declarations and the collection of required documents, (2) additional driving (via customs offices) and the handling of customs procedures, (3) the handling of simplified procedures and the activities needed to meet the additional requirements of these procedures (e.g. the specification of the accounting system and measures of internal control) and (4) the provision of data to the customs authorities and the time needed to clarify the requested information. Firms that outsource the handling of customs procedures were requested to indicate the costs involved. Time measurements of the various activities were translated into monetary values using the firm's average hourly labour costs of accounting personnel, including a mark-up for overhead costs.

Similar to the results in Cecchini et al. (1988), we find a negative correlation between firm size and customs-related transaction costs. Table I presents the customs-related transaction costs per consignment in our data and the costs reported by Cecchini et al. (1988). Table I shows that in both studies larger firms face lower customs-related transaction costs. The absolute differences in customs-related transaction costs should be interpreted with caution, since Cecchini et al. (1988) report the average of six Member States of the EU. At that time customs-related transaction costs were significantly lower in the Netherlands than in other Member States (46 and 50 Euro for import and export consignments respectively).

Table I shows that the relative difference in customs-related compliance costs between small and large firms is still substantial. However,

TABLE I
A comparison of the relationship between firm size and customs-related transaction costs reported by Cecchini et al. (1988) and in this study

Firm size (employees)	Customs-related transaction costs per import consignment in Euro's (Cecchini)*	Customs-related transaction costs per export consignment in Euro's (Cecchini)*	Customs-related transaction costs per import/export consignment in Euro's (this study)
1–249	85	95	48
≥ 250	47	75	38

* *Source:* Cecchini et al. (1988, p. 18).

according to our theoretical framework, there is no effect of firm size, once transaction size and transaction frequency are taken into account. In the next section we test the predictions from our theoretical framework using linear regression techniques. Correlations between all the variables used in this study are presented in the Appendix.

4. Empirical results

In this section, we start with a model that relates the characteristics of a firm to the customs-related transaction costs, which we measure by the ratio of these costs to the total value of international transactions. This model is used to test the first four hypotheses. In Section 4.2, the model for international trade intensity, measured by the total value of international trade divided by total sales of the firm, is presented. Here we test Hypotheses 5 and 6.

4.1. *Determinants of customs-related transaction costs*

In this section, we consider the empirical relationship between total customs-related transaction costs, as a fraction of the total value of international transactions, and the characteristics of firms. The average size of customs-related transaction costs, as a percentage of international trade, is 2 per cent. The size of the standard deviation (4 per cent) suggests that there is an enormous amount of variation in customs-related compliance costs. In order to identify the determinants of this variation, we use an econometric model based on a log-log specification. This means that the natural logarithm of customs-related transaction costs is regressed on, for example, the natural logarithm of firm size or average transaction size. Dummy variables are included in the usual way. This approach has been used in previous research: see, among others, Hudson and Godwin (2000), Blumenthal and Slemrod (1995) and Guntz et al. (1995). Various measures can be used to express firm size, such as the number of employees, total sales or total assets. We have chosen the number of employees as our size measure because economies of scale of compliance activities result from the benefits of specialisation of employees (see Section 2.2). The mathematical specification of the model is presented in Table II, together with a description of the variables that are used.

The model is estimated with ordinary least squares regression and the estimation results are presented in Table III. The *F*-value of 27 is substantially higher than the 99 per cent critical *F*-value. The regression equation is therefore statistically significant.[6]

Economies of scale (H1 and H2). Hypotheses 1a and 1b are concerned with the effect of transaction frequency and transaction size on customs-related transaction costs. The estimation results show that when the average transaction size (respectively transaction frequency) is increased by 1 per cent, average customs-related transaction costs decrease by 0.74 per cent (respectively 0.57 per cent). These effects are highly significant, supporting Hypotheses 1a and 1b. Hypothesis 1c states that the effect of a relative change in average transaction size is stronger than the effect of the same relative change in transaction frequency. The parameter estimates support this hypothesis and a Wald test shows that the difference is highly significant. The strong support for Hypothesis 1 in general indicates that measures of the scale of international trade activities are important.

In line with the findings reported by Cecchini et al. (1988), we find a highly significant negative correlation between firm size and customs-related transaction costs (–0.40). However, the results in Table III indicate that – conditional on the scale of international trade activities – the effect of firm size itself is very small and highly insignificant, which supports Hypothesis 2. Thus, the firms that are small in international trade are the firms that suffer most from customs-related transaction costs, not necessarily every small firm.

