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Cross-Border Mergers & Acquisitions
and the Role of Trade Costs
(revised March 2006)

by

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Abstract

Cross-border mergers and acquisitions (M&As) have increased dramatically over the last two decades. This paper analyses the role of trade costs in explaining the increase in the number of cross-border mergers and acquisitions. In particular, we distinguish horizontal and non-horizontal M&As and investigate whether trade costs affect these two types of mergers differently. We analyse this question using industry data for 23 OECD countries for the period 1990-2001. Our findings suggest that while in the aggregate trade costs affect cross-border merger activity negatively its impact differs importantly across horizontal and non-horizontal mergers. The impact of trade costs is less negative for horizontal mergers, which is consistent with the tariff-jumping argument.

Keywords: mergers and acquisitions, international trade, trade costs, gravity, FDI

JEL: F02, F15, F21, F23

Outline

Non-technical summary

Cross-border mergers and acquisitions (M&As) have increased dramatically over the last two decades. Given this rapid increase, fully understanding the determinants and implications of mergers and acquisitions has been high on the agenda for both policy makers as well as academics.

Traditionally, much of the FDI activity, be it M&As or greenfield investment, has been explained by the "tariff jumping" argument. This explanation for FDI posits that exporting and investing abroad are substitutes, and as trade costs increase (making exporting more costly), firms are more likely to choose investing abroad. More recently, studies focussing more on the industrial organisation aspect of firm behaviour, have provided alternative views. In these models, it is found that high trade costs do not necessarily induce foreign M&As, contrary to the tariff jumping argument.

These theoretical models implicitly relate to horizontal mergers, i.e., mergers between firms in the same industry. However, empirically much of international M&A activity involves mergers between firms in different industries, that is, vertical and/or conglomerate mergers. For such M&As predictions about horizontal mergers may not be straightforwardly applicable. This observation is one of the starting points for our paper.

We use micro level data on merger deals, which we aggregate to the industry level to study explicitly the impact of trade costs and impediments to trade and investment on M&As, paying particular attention to differences between horizontal and non-horizontal mergers. Horizontal M&As are defined as mergers between firms within the same industry, whereas non-horizontal M&As are defined as mergers between firms in different industries. Our data provide detailed information on the number and value of international merger deals for a number of OECD countries over the period 1990 to 2001.

The role of trade costs in determining international exchanges of capital and goods is far from negligible despite an increasingly globalised world. Hence, an analysis of the impact of trade costs on international merger activity is interesting not only from an academic point of view, but may also provide valuable information for policy makers.

In order to take account of the effects of trade impediments on cross-border M&As we consider three measures of barriers to trade. The first one is the distance between the two countries; a variable commonly employed in gravity models of trade and investment. Apart from distance we also analyse the impact of different tariff measures on cross-border M&A via its impact on trade costs.

The results suggest that distinguishing empirically between horizontal and non-horizontal M&As brings to the fore a number of differences in the determinants between the two types of mergers. While in the aggregate trade costs affect cross-border merger activity negatively its impact is significantly less pronounced for horizontal mergers than for non-horizontal mergers. Hence, treating heterogeneous mergers as a homogenous group at the country level may potentially bias results and lead to unreliable conclusions to be drawn from such estimations.

Our findings have important policy implications. Increasing relative protection in terms of tariff rates is associated with decreases in total merger activity. However, this result is reversed if merger activity is mainly taking place in the same industry, i.e., if mergers are horizontal. This gives support to the tariff jumping argument put forward in the literature on the determinants of horizontal FDI. The trade regime might thus have important implications for attracting inward investment in terms of M&As, an issue that should be recognised by governments wishing to attract foreign investment in order to benefit from technology and spillovers.

1. Introduction

Cross-border mergers and acquisitions (M&As) have increased dramatically over the last two decades. In 1999, the value of completed cross-border M&As world-wide was around $720 billion. The value of all M&As, both cross-border and domestic, amounted to an equivalent of 8 percent of world GDP in the same year, compared to 0.3 percent in 1980 (UN 2001). Also, over that period, most of the growth in foreign direct investment flows (FDI) has been attributed to M&As rather than greenfield investment (UN 2001). Given this rapid increase, fully understanding the determinants and implications of international mergers and acquisitions has been high on the agenda for both policy makers and academics.

There has been a long tradition in international economics of analysing the determinants of FDI. This literature generally does not distinguish between FDI through M&A or greenfield investment. Traditionally, much of the FDI activity has been explained by the "tariff-jumping" argument. In a nutshell, this explanation posits that exporting and investing abroad are alternative modes to enter foreign markets. As trade costs increase and exporting becomes more costly, firms are more likely to choose investing abroad. These ideas have been formalised in theoretical models by, e.g., Brainard (1997) and Markusen (2002), while Brainard (1997), Carr et al. (2001) and Blonigen et al. (2003) provide empirical evidence.

Another strand of literature has recently investigated the determinants of international M&A activity from a more industrial organization (IO) oriented background. Interestingly this has brought to the fore a different view on the importance of trade costs. For example, Horn and Persson (2001), Bjorvatn (2004) and Norbäck and Persson (2004) provide theoretical models where foreign firms may acquire domestic acquisition targets, with the acquisition price being determined endogenously in a bargaining process. In these models, contrary to the tariff-jumping argument, high trade costs do not necessarily induce cross-border M&As. High trade costs not only encourage tariff-jumping mergers, but also increase the incentives for domestic mergers as they reduce the degree of competition in the domestic market thereby increasing the acquisition price domestic acquirers are prepared to pay for domestic targets ('pre-emptive' domestic mergers).[1]

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[1] In a related paper Tekin Koru (2004) provides empirical evidence using firm level data for Swedish firms that trade costs are negatively related to the choice of M&As as opposed to greenfield or exporting.

