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European Firms In a Global Economy EFIGE

SEVENTH FRAMEWORK PROGRAMME

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Abstract

Most trade theories assume bilateral trade relationships are forged on the basis of some comparative advantages, scale considerations, market structure or some productivity advantage of firms. Since these factors change slowly, bilateral trade relationships should be stable. However, we argue that over half of the non-zero bilateral trade relationships are of temporary nature: they last for a short period only or appear and disappear in an erratic fashion. With a very detailed country-product transaction level dataset on Hungarian exports, evidence is provided for the importance of temporary trade relationships at the bilateral level. A large share of bilateral trade flows are driven by just a few firms, and results indicate that temporary trade is important for all kinds of firms and products. In terms of empirical applications, we show that gravity equations suggest important differences between the determinants of permanent and temporary trade; and the extensive and intensive margins of trade can also be very sensitive to changes in temporary trade.

Keywords: international trade, exporting, firm-product level data.

JEL classification: F23, F14, D21, R12, R30

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1 Introduction

Most trade theories assume bilateral trade relationships are forged on the basis of some comparative advantages, scale considerations, market structure or some productivity advantage of firms. These theories would predict that a trade relationship (i.e. a set of non-zero annual exports to a given country in a given product) lasts unless shocked by an alteration of external conditions. This paper will argue that such stability in trade is only part of the story.

When national comparative advantages are the key motivation for trade, a country, which enjoys comparative advantage in a given product to a type of countries, will always export it. Fluctuations are possible inasmuch these conditions would be altered substantially - leading to a loss of previously enjoyed advantage in production.

In factor models of trade, such as that of Hecksher-Ohlin-Vanek framework, relative abundance of factors such as land or capital would induce a pattern of specialization across industries. A trade pattern would be upheld unless factors or prices moved.

In new trade theories, technology and demand matter allowing for intra-industry trade. Here, a shift in demand or an alteration of production technology leading to a loss of return to scale advantages would be considered a shock large enough for trade patterns to change rapidly. In the particular case of heterogenous firms models following Melitz (2003), trade pattern is an outcome of firm decisions. Such pattern would change only when a shock to the cost structure of export is large enough to alter the marginal cost of export dramatically so that a firm would halt trading even having already paid the fixed cost.

In all these models, trade relationship between two countries in a given product are either non-existent or will be stable. The fact that there is no trade relationship between two countries or there are a lot of zeros in destination-product matrices has found robust empirical support of late [1] . However, bilateral trade flow data shows that trade relationships are surprisingly fragile

[1] In 2005 The US exported 8880 (10-digit) products (Baldwin and Harrigan, 2007) and has commercial relationship with basically all countries accounted for in trade statistics. Even a small open economy, like Hungary exported 7751 products in 2003 to over 185 countries. Yet, if one looks at trade flow matrices (of country-product pairs), 82% of cells will be found zero in the US and more than 90% in Hungary. (To make this number comparable to the Baldwin and Harrigan (2007) results, we used the same HS-10 categorization and dropped all flows below 2500 USD.)

in nature. This paper will argue that more than half of the trade relationships are fragile, and temporary relationships play a great role in trade. Products from a given country are often shipped to given destinations one year but are not the next.

Instability in trade has already had some empirical support for a set American and European countries. For instance, Besedes and Prusa (2006) suggested that trade flows are surprisingly short at the bilateral level. Eaton et al. (2007) showed the large importance of one-time exporters at the firm level [2]. Our aim in this paper is to dig deeper into this phenomenon and show some of its consequences.

It is the stability of trade relationship that is in the focus of this work, introducing two key concepts. Permanent trade in a product is a stable relationship between the sending and the destination country occurring at least several years in a row. Temporary trade is fragile in nature lasting for a shorter period or time, or recurring with intermittencies. For instance, temporary trade covers patterns when export to a country is positive in year but zero the next, and positive again (in other words the bilateral trade relationship is active in one year, passive the next and then active again). These concepts allow for categorisation of product-destination level trade relationships.

This paper uses Hungarian Customs Statistics data covering all trade transactions for 1992-2003 with our focus on the 1997-2003 period. Data are at the firm-product-destination level. Looking at this data, we found that less than half of the Hungarian bilateral trade flow (in a product-destination context) is stabile. We present several international comparisons to underline the generality of our findings.

The main contribution of this paper is to highlight two categories in bilateral trade relationships based on their stability, where behavior between categories differ substantially. It will be argued that a distinction between temporary and permanent trade relationship is important for several reasons. First, it offers a substantive empirical support to recent trade cost models. Second, estimation of models built on steady state trade relationships may be mishandled without extracting temporary relationships. Third, in several situations, policy evaluations should be based on permanent changes in trade.

This paper is organised as follows. First, it will argue that standard fixed cost

[2] In a rather different exercise, Armenter and Koren (2008) proposed an atheoretical approach suggesting that a randomized export pattern would indeed produce a large number of zeroes. Such random pattern would also produce short-lived relationships

models do not predict such dynamics in bilateral trade flows. It will also show that prevalence of temporary trade relationships does not only result from the actions of a small subset of firms. This suggests that the structure of fixed cost is not simple. Data is introduced in in Chapter 3. After showing the empirical importance of temporary trade in Chapter 4, we try to look behind temporary trade relationships using a large Hungarian dataset for manufacturing firms in the 1992-2003 period. Chapter 5 shows that there are only very few firms behind each cell, suggesting that firm-level decisions and shocks may play a more important role on the bilateral level than usually assumed. We also show that some very short trade relationships may be 'noise' in the sense that they may represent sales of assets and inventories rather than products of the firm. We take the two most common application of detailed trade data to see how our point would influence results in Chapter 6. By employing a gravity model, we show that temporary trade behaves differently on the aggregate level from permanent trade. Then, intensive and extensive margin changes are traced. A conclusion summarises key findings.

The Appendix serves for several purpose. First, we present an alternative definition for temporary, approaching the issue from a rather different angle: yet with the same results. Second, the method to identify assets and inventories are presented. Third, a set of additional descriptive statistics are presented as well graphical representations on role temporary trade plays.