Filing frequency (H3). The positive and significant coefficients of the variables SAD (α_4), procedures (α_5) and transports (α_6) imply that if the frequency of these compliance activities increases by 1 per cent, then the customs-related transaction costs will increase by, respectively, 0.28, 0.30 and 0.09 per cent. The advantages of reducing filing frequency are mainly the reduced costs of administrative handling of customs procedures, while the effect of the reduced transport time spent on customs-related transaction costs is

TABLE II
Model specification of the determinants of customs-related transaction costs

Log Customs-related transaction costs$_i$ = α_0 + α_1(Log Frequency)$_i$ + α_2(Log Average size)$_i$ + α_3(Log Firm size)$_i$ + α_4(Log SAD)$_i$ + α_5(Log Procedures)$_i$ + α_6(Log Transports)$_i$ + α_7(Licence)$_i$ + α_8(Integration)$_i$ + α_9(EDI with buyers)$_i$ + α_{10}(EDI with suppliers)$_i$ + α_{11}(EDI with customs)$_i$ + α_{12}(Manufacturing)$_i$ + α_{13}(Trade)$_i$ + α_{14}(Transport ratio)$_i$ + α_{15}(Export ratio)$_i$ + ε_i

where for firm i:

Log Customs-related transaction costs	The log of customs-related transaction costs expressed as a percentage of the value of international trade
Log Frequency	The log of the number of international transactions
Log Average size	The log of the average size of international transactions
Log Firm size	The log of firm size expressed as the number of employees (in full-time equivalents)
Log SAD	The log of the number of lodged Single Administrative Documents
Log Procedures	The log of the number of handled customs procedures
Log Transports	The log of the number of transports via customs office
Licence	Licence for a monthly declaration (dummy variable)
Integration	Integrated inventory and invoice business information system (dummy variable)
EDI with buyers	Electronic data interchange with buyers (dummy variable)
EDI with suppliers	Electronic data interchange with suppliers (dummy variable)
EDI with customs	Electronic data interchange with customs authorities (dummy variable)
Manufacturing	Firms mainly active in manufacturing activities (dummy variable)
Trade	Firms mainly active in trading activities (dummy variable)
Transport ratio	Value of goods transported to The Netherlands without using the territory of other Member States divided by the total value of international transactions
Export ratio	Value of export transactions divided by the total value of international transactions

TABLE III
Estimation results of the determinants of customs-related transaction costs

Explanatory variable		Estimated coefficient	Standard error	*t*-value	Significance
(Constant)	(α_0)	3.3695	0.8177	4.121	$P < 0.01$
Log Frequency	(α_1)	–0.5654	0.0678	–8.337	$P < 0.01$
Log Average size	(α_2)	–0.7409	0.0663	–11.168	$P < 0.01$
Log Firm size	(α_3)	–0.0041	0.0713	0.058	N.S.
Log SAD	(α_4)	0.2775	0.0433	6.416	$P < 0.01$
Log Procedures	(α_5)	0.2961	0.0417	–7.098	$P < 0.01$
Log Transports	(α_6)	0.0921	0.0531	–1.736	$P < 0.10$
Licence	(α_7)	–0.4377	0.2168	–2.019	$P < 0.05$
Integration	(α_8)	–0.5545	0.3075	–1.743	$P < 0.10$
EDI with buyers	(α_9)	0.7403	0.3801	1.948	$P < 0.10$
EDI with suppliers	(α_{10})	–0.6298	0.3587	–1.756	$P < 0.10$
EDI with customs	(α_{11})	–0.8469	0.5038	–1.681	$P < 0.10$
Manufacturing	(α_{12})	–0.0720	0.3696	–0.195	N.S.
Trade	(α_{13})	0.2637	0.3417	0.772	N.S.
Transport ratio	(α_{14})	–0.5403	0.2411	–2.241	$P < 0.05$
Export ratio	(α_{15})	–0.0511	0.2399	–0.213	N.S.
Model summary		Adjusted R^2 = 0.74	F = 27	N = 145	

much smaller. One explanation of this result could be that the reduction in delays is not substantial. Another explanation could be that the delays are anticipated in the logistical planning and therefore the costs of delays are small. The negative and significant effect of the variable customs licence (α_7) indicates that companies that reduce the filing frequency to a monthly basis have lower customs-related transaction costs. The coefficient indicates that companies with a monthly filing frequency have customs-related transaction costs that are approximately 36 per cent lower, everything else being equal. Our results strongly support Hypothesis 3 and suggest that reducing the filing frequency by simplified customs procedures is an effective method of reducing customs-related transaction costs.