The present paper is motivated by two empirical observations. First, in reality, as we show in Section 2, much of international M&A activity involves mergers between firms in different industries, which one could arguably define as vertical and/or conglomerate mergers. The theories discussed above however refer explicitly to horizontal mergers. Consequently, it does not seem implausible that the role of trade costs differs across horizontal and non-horizontal mergers.

Second, the ambiguity in the IO models discussed above with respect to the role of trade costs in explaining cross-border M&A arises in an international oligopoly of two countries. In a world with more than two countries the market access motivation, which gives rise to tariff-jumping, and the market power motivation, which drives 'pre-emptive' domestic mergers, can no longer be considered two sides of the same coin, i.e. the bilateral tariff. While market access continues to be a function of the bilateral tariff market concentration becomes a function of the degree of foreign competition more generally, also taking account of third countries. The smaller the degree of foreign competition the larger will be the incentive to merge for domestic firms. In an empirical setting with more than two countries the ambiguity in the international IO literature therefore tends to disappear.[2]

In the present paper we empirically analyse the role of trade costs in explaining cross-border M&A. As Anderson and Van Wincoop (2005) show the role of trade costs in determining international exchanges of capital and goods is far from negligible despite the increasingly globalized world economy.[3] Micro data with detailed information on the number and value of international merger deals are obtained from the Thomson Financial Securities *Global Mergers and Acquisitions* database.[4] We use this information to construct a comprehensive dataset at the industry level for 23 OECD countries for the period 1990-2001.

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[2] Both strands emphasise the importance of market access considerations in explaining cross-border M&A. The IO literature enriches our understanding of cross-border M&A by building market power considerations into the model. Market power is generally considered to be the main motivation for mergers, at least in a domestic context and mergers are well-known to account for the lion's share of FDI.

[3] They estimate that the tax equivalent of international trade costs for a typical industrial country is 74%. These consist of transportation costs (21%), tariff and non-tariff policy barriers (8%) and other border-related non-policy barriers (33%).

[4] These data have been used in a limited number of recent studies that investigate specifically the determinants of international cross-border M&As (e.g., Di Giovanni, 2005, Bertrand et al., 2004). Di Giovanni (2005) uses M&A data at the country level. Bertrand et al. (2004) use industry level data but do not distinguish vertical and horizontal mergers. Also related to our work are empirical papers on the determinants of cross-border equity flows (portfolio investment), see, e.g., Portes *et al.* (2001) and Portes and Rey (2005).

In order to capture the fact that the tariff-jumping argument and the IO models discussed above explicitly relate to horizontal mergers and may thus not be straightforwardly applicable to non-horizontal mergers we explicitly distinguish between horizontal mergers and non-horizontal mergers. Horizontal M&As are defined as mergers between firms within the same industry, whereas non-horizontal M&As are defined as mergers between firms in different industries. To the best of our knowledge, the present paper is the first to explicitly distinguish these two types of cross-border mergers. We conjecture that tariff-jumping considerations are more important for horizontal than for non-horizontal measures. It, thus, relates to and extends the empirical literature that attempts to distinguish indirectly horizontal from vertical FDI based on the knowledge-capital model (Carr et al., 2001; Blonigen, 2003), although we are cautious to point out that our measure of non-horizontal mergers includes both vertical and conglomerate mergers.

We further attempt to account for the anti-competitive effect of trade barriers that are emphasised in the international IO literature by including a multilateral index of trade costs with respect to third countries (weighted by respective market size). In fact, this measure is identical to the remoteness measure commonly employed in the economic geography literature (Helliwell, 1998). [5] The effect of multilateral trade costs on cross-border M&A may thus not only represent pre-emptive domestic mergers but also the incentives for competing firms to bid for a potential target on the basis of tariff-jumping considerations. Thus in a world with more than two countries the multilateral trade cost index is positively related to *both* domestic and cross-border pre-emptive mergers. In order to avoid having to model market structure in a multi-country setting we emphasise the latter channel in our theoretical model.

Distinguishing empirically between horizontal and non-horizontal M&As brings to the fore a number of differences in the determinants between the two types of mergers. While in the aggregate trade costs affect cross-border merger activity negatively its impact is significantly less pronounced for horizontal mergers than for non-horizontal mergers. This

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[5] In a trade context remoteness is used to capture the set of alternative locations from which a country may import. The availability of nearby alternatives is important as it reduces its dependence on a particular closely located exporting country. The logic in the context of cross-border mergers is very similar.

suggests that treating heterogeneous mergers as a homogenous group at the country level fails to uncover useful information and may potentially produce biased results.

The remainder of the paper is structured as follows. Section 2 describes the database on M&As and presents some descriptive statistics. In section 3 we develop a simple theoretical model of cross-border M&A. Section 4 introduces the empirical model, describes the variables and discusses the econometric methodology. Section 5 presents and analyses the estimation results of the basic model. Section 6 sums ups the conclusions.