2 Fixed cost of exporting theories and temporary trade

There is a key source of temporary trade at the bilateral level: when one or very few firms operate behind particular country-product pairs. Indeed, we will show that in a large number of cases there are only very few firms behind each cell of the bilateral flow matrix. Such a result may stem both from atheoretical model of Armenter and Koren (2008) as well as a model of international trade with heterogeneous firms, where the number of exporting firms will vary across destination countries as in Helpman et al. (2007). Such a phenomenon is also natural in the Ricardian framework of Eaton and Kortum (2002). We know that firms rather than countries trade, and this exercise is a clear example of the dependence of national trade on firm-level decisions. Thus, one need to pay a special attention to trade theories based on firm level decisions.

There are several explanations arguing that traditional heterogenous firms

models based on the notion that fixed entry costs drive firm level self-selection may cover only one part of transactions; this section will briefly review a few. While individual explanations below may have very different empirical consequences, the aim of the paper is to give a first estimate of the overall problem and draw attention to some non-standard theories of export decisions. Eventually these theories and propositions imply different patterns in trade relationships - many of which will be unveiled or even tested in the paper.

Uncertain entry conditions: One argument for the existence of temporary trade is related to uncertain entry conditions. For instance, Rauch and Watson (2003) argued, that when firms from developed countries try to find suitable trade partners in less developed countries, it can be optimal to 'test' potential foreign partners by starting small. They should only continue the relationship, if the potential partner successfully stood this test. They also analyse the relationship between starting small, risk and search costs. They also show that starting small can increase the expected duration of cooperation. Besedes (2006) test this model empirically using US trade data. He shows that initial size, risk and search costs play an important role. Higher reliability and lower search costs lead to larger initial transactions and longer duration. According to the empirical results, this relationship is true both for developed and less developed countries. If this is relevant, we will see many 1-2 year long trade relationships, as well as some on and off patterns as firms go and test waters (see Chapter 5.2). Further, firms are more likely to be testing export markets that are closer to home and/or share a trade group or common market (see Chapter 6.2)

Uncertainty at some export markets: Crozet et al. (2008) argue that uncertainty at an export market is different to tariffs inasmuch that while insecurity affects all firms since all of them face the same risk, *ex-post* some of them are not hurt. When the macroeconomic background (such as the exchange rate) is volatile, institutional quality is poor and corruption is rampant, some firms whose productivity warranted export, will face a problem at site: whether to pay an additional cost or loose the transaction. Thus, uncertainty at site will make some firms suddenly exit - despite their productivity advantage. If this is the case, further away export as well as non-EU export should show a greater instability for Hungarian exports.

Flexible trade technology: Third, the presence of large and fixed trade costs may be not that important in determining decisions. Theories assuming more flexible exporting technology are more relevant when describing the behavior of firms that fail to maintain a stable trade relationship. In the Arko-

lakis (2006) model of marketing costs with product differentiation and firm heterogeneity, a firm will enter a market whenever it profits from even a single consumer. However, marginal cost is related to the number of additional consumers reached. Thus, different firms may rely on different strategies and try to reach more or fewer number of consumers. In broader terms, firms may rely more on variable costs when expected amount of shipment is small. This model will predict a lot of small export decisions (in line with our data, see Chapter 5). Of course this is a firm's own decision, and endogeneity will be have to be treated (see Chapter 6.3 on the problem).

Multiproduct firms: Fourth, it has been found in several countries that multi-product firms may switch their product portfolio frequently, and this adjustment can play an important role in export survival. In case of large firms, recently developed theories of multiproduct exporters (e.g. Bernard et al. (2006)) may provide more relevant predictions than standard theories of single-product firms. Arkolakisz and Muendler (2007) emphasize that international evidence suggests a majority of export shipments being carried out by multiproduct firms. In their model, firms first incur a broad market-entry cost and then an additional fixed product-entry cost that is line with the magnitude of the particular overseas presence. Importantly, these are related to distribution. Using Brazilian panel data for firms, products and destinations, a firm-level global presence (sales) is negatively associated with average product scale. In other words, large multinational-multiproduct firms sell relatively less of one product in a country. Arkolakisz and Muendler (2007) argue that distribution-side dis-economies of scope are key to explain such behavior.

Multinational firms with multinational fixed costs: It is possible that large multinational firms have a different cost structure to domestic firms and hence, they are less sensitive to the national cut-off point. Indeed, foreign owned firms, most of them being member of a multinational group, may have paid a fixed cost of trade at a group level, and hence may enter trade more easily, even at a lower productivity level. If this is the case, we shall find multinational firms carrying out more temporary trade with all kinds of spell patterns (as in Chapter 5.2).

All these propositions were related to the cost structure of trade. It has been implicitly assumed that firms produce a good, search for opportunities, invest in a new market and sell their goods to recuperate their investment. However, firms may not sell goods other than their core products, involving a rather different fixed costs consideration.

Non-core product sale: A great number of trade relationships do not in-

volve the product of the firm - it consists of sales of machines or raw materials that were not produced by the firm. Such mostly one-off deals imply that a firm, instead of selling at home, will sell them abroad as part of its expansion (investment in new machinery) or contraction (sale of unused materials). This proposition can directly be checked based on the sectoral classification of exported goods (see Chapter 5.4).

3 Data and definitions

3.1 Dataset

The dataset covers all export data from Hungary, for the 1992-2003 period. The data is structured at a firm-product-destination level and includes information on transaction value and quantity. Note that the Hungarian trade structure is close to EU countries as described in Mayer and Ottaviano (2008) even if the concentration and role of large firms is slightly higher in Hungary than in most EU countries. Hungary is about as open as Ireland or Belgium and accordingly the share of trading firms is fairly close to the ratios in those countries [3].

The data used for our empirical analysis were gained from the Customs Statistics. The dataset consists of all Hungarian exports between 1992 and 2003. We have only included manufacturing firms, as temporary trade is probably less surprising in agriculture or the retail sector. One observation in the database is the export of product i by firm j to country k in year t. When analysing bilateral trade flows, we aggregate this data: one observation in this case is the export of product i to country j in a given year.

Certain aspects of the data are comparable to previous findings on US and some European data (Baldwin and Harrigan, 2007; Besedes and Prusa, 2006; Mayer and Ottaviano, 2008; Arkolakisz and Muendler, 2007). International comparisons are important to underline the generality of our findings. Furthermore, the dataset is superior to some well-known international datasets such as Intrastat and Comstat in that it covers the full universe of trading firms not only those sampled in a particular year. Thus, our data has the potential to uncover the scale and nature of temporary trade to a greater

[3] For more on the Hungarian dataset and a set of descriptive statistics regarding trading firms, see Békés et al. (2008).

extent.