Information and communication technology (H4). The coefficient of the dummy variable integration (α_8) confirms the importance of integrated computer information systems for reducing customs-related transaction costs, as suggested by Hypothesis 4. The coefficients of the variables EDI with suppliers (α_{10}) and EDI with customs (α_{11}) also indicate that information technology can reduce customs-related transaction costs, by as much as 50%. However, the value of the coefficient of the variable EDI with buyers (α_9) is positive and statistically significant. This result seems to contradict the cost savings predicted by Hypothesis 4. An explanation for this difference may be that additional legal requirements of electronic invoicing cause serious problems that are difficult and costly to overcome. This is particularly true for international transactions where two authorities are involved with different sets of requirements, see Wille et al. (2000) and Schmidt (1997).

Remaining variables. The small and insignificant values of the coefficients of the variables manufacturing (α_{12}), trade (α_{13}) and export ratio (α_{15}) indicate that the types of transaction (import or export) or business activity do not have an independent influence on the customs-related transaction costs. The insignificant coefficient of the variable export ratio (α_{15}) suggests that there is no large difference in customs-related transaction costs between imports and exports. This supports the finding reported by Cecchini et al. (1988, p. 13) that differences in the costs of import and export transactions largely reflect differences in the industrial composition and the presence of outliers.

The significant coefficient of the variable transport ratio (α_{14}) suggests that goods transported via other Member States of the EU to The Netherlands have higher customs-related transaction costs than goods transported directly to The Netherlands. One reason could be the efficiency of the Dutch implementation of European customs regulations, but language or cultural differences can also play a role. However, it is difficult to reconcile the idea of a Single European Market with the finding that the level of customs-related transaction costs depends on the entry location in that market.

Our results with respect to the size of the cost reductions induced by the cost reducing strategies, i.e. the variables related to customs procedures (SAD, Procedures, Transports and Licence) and the business information system (Integration and EDI), may be influenced by the possible endogeneity of these strategies. Firms with high costs might be more likely to use cost reducing strategies than firms with low costs. Since eight of the explanatory variables are related to cost reducing strategies, at least eight instrumental variables would be required for estimation with two stage least squares. This is not feasible in our database, and given the large amount of information required, this would generally not be feasible in any database. However, if these variables are endogeneously determined, the estimated cost reductions are in fact underestimating actual cost reductions, so our conclusions do not change.

Underestimation of the effectiveness of the cost reducing strategies might also affect the estimated effect of firm size itself, as firm size and the use of cost reducing strategies might be positively correlated. Underestimation of the effect of cost reducing strategies would indicate that the effect of firm size is higher, so the result that, conditional on the other variables, larger firms don't have lower costs is also not affected by the possible endogeneity of the cost reducing strategies. This is confirmed by a regression analysis where the variables related to cost reducing strategies are excluded. In this model there is again no significant effect of firm size on customs-related transaction costs.

Summarising our results so far, the scale of international trade activities is an important determinant of customs-related transaction costs. Although firm size is positively correlated with transaction costs, it has no direct effect on the level of these costs, conditional on frequency and average size of international transactions. Besides transaction-related economies of scale, information and communication technology also provide many opportunities for cost reductions. Finally, substantial efficiency gains can be realised by using simplified customs procedures.

4.2. *Customs-related transaction costs and international trade intensity*

The second part of our analysis concerns the impact that customs-related transaction costs have on a firm's international trade intensity, controlling for the possible influences of firm size and the type of industry.[7] We measure a firm's international trade intensity by the total value of international transactions divided by the total sales of the firm. If customs-related transaction costs cause a bias for domestic trade, international trade intensity will decrease when customs-related transaction costs are increased. We examine this relationship with a regression model, where international trade intensity is the dependent variable and the log of customs-related transaction costs is one of the independent variables. The log of firm size and dummies for industry type are included to control for the influence of firm size and industry characteristics. An interaction term[8] is included between the variables customs-related transaction costs and firm size. This controls for the hypothesised effect of firm size on the relationship between customs-related transaction costs and international trade intensity (Hypothesis 6). The resulting model is presented in Table IV.

The estimation results of the model are presented in Table V. The *F*-value of 8.5 is above the 99 per cent critical *F*-value, so the regression equation is statistically significant.