2. Definitions and Patterns

Data on mergers and acquisitions originate from the Global Mergers and Acquisitions database included in Thomson Financial Securities. It is claimed that this dataset includes all domestic and cross-border mergers and acquisitions worldwide in excess of one million dollar. This dataset has been used relatively little in previous research, although a number of studies have used these data to analyse the nature of primarily domestic mergers (for example, Gugler et al. 2003). Manchin (2004) and Di Giovanni (2005) appear to be the only studies to have used these data to explicitly analyse patterns in aggregate cross-border mergers and acquisitions.[6]

For the present analysis we use a fairly restrictive definition of M&A which excludes portfolio investment. More particularly, we include all M&As in which the acquirer obtains a majority interest in the target by either

- acquiring an interest of 50% or over in the target
- raising its interest from below to above 50%, or

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[6] Given the close link between the present paper, which focuses on cross-border M&A, and the FDI literature, which resolves to an important extent around the role of trade, it is worthwhile making clear the relationship between cross-border M&A and FDI. Cross-border M&A is typically considered to be a subset of FDI ranging from about 50% to 90% depending on the source that is consulted. The remainder of FDI is generally considered to be realised through greenfield investment. Thus, a majority of FDI tends to occur through cross-border M&A. While thinking of cross-border M&A as simply a component of FDI may be useful, the UNCTAD's *World Invest Report* for 2000, emphasises that the link between cross-border M&A and FDI is much more complicated in reality. FDI, in contrast to cross-border M&A, solely refers to transactions between parents and affiliates. Cross-border M&A includes also investments that are financed via domestic and international capital markets. It is not always possible to trace the country from which these funds originate. Moreover, FDI refers to net investments whereas M&A refer to gross transactions (acquisitions and divestments). Due to those differences, it is therefore well possible that cross-border M&A exceeds the documented value of FDI. The statistical difference between M&A and FDI explains why the literature on M&A pays more attention to its financial characteristics. However, in the present paper we will ignore the potentially important role of financial variables (see Giovanni, 2005).

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- acquiring the remaining interest it does not already own.[7]

Moreover, we concentrate on announced rather than actual M&A. This allows us to analyse the desire to merge, which is not necessarily the same as actual mergers due to, for example, the impact of merger policy. A large merger may be desired and announced by the acquirer (and target) but the competition authority may not allow this transaction to go ahead. This instance would, however, still be recorded in the data. The vast majority of announced mergers are consummated, however.

The database allows us to determine the main industry of the acquirer as well as of the target company. Hence, we can determine whether two firms within the same industry merge, or whether the merger takes place across industries. The former case is a standard horizontal merger whereas the latter combines both vertical and conglomerate mergers. More specifically, horizontal M&A is defined as the activity of M&A that takes place within the same 4-digit US SIC industry. It is thereby assumed that 4-digit industries represent homogenous groupings of firms.[8] The main motivation to engage in horizontal cross-border M&A is market access. Non-horizontal mergers are those that take place across 4-digit industries.[9] The main question is to see whether horizontal and non-horizontal mergers behave differently in the presence of trade costs.

Table 1 summarises the number of deals and the average value of deals for different types of mergers over the 1990s. We distinguish between horizontal and non-horizontal transactions as well as between domestic and cross-border deals. When comparing cross-border M&A with domestic mergers a number of points can be made. First, the average

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[7] The analysis excludes minority stake acquisitions, repurchase programs, self-tender offers, recapitalisation, and exchange offers.

[8] Classifying horizontal and non-horizontal mergers on the basis of their 4-digit SIC code may in some cases be too restrictive. Specifically, some transactions across 4 digit industries may still involve horizontal mergers, in particular when multi-product firms are prevalent. This could only be addressed adequately if data were available on all products produced by a firm, which is not the case with the data available to us. Alternatively, one may classify mergers at higher levels of aggregation. However, this is likely to contaminate the group of horizontal mergers with non-horizontal mergers. As our main focus is with horizontal mergers we prefer a conservative definition of horizontal M&A.

[9] Vertical mergers take place across 4-digit industries between firms that are related through buyer-supplier links. Conglomerate mergers also take place across 4-digit industries, but are not associated with input-output linkages. In order to distinguish these two types of mergers directly one would need detailed input-output tables for a large number of countries. Using the Input-Output table for 1992 for the US (assuming that these relationships are representative for the OECD as a whole) in combination with bilateral trade data suggests that the actual number of vertical cross-border M&A is very small. This is also confirmed by Gugler *et al.* (2003) who suggest that most mergers across 4-digit industries are unrelated to input-output linkages.

value of cross-border transactions is substantially higher than that of domestic merger transactions. This may reflect the higher fixed cost associated with investment abroad.

Second, both in terms of the number of deals as well as their average value the relative importance of cross-border mergers in global merger activity is on the increase. The number of cross-border deals increased by 146% from 1990/1991 to 2000/2001, while the number of domestic deals increased by 116% over the same period. Also in terms of the value per merger the importance of cross-border merger activity has increased relative to domestic M&A. In particular, the average value of cross-border deals has increased by 18% relative to 12% for domestic deals.[10]

Third, horizontal M&A accounts for about 42% of total global M&A.[11] However, the share of horizontal mergers in cross-border M&A is substantially smaller (at 32%) than that of horizontal mergers in domestic M&A (45%). There may be a number of reasons for this. On the one hand, the scope for strategic behaviour within one's own industry may be limited at the international level due to more intense competition at the global level. On the other hand, non-horizontal mergers may be more frequent in an international context as the incentives for non-horizontal mergers are likely to be stronger. The potential gains from international diversification are expected to be larger thus encouraging conglomerate mergers. More related to the theory on foreign direct investment, persistent differences in factor prices render the establishment of international production networks through vertical mergers attractive (see Markusen, 2002).