The product dimension of the dataset is highly disaggregated; it is broken down to 6-digit Harmonized System (HS) level. We define a product as a 6-digit category, although using more aggregated (4-digit) categories does not change our results. "Motor cars and vehicles for transporting persons" is an example for a 4-digit category, while "Other vehicles, spark-ignition engine of a cylinder capacity not exceeding 1,500 cc" is an example 6-digit category.

3.2 Classification of trade flows

We denote the value of trade of good i to destination k from Hungary in year t as $\mathbf{E}_{k,i,t}$. Let us start our analysis by setting a 'base' year t. We define a cell of the bilateral trade matrix ($\mathbf{R}^t_{k,i}$) as an *ongoing trade relationship* in year t, if $\mathbf{E}_{k,i,t} > 0$ in any of the years during the $(t-3)$ - $(t+3)$ period. Thus, an active trade relationship in year t means that the cell is either active in year t or it was active shortly before or will be active shortly after.

For each positive $\mathbf{E}_{k,i,t}$ we can define the spell of the trade relationship as the number of consecutive years the product was exported around year t. However, for the sake of analysing fragile trade relationships, we would not need the total spell of the trade relationship (which we can only observe in a truncated way owing to a limited time dimension of the database). Instead, we need to know whether the spell is shorter than a predefined length. As a result, for each ($\mathbf{R}^t_{k,i}$) we define *truncated spell*, $\mathbf{S}^t_{k,i}$ to be the number of years of the longest *uninterrupted* sequence of consecutive years with the product being exported between year $t-3$ and $t+3$. Naturally, this measure may take a value between 1 and 7. Note, that if $\mathbf{S}^t_{k,i} > 3$, year t must be part of the truncated spell, consequently $\mathbf{E}_{k,i,t} > 0$.

We call an active trade relationship, ($\mathbf{R}^t_{k,i}$) a *permanent trade relationship* if $\mathbf{S}^t_{k,i} > 3$, thus the cell was active for at least 4 consecutive years within a 7-year period. This means, that the product was exported in year t and we can observe that this year is part of a spell which is at least 4 years long (of course, we do not know the real length of the spell, as it is truncated in our data).

We define two kinds of *temporary trade relationships*. An active temporary trade relationship means that $\mathbf{E}_{k,i,t} > 0$ and $\mathbf{S}^t_{k,i} < 4$. In this case the cell was active in year t but the spell ongoing in that year was shorter than 4 years. The other type of temporary trade relationship intends to capture trade rela-

tionships which are positive both shortly before and after year t, but inactive in year t, suggesting fragile behaviour or and on-and-off pattern. Thus we define a trade relationship as an inactive temporary trade relationship, if $\mathbf{E}_{k,i,t}$ takes at least one positive value between $t-3$ and $t-1$ and it is also positive at least once between $t+1$ and $t+3$.

In this work, we use Hungarian data and hence, one leg of the country pair will be Hungary. Also, if not otherwise indicated, we use year 2000 as the base year t in all our calculations. The choice of the time period also seems to be reasonable for us, as transition and the most important structural changes in the Hungarian economy already took place before 1997, thus the observed dynamic nature of trade relationships is not a consequence of transition, but the normal working of a market economy.

To sum up, permanent trade means that the cell is active in year $t = 2000$, and the flow ongoing in that year is at least 4 years long; while temporary trade means that the flow in year 2000 is part of a shorter spell or that the product was traded both shortly before and after 2000 but not actually in 2000. With this filter we capture short spells as well as some on-and off behaviour. A few illustrative examples are shown below.

Fig. 1. **Occurrence of trade and relationship categories**

1997	1998	1999	2000	2001	2002	2003	Classification	Argument
●	●	●	●	●	●	●	permanent	all years active
			●	●	●	●	permanent	4 consq. years
●	●		●	●		●	temporary - active	5 years but not consequtive
			●				temporary - active	short spell, active in 2000
			●	●		●	temporary - active	on and off, active in 2000
		●		●			temporary -inactive	on and off, inactive in 2000
					●		no trade	No trade in 2000, only after not before

While this approach is arbitrary to some extent, we find it quite useful and straightforward. On the choice of the time window, four years of consecutive export is long enough to be considered as permanent - in line with the results of Besedes and Prusa (2006), who estimate the duration of trade relationships and find that the survival rates decrease rapidly in the first 4-5 years (to about 45-50%), and remain reasonably stabile afterwards. We consider this definition of temporary trade relationship quite strict. We have also experimented with other definitions, in which temporary trade was even more important [4]. However, results were unaffected qualitatively by applying different definitions

in terms of length of window or base year t [5] .

3.3 Duration analysis and temporary trade

Clearly, our definition of temporary trade is closely related to duration analysis, and to the recent findings about the importance of very short trade flows. Besedes and Prusa (2006), for example, show that the median duration of exporting a product is between two and four years in the United States. Similarly, Nitsch (2007) shows that the same phenomenon can be observed in Germany - the majority of trade relationships exist for only one to three years. On Hungarian data, Görg et al. (2008) estimate survival functions for export products of Hungarian firms (at the firm $\times$ product level), and show that the median survival of such export products is between 2 and 3 years.

Our definition of temporary trade is, however, different from short trade flows. First, it is broader as on-and-off type patterns are also part of it. Second, while duration analysis considers every flow in a time window as an observation, our approach is related to a particular point of time. As a consequence, repeated spells appear as totaly new spells in duration analyses. This problem is not trivial: in the 12 years between 1992 and 2003, 20% of spells were repeated. This kind of 'pooled' data is not necessarily a good starting point for analysing the properties of different kinds of trade flows. Starting from a cross section at year t we are able to classify the ongoing trade flows into permanent and temporary trade with our filter - making use of the time dimension of the database. As a result, at each point in time we are able compare temporary and permanent trade, and apply methods designed to analyse a cross section of trade, for example the gravity framework.

To relate our classification to findings of the well-established duration literature, we estimate the survival functions in the Hungarian dataset. In this analysis, we consider the whole time dimension of the database, so we start from all bilateral product $\times$ destination observations between 1992 and 2003.