One might argue that the estimation results presented in Table V also suffer from endogeneity. The argument would be that firms with more international trade might have a stronger incentive to reduce customs-related transaction costs. However, it is not necessarily the case that firms who export more in a relative sense, which is what export intensity measures, have stronger incentives. In any case, if such endogeneity would be relevant, the effect of customs-related transaction costs would be overestimated. However, when we estimate the model using instrumental variables, the parameter estimate becomes larger instead of smaller, and the effect remains significant. The fact that when using instrumental variables the estimate is larger suggests that endogeneity of cost reducing strategies is not an issue in this model. Consequently, the regular ordinary least squares estimates presented in Table V are the preferred estimates.

Customs-related transaction costs (H5). Hypothesis 5 concerns the impact of customs-related transaction costs on international trade intensity. From the estimate of α_1 in Table V, it is clear that customs-related transaction costs repress the

TABLE IV
Model specification of the relationship between customs-related transaction costs, firm size and international trade intensity

$$\text{International trade intensity}_i = \alpha_0 + \alpha_1(\text{Log Customs-related transaction costs})_i + \alpha_2(\text{Log Firm size})_i + \alpha_3(\text{Log Firm size})_i \times (\text{Log Customs-related transaction costs})_i + \alpha_4(\text{Manufacturing})_i + \alpha_5(\text{Trade})_i + \varepsilon_i$$

where for firm i:

International trade intensity	The total value of international transactions divided by the total sales
Log Customs-related transaction costs	The log of customs-related transaction costs of international transactions expressed as a percentage of the value of international transactions
Log Firm size	The log of firm size expressed as the number of employees (in full-time equivalents)
Manufacturing	Firms mainly active in manufacturing activities (dummy variable)
Trade	Firms mainly active in trading activities (dummy variable)

TABLE V
Estimation results of the relationship between customs-related transaction costs, firm size and international trade intensity

Explanatory variable		Estimated coefficient	Standard error	*t*-value	Significance
(Constant)	(α_0)	0.702	0.172	4.081	$P < 0.01$
Log Customs-related transaction costs	(α_1)	–0.027	0.013	–2.062	$P < 0.05$
Log Firm size	(α_2)	–0.108	0.036	–3.033	$P < 0.01$
Interaction size-costs (mean-centred)	(α_3)	–0.004	0.007	–0.634	N.S.
Manufacturing	(α_4)	–0.047	0.100	–0.470	N.S.
Trade	(α_5)	–0.033	0.097	–0.340	N.S.
Model summary	Adjusted $R^2 = 0.21$		$F = 8.5$	$N = 145$	

international trade intensity of firms and that this effect is significant at the 5 per cent level, so Hypothesis 5 is supported.

The effect of firm size (α_2) is negative and highly significant. This means that – conditional on customs-related transaction costs – firm size is negatively related to international trade intensity. The general relationship between firm size and international trade intensity can be examined with regard to two aspects: (1) the propensity of being a firm with international trade activities and (2) the intensity of international trade activities among firms with international trade. There is general consensus in the literature that the probability of being a firm with international trade activities increases with firm size (e.g. Wagner, 1995; Calof, 1994; Bonaccorsi, 1992). As our results are based on a sample of firms that are engaged in international trade activities, our results only have implications for the effect of firm size on the intensity of international trade activities. Here, the empirical findings have been mixed in the literature, suggesting the influence of an intervening variable or variables on this relationship. However, most studies indicate that firm size is not a barrier to specialisation in international trade *per se* (e.g. Moen, 1999; Calof, 1994; Bonaccorsi, 1992).

The negative coefficient for firm size in Table V even indicates that small firms have, on average, a higher export intensity than large firms, conditional on the other variables. An explanation for this is that to meet the additional requirements of international trade, firms need more complex inter-organisational co-ordination with the foreign exchange partner and more complex intra-organizational co-ordination between marketing, logistical and accounting departments (Gomes and Ramaswamy, 1999). Smaller firms are seen as being quicker and more nimble than their larger counterparts due to structural simplicity (Chen and Hambrick, 1995), and therefore they may be more effective in responding to the specific requirements of foreign trade, conditional on the level of customs-related transaction costs.