Table 2 reports the number of cross-border mergers, the main interest of this paper, by broad industrial category. Manufacturing is the largest acquiring industry, followed by the financial sector. The former is, also, the most important target industry for mergers, accounting for approximately 40% of cross-border acquirers and targets. The dominance of manufacturing in cross-border M&A may be explained by the strong pressure in developed economies to restructure its manufacturing activities due to increased foreign competition or technological progress. This dominance provides a justification for concentrating on

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[10] These trends are in line with the evidence provided by OECD (2001) and Di Giovanni (2005). While the latter reports larger total numbers, the average values are similar to ours. This may be explained by the more restrictive definition of M&A employed in the present paper. Note that UN (2000) does not report an increase in the importance of cross-border M&A in total M&A either in terms of numbers or values. This difference results from the different starting point used in the World Investment Report (1987 rather than 1990).

manufacturing in the empirical part of this paper. Another reason to restrict our focus to manufacturing is that its outputs tend to be tradable, whereas this may be less so for other sectors. Hence we would expect the role of trade costs to be most visible in manufacturing.

3. A Simple Model of Cross-Border M&A

This section provides a highly stylised model of cross-border M&A as a backdrop to our empirical analysis. The model is based on the dartboard model recently proposed by Head and Ries (2005). They apply the model to explain the pattern of Japanese FDI. We extend their model by distinguishing between different types of cross-border M&A, namely horizontal and non-horizontal mergers.[12]

The probability of a cross-border acquisition of a given unit in industry j and country l by a bidder in industry i and country k is denoted by P. The expected number of bilateral cross-border M&A, m, is then given by:

$$m_{ijkl} = P_{ijkl} n_{jl} \tag{1}$$

where n refers to the total number of potential target firms in industry j and country l. We assume that the valuation of potential targets is independently and identically distributed across bidders.[13] Everything else equal, all bidders have an identical probability of winning a bid. In a frictionless world, the probability of a firm in industry j in country l being acquired by a firm in industry i in country k is given by the number of potential acquiring firms in industry i and country k over the total number of potential acquirers in the world.

$$P_{ijkl} = \frac{n_{ik}}{\sum\limits_{i=1}^{I} \sum\limits_{k \neq l}^{K} n_{ik}} \tag{2}$$

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[11] Gugler et el. (2003) provide very similar figures on the importance of horizontal M&A activity.
[12] The knowledge-capital model could have provided a useful starting point (Markusen, 2002). While this model provides some important insights for our empirical analysis it is limited due to three aspects. Firstly, the model does not distinguish between greenfield and M&A FDI; if anything the model may be regarded as implicitly being applicable to greenfield FDI. Secondly, only horizontal and vertical activities are modelled, while, as shown in the previous section, much of our data falls in neither of those categories but is more appropriately termed conglomerate M&A activity. Third, the model only considers two countries and it is not clear how the model extends to the multiple country case. This is problematic for our analysis, which uses data for a number of OECD countries.
[13] This represents a strong departure from the theoretical M&A literature (Horn and Persson, 2001) in which the price of the bid is endogenously determined in a bargaining game.

We thus exclude the possibility of pre-emptive domestic mergers as such mergers are typically motivated by market power considerations. In order to keep the model as simple as possible we abstract from market structure considerations altogether.[14]

In order to take account of transaction costs consider a firm g's private valuation, v^*, of a potential target, h,

$$v_{gh}^* = X_{gh}\beta + \varepsilon_{gh} \tag{3}$$

which is a function of observed, X, and unobserved characteristics, ε. The last term is a random term with Type I Extreme Value distribution with cumulative distribution function: $CDF(\varepsilon) = \exp[-\exp(-\varepsilon)]$. The error term refers to the base valuation in a frictionless world (Head and Ries, 2005).

In a world where frictions are important the valuation of the firm will be dependent on trade costs. We consider both transport and information costs. The role of transport costs on a firm's private valuation depends on the objective a potential take-over is supposed to fulfil, i.e., whether it is a horizontal or a non-horizontal cross-border merger. A horizontal merger is typically assumed to be driven by market access considerations. Such mergers may thus be considered as alternatives to exporting in supplying a foreign market. Transport costs may be expected to affect the relative attractiveness of these alternative modes of entry and thereby affect the desire to engage in M&A.[15] The tariff-jumping argument entails that the incentive for a profit-maximising firm to engage in a horizontal merger increases in the level of transport costs (Brainard, 1997; Markusen, 2002).[16]

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[14] We justify this important simplification in our model by pointing out that pre-emptive tariff-jumping mergers and pre-emptive domestic mergers respond in an observationally similar way to trade costs. While in our theoretical model we only allow for pre-emptive cross-border mergers we cannot differentiate between these two channels in our empirical analysis.

[15] For the moment, we solely concentrate on the relationship between trade and M&A, and assume that M&A and greenfield investment are independent. The latter assumption is admittedly quite restrictive, but allowing for this interdependence is beyond the scope of this paper. Theoretical contributions emphasising the interdependence of those two modes of entry are provided by Ferret (2003), Norback and Persson (2004), and Nocke and Yeaple (2004).

[16] To the extent that mergers across different industries are driven by vertical linkages they facilitate the development of international production networks and are likely to complement trade in a way similar to (vertical) greenfield investment (Markusen, 2002). Trade costs reduce the cost-saving potential of vertical mergers provided by international factor price differences. However, as stated in the previous section the

In addition to transport costs there may also be informational barriers which contribute to trade costs and thereby reduce a firm's private valuation of potential target firms (Portes and Rey, 2005). While, there does not seem to be any reason to believe that informational barriers affect horizontal and non-horizontal mergers differently, the presence of informational barriers provides a rationale for explaining why potential targets are not acquired.

