Cross-Border Mergers and Acquisitions: On Revealed Comparative Advantage and Merger Waves

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Abstract

By combining two large data sets (on international trade flows and on mergers and acquisitions – M&As), we are able to test two implications of Neary's (2003, 2004a) recent theoretical work. Analyzing M&As in a General Oligopolistic Equilibrium (GOLE) model incorporating strategic interaction between firms in a general equilibrium setting, we argue that: (i) M&As follow revealed comparative advantage as measured by the Balassa index, and (ii) M&As come in waves. We find convincing support for both hypotheses, thus showing for the first time that there is an empirical connection between export performance and mergers and acquisitions.

JEL Code: F10, F12, L13.

Keywords: comparative advantage, cross border mergers and acquisitions, merger waves, general oligopolistic equilibrium model.

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1 Introduction

Cross border mergers and acquisitions (M&As) are the main force behind the surge in foreign direct investment. Yet despite its obvious quantitative importance, the reasons for cross border M&As are not well-understood. Following Neary (2004a) various motives for M&As can be distinguished in general. In the Industrial Organization (IO) literature two basic motives stand out: an efficiency motive and a strategic motive. Efficiency gains arise because takeovers increase synergy between firms that increase economies of scale or scope. Furthermore, from a strategic perspective M&As might change the market structure and as such have an impact on firm profits, which might even be reduced to zero (this is the so-called 'merger paradox', Salant et al., 1983).[2]

The problem with these explanations is that they are based on *partial equilibrium* models and do not deal explicitly with *cross-border* M&As. The partial modeling of M&As provides fundamental, but also limited understanding of this form of takeover, as *cross-border* mergers are most likely related to economy-wide shocks such as economic integration, changes in the legal and regulatory environment, or possible asymmetric business cycles. Factors like these change the position of one country relative to another, and point in the direction of standard trade theories rather than to the more partial oriented IO models. The standard general-equilibrium trade theories, however, are not equipped to explain M&As as these often assume symmetric (representative) firms. This precludes strategic interaction between firms. This not only holds for the neo-classical perfect competition models, but also for the models based on increasing returns to scale and monopolistic competition. The latter is forcefully brought forward by Neary (2004a,b), but also by the founding fathers of the second monopolistic competition revolution themselves – Avinash Dixit (2004) and Joseph Stiglitz (2004).

The model developed by Neary (2003, 2004a) combines general-equilibrium trade theory with imperfect markets and strategic behavior between firms. This is difficult, because pricing decisions of large firms not only directly affect profits, but their

[2] This result can be understood as follows. In a symmetric Cournot setting a merger initially increases industry concentration and therefore industry profits (the merging firms tend to reduce output in order to increase profits). In a Cournot setting, however, competitors react by increasing output, which harms the firms involved in the merger and the final result is that the merger has no effect whatsoever. As usual, strategic outcomes depend on the type of strategic interaction, form of demand schedules, and of the type of game that is played (see Neary, 2004).

market (pricing) behavior also affects national income and the real income of their customers. Furthermore, large firms could also influence factor prices. All these effects combined imply that firms have to *"…calculate the full general equilibrium of the whole economy in making decisions"* (Neary, 2003, p. 249).

Neary's (2003) General Oligopolistic Equilibrium (GOLE) model avoids some of the standard pitfalls of modeling oligopolistic markets, but simultaneously allows for strategic interaction between firms. Interestingly, by allowing for M&As in this model one can derive straightforward hypotheses on cross-border M&As, based on comparative advantage. Firms that have a comparative, and thus a cost, advantage have an incentive to merge or acquire a firm that is less strong. If these cost differences are economy-wide, the model explains cross-border M&As. Furthermore, the model also explains the stylized fact of M&A waves. An initial M&A makes the next one more attractive, which leads to M&A waves.

The aim of our paper is to test (i) whether or not comparative advantage indeed explains the direction of M&As, and (ii) whether or not we observe M&As waves. To do so, we combine two large data sets: the bilateral trade data compiled by Feenstra et al. (2005) and the Global Mergers and Acquisitions database of Thomson Financial Securities Data. Both hypotheses above are supported by the data: M&As follow comparative advantage and current M&As are determined by past M&As.

The paper is organized as follows. Section 2 describes some stylized facts on cross-border M&As. Section 3 reviews the model developed by Peter Neary and highlights the two main hypotheses tested in this paper. Section 4 discusses and describes the two data sets. Section 5 presents our empirical findings and section 6 concludes.

2 Cross-border mergers and acquisitions: some facts

Table 1 shows that cross-border M&As constitute a main vehicle for FDI, especially for FDI flows to developed countries. Also, if one looks at cross-border M&As as a share of total M&A activity, it is clear that cross-border M&As are quite important. During, for instance, the period 1987-1999, which captures most of the so-called 4th and 5th merger wave, in terms of both the value and the number of the transactions, cross-border M&As, on average, made up for about 25-30% of total M&A activity

(Schenk, 2002). As Table 1 suggests, cross-border M&As are particularly relevant within the group of developed countries. OECD data show that, measured as a share of their national GDP, the UK and the Netherlands, followed by Germany and France, are the leading countries in cross-border M&As. Firms from these countries are most active in acquiring (stakes in) firms in other countries. At the peak of the 5th merger wave in the late 1990s, for instance, cross-border M&As (as a percentage of GDP) were 16.3 in the UK and 13.7 in the Netherlands.

Table 1 Cross-border M&A investments (percent of FDI inflows to the host countries)

	1987-91	1992-94	1995-97	1998-2001
World	66.29	44.75	60.18	76.23
Developed countries	77.49	64.93	85.39	88.96
Developing and transition economies	21.94	15.49	25.79	35.74

Source: Barba-Navaretti and Venables (2004, p.10).

To date, the best and most extensive data source for M&As is the *Global Mergers and Acquisitions* database of *Thomson Financial Securities Data* (Thomson, hereafter). Thomson gathers information on M&As exceeding 1 million US dollar. Its main sources of information are financial newspapers and specialized agencies like Bloomberg and Reuters. Our Thomson data set begins in 1979 and ends in April 2005. It should be kept in mind that until the mid-1980s Thomson focused very much on M&As for the USA only, and it is only for about the last 20 years that (systematic) M&A data gathering took place for other (developed) countries. For more information on the specifics of the Thomson data set we used for our analysis, see section 4.

Gugler, Mueller, Yurtoglu, and Zulehner (2003) use the Thomson M&A data base for the period 1981-1998 and provide the summary statistics on which Table 2 is based. For each country (group) Table 2 gives the number of M&A deals, the average deal value (in millions of US $) and the percentage of cross-border M&As. Table 2 illustrates the dominant position of the USA in terms of the number of M&A deals (which is partly a reflection of the US-bias in the Thomson data set). At the same time it is clear that for cross-border M&As, Continental Europe and the UK outstrip the USA. The relatively high share of cross-border M&As in Europe reflects the fact that the process of European economic integration has stimulated cross-border M&A activity. The relative importance of cross-border M&A is even larger for Japan, but the overall number of deals is rather low. Gugler et al (2003) also show for their sample that on average the profit rate of the acquiring firm is *higher* than for the target firm (which can be interpreted as evidence for productivity differences). The main point is that cross-border M&As make up a large part of total M&A activity. A similar conclusion is reached by Rossi and Volpin (2004), who use the cross-border M&A ratio, the percentage of completed M&A deals in which the acquirer is from a different country than the target. For their sample of 49 countries (based on the Thomson data set), the cross-border ratio is on average about 43 percent.