Initially, we included the quadratic terms for the effect of firm size and customs-related transaction costs, but these proved to be insignificant and were omitted in the specification in Table IV. The insignificance of these terms indicates that the influence of firm size on international trade intensity is not decreasing or increasing with firm size. And, more importantly, the insignificant effect of the quadratic term in customs-related transaction costs indicates that changes in these costs reduce international trade intensity independent of the level of customs-related transaction costs. This supports the proposition of Obstfeld and Rogoff (2001) that even relatively small differences in differential transaction costs can induce a significant bias for domestic trade.

The moderating role of firm size (H6). Hypothesis 6 states that the effect of customs-related transaction costs is moderated by the size of the firm. The estimation results in Table V, however, indicate that the interaction effect between firm size and these costs has no statistically significant influence on the international trade intensity of a firm. Thus, the data do not support the hypothesis that the impact of these costs on international trade intensity is moderated by firm size. Although small firms perceive customs procedures as a more inhibiting factor than larger firms, this does not

affect the intensity of their international trade activities. The negative sign of the estimated coefficient even suggests that customs-related transaction costs are more influential for larger firms. An explanation for this could be that larger firms have higher sales volumes with lower contribution margins. This makes larger firms more vulnerable to the detrimental effect of customs-related transaction costs. Thus, if smaller firms operate in markets with higher profit margins, this could counterbalance the limited resources argument, which motivated Hypothesis 6.

5. Policy implications

The results presented in this paper suggest that the burden of customs-related transaction costs is mainly determined by transaction-related economies of scale, the use of simplified customs procedures and the use of advanced information and communication technology. The economic relevance of customs-related transaction costs is shown by the repressive effect they have on international trade activity. In addition, this repressive effect of customs-related transaction costs on international trade may negatively influence the growth of firms. This follows from Wagner (1995), who finds a positive effect of export intensity on firm growth, and Roper (1999), who reports positive effects of the development of new export markets on both a firm's profitability and a firm's growth. Such dynamic effects could reinforce the negative effect found in this cross-sectional study. Furthermore, it is surprising that the effect of changes in customs-related transaction costs is not smaller for firms that face lower levels of these costs. This indicates that even low levels of customs-related transaction costs can induce a significant bias for domestic trade.

Our findings have implications for firm strategy as well as for public policy. The two important questions that our analysis raises are (1) how can international firms effectively deal with customs-related transaction costs? and (2) what can be done by government authorities to minimise the detrimental effect of customs regulations on the international trade activities of firms?

Firm strategy. The results of this study show that firms can substantially reduce customs-related transaction costs by using simplified customs procedures and advanced information and communication technology. Furthermore, firms can reduce costs by consolidating shipments, thereby increasing transaction-related economies of scale. Such policies will become more important in the near future with the growth of online markets, decreasing inventory levels and increasing product variety. These developments will decrease the average size of transactions, which leads to substantial increases in the burden of customs-related transaction costs.

Our results indicate that economies of scale in international trade are determined by the size of the international trade activities and that firm size has no independent influence on the level of customs-related transaction costs. Since the correlation between firm size and international trade volume is positive and significant but rather low, this suggests that small firms with a focus on international markets can successfully realise economies of scale in customs procedures.

Small firms can also outsource customs-related activities to trading partners, logistical service providers or specialised international trade intermediaries. Besides the cost savings from a more advanced business information system, an outsourcing strategy enables small firms to enjoy the benefits of a licence that permits them to reduce their filing frequency. As our study indicates, the cost savings of a more advanced business information system and a reduced filing frequency are substantial. A disadvantage of outsourcing these activities is the specific investments, which may increase switching costs, thereby creating a lock-in situation for these firms.

Public policy. Customs authorities should be aware that they are part of complex international supply chains. The performance of these supply chains is determined by their weakest parts. The results of this study show that customs-related transaction costs repress international trade activities of firms. Customs authorities can reduce this barrier by facilitating business logistical and administrative processes. Our results suggest that the various facilities provided by customs authorities in the EU effectively reduce customs-related transaction costs. However, as our results with respect to EDI indicate, governments should co-

operate in defining the conditions under which the use of these facilities is allowed. Furthermore, the conditions for obtaining a licence for simplified customs procedures generally favour larger firms. The reason is that these conditions – such as the specification of the accounting information system and measures of internal control – are likely to increase the costs of small firms more than the costs of larger firms. Measures of internal control may include the division of administrative activities among different employees, thereby increasing the threshold costs of such a licence significantly. Very small firms may even find it impossible to comply with such requirements. Thus, applying these conditions to small firms without additional support may be at the cost of fair terms of competition.