In the Hungarian data, the probability that a trade flow ends before 4 years is about 0.5. This is not only a consequence of one-time exports: the probability that a trade flow ends after 2 or 3 years is 25%. Interestingly, this is rather

[4] According to an alternative definition temporary trade is defined as a trade relationship, in which we can observe at least 1 positive value in a given 4-year period, but the cell is not active for all four years. With this definition, more than 2/3 of active trade flows are classified as temporary. For a short presentation of results and a description of key figures, see the Appendix.

[5] See the Graph 6 presented in Appendix

close to international evidence. To show that, we estimated the Kaplan-Meier survival functions[6] for different levels of aggregation (Besedes and Prusa, 2006). Results are very similar both qualitatively and quantitatively to survival functions from the US: The median at the 6-digit level is about two years in both economies (see graph 6 in Appendix). The comparability of Hungarian, German and US data, the proximity of results is another support for the usability of Hungarian datasets[7].

These results provide suggestive evidence that 1-3 year long trade flows, and thus temporary trade is qualitatively very important. Also, temporary trade does not only consists of one-time transactions but it represents much richer phenomena: 2-3 years long trade flows and on-and-off type of behaviour.

4 The relevance of temporary trade

This section presents the case for the importance of temporary trade relationships. As a start, we put trade in a perspective comparing ongoing trade relationships to inactivity (no-trade) in a product-destination relation. Then, robustness checks are carried out regarding the relevance of temporary trade.

First, clearly most cells of the bilateral trade flow matrices (i.e. all possible $\mathbf{C}^t_{k,i}$ combinations, constructed from all trade partners and manufacturing exports of Hungary between 1997 and 2003) are empty. This matrix has more than 780,000 cells. From this, 740,000 cells (91.7%) are empty in the period under study. The share of zero cells remains significant after dropping less important trade partners and export products of Hungary: after dropping destinations to which Hungary exported less than USD 50,000 and products from which the export revenue was less than USD 10,000, the share of zeroes still remains 78%. These numbers are comparable with the results of Baldwin and Harrigan (2007) who reported for the United States that 82% of all potential trade flows were zeroes in 2005. This shows that in a small open economy, like Hungary, the frequency of zeroes is even greater than for the United States.

Non-zero trade is registered for 8.3% of all potential occasions (i.e. cells in the

[6] Kaplan and Meier (1958)

[7] Survival rates are naturally higher at higher levels of aggregation. The most important quantitative difference can be seen at the short durations. One-year survival rates are significantly larger in Hungary than in the US. This rate is 0.6 and 0.78 for 3-digit and 1-digit categories in the US, respectively (Besedes and Prusa (2006) p. 281). In the Hungarian data 1-year survival rates are higher by about 0.1. Long-term survival rates, on the other hand are very similar in the two economies.

matrix). Table 1 reports more detailed numbers, suggesting that 53% of active cells were temporary in this period. This result is striking: more than half of all trade relationships were not stable for a period of four years. Temporary trade is rather the rule and not the exception. Graph 7 in the Appendix illustrates the shares.

While our definition is arbitrary to a large extent, several robustness checks confirmed that this figure is above 50% in most cases . Indeed, we consider robustness checks along four dimensions: dropping nuisance (i.e. very small) deals, dropping far-away countries, changing the number of years and the level of aggregation. Descriptive results are presented in table 1. First, if we restrict the bilateral matrix only to significant trading partners and products, the share of such fragile trade relationships decreases somewhat (to 46%), but temporary trade still constitutes almost the majority of trade relationships. Second, temporary trade is important both in the enlarged European Union and outside it. Note, however, that temporary trade is more frequent for less important trade partners. (Hungary's most important export destinations are members of the enlarged EU).

Table 1
Importance of temporary trade in different samples and under different definitions

	Permanent	Active temporary	Inactive temporary	Share of temp. trade
Full sample, 6-digit HS	18268	14674	6323	53%
Excluding products less 10,000 USD	17662	12889	5508	51%
Excluding destinations less 10,000,000 USD	11694	10990	5459	50%
Excluding both	15985	9973	4656	46%
Only EU25	12582	7753	3654	48%
Only non-EU25	5686	6921	2669	63%
Four-year interval	14845	16793	8001	62%
4-digit HS	10826	6731	3042	47%
2-digit HS	2815	1168	554	37%
Base year=1995	8447	9825	3623	61%

The prevalence of temporary trade remains a feature of data when we change factors of our filter. If we change the number of years which are required to classify a trade relationship to be temporary from 3 to 4 [8], the share of temporary trade flows increases to 62%. Also, changing the level of aggregation does not change the results qualitatively: 46% and 37% of trade flows remains

temporary when we aggregate products into four-digit and the very broad two-digit Harmonised System level categories, respectively [9] . This later results is quite strong, as it proves that temporary trade is not only a consequence of using a 'too' disaggregated product level - it is not the case of exporting blue pencils in one year and red pencils in another. Finally, to see whether this phenomenon was present earlier, we calculated these numbers for another base year, $t = 1995$. In that year the share of temporary trade was much larger, which reflects the more volatile nature of trade in that earlier period of intense structural change in the Hungarian economy. The share of temporary trade remains above 45% if we exclude small trade flows, nearby or farther destinations or change the number of years in our definition.

Of course, our filter is not the only possible definition for temporary trade. One may consider a shorter period and look at dynamics of bilateral relationships within a fixed, say 4-year-long period. As a final robustness check, we applied a different approach and classified permanent trade as four consecutive years of active trade while temporary trade was defined as one to three occasions of trade within that 4-year-long period. In such a setting, the share of temporary trade was even higher, about 2/3 of all relationships were categorised as temporary. All robustness checks to this latter definition also pointed to at least a 50% share. For details, see Appendix 1.