Table 2 Summary statistics on M&As for selected countries, 1981-1998

	Number of deals (thousands)	Average deal value (million US $)	Percent cross-border
USA	21.148	246.7	10.6
UK	4.717	158.3	29.9
Continental Europe	9.595	285.9	33.5
Japan	0.646	464.9	52.6
Australia / New Zealand / Canada	3.232	156.0	30.0
Rest of the World	5.262	128.3	28.5

Source: Gugler, Mueller, Yurtoglu, and Zulehner (2003), p. 633-634

Finally, there is one important stylized fact as to the development of M&A activity over time: they come in waves. It is common to distinguish between five merger waves during the 20th century, three of which are recent (Andrade, Mitchell, and Stafford, 2001). The 3rd wave took place in the late 1960-early 1970s, the 4th wave ran from about the mid 1980s until 1990, and the 5th wave started around 1995 and ended in 2000 with the collapse of the "New Economy". Merger waves are very much (positively) correlated with increases in share prices and p/e ratios and with the overall business cycle in general. When one sticks to standard M&A motives, like the efficiency argument, it is rather difficult to explain the synchronicity of M&As. Interestingly, Gugler, et al. (2004) find that merger waves can be understood if one acknowledges that M&As do *not* boost efficiency and hence do not increase shareholders' wealth, but instead find that M&A waves are best looked upon as the result of overvalued shares and managerial discretion. In section 4 we will see if, just like the theoretical model predicts, M&A waves are also present in the data when one only looks at cross-border M&As. For the case of the USA and restricting their sample to firms that are publicly traded, Andrade et al. (2001) show that with each merger wave the value of the M&A deals (measured by firms' market capitalization) increases strongly. Merger waves in Europe seem to follow those in the USA with a short lag, and until the most recent (completed) merger wave, the number and value of M&A deals during these waves fell short compared to those in the US counterpart. But during the 5th merger wave, European firms engaged in a number of (mega) M&As with the cross-border take-over of Mannesmann (Germany) by Vodafone (UK) for 172 billion US$ in 2000 as to date the largest M&A in Europe. These facts are clearly interesting, but they do not tell us much about the motives for M&As. The next section therefore presents a model explaining cross-border M&As.

3 A model of mergers and acquisitions: GOLE

In this section we give a brief description of the GOLE model and formulate the central hypotheses we like to test.[3] We distinguish between two countries: Home and Foreign, where an asterisk denotes Foreign variables when appropriate. Suppose there is a continuum of markets indexed by $z \in [0,1]$ in which there are n domestic firms with unit costs $c(z)$ under Cournot competition (and thus n^* foreign firms with unit costs $c^*(z)$).[4] Consumers maximize preferences subject to a budget constraint, see equation (1), where U is utility, I is income, $p(z)$ is the price of good z, and $\bar{x}(z)$ is the demand for good z. If we let λ denote the marginal utility of income (the Lagrange multiplier), then $p(z) = (1/\lambda)[\bar{a} - \bar{b}\,\bar{x}(z)]$ gives the demand for good z in Home. The quadratic specification allows perfect aggregation over different countries, so the simple total demand function is given in (2), where $x(z) \equiv \bar{x}(z) + \bar{x}^*(z)$, $a \equiv (\bar{a} + \bar{a}^*)/(\lambda + \lambda^*)$, and $b \equiv \bar{b}/(\lambda + \lambda^*)$. Note that firms are large in their own sector, where they behave strategically, but small relative to the economy as a whole.

3 A complete description and derivation of the model is given in Neary (2003, 2004).

4 For now we take the unit costs as given, but they are determined in general equilibrium. There are no fixed costs of production as these provide a well-known incentive for M&As.

(1) $\max U = \int_0^1 \left[\bar{a}\,\bar{x}(z) - (1/2)\bar{b}\,\bar{x}(z)^2 \right] dz$; s.t. $\int_0^1 p(z)\,\bar{x}(z)\,dz \leq I$

(2) $p(z) = a - b\,x(z)$

The first order condition for profit maximization for a firm active in sector z is equal to: $p(z) - c(z) = b\,y(z)$, where $y(z)$ is the firm's supply. From this it follows directly that the firm's profits, π say, are proportional to the square of output $\pi = b\,y(z)^2$. In equilibrium, the output for domestic and foreign firms will depend on the number of competitors, the unit costs, and the parameters. Using the first order conditions and equating total supply and demand in the market we can determine a firm's output:[5]

(3) $y(n, n^* | c, c^*, a, b) = \dfrac{(n^*+1)(a-c) - n^*(a-c^*)}{b(n+n^*+1)}$

Figure 1. Comparative advantage and production

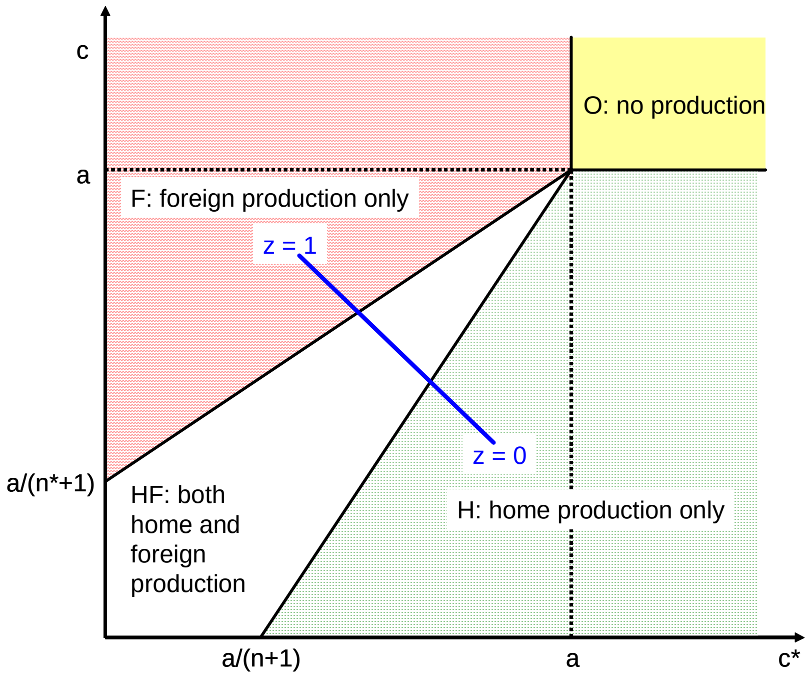


Figure 1 summarizes the situation in a two country setting for all markets. The axes depict marginal costs in both countries. From (3) we see that domestic firms have a positive output level only if their costs are below a weighted average of the demand intercept and the foreign firm's costs: $c < \xi_0 a + (1-\xi_0)c^*$, with $\xi_0 \equiv 1/(1+n^*)$. This

[5] Similarly for a foreign firm, of course.

condition divides the cost area in Figure 1 in four regions. If costs are too high for both firms, there is no production (area O). If domestic costs are much higher than foreign costs, only foreign firms will produce (area F). If foreign costs are much higher than domestic costs, only domestic firms will produce (area H). If domestic and foreign costs are neither too high or too different, both domestic and foreign firms will produce (area HF). Comparative advantage is most easily incorporated using a Ricardian model based on Dornbusch et al. (1977). If labor is the only input and $\alpha(z)$ is the unit labor requirement in sector z, unit costs are simply given by $c(z) = w\alpha(z)$, where w is the wage rate. If we now rank the sectors such that the Home country is efficient in sectors with a low value of z, as indicated by the zz-line in Figure 1, the domestic firms will be the only producers for low values of z, both countries will be active for intermediate values of z, and the foreign firms will be the only producers for high values of z.[6] The cut-off values will be determined in general equilibrium by the labor market clearing conditions. Note in particular that the zz-line will shift in response to changes in the wage rates.