A limitation of this study is that it is based on a database of international traders in The Netherlands only. Future studies could validate the results in other Member States of the EU and explore the effect of new simplified procedures and innovations in information and communication technology. It would also be interesting to see whether the patterns found in this study apply under systems of customs controls in other parts of the world. International firms report increased use of customs as a concealed non-tariff trade barrier (Biederman, 1999). Firms often lack the resources to take complaints to the World Trade Organisation or are afraid of retaliation by the foreign government. In order to avoid the misuse of customs as a non-tariff trade barrier, the World Trade Organisation could carry out surveys of business costs under different systems of customs controls. The results of these studies could determine whether a country's system of customs controls is relatively efficient and non-discriminatory. Thus, more extensive research in a variety of institutional settings is needed in order to reveal the impact of this hidden barrier in international trade.

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Notes

[1] For a detailed version of this report, see European Commission (1988).

[2] The monetary values in the Cecchini Report are denominated in ECU. All monetary units in this paper have been converted into Euro.

[3] Regulation (EEC), No. 2913/92, Pb.EC 1992.

[4] However, for various reasons such as tax revenue or trade policy, customs-related transaction costs might differ between imports and exports. To control for a possible difference in costs between import and export transactions, we include the ratio of exports to total international trade in our empirical model. This ratio turns out to be insignificant, which confirms that there are no large differences in the costs between import and export transactions.

[5] This hypothesis follows from the fact that to keep international trade volume constant, a relative change in the transaction frequency has to be accompanied by the same relative change in the average transaction size, but in the opposite direction.

[6] The Goldfeld-Quandt test was used to identify possible heteroscedasticity, and variance inflation factors and matrix decomposition were used to detect multicollinearity. The results did not indicate any problem, and plots of the error term of the regression model suggest a normal distribution.

[7] We disregard a number of other factors that interact to determine international trade intensity, such as the firm's strategic considerations and domestic market size. However, this restriction should not be a cause of great concern since we are focusing on firms that have already decided to be active in international trade and operate in a very large domestic market (the European Union).

[8] The variables involved in the interaction were mean-centred, a procedure commonly recommended to reduce multicollinearity and provide unbiased parameter estimates (Aiken and West, 1996). To check if this was successful, we employed two widely used measures of multicollinearity. The maximum variance inflation factor and the maximum condition index were well below the levels (10 and 30 respectively) that commonly signal detrimental multicollinearity.

Appendix: Correlations of the variables of interest in this study (*Significant at $P < 0.05$)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Log Customs-related transaction costs (1)	1	–0.25*	–0.56*	–0.40*	0.20*	0.17*	0.09	–0.27*	–0.13	–0.06	–0.18	–0.14*	–0.15*	0.10	–0.28*	0.16*
Log Frequency (2)		1	–0.13	0.58*	0.52*	0.42*	0.33*	0.36*	0.22*	0.24*	0.30*	0.25*	–0.10	–0.12	0.04	–0.03
Log Average size (3)			1	0.22*	–0.10	0.12	0.18*	0.10	0.16*	–0.07	0.04	0.06	0.17*	–0.16*	0.26*	–0.22*
Log Firm size (4)				1	0.19*	0.27*	0.21*	0.25*	0.26*	0.24*	0.32*	0.20*	0.38*	–0.40*	0.05	–0.07*
Log SAD (5)					1	0.25*	0.29	–0.12*	0.01	0.17*	0.18*	0.10	0.10	–0.15	–0.05	0.16
Log Procedures (6)						1	0.60*	0.15*	0.05	0.08	0.12	0.16*	0.17*	0.19*	0.14*	–0.08
Log Transports (7)							1	0.28*	0.28*	–0.06	–0.04	0.22*	0.22*	–0.24*	–0.01	–0.09
Licence (8)								1	0.28*	0.14*	0.11	0.18*	–0.10	0.05	–0.03	–0.11
Integration (9)									1	0.13*	0.18*	0.07	0.19*	–0.17*	–0.08	–0.06
EDI with buyers (10)										1	0.60*	0.19*	0.11	–0.13*	–0.02	–0.20*
EDI with suppliers (11)											1	0.19*	0.05	–0.06	0.05	–0.16*
EDI with customs (12)												1	–0.02*	–0.02	0.07	–0.20*
Manufacturing (13)													1	–0.80	0.04	0.20
Trade (14)														1	–0.06	–0.20
Transport ratio (15)															1	0.01
Export ratio (16)																1

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