Thus, we assume that a firm's private valuation depends on trade costs, either in the form of informational or transport costs. A firm will adjust its private valuation by:

$$-\alpha_1 \ln \tau_{kl} + \alpha_2 D_{ij} \ln \tau_{kl} \qquad (4)$$

where α_1 refers to the impact of information costs for non-horizontal mergers.[17] The second term interacts an indicator variable which equals one when an intended is horizontal ($i = j$), and zero otherwise ($i \neq j$) with trade costs. The second term gives the differential impact of trade costs across horizontal and non-horizontal mergers. A priori we would expect this to be positive under the "tariff-jumping" argument. The total impact of transaction costs on a bid leading to horizontal M&A is given by $-\alpha_1 + \alpha_2$.[18]

Using discrete choice theory it can be demonstrated that the probability that a potential acquiring firm g is prepared to pay the highest bid (expects the highest profits) for a potential acquiring firm h amongst competing potential acquirers is given by the following logit expression:

$$\frac{\exp[-(\alpha_1 - \alpha_2 D_{ij}) \ln \tau_{kl}]}{\sum_{i=1}^{I} \sum_{k \neq l}^{K} \exp[-(\alpha_1 - \alpha_2 D_{ij}) \ln \tau_{kl}]} \qquad (5)$$

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actual number of cross-industry mergers driven by input-output linkages is likely to be very small in practice. The majority of cross-industry mergers are likely to be conglomerate deals, which cannot be assumed to be related to trade costs in any systematic way.

[17] Possibly also transport costs when the merger is motivated by vertical linkages.

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The probability of a certain horizontal cross-border merger thus depends positively on trade costs, but negatively on the trade costs between the potential target and competing acquirers. The probability that any firm in industry i and country k will acquire any potential target in industry j and country l can then be derived by rewriting (5) and multiplying it by (2) to obtain:

$$P_{ijkl} = \frac{n_{ik} / \tau_{kl}^{(\alpha_1 - \alpha_2 D)}}{\sum_{i=1}^{I} \sum_{k \neq l}^{K} n_{ik} / \tau_{kl}^{(\alpha_1 - \alpha_2 D)}} \tag{6}$$

For a cross-border merger to actually occur the highest bid needs to be profitable, which is satisfied when the level of expected additional profits exceeds $-(\alpha_1 - \alpha_2 D_{ij}) \ln \tau_{kl} + \varepsilon$.

The expected number of bilateral cross-border M&A, m_{ijkl}, is then given by substituting (6) into equation (1):

$$m_{ijkl} = \frac{\rho_l n_{ik} n_{jl}}{\tau_{kl}^{(\alpha_1 - \alpha_2 D)}} \tag{7}$$

where $\rho_l = 1/(\sum_{i=1}^{I} \sum_{k \neq l}^{K} n_{ik} / \tau_{kl}^{(\alpha_1 - \alpha_2 D)})$ a multilateral index of trade costs. This is essentially an index of proximity of bidding teams for a given unit in industry j and country l. Head and Ries (2005) label this term therefore the bid potential. [19]

Thus, trade costs affect cross-border mergers in two ways. A direct effect captured by τ encourages tariff-jumping in the form of horizontal cross-border mergers and an indirect effect ρ which encourages horizontal cross-border mergers by competing acquiring firms.

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[18] As mergers are classified at the 4-digit level but the analysis is carried out at the 2-digit level the share varies between zero and unity for observations within the same 2-digit industry and always equals zero for observations across different industries.

[19] It also corresponds to the remoteness measure sometimes used in the trade and geography literature when we assume that $\alpha_1 - \alpha_2 D = 1$ (Helliwell, 1998). In a trade context, remoteness captures the set of alternative locations from which a country may import. The availability of nearby alternatives is important as it reduces its dependence on a particular closely located exporting country. For instance the amount of trade between Australia and New Zealand is likely to be much larger than that between the US and Canada, or two countries in continental Europe with similar sizes and distance.

In the Horn and Persson (2001) model, which assumes two countries, pre-emptive cross-border mergers are necessarily absent. Instead, their model allows for pre-emptive domestic mergers which become more attractive in the presence of high trade costs as these increase the rewards to market concentration. We do not allow for pre-emptive domestic mergers here as this would require modelling the degree of market concentration. This however becomes very complicated in a setting with more than two countries. The analysis presented by Horn and Persson (2001) suggests that our multilateral index of trade costs may also be considered a measure of foreign competition, and may therefore be related to domestic pre-emptive mergers. In our empirical model therefore we refrain from making any explicit comments as to whether the multilateral trade cost index role is related to competing cross-border or domestic bidders.

4. Empirical Methodology

Having provided a stylised theoretical model highlighting: i) the dual role of trade costs, and ii) the possibility that trade costs may affect horizontal and non-horizontal mergers differently, we now proceed with the empirical model, data issues and the econometric methodology.