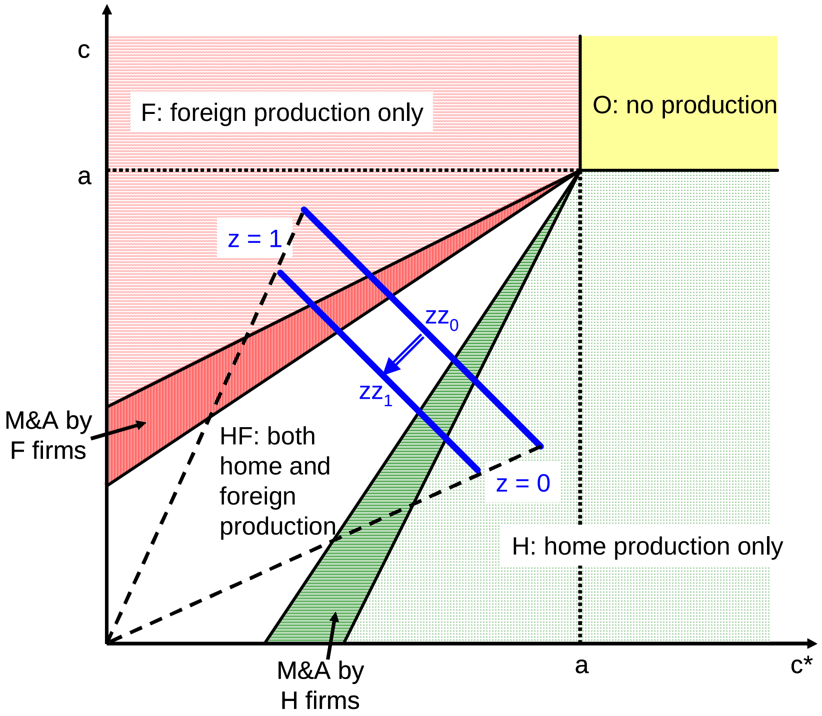
We can now analyze the profitability of mergers and acquisitions within this model. Let "1" and "0" indicate the *post*- and *pre*-merger situation, respectively. Then the gain of taking over a Home firm, G_H say, for a foreign firm is given by:

(4) $$G_H = \left[\pi_1^*(n-1, n^*|.) - \pi_0^*(n, n^*|.)\right] - \pi_0(n, n^*|.) > 0$$

The first term (in square brackets) relates to the gain in profitability from reduced competition by taking over the domestic firm. The second term indicates the cost of acquiring the domestic firm, equal to compensating the owners for their profit loss. Since the cost of acquiring the domestic firm is small if this firm has high costs, leading to a low output and profit level (see equation 3), it pays to take over a domestic firm if you have a cost advantage. On the other hand, the cost advantage should not be too big, because otherwise there are no active foreign firms to take over. Neary (2004a) therefore shows that M&As take place at the borders of the FH area in Figure 1, enlarging the areas in which only domestic or only foreign firms are active.

[6] Note that the zz-line could be a curve instead of a line, but this is not material to our discussion.

Figure 2 Comparative advantage and M&As



It turns out that (4) holds if domestic costs are above a weighted average of the demand intercept and the foreign costs: $c > \xi_1 a + (1-\xi_1)c^*$, with $0 < \xi_1 < \xi_0$.[7] This determines the shaded areas in Figure 2 where it is profitable to take over other firms, namely if stronger firms take over not too-weak firms. For ease of exposition the general equilibrium consequences of allowing for M&As are illustrated for two symmetric countries in Figure 2. The zz_0 line indicates the distribution of costs and sectors at the initial trade equilibrium, before M&As are possible. Once these are allowed, the M&As cause profits to increase and the demand for labor and the wage rate to fall. This leads to the inward shift of the zz curve from zz_0 to zz_1. Evidently, this general equilibrium effect influences the range of firms actually taken over and the distribution of sectors specializing either completely or incompletely, but it does not change any of the main implications of the model. Since the (strong) acquiring firms have cost advantages and are exporters, we will identify them by the popular notion of revealed comparative advantage frequently used in the empirical international trade literature, which brings us to:

[7] $\xi_1 \equiv \dfrac{\left[2nN + (n^*+1)(N^2-1)\right] - \left[2(n+1)N + n^*(N^2-1)\right]}{\left[2nN + (n^*+1)(N^2-1)\right]}$; $N \equiv n + n^*$, see Neary (2004).

Hypothesis 1

Acquiring firms operate in sectors with a higher revealed comparative advantage.

This hypothesis, based on the work of Peter Neary, is new and it is tested here for the first time. Our second hypothesis involves the phenomenon of mergers waves. It is already well-established empirically, see for example Evenett (2003), and there are alternative theoretical explanations for this phenomenon, see, for example, Gorton, Kahl, and Rosen (2005) who argue that a technological or regulatory change can induce a preemptive wave of defensive acquisitions.[8] Within the Neary framework, the crucial point to note regarding equation (4) on the profitability of M&As is: (i) that non-participating firms also benefit from the takeover through a reduction of competition, and (ii) an M&A increases the profitability, and thus attractiveness, of the next M&A. This leads to a 'wait and see' or 'after you' effect which Neary, using a game-theoretic setting, translates into a theory of merger waves.

Hypothesis 2

Mergers and acquisitions come in waves.

4 Confronting the cross-border M&A data with trade data

4.a M&A characteristics

The Thomson data set allows us to analyze Mergers & Acquisitions (M&As) for a large range of countries and years. After some preliminary investigations, we decided to restrict our analysis to cross-border merger deals in the period 1980 – early 2005 for five rather active countries, varying in size and geographic location, namely Australia, France, the Netherlands, the United Kingdom, and the United States (see section 2).[9] This resulted in 11,721 observations, or about 28.5 per cent of all cross border M&As, as summarized in Table 3. The USA was the most active country (40.3 percent of the acquisitions and 43.7 percent of the targets), closely followed by the UK (39.5 and 27.6 percent, respectively). Note that cross-border M&As with acquirer

[8] Fridolfsson and Stennek (2005) argue that M&As may reduce profits if being an 'insider' is better than being an 'outsider'. In general, they show the difficulty of accurately estimating M&A profits.