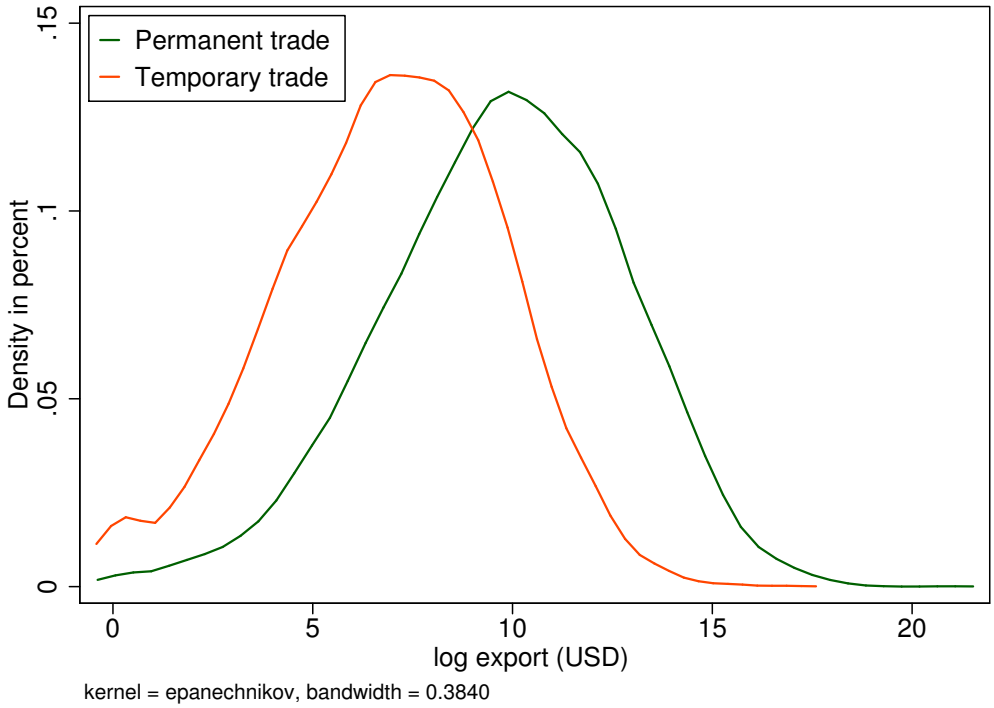
While temporary trade matters a lot in terms of numbers of trade relationships, its value is much smaller. Not all temporary trade is of small value. Kernel densities of volumes by the two categories of trade flows illustrated in Figure 2. While the volume of temporary trade flows is systematically smaller than permanent trade, there are relatively large temporary trade flows, with a maximum around USD 50,000. These facts suggests that the presence of temporary trade is likely to influence calculations when the unit of observation is a trade flow (as in gravity estimation) as opposed to the case when trade flows are weighted with their volume.

To sum up, temporary trade covers about half of the active trade relationships, ranging between 37% and 70% depending on its measurement. Hence the argument, that trade theories as well as empirical work shall take into account the difference between permanent or temporary trade, especially when firm

[8] Here we change the definition of active temporary trade to at least 4-year long trade flows and the definition of inactive temporary trade to be present both after and before the base year in a 9-year long window. As the dataset ends in 2003, we changed the base year, t to 1999, as otherwise it would not be possible to know for sure whether a spell beginning in the base year ends within 4 years.

[9] An example for a 2-digit category is "NUCLEAR REACTORS, BOILERS, MACHINERY & MECHANICAL APPLIANCES, COMPUTERS".

Fig. 2. **Kernel densities of permanent and temporary trade**



behaviour is the focus of the research.

5 What is behind temporary trade?

Firms rather than countries trade. While the previous section has shown the prevalence of temporary trade flows, it is also important to see the firm-level decisions behind them. This can shed some light on the appropriate theory that can explain the relevance of zeroes and instable trade flows.

In this section we examine some firm-level phenomena behind temporary trade. First, we show that there are a small number of firms behind most cells of bilateral trade flow matrices, suggesting that firm-level decisions and individual shocks can play a decisive role in determining bilateral flows. After this, we show that temporary trade is not restricted to special kinds of firms, instead, all sorts of firms are engaged in temporary trade. Third, temporary trade is not restricted to a particular group of goods. Fourth, evidence is shown regarding the lack of bias by very large items. Fifth, we show that a significant portion of temporary trade can be explained by the fact that in a

small open economy a large number of firms sell their assets and inventories to other countries.

5.1 Few firms behind most cells

When thinking on firm level phenomena behind country-product level survival, an important statistic is the number of firms behind the cells of the bilateral trade flow matrix. Table 2 shows the distribution of the number of firms that export product i to country k in year 2000 (obviously, only active temporary trade is taken). The most striking result is that we find only one firm behind 25.1% of the active cells in 2000. Also, half of occasions, there are less than no more than three firms exporting a product to a given destination. Just about fifth of product-destination pairs is served by more than ten firms. This suggests that decisions of a small number of firms may lead to significant changes in the distribution of zeroes in trade flow matrices - firm-level variability may play a very important role in bilateral flow dynamics.

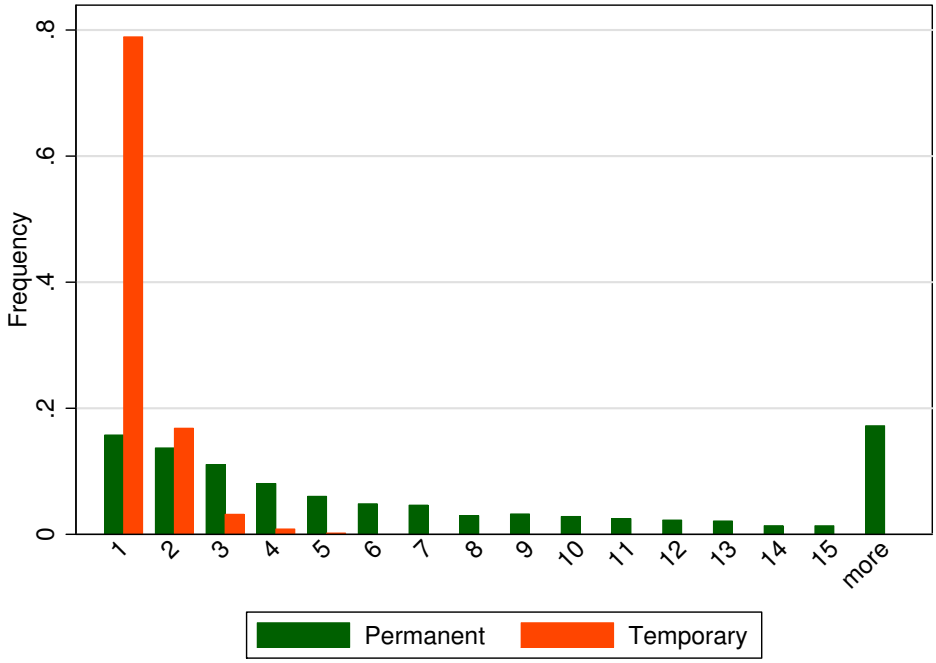
Table 2
Number of firms behind the cells

	Firms	Percent
1	15938	25.1%
2	8982	14.1%
3	6276	9.9%
4	4432	6.9%
5	3275	5.1%
6	2616	4.1%
7	2499	3.9%
8	1600	2.5%
9	1746	2.7%
10	1530	2.4%
More	14483	22.8%

Not surprisingly, the number of firms behind a cell (the firm extensive margin) is strongly related to the duration of trade, as it is shown in Figure 3, which breaks down the share of firms by the stability of the trade flow. While only one firm is behind more than 78% of temporary cells, the same number of 17% for permanent flows. However, as the numbers suggest, temporary trade is also present in cells into which several firms export.