In order to bring our model to the data we assume that the number of bidders in each industry is proportional to the size of its industry and log-linearise equation (7). Moreover, as we aggregate the data from the 4-digit US SIC classification to the 2-digit SIC classifications to keep computations manageable, we replace D_{ij} by the share of horizontal merger in total cross-border mergers, σ_{ij}. We thus obtain the following estimable model of the expected number of cross-border mergers (m) by acquirers in industry i in country k with target in industry j in country l at time t:[20]

$$\ln m_{ijklt} = \alpha_0 + \alpha_1 \ln Y_{ikt} + \alpha_2 \ln Y_{jlt} - \alpha_3 \ln \tau_{klt} + \alpha_4 \sigma_{ijkl} \ln \tau_{klt} + \alpha_5 \ln \rho_l \\ + \alpha_6 \sigma_{ijkl} \ln \rho_l + \varepsilon_i + \varepsilon_j + \varepsilon_k + \varepsilon_l + \varepsilon_t + \varepsilon_{ijklt}$$

(8)

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[20] This effectively represents a standard gravity model applied to cross-border M&A. Gravity models have had a long history in the empirical analysis of trade flows and, more recently, have also become popular in the analysis of foreign direct investment flows (e.g., Carr et al., 2001), equity capital flows (Portes and Rey, 2005) and M&A activity (e.g., Di Giovanni, 2005). While gravity models based on general equilibrium theory (Carr *et al.,* 2001) are conducted at the country level, the present analysis essentially adopts a partial equilibrium approach as it is conducted at the industry level.

where *Y* is the economic size of the industry in each country, ρ is the multilateral trade cost index of target country *l*, τ is a proxy for trade costs and $\sigma \ln \tau$, $\sigma \ln \rho$ are the interaction terms between the share of horizontal mergers over total mergers and bilateral trade costs and the multilateral trade cost index respectively. While the second interaction does not strictly come out of the theoretical model, the model does suggest that the impact of multilateral trade costs is likely to differ across horizontal and non-horizontal mergers.[21] We include a full set of acquisition industry, target industry, acquisition country, and target country dummies to control for time-invariant fixed effects. Industry-specific fixed effects may go some way to control for market structure, whereas country-specific fixed effects are included to control for differences in the institutional environments including taxation and merger policies. In addition, we include a full set of time dummies to control for global macro-economic influences and asset market bubbles. The last term ε_{ijklt} captures any remaining white noise. In order to deal with the fact that the log of zero is not defined we use *ln(n+1)* as the dependent variable in the Tobit estimations where *n* is the number of cross-border mergers.

A key econometric issue is how to account for zero observations. Whilst the full sample used for econometric analysis consists of more than half a million observations the majority of those are zero. In fact, the proportion of zero observations is much larger than in previous studies since the current analysis is conducted at the industry level. It, thereby, accounts for merger deals across industries as well as within industries and, hence, enlarges dramatically the number of possible cells compared to standard cross-country analyses of investment flows and industry/country level studies of trade flows.

In the majority of cases zero observations are not related to data availability, but reflect the optimal choice of profit maximising firms. Zero cross-border investment may be optimal for example in the presence of fixed cost to international investment (Razin et al., 2004). The zero observations can therefore be considered corner solution outcomes and should be addressed in what Wooldridge (2002) appropriately terms corner solution models, a subset of censored regression models. Recently, a number of papers that look at the value of trade or cross-border capital flows have explicitly taken account of zero observations. Di Giovanni (2005) and Felbermayr and Kohler (2004) use Tobit estimations to allow for the

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[21] Otherwise, we would have to assume that $\alpha_1 - \alpha_2 \sigma = 1$.

presence of the limited dependent variable. The latter paper is particularly interesting in that it explicitly adopts the corner solution model while embedding it in a compelling theoretical structure. We follow this approach in the present paper.[22]

We use three measures of trade costs: i) distance data which are obtained from CEPII, ii) the level of applied protection and iii) tariff data. The former two are time-invariant, whereas the latter is time-varying. Industry data are obtained from the OECD STAN database.

In a trade context distance has been interpreted as a measure of trade costs. While distance has often been used as proxy for both policy barriers and transport costs, recently, Portes and Rey (2005) have shown that distance may also proxy for informational barriers to international capital flows.

Data on the level of applied protection are obtained from a new dataset called Market Access Map (MAcMap), developed jointly by ITC (UNCTAD-WTO, Geneva) and CEPII (Paris). It provides detailed information on highly disaggregated bilateral applied tariff duties. The tariff data represent equivalent *ad valorem* tariffs taking into account *ad valorem* and non *ad valorem* tariffs, quotas, antidumping measures and preferential trade agreements. For a detailed description of this dataset see Bouët et al. (2004). As these data are only available for the year 2000 we assume that the level of protection is constant throughout the sample period.

As a robustness check we also use tariff data that come from the TRAINS database. The MAcMap database differs from the TRAINS database provided by UNCTAD by its more comprehensive treatment of preferential trade agreements and by proposing ad valorem equivalent calculations. It thus provides a unique resource that is well equipped to the analysis of applied protection at the disaggregated level.[23]

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[22] Note that for a number of transactions the deal value is missing in the dataset. In these instances the transactions were removed from the sample. Similar to Di Giovanni (2005) we assume that missing values are randomly distributed.

[23] The most obvious way to address to what extent trade policy affects cross-border M&A through its impact on trade costs is by including trade policy variables in the form of tariffs. Specifically, we use bilateral tariff data at the sectoral level to measure the tariff rate to which exports of good i from country k to country l are subjected. Adding tariffs as an explicit proxy for trade costs allows one to assess to what extent the differential effect of distance on horizontal and non-horizontal mergers is indeed driven by the presumed interdependence of trade and horizontal M&A. In order to assess to what extent non-horizontal mergers are

We estimate the model using data for 23 OECD countries and 19 manufacturing industries for the period 1990-2001. In order to enhance the manageability of the dataset we use 2-year averages except for the last year. This gives us 23 source countries * 22 target countries * 19 source industries * 19 target industries * 6 periods = 1,095,996 observations. The actual number of observations in the dataset is somewhat smaller due to the presence of missing values in the OECD STAN data.