[9] At this stage we included all cross border M&As with a value above $1 million between 1 January 1979 and 4 April 2005 where the acquirer and target were located in one of the countries above. For this period the Thomson data set gives a total of 159,791 completed M&A deals. Of these deals a total of 41,106 are cross-border M&As. Restricting the cross-border M&As for both acquirer and target firm to only apply for the USA, UK, The Netherlands, Australia, and France finally gives the 11,721 observations on cross-border M&As used in our analysis.

and target located in the same country are possible, for example when an American firm takes over another American firm that is active abroad. About 48 per cent of M&As can be classified as horizontal M&As at the 2-digit level. In most cases the M&A is a complete takeover (72.4 percent) or results in a complete takeover (76.8 percent). The distribution is very skewed and very close to a log-normal distribution, with a mean value of $186 million and a median value of $20 million.

Table 3 Overview of mergers and acquisitions; all sectors, 1980-2005

		Acquirer					
		AUS	FRA	USA	GBR	NLD	sum
# of M&As							
Target	AUS	562	23	388	351	26	1,350
	FRA	14	223	425	608	74	1,344
	USA	231	310	2,136	2,229	213	5,119
	GBR	137	249	1,602	1,095	154	3,237
	NLD	13	52	178	351	77	671
	sum	957	857	4,729	4,634	544	11,721
per cent							
	AUS	4.8	0.2	3.3	3.0	0.2	11.5
	FRA	0.1	1.9	3.6	5.2	0.6	11.5
	USA	2.0	2.6	18.2	19.0	1.8	43.7
	GBR	1.2	2.1	13.7	9.3	1.3	27.6
	NLD	0.1	0.4	1.5	3.0	0.7	5.7
	sum	8.2	7.3	40.3	39.5	4.6	100

Horizontal M&As (2-digit sic level):		5,628	(48.0%)
100 % acquired in M&A		8,487	(72.4%)
100 % owned after M&A		9,007	(76.8%)
Value of transaction (million $):	mean		186.17
	median		20.00
	maximum		60,286.67

4.b Concordance

Since we want to investigate to what extent (revealed) comparative advantage (as measured by the Balassa index) affects M&As, we have to make a connection between the sectors as identified by SIC code in the Thomson data base and trade data which allows us to calculate the Balassa index. For the latter, we use the database from Feenstra *et al.* (2005), which provides trade data between countries by commodity, classified by SITC (revision 2) code at the 4-digit level of detail.

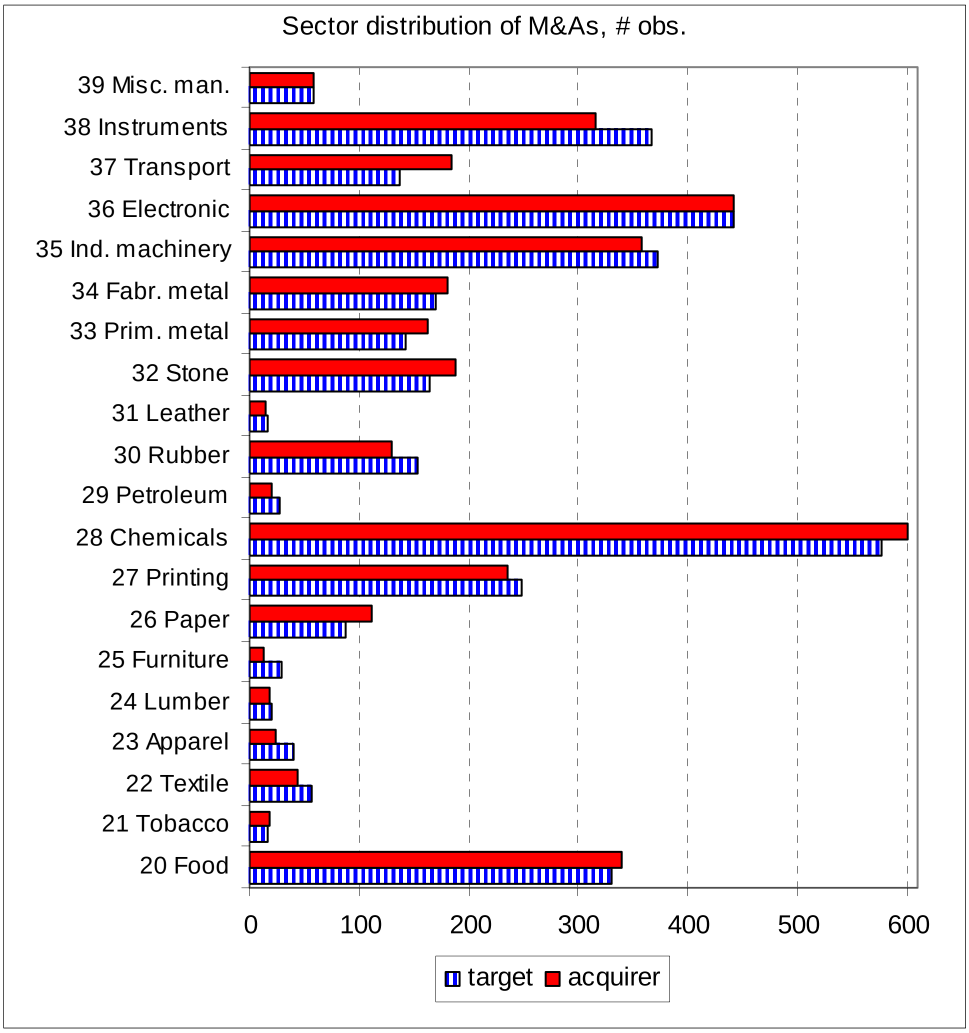
Table 4 Overview of M&As; concordance subset (I'), 1980-2005

		Acquirer					
		AUS	FRA	USA	GBR	NLD	sum
# of M&As							
Target	AUS	106	3	85	64	3	261
	FRA	3	54	160	185	14	416
	USA	56	112	624	832	71	1,695
	GBR	21	74	497	252	34	878
	NLD	3	14	67	113	15	212
	sum	189	257	1,433	1,446	137	3,462
per cent							
	AUS	3.1	0.1	2.5	1.8	0.1	7.5
	FRA	0.1	1.6	4.6	5.3	0.4	12.0
	USA	1.6	3.2	18.0	24.0	2.1	49.0
	GBR	0.6	2.1	14.4	7.3	1.0	25.4
	NLD	0.1	0.4	1.9	3.3	0.4	6.1
	sum	5.5	7.4	41.4	41.8	4.0	100

Horizontal M&As (2-digit sic level):		2,234	(64.5%)
100 % acquired in M&A		2,833	(81.8%)
100 % owned after M&A		2,987	(86.3%)
Value of transaction (million $):	mean	175.93	
	median	22.50	
	maximum	27,223.95	

As a first step, a concordance between SITC rev. 2 and the international industrial classification ISIC rev. 2 is applied.[10] This step results in trade data classified by sector at the 4-digit level of detail for manufacturing industries. The next step is to apply a concordance between ISIC rev. 2 and the SIC87 industrial classification, which is the classification used in the Thomson mergers & acquisitions database. This concordance, from 3-digit ISIC rev. 2 industries to 2-digit SIC87 industries, is based on a matching of industry names. Since SIC87 was initially derived from ISIC rev. 2, this matching was fairly straightforward.[11]

Figure 3 Sector distribution of M&As, concordance subset I'*, 1980-2005*



The figure gives brief sector descriptions only; see Table 1 for details.