To sum up findings, only one-tenth of all relationships is permanent when the relationship is served by one firm, while only one-tenth of all relationships is

Fig. 3. **Number of firms behind cells of the bilateral trade matrix**



temporary when the relationship is served by at least three firms.

5.2 All kinds of firms trade temporarily

In this section we study which types of firms are involved in temporary trade. The results suggest that most firms engage in temporary trade, and there is only a very weak relationship between observable firm characteristics and the importance of temporary trade at the firm level. Note, that we still define temporary trade at the bilateral level, consequently we study whether the goods traded by the firm are part of a temporary or a permanent bilateral trade flow.

First, we study whether temporary trade is restricted only to a small fraction of firms. It turns out that more than 56% of firms trade some products permanently and other products temporarily. 5.5% of firms trade only tem-

porarily, and 38.1% trade all its exports permanently. Temporary trade is not restricted to a small subset of firms. A graphical representation is shown in the Appendix (Graph 8.

While the previous results show that most firms trade both permanently and temporarily, it is still possible that some dimension of observed firm heterogeneity is key in determining which firms are engaged in temporary trade. For a discussion, see Chapter 2. Especially, it is possible that only small firms, who may start and stop erratically, are responsible for the prevalence of temporary trade. An opposing view is also possible: only large multinationals are responsible for temporary trade, as they manage transactions hectically among affiliates in different countries. Given that trade volumes are influenced by a handful of large firms [10] , this concern may be especially important in Hungary.

To evaluate if firms with certain characteristics were responsible for the bulk of temporary trade relationships, we took each product-destination relationship and looked at firms behind each cell. For each firms, we averaged the share of temporary relationships. Simple descriptive statistics suggest that the relevance of temporary trade differs only slightly with respect to key observable firm-level variables. Domestic firms are somewhat more likely to trade temporary exports: the average share of temporary exports in value terms is 18.9% for foreign-owned firms compared to 16.2% for domestic firms. In terms of firm size, all types of firms are engaged in temporary trade to a similar extent: the correlation between the number of employees and share of temporary trade is only -0.03, which suggests that larger firms are slightly more likely to trade temporarily.

Also, we tried to explain the share of permanent trade at the firm level by running a regression with the number of employees, the ownership status and the interaction of these two variables. The dependent variable $permsh_n$ is the ratio of products exported permanently, to all exports, weighted by export values for a firm n: $permsh_n = [\sum_{i,j}((1 - temp_{ij|n}) * exp_{ij|n})]/(\sum_{i,j} exp_{ij|n})$. Here, $exp_{ij|n}$ denotes exports of a firm n, and the estimated equation is:

$$permsh_n = \alpha + \beta * For_n + \gamma * emp_n + \delta * For_n * temp_n + \mu_s + \epsilon_n \qquad (1)$$

Results are presented in Table 3, For_n is a dummy taking 1 if the firm is foreign owned (at least 10% of equity), emp_n is the number of employees is μ_s denotes sectoral dummies at NACE4 level.

[10] See Mayer and Ottaviano (2008). In Hungary, the top 1% of firms are responsible for 60% of export volume.

Table 3
Firm characteristics and the share of permanent trade

	(1)	(2)
Foreign	0.174***	0.158***
	(0.017)	(0.017)
Employment (1000 employees)	0.588***	0.489***
	(0.182)	(0.155)
Foreign x employment	-0.0005***	-0.0004***
	(0.0002)	(0.0002)
Constant	0.532***	0.994***
	(0.013)	(0.002)
Observations	4542	4542
R^2	0.049	0.129
Fixed effects	No	NACE-4

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Results suggest significant relationship, but the explanatory power of the regression, however, is not high, R^2 is below 0.05. Considering industry heterogeneity, the average share of temporary trade varies between 11.2% for the wood industry (NACE 20) and 36% for Manufacture of food (NACE 15) [11]. This number, however varies between 15-30% for most of the industries. Specification (2) in Table 3 also includes 4-digit industry dummies. Results are unchanged.

Overall, we do find evidence that most firms are engaged in temporary trade, and it is not restricted to a group: starters do it, small firms do it, even foreign and multiproduct firms do it. Explanation of temporary trade may require a quite general framework instead of suggesting that only some special firms generate this kind of trading behaviour at the bilateral level. Hence, these results provide evidence for all alternative trade cost theories described in Chapter 2. However, note that given the weakness of explanatory power of explanatory variables, no one model stands out in particular.

5.3 All kinds of goods are traded in temporary fashion

Importantly, temporary trade is important across the board. Table 4 shows the shares of various types of trade relationships by three categories. First,

[11] This number is even lower, 8.7% in manufacture of coke and refined petroleum, but there are only 3 firms in this industry.

relationships were grouped by the products and aggregated up to the 2-digit level of Harmonised Systems (HS2). This is the level that descried broad industries such as textiles or metals. As shown in the table, temporary trade is very important in all categories despite considerable heterogeneity. This confirms that temporary trade is not an industry specific phenomenon.

Second, we considered the UN's Broad Economic Categories (BEC), a classification, which groups tradable goods by the main end use. Temporary trade turns out to be very important in all categories, especially capital goods and raw materials. This suggests that temporary trade is present in all steps of the production process from raw materials to consumer goods.

Table 4
Share of temporary trade by good categories

	Max		Min	
HS2	animal products	78%	plastics, rubbers	46%
BEC	other	75%	intermediate	50%
Rauch	homogenous	56%	differentiated	52%

Third, we wondered if contractibility is related to temporary trade - does the trade of homogenous goods, which require no specific contracts and hence, require lower fixed costs, fluctuate in a less stable fashion. We used three categories as suggested by Rauch (1999): heterogenous, homogenous and quoted priced goods. Temporary trade was found to be just about equally important by all these categories. Thus, the fact that it is harder to contract on very special (heterogenous) product seems to have no direct impact on the fragility of a trade relationship.