5. Results

Table 3 presents the results obtained from estimating equation (8). The first set of regressions presents pooled tobit estimates. In the second set we include four full sets of dummy variables indicating acquisition industry, target industry, acquisition country, and target country. Each set reports the results for our three measures of trade costs: distance, the level of applied protection, and tariffs. As distance does not vary across industries, we account for the cross-sectional correlation across industries within country pairs by clustering (Moulton, 1990). This is of course not necessary for the specifications that concentrate specifically on the level of applied protection or tariffs, which are measured at the industry level.

We find that the number of mergers increases in both the market size of the acquisition and the target country. The statistically significant coefficients on the interaction terms of bilateral and multilateral trade costs indicate that the role of trade costs differs across horizontal and non-horizontal mergers. Broadly speaking, the impact of bilateral trade costs is more positive the higher the share of horizontal mergers in total mergers. This is taken as evidence that tariff-jumping motivations do play a role in explaining horizontal mergers. Multilateral trade costs, on the contrary, tend to reduce the number of cross-border mergers the higher the share of horizontal mergers. Thus, the more isolated a country is due to either its geographical location or policy barriers the more likely is it that a potential target is acquired by pre-emptive mergers, be they cross-border as our model or domestic as in Horn and Persson (2001). These results thus suggest that, in contrast to the suggestion raised in the literature, no opposing tendency exists between the market access and market power incentives to merge across borders. These results appear to be consistent across the three

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associated with re-exports back home we also include a tariff variable to measure the level of protection on good i from country l to country k.

different measures of trade costs. Quantitatively, however, there are some important differences across specifications.

Inclusion of the sets of dummy variables has both qualitative and quantitative consequences. Note that including a dummy for target country wipes out the effect of multilateral trade costs. This was of course to be expected and is not something to be concerned about. Controlling for the cross-sectional correlation within country pairs weakens our results. However, the results with clustered standard errors as well as our results with industry level trade costs clearly indicate that the cross-sectional correlation in the regressions using distance does not drive our main results.

The average effect of bilateral trade costs on cross-border M&A is given by the coefficient on τ plus the coefficient on the interaction term times the share of horizontal mergers in total mergers. The average value for the share of horizontal mergers is 0.32. As the quantitative effect of bilateral trade costs varies considerably across the three different measures of trade costs we will discuss them one by one. The average effect of distance ranges from -0.08 in the regressions without to -0.21 in the regressions with dummy variables. For the level of applied protection the average effect is between -4.95 and -1.95. Finally, the average effect of tariffs ranges from -0.006 and -0.001. Thus, on average the effect of bilateral trade costs on cross-border M&A is negative. While a negative effect of trade costs on cross-border capital flows has been found in most previous work (see for example, Carr et al., 2001; Portes and Rey, 2005; Di Giovanni, 2005), those studies are all conducted at the country level.

Alternatively, one may calculate the critical value of HMA at which the marginal effect of bilateral trade costs switches signs. For distance we observe that when the share of horizontal mergers in total mergers exceeds 0.82 (0.146/0.178) in the pooled regressions or 2.95 in the regressions controlling for industry and country specific effects. For the level of applied protection the critical value varies between 0.66 and 1.11. For tariffs the critical value is estimated to be in the range of 0.05 and 0.29. Of course, the share of horizontal mergers in total mergers cannot exceed unity. The results thus do not suggest that firms necessarily tariff jump in the presence of high bilateral trade costs, but that the effect of

bilateral trade costs becomes less negative for horizontal mergers. [24] A similar exercise could of course also be conducted for the role of multilateral trade costs, but does not yield any new insights.

Thus, using sectoral data we show that the effect of trade costs differs between different types of merger activity. More particularly, while the estimated effect of trade costs is negative for all types of mergers it is less negative for horizontal mergers.[25]

6. Conclusions

This paper analyses in detail the role of trade costs on bilateral cross-border M&As for 23 OECD countries over 1990-2001 using industry level data on merger activity and a new data source on with detailed information on the bilateral level of applied protection. In the aggregate, trade barriers have negative effects on cross-border M&A. An important finding of our paper is that the effect of trade costs differs depending on whether mergers are horizontal (i.e., with acquirer and target in the same industry) or whether they span different industries. This suggests that results based on aggregate data which do not distinguish these types neglect an important source of heterogeneity. The less negative effect on horizontal mergers provides support to the tariff-jumping argument put forward in the literature on the determinants of horizontal FDI.

Our findings may have important policy implications. The main findings in the paper that cross-border M&A respond negatively to trade costs in the aggregate and that the share of horizontal M&A increases in the level of trade costs provide an additional rationale for free trade. To the extent that horizontal mergers are less likely to be associated with productivity spillovers and more likely with anticompetitive behaviour freeing up trade not only increases the level of inward investment but also its composition in a way that is likely to benefit the economy. The trade regime might thus have important implications for

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[24] This is in contrast to the evidence provided by Tekin-Koru (2004), who uses firm level data on total merger activity and does not distinguish between horizontal and non-horizontal activities. Note that in the aggregate our results, like those by Tekin-Koru, point against the tariff-jumping argument. The present finding that the effect of distance is increasing in the share of horizontal mergers however is inconsistent with the theoretical prediction by Tekin-Koru and others of a negative relationship due to the impact of distance on the acquisition price.