[10] For this concordance, see: http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/Concordances/FromSITC/sitc2.isic2.txt

[11] This concordance is available upon request.

The above exercise results in 20 2-digit SIC sectors for which we have reliable trade data (and thus information on revealed comparative advantage) available. A complete list of countries and SIC-sectors in our sample can be found in Appendix I. Finally, we restricted our set of M&A observations to those 2-digit sectors for which both acquirer and target are an element of the concordance subset (I'), see 4.c below. This reduced the number of observations to 3,462, with the summary information as given in Table 4. Note that, as a result of this restriction, the share of horizontal M&As increased substantially (from 48.0 to 64.5 percent), as did the share of complete takeovers (from 76.8 to 86.3 percent complete ownership after the M&A). There is very little effect on the value distribution of M&As (which is still log-normal).

Figure 3 depicts the distribution of the number of M&As over the various sectors of the concordance subset I'. In general, the correlation for a sector is high, which is not too surprising in view of the high share of horizontal M&As. The most active sectors were SIC 28 (Chemicals), SIC 36 (Electronics), SIC 35 (Ind. machinery), SIC 38 (Instruments), and SIC 20 (Food).

4.c Balassa index characteristics

Let $X_{i,t}^{j}$ denote the value of exports of sector $i \in I$ from country $j \in J$ in period $t \in T$. Then the Balassa index $BI_{i,t}^{j}$ of revealed comparative advantage is defined as

$$(7) \qquad BI_{i,t}^{j} \equiv \frac{X_{i,t}^{j} / X_{t}^{j}}{X_{i,t} / X_{t}}; \quad where\ X_{t}^{j} \equiv \sum_{i} X_{i,t}^{j};\ X_{i,t} \equiv \sum_{j} X_{i,t}^{j};\ X_{t} \equiv \sum_{i}\sum_{j} X_{i,t}^{j}$$

If $BI_{i,t}^{j} > 1$, indicating that sector *i*'s share in country *j*'s exports in period *t* is larger than in the group of reference countries J, country *j* is said to have a *revealed* comparative advantage in sector *i*. We have annual observations available for the period 1980-2000. Our group of reference countries J consists of the OECD countries. The core of our paper analyzes a subset of data, consisting of 20 2-digit SIC sectors ($I' \subset I$) and 5 individual OECD countries ($J' \subset J$), see Appendix I.[12]

[12] Note that, when calculating the Balassa index for the respective sub-groups, we do include all exports of goods and services for an individual country (sectors *I*) and relate this to the exports of all reference countries (OECD countries *J*), see equation (7).

Table 5 Summary information for Balassa index (BI), 1980 - 2000

a. Benchmark

Statistic	All	AUS	FRA	NLD	GBR	USA
# Observations	2,100	420	420	420	420	420
Mean	0.94	0.85	0.89	1.03	0.96	0.98
Median	0.79	0.33	0.82	0.72	0.87	0.91
Variance	0.59	1.37	0.14	0.87	0.30	0.25
Minimum	0.00	0.00	0.19	0.12	0.12	0.14
Maximum	6.44	6.44	2.06	5.62	3.09	2.87
# BI >1	676	98	164	104	139	171
Share BI > 1 (%)	32.2	23.3	39.0	24.8	33.1	40.7

b. M&A acquirer

Statistic	All	AUS	FRA	NLD	GBR	USA
# Observations	3,462	189	257	137	1,446	1,433
Mean	1.08	1.24	1.06	1.10	1.04	1.10
Median	1.00	0.77	1.13	0.89	0.98	1.01
Variance	0.19	1.34	0.10	0.39	0.11	0.11
Minimum	0.01	0.01	0.29	0.13	0.16	0.19
Maximum	6.44	6.44	1.75	3.89	2.58	2.48
# BI >1	1,783	61	150	48	673	851
Share BI > 1 (%)	51.5	32.3	58.4	35.0	46.5	59.4

c. M&A target

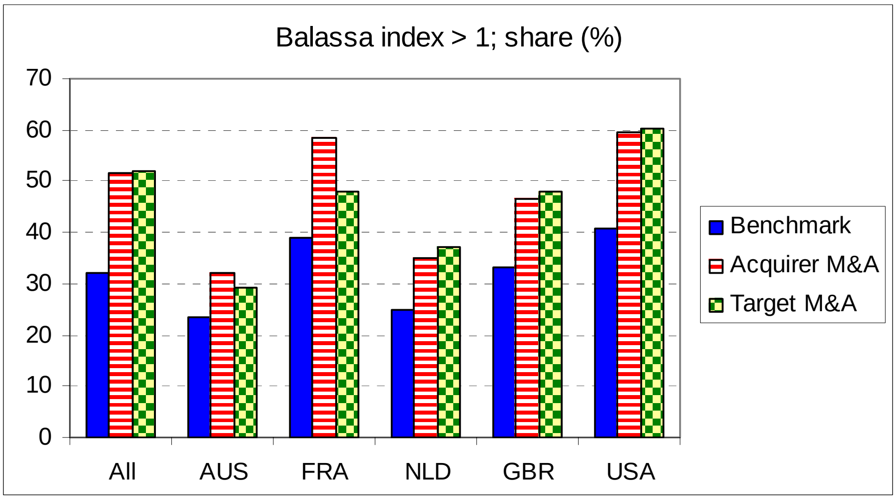
Statistic	All	AUS	FRA	NLD	GBR	USA
# Observations	3,462	261	416	212	878	1,695
Mean	1.08	1.12	1.00	1.14	1.04	1.11
Median	1.00	0.71	0.96	0.90	0.99	1.03
Variance	0.24	1.29	0.11	0.62	0.12	0.12
Minimum	0.00	0.00	0.29	0.12	0.15	0.15
Maximum	6.44	6.44	1.75	5.62	2.43	2.54
# BI >1	1,800	76	200	79	421	1,024
Share BI > 1 (%)	52.0	29.1	48.1	37.3	47.9	60.4

For M&A acquirer and target in the period 2001-2005 the (most recent) BI of 2000 was used.

Table 5 provides summary statistics on the distribution of the Balassa index for the five countries separately and combined for three different data selections, namely (a) the benchmark distribution for all sectors in our data set for all years, (b) the distribution of the Balassa index for the acquirer of an M&A, and (c) similarly for the target of an M&A. A few observations on these statistics can readily be made.

- *The distribution differs per country*. The benchmark median for the USA (0.91), for example, is almost three times that for Australia (0.33). Similarly, the benchmark share of sectors with a Balassa index above 1 is higher for the USA (40.7 percent) than for Australia (23.3 percent) and the Netherlands (24.8 percent).
- *The Balassa index is higher for the acquirer than the benchmark*. For each individual country and for the group as a whole, the mean, median, and the share of sectors with a Balassa index above 1 is higher for the M&A acquirer distribution than for the benchmark distribution.
- *The Balassa index is higher for the target than the benchmark*. Again, for all countries the mean, median, and the share of sectors with a Balassa index above 1 is higher for the M&A target distribution than for the benchmark distribution.