Overall, we found that temporary trade is not a feature for a particular group of products. For details, see Figure 9 in the Appendix.

5.4 Exporting airplanes?

One possible explanation for temporary trade is lumpy export of goods that are too large to be sold every year. Aircrafts, ships or telecommunication network equipment may be exported infrequently. Such phenomenon would be picked up as temporary trade - as an 'on and off' pattern. In order to filter this out, we cut the most expensive (highest unit value) items out of the sample. The 95^{th} percentile of the unit values is $ 111, while the 99^{th} percentile is $ 527. As items below $ 500 are clearly not airplanes or large ships, we have chosen $

527 as the threshold. If we drop all transactions above this value, the share of temporary trade remains 53.6%. Moreover, for items with unit values above this 99^{th} percentile, permanent trade is more important than for the average product; temporary trade only represents 1/3 for these products. These results suggest that trade in large, lumpy goods is not an important factor behind temporary trade.

5.5 Firms export assets and inventories

Firms sell non-core products abroad. A large share of such non-core products are not produced by the firm, but instead are inputs of the firm: fixed assets or inventories [12] . Given the very nature of such deals - e.g. selling a particular set of machinery or unused bundle of raw materials, this phenomenon may provide an explanation for the large number of short export spells.

Consider, for example a large firm producing lighting equipment. This firm exported more than 500 products. From these, 8 products are exported for a very large number of countries for long periods of time. All these 8 products have the same HS-4 code, 8539, "electric filament or discharge lamps, parts". Actually, about 150 of the exported products are in the same two-digit category, 85, "electrical machinery and equip. and parts, telecommunication equip., sound recorders, television recorders". This is likely to be the set of core-product by the company. From the database it is quite obvious that the remaining very large number of exported products are mainly one-off exports, and has nothing to do with the core-product of the firm. Examples include small quantity one-time exports of hand saws, screwdrivers, hammers and a great number of other hand tools to Belgium. Note that we look at individual companies rather than groups that would deal with a large set of companies and core-products.

For this reason, we tried to distinguish between the products of firms and other goods exported by them. This is not a straightforward and we summarize the procedure in Appendix 2. In a nutshell we define assets as capital goods, when the main profile of the firm is not capital goods production, while we define inventories as intermediate goods when the profile of the firm is different from this. To make things simple, we only consider bilateral flows with one firm behind, as this makes possible a one-to-one correspondence between the firm level and the bilateral classification.

[12] In this paper we use inventory as a synonym for intermediate inventory, as this it is the input, rather than the output of the firm.

Figure 4 shows the relevance of asset and inventory sales. The figure suggests that this kind of noise is responsible for more than 22% of one-firm temporary trade cells, while its importance in permanent trade is just 2.2% - one-tenth of the value for temporary trade. We examined whether this phenomenon is restricted to multinationals trading among their affiliates in different countries, or it is a rather widespread phenomenon. To investigate this, we have done the calculations separately for foreign- and domestic-owned firms. We have found, that the importance of asset and inventory sales was very similar in the two groups of firms: asset sales added up to 3.1% for domestic firms and to 3.8% for foreign-owned ones; inventory sales represented 8.4% and 7.4% of temporary exports for domestic and foreign firms, respectively. These figures suggest that asset and inventory sales play an important role for all firms.

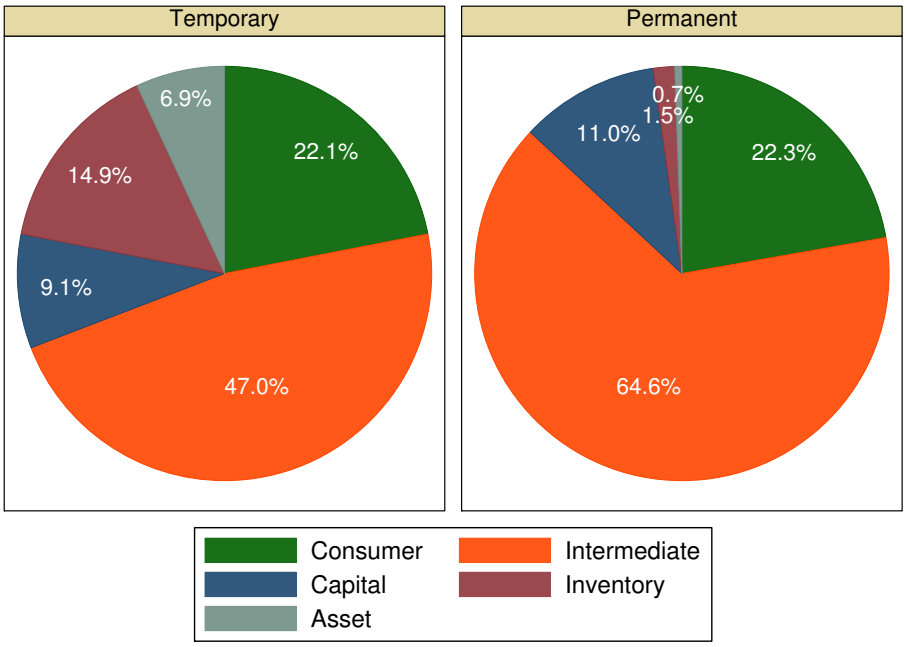
Overall, the distinction between export products and input exports seems to be important when analyzing real trade data, especially for a small open economy, where firms are likely to find a buyer for their assets and inventories in another economy.

6 Application: two consequences for empirical work

The notion of temporary trade may be useful for several trade policy applications. For instance gravity equations have been used to investigate the effect of classic economics problems such as trade liberalization, monetary integration and exchange rate arrangement as well as political economy issues like war and peace, institutional quality or the impact of contractibility. Theoretical advances in heterogenous firms literature from Melitz (2003) to Chaney (2008) as well as emerging evidence on product level trade relationships have led to a new question: what is behind an aggregate trade reaction to policy? In the Chaney model, lower transport costs (i.e. physical proximity) lead to both more firms engaged in trade and a higher average shipment value. Yet, reactions may differ and certain policies, such as the introduction of the common European currency may affect one or the other channel. Indeed, Mayer and Ottaviano (2008) argued that the variation in the number of firms that manage to export as well as the number of exported products accounts for most of the 'gravity effects', while quantities defy 'gravity'.