[25] When replacing the log number of mergers with the log value of mergers as a robustness the general message remains unchanged.

attracting inward investment in terms of M&As, an issue that should be recognised by governments wishing to attract foreign investment.

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Table 1: Summary statistics M&A, 1990-2001

	Domestic M&A			Cross-border M&A		
	Non-Hor	Horizontal	Total	Non-Hor	Horizontal	Total
Number of deals						
1990/1991	55.36%	44.64%	6,281	70.15%	29.85%	2,161
1992/1993	58.01%	41.99%	7,575	69.24%	30.76%	2,123
1994/1995	53.58%	46.42%	10,245	68.16%	31.84%	2,921
1996/1997	53.73%	46.27%	13,760	66.82%	33.18%	3,668
1998/1999	53.19%	46.81%	17,586	67.91%	32.09%	5,042
2000/2001	59.46%	40.54%	13,557	68.75%	31.25%	5,319
Total	55.31%	44.69%	69,004	68.33%	31.67%	21,234
Average deal value (mln $)						
1990/1991	50.95	41.04	46.53	61.37	54.49	59.32
1992/1993	40.45	38.82	39.76	48.71	44.05	47.27
1994/1995	38.71	44.19	41.25	45.92	49.09	46.93
1996/1997	49.35	55.10	52.01	59.35	63.83	60.83
1998/1999	51.45	52.55	51.96	64.67	70.70	66.60
2000/2001	48.66	57.62	52.29	69.80	71.33	70.28
Total	47.31	50.23	48.61	60.53	62.48	61.15

Table 2: Summary Statistics M&A by Acquirer and Target Industry, 1990-2001

Acquirer\Target	Agr. & Mining	Man.	Trans.	Wholes.	Finance	Other services	Health & Edu.	Total
Agriculture & Mining	1205	194	79	61	53	46	34	1672
Manufacturing	269	6597	180	636	162	412	178	8434
Transportation & Public Util.	64	150	1246	50	43	176	31	1760
Wholesale	48	346	49	831	42	107	20	1443
Finance, Ins. & Estate	233	859	309	248	2260	499	108	4516
Other services	46	232	107	146	108	1931	136	2706
Health & Education	47	142	27	36	27	87	277	643
Total	1909	8514	2005	2009	2695	3258	784	21174

Government sector excluded.

Table 3: The number of cross-border mergers: Tobit regression results

	distance	distance$^{\#}$	protection	tariffs	distance	distance$^{\#}$	protection	tariffs
Y_k	0.285	0.285	0.31	0.187	0.495	0.495	0.484	0.418
	(0.009)	(0.040)	(0.010)	(0.010)	(0.046)	(0.057)	(0.046)	(0.053)
	***	***	***	***	***	***	***	***
Y_l	0.281	0.281	0.314	0.186	0.210	0.210	0.195	0.192
	(0.010)	(0.051)	(0.010)	(0.012)	(0.038)	(0.046)	(0.041)	(0.044)
	***	***	***	***	***	***	***	***
ρ	0.159	0.159	0.037	0.092	-0.166	-0.166	0.027	0.359
	(0.024)	(0.155)	(0.005)	(0.020)	(0.240)	(0.335)	(0.035)	(0.259)
	***		***	***				
τ	-0.146	-0.146	-6.957	-0.008	-0.236	-0.236	-3.78	-0.001
	(0.018)	(0.093)	(0.604)	(0.001)	(0.020)	(0.033)	(0.981)	(0.001)
	***		***	***	***	***	***	
$\rho*HMA$	-0.430	-0.430	-0.209	-0.352	-0.359	-0.359	-0.157	-0.282
	(0.017)	(0.040)	(0.003)	(0.006)	(0.020)	(0.034)	(0.003)	(0.005)
	***	***	***	***	***	***	***	***
$\tau *HMA$	0.178	0.178	6.289	0.028	0.080	0.080	5.734	0.022
	(0.023)	(0.048)	(0.980)	(0.004)	(0.026)	(0.050)	(1.372)	(0.005)
	***	***	***	***	***		***	***
Constant	-11.576	-11.576	-14.172	-9.701	-16.218	-16.218	-20.256	-11.709
	(0.465)	(2.343)	(0.317)	(0.451)	(2.300)	(2.871)	.	(4.104)
	***	***	***	***	***	***		***
Dummies: Acquisition industry	No	No	No	No	Yes	Yes	Yes	Yes
Target industry	No	No	No	No	Yes	Yes	Yes	Yes
Acquisition country	No	No	No	No	Yes	Yes	Yes	Yes
Target country	No	No	No	No	Yes	Yes	Yes	Yes
Observations	704668	704668	648626	584201	704668	704668	648626	584201
Uncensored	2108	2108	2016	1153	2108	2108	2016	1153
Left-Censored	702560	702560	646610	583048	702560	702560	646610	583048
Log	-11664	-11664	-10936	-6655.08	-9300.92	-9300.92	-8828.78	-5588.63

Likelihood Chi-Square	5747.9	2016.2	5470.24	3470.33	7155.11	10449.61	5946.08	3672.49

A full set of time dummies is included, all variables are in logs. Robust standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%, for industry i in acquisition country k, and industry j in target country l. # indicates that results are clustered by country pair.