Figure 4 Relationship between M&As and revealed comparative advantage

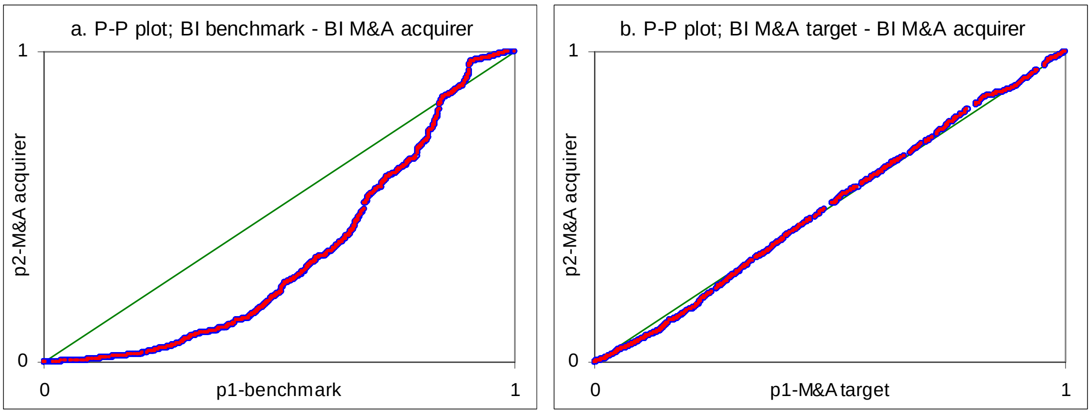


These findings are illustrated for the share of sectors with a Balassa index above 1 in Figure 4. Note that the Balassa index appears to be higher for both acquirer and target. To some extent this represents a problem for the above theory as the acquirer is thought to be a more efficient firm than the target. To some extent this is in line with the above theory, as the difference between the acquirer's and the target's efficiency should not be too large. As we argue below, the distributions do not differ significantly between acquirer and target, so we follow the convention of focusing on the acquirer's perspective in the sequel.

The disadvantage of focusing on a few summary statistics, as given in Table 5, is that it ignores the majority of the information available in the underlying distribution functions. Although these distributions of the Balassa index for the individual countries and the group as a whole are not known, we can apply the distribution-free Harmonic Mass index procedure developed by Hinloopen and van Marrewijk (2005) to test formally if any pair of distribution functions is identical.[13] With a 5 per cent significance level, this leads to the following formal conclusions (see Appendix II):

- The benchmark distribution *differs significantly* from the M&A acquirer and target distributions, both in the aggregate and for individual countries.
- The M&A acquirer distribution does *not* differ significantly from the M&A target distributions, both in the aggregate and for individual countries, with the exception of France.
- The distributions for individual countries differs significantly, with the exception of France – USA in the benchmark.

Figure 5 Comparison of comparative advantage distributions, 1980-2005

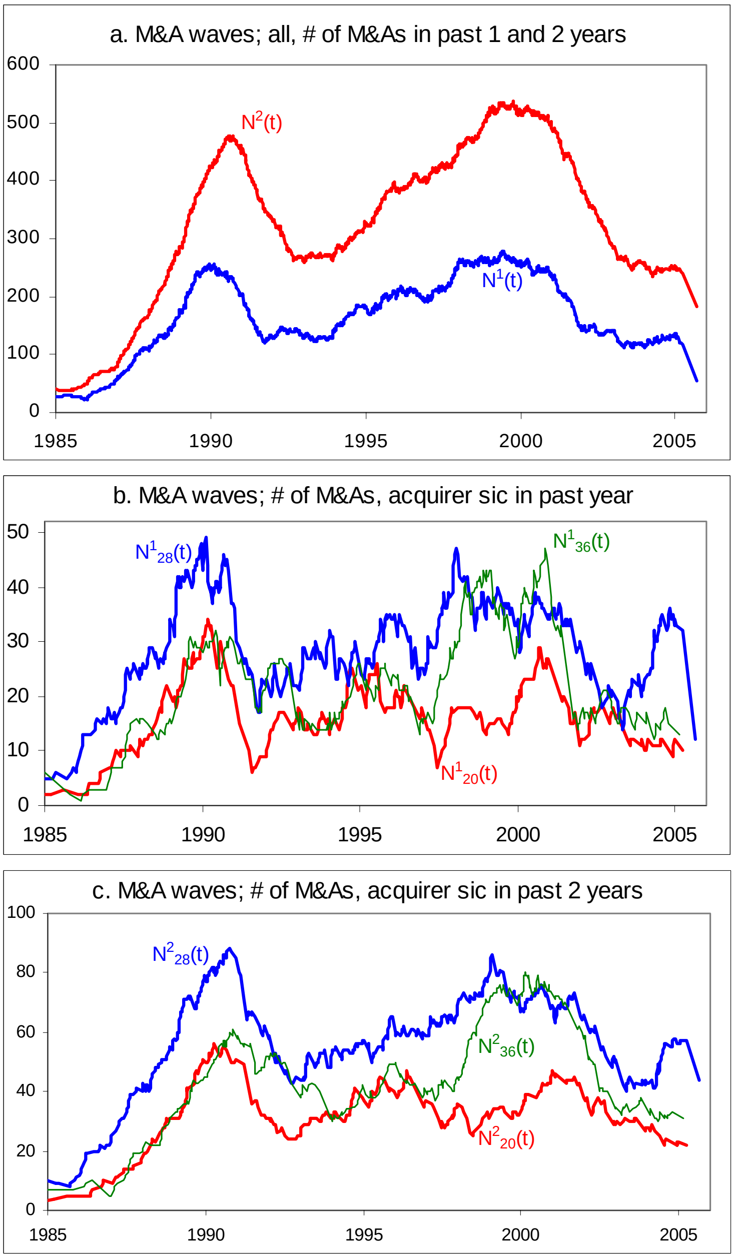


These conclusions are illustrated for the aggregate distributions in Figure 5 using P-P (probability – probability) plots, a method for comparing distribution functions used as the basis for the Harmonic mass index which, if the underlying distributions are identical, results in a plot coinciding with the diagonal. Clearly, the deviation between

[13] They also explain the advantages of this procedure over the more commonly used Mann-Whitney-Wilcoxon test.

the plot and the diagonal is large if we compare the benchmark with the acquirer's distribution and small if we compare the acquirer's and the target's distribution.

Figure 6 M&A waves



4.c Waves

To get a first indication of M&A waves, we let $N_i^k(t)$ denote the number of M&As in sector $i \in I'$ in the k year period immediately preceding continuous time t (for all countries $j \in J'$ combined). We denote their sum by $N^k(t)$, that is $N^k(t) \equiv \sum_{i \in I'} N_i^k(t)$. Figure 6a depicts the evolution over time of $N^1(t)$ and $N^2(t)$, that is the number of M&As in the previous one and two years, respectively. There have been two clear waves for all sectors combined, namely around 1990-1991 and around 1999-2001 (this is most evident over a two-year period). Figures 6b and 6c, similarly, depict the evolution over time within a one-year and two-year period for some individual sectors from the acquirer's perspective.[14] Although the sector peaks coincide largely with the aggregate peaks around 1990 and 2000, there are also sector-specific peaks, for example at the end of 2004 for sic 28 (Chemicals and allied products) and around 1995-1996 for sic 20 (Food and kindred products).

5 Empirical results

To test the theoretical model outlined above from the acquirer's perspective, we analyze the number of M&As undertaken by firms in a specific country and sector for the period 1980-2004. As there are 5 countries, 20 sectors, and 25 years, this leads to a total of 2,500 observations. Taking country- and sector-specific effects into account, our focus is on the impact of revealed comparative advantage as measured by the Balassa index and the idea that M&As come in waves. Our dependent variable is a discrete counting variable (the number of M&As in a specific country and sector in a given year) such that we can use the Poisson regression model (Greene, 2003), where it is assumed that M&As follow a Poisson distribution:

$$(8) \qquad \text{Prob}(\#\, of\ \ M\ \&\ As = k) = \frac{\exp(-\lambda)\lambda^k}{k!}, \quad where\ E(M\ \&\ A) = \lambda, \text{var}(M\ \&\ A) = \lambda$$

The model specifies the – conditional – mean as $\exp(\beta' x_i)$, where the x_i are the explanatory variables (and the βs semi-elasticities). The Poisson model, however, imposes the restriction that the conditional mean of the dependent variable is equal to its variance, whereas the negative binomial regression model generalizes the Poisson model – by introducing an individual unobserved effect into the conditional mean – and allows for over-dispersion in the data (variance exceeding the mean), see, for example Bloningen (1997), Coughlin and Segev (2000), Barry, Görg, and Strobl (2003), and Appendix II. Extensive experimentation using both approaches has shown that the Poisson process is not suitable for our data set, such that we only report and discuss the outcomes for the negative binomial model below. In short-hand notation:

[14] At the sector level we can distinguish between the number of M&As in the acquirer's sector and in the target's sector in the k-year period preceding time t. The difference is generally small and disappears in the aggregate (when we sum over all sectors).

(9) $\text{Prob}(\#\,of\ \ M\ \&\ As) = f\,(Balassa, waves \mid country, sector)$,

where *Balassa* refers to the Balassa index of equation (7) and *waves* refers to the variables depicted in Figure 6, conditional on *country* and *sector* dummies. We used the robust Quasi-Maximum Likelihood (QML) estimation procedure as it produces more consistent estimates of the parameters of a correctly specified conditional mean than the Maximum Likelihood (ML) estimation procedure, even if the distribution is incorrectly specified. The standard errors and significance levels reported below are based on the Huber/White robust covariance estimation procedure. The default country is the USA and the default sector number 34 (fabricated metal products).[15]

The first column of Table 6 shows the comparative advantage effect as measured by the Balassa index. Since the structure of this index differs significantly between countries (section 4), we construct Balassa index–country interactions, to deal with these differences. The BI – AU variable, for example, reports the value of the Balassa index for Australia for the sector under consideration if the country is Australia, and zero otherwise.[16] There is strong support for Hypothesis 1 in all countries. We do not report the significant country and sector dummies (these are available upon request). In general, they indicate that, other things equal, Australia, France, and the Netherlands are less active in the cross border M&A takeover game than are the USA and the UK. There is no significant difference between the UK and the USA. Both results are robust throughout our estimation procedures.

The second column of Table 6 shows that past history of M&As also determine current M&As. This indicates that waves are indeed a fundamental characteristic of M&As. We distinguish between two types of waves, namely a sector-wave effect and a total-wave effect, for two different time periods, namely the previous year and the previous two years. The variable Sector – 1, for example, measures the number of M&As in the same sector in the previous year (for all countries). Similarly, the variable Total – 2 measures the total number of M&As in all sectors (for all countries) in the previous 2 years. There is support for Hypothesis 2; for sector-waves only with a two-year horizon (positive) and for total-waves both with a one-year horizon (positive) and a two-year horizon (negative). In line with the model of section 3, this

[15] We experimented a little with other default choices, but this did not materially influence the results.
[16] Note that we do not include the BI – USA variable to avoid (almost) overidentification.

suggests that the positive (after-you) effect of increased profitability of takeovers lasts about one year and evaporates in two years time.

Table 6 M&A per sector per year regressions, 1980 - 2004

Negative binomial count; (standard errors); [p-value]

	Balassa	Waves	Both	Select
Balassa index				
BI – AU	0.3067*** (0.0703) [0.0000]		0.2601*** (0.0697) [0.0002]	0.2601*** (0.0697) [0.0002]
BI – FR	0.4084* (0.2455) [0.0962]		0.3348+ (0.2311) [0.1474]	0.3350+ (0.2311) [0.1473]
BI – NL	0.2337* (0.1323) [0.0774]		0.1987+ (0.1273) [0.1185]	0.1987+ (0.1273) [0.1186]
BI – UK	0.1695*** (0.0577) [0.0033]		0.1438** (0.0560) [0.0103]	0.1439** (0.0560) [0.0102]
Waves				
Sector – 1		0.0042 (0.0182) [0.8175]	0.0038 (0.0177) [0.8308]	
Sector – 2		0.0294*** (0.0103) [0.0041]	0.0278*** (0.0100) [0.0053]	0.0297*** (0.0058) [0.0000]
Total - 1		0.0229*** (0.0035) [0.0000]	0.0224*** (0.0034) [0.0000]	0.0226*** (0.0031) [0.0000]
Total – 2		-0.0031*** (0.0018) [0.0795]	-0.0028+ (0.0018) [0.1118]	-0.0029* (0.0016) [0.0702]
Observations	2500	2500	2500	2500
LR statistic	2336*** [0.0000]	2604*** [0.0000]	2619*** [0.0000]	2619*** [0.0000]
LR index (pseudo-R^2)	0.289	0.322	0.324	0.324

*** = statistically significant at 1% level, ** 5% level, * 10% level, and + 15% level; Huber/White standard errors and covariance; all regressions include significant country and sector dummies

The third column of Table 6 combines the Balassa and wave effects. The results reported above are robust to this combination, although the Balassa estimates are somewhat weakened for France and the Netherlands if waves are included. The fourth column of Table 6 drops the insignificant sector – 1 variable, giving our final result. To summarize our conclusions:

- Australia, France, and The Netherlands, other things being equal, are less active in the M&A takeover game than the UK and the USA.
- M&As are undertaken by 'strong' firms, that is firms active in sectors with a revealed comparative advantage as measured by the Balassa index, in accordance with Hypothesis 1.
- Waves play an important role in the M&A takeover game, in accordance with Hypothesis 2. Sector-waves with a (positive) two-year horizon and total-waves with a (positive) one-year horizon and a (negative) two-year horizon.

Table A.3 in Appendix IV provides some further robustness checks. First, our trade data only allow us to calculate the Balassa index up to the year 2000.[17] We therefore used this most recent observation for the M&As in the years 2001-2004. Ignoring the last three years of observations does not materially affect our results. Similarly, we can only adequately calculate the wave variables with a one- and two-year lag, while it is argued that the Thomson sampling methodology is US-biased in the first half of the 1980s. Again, ignoring the first two- or five-years of observations does not materially affect our results, despite the more limited number of observations.

6 Conclusions

Traditionally, the modeling of M&As provides only a partial understanding of *cross-border* M&As, which are most likely related to economy-wide differences between countries. This suggests that international trade theory is perhaps better suited to analyze cross-border M&As than IO models. Neary (2003, 2004a) combines general-equilibrium trade theory with imperfect markets and strategic behavior of firms. Although this work is mainly theoretical, it leads to two testable hypotheses. First, acquiring firms tend to be efficient and therefore operate in sectors that have a revealed comparative advantage as measured by the Balassa index. Second, M&As

[17] Changes in the Balassa index are generally gradual from one year to the next, see Hinloopen and van Marrewijk (2001).

come in waves as a given takeover generally makes the next takeover more attractive. To test these two hypotheses, we combine two extensive data sets: the bilateral trade data compiled by Feenstra et al. (2005) and the Thomson data on M&As. Using some robustness checks, we conclude that both hypotheses are supported by the data. The main novelty of the paper is the positive relationship between revealed compararative advantage and M&As. Future theoretical work, involving competing explanations for cross-border M&As, see for instance Rossi and Volpin (2004), should focus on better understanding this relationship, particularly from the target's perspective. Future empirical research should extend the analysis to other countries.

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Appendix I Country and sector description

Table A.1 Overview of analyzed sectors ($I' \subset I$) and countries ($J' \subset J$)

a. Sectors I'		*b*. Countries J'	
SIC	Description	Code	Name
20	Food and kindred products	AUS	Australia
21	Tobacco products	FRA	France
22	Textile mill products	NLD	Netherlands
23	Apparel and other textile products	GBR	United Kingdom
24	Lumber and wood products	USA	United States
25	Furniture and fixtures		
26	Paper and allied products		
27	Printing and publishing		
28	Chemicals and allied products		
29	Petroleum and coal products		
30	Rubber and miscellaneous plastics products		
31	Leather and leather products		
32	Stone, clay, and glass products		
33	Primary metal industries		
34	Fabricated metal products		
35	Industrial machinery and equipment		
36	Electronic and other electric equipment		
37	Transport equipment		
38	Instruments and related products		
39	Miscellaneous manufacturing industries		

Appendix II

Table A.2 Harmonic Mass index; bilateral comparison of distribution functions (shaded cells are identical *at 5% significance level)**

	Benchmark						Mergers & Acquisitions											
							all		acquirer					target				
	all	AUS	FRA	NLD	GBR	USA	acq	tar	AUS	FRA	NLD	GBR	USA	AUS	FRA	NLD	GBR	USA
benchmark																		
All	0.000	0.343	0.127	0.093	0.118	0.153	0.319	0.300	0.155	0.348	0.186	0.317	0.387	0.174	0.263	0.179	0.323	0.386
AUS		0.002	0.461	0.365	0.430	0.463	0.542	0.530	0.290	0.560	0.484	0.547	0.581	0.245	0.528	0.474	0.547	0.578
FRA			0.002	0.175	0.094	0.075	0.266	0.247	0.271	0.291	0.140	0.251	0.336	0.295	0.187	0.125	0.253	0.336
NLD				0.002	0.186	0.202	0.397	0.367	0.176	0.414	0.233	0.416	0.459	0.184	0.339	0.221	0.418	0.450
GBR					0.002	0.082	0.241	0.224	0.269	0.272	0.097	0.224	0.333	0.287	0.159	0.104	0.233	0.335
USA						0.002	0.182	0.162	0.289	0.220	0.094	0.189	0.252	0.311	0.137	0.073	0.199	0.252
M&As																		
acq-all							0.004	0.024	0.410	0.090	0.211	0.079	0.097	0.431	0.131	0.204	0.077	0.111
tar-all								0.003	0.389	0.091	0.184	0.093	0.102	0.411	0.119	0.177	0.091	0.108
acq-AUS									0.019	0.417	0.315	0.423	0.458	0.072	0.368	0.298	0.424	0.451
acq-FRA										0.014	0.228	0.108	0.130	0.438	0.131	0.230	0.108	0.128
acq-NLD											0.017	0.237	0.290	0.338	0.151	0.048	0.246	0.277
acq-GBR												0.008	0.170	0.442	0.134	0.234	0.021	0.181
acq-USA													0.012	0.483	0.188	0.277	0.170	0.029
tar-AUS														0.016	0.393	0.324	0.443	0.476
tar-FRA															0.012	0.153	0.137	0.191
tar-NLD																0.013	0.244	0.272
tar-GBR																	0.012	0.180
tar-USA																		0.010
# obs	2100	420	420	420	420	420	3462	3462	189	257	137	1446	1433	261	416	212	878	1695

* Values in cells indicates Harmonic Mass index (exception: # obs); the solid borders indicate the most relevant comparisons, as emphasized in the main text.

Appendix III Negative binomial

The log likelihood for the negative binomial given x_i is given by

$$l(\beta,\eta)=\sum_{i=1}^{N} y_i \log(\eta^2 m(x_i,\beta))$$
$$-(y_i+1/\eta^2)\log(1+\eta^2 m(x_i,\beta)+\log\Gamma(y_i+1/\eta^2)-\log(y_i!)-\log\Gamma(1/\eta^2)$$

where y_i is a non-negative integer valued random variable and m is the conditional mean function. The following moment conditions hold:

$$E(y_i | x_i,\beta)=m(x_i,\beta)$$
$$\mathrm{var}(y_i | x_i,\beta)=m(x_i,\beta)(1+\eta^2 m(x_i,\beta))$$

such that η^2 is a measure of the extent to which the conditional variance exceeds the conditional mean.

Appendix IV Sensitivity analysis: period analyses

Table A.3 M&A per sector per year regressions, various periods

Negative binomial count; (standard errors); [p-value]

	1980-2004	1980-2000	1982-2004	1985-2004
Balassa index				
BI - AU	0.2601***	0.2936***	0.2513***	0.2192***
	(0.0697)	(0.0746)	(0.0691)	(0.0690)
	[0.0002]	[0.0001]	[0.0003]	[0.0015]
BI - FR	0.3350+	0.2764	0.3361+	0.3769+
	(0.2311)	(0.2517)	(0.2329)	(0.2334)
	[0.1473]	[0.2721]	[0.1490]	[0.1063]
BI - NL	0.1987+	0.2341*	0.1972	0.1524
	(0.1273)	(0.1328)	(0.1263)	(0.1333)
	[0.1186]	[0.0779]	[0.1186]	[0.2530]
BI - UK	0.1439**	0.1260**	0.1405***	0.1299***
	(0.0560)	(0.0623)	(0.0536)	(0.0501)
	[0.0102]	[0.0431]	[0.0087]	[0.0095]
Waves				
Sector - 2	0.0297***	0.0310***	0.0271***	0.0234***
	(0.0058)	(0.0063)	(0.0056)	(0.0054)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Total - 1	0.0226***	0.0250***	0.0207***	0.0183***
	(0.0031)	(0.0037)	(0.0030)	(0.0028)
	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Total - 2	-0.0029*	-0.0038**	-0.0034**	-0.0058***
	(0.0016)	(0.0019)	(0.0015)	(0.0014)
	[0.0702]	[0.0398]	[0.0279]	[0.0001]
Observations	2500	2100	2300	1900
LR statistic	2619***	2244***	2417***	2032***
	[0.0000]	[0.0000]	[0.0000]	[0.0000]
LR index (pseudo-R^2)	0.324	0.330	0.313	0.296

*** = statistically significant at 1% level, ** 5% level, * 10% level, and + 15% level; Huber/White standard errors and covariance; all regressions include significant country and sector dummies

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