In what follows, we demonstrate that the aggregate gravity equation as well as estimations of the intensive and extensive margin reactions are sensitive to trade stability. When the policy question is about how a specific measure

Fig. 4. **The importance of asset and inventory sales**



affected the size and structure of trade, we propose to apply our filter and study the impact on permanent trade only. Taking into account temporary trade, ie. the adaptation itself, may be misleading in cases.

6.1 Where is temporary trade shipped?

In this subsection we compare the destination profile of permanent and temporary trade. After showing some descriptive statistics, we estimate a simple probit specification to model the probability of a trade relationship being permanent, conditional of a positive trade flow in the studied period. Our results suggests that temporary trade is more relevant in more distant and smaller markets. Second, we estimate gravity equations to see whether gravity variables affect temporary and permanent trade differently.

6.1.1 Descriptive evidence

In this subsection we provide some evidence that gravity variables play an interesting role in determining whether trade relationships are permanent. For the US, Bernard et al. (2007) showed that distance has a strong negative effect on the number of products exported and that average sales of individual products is increasing with distance. Lawless and Whelan (2007) took this result and argued that this finding is consistent with models of heterogeneous firms and fixed costs associated with exporting to each market.

In this spirit, we calculate the *trade stability index*, which is the share of products that were traded permanently at the bilateral level for a given destination country. Figure 5 depicts the relationship between (log) distance, (log) GDP and this measure of fragility in 2000. Each data point (depicted by a circle) relates the stability index to a measure of one in the 185 countries Hungary trades with. The size of the circles is proportional to total Hungarian exports in USD. The graphs clearly suggest that these variables are fundamental determinants of trade fragility: fragility increases with GDP and decreases with distance.

6.1.2 Probability of temporary trade

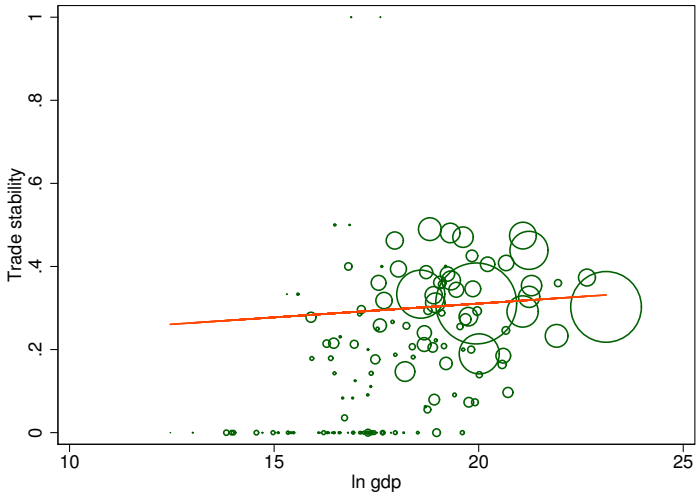
We model the determinants of temporary trade by a probit model, where the dependent variable is whether the relationship is permanent (took for at least 3 years). The estimated marginal effects are shown in table 5. The sample consists of all entries of the bilateral trade matrix in which trade was at least 2000 USD. The estimated equation is the following:

$$P(Perm_{ij} = 1) = F(\beta X_{ij}) + \epsilon_{ij} \tag{2}$$

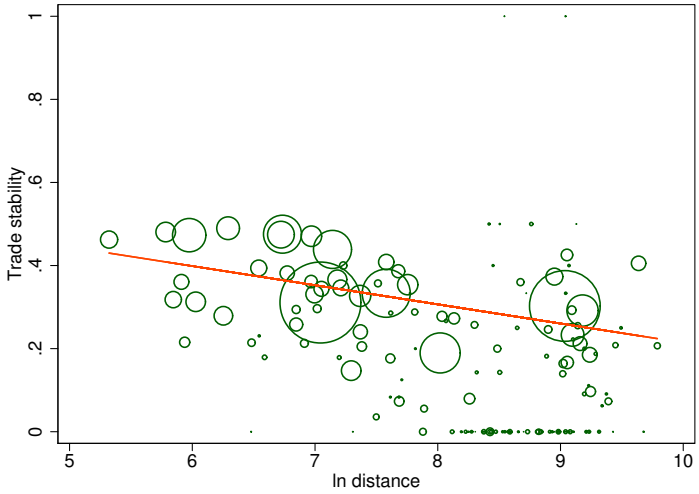
The dependent variable shows whether the export is permanent, i.e. it takes the value of one, if the product i was was exported to destination j at year 2000, and this was part of a spell which was at least 4 years long. On the other hand, $Perm_{ij}$ is zero, when the ongoing spell was shorter than 4 years. The explanatory variables are those of a standard gravity model: log distance and log GDP of the destination country.

We report 4 different specifications of this equation. Following Baldwin and Harrigan (2007), we estimate a linear probability model with product fixed effects (specifications (1) and (2)) and a random effects probit model (specifications (3) and (4)). In (1) and (3) we consider trade flows in excess of USD

Fig. 5. **Effect of gravity on trade stability index**



(a) **GDP**



(b) **DISTANCE**

2000 while we restrict the sample to larger trade flows than USD 5000 in (2) and (4). The results show that temporary trade is far from being random, and our estimates are quite robust to the specification. Trade flows to more distant and smaller economies are more likely to be temporary. These effects are significant both statistically and economically: if one destination market is twice as far from Hungary than another, trade flows are 13% more likely to be temporary in the farther country, than in the nearby one. Similarly, twice as large GDP increases the probability of permanent trade by about 4%.

Table 5
Probability models for permanent trade

	(1) FE OLS	(2) FE OLS	(3) RE Probit	(4) RE Probit
sample:	> USD 2000	> USD 5000	> USD 2000	> USD 5000
ln dist	-0.137***	-0.125***	-0.547***	-0.556***
	(0.012)	(0.013)	(0.017)	(0.019)
ln gdp	0.061***	0.055***	0.237***	0.233***
	(0.007)	(0.007)	(0.011)	(0.013)
ln gdp per capita	0.041***	0.039***	0.159***	0.172***
	(0.011)	(0.011)	(0.020)	(0.023)
Constant	0.174	0.250	-1.649***	-1.422***
	(0.169)	(0.153)	(0.217)	(0.252)
Observations	15478	13006	15478	13006
R^2	0.392	0.406	.	.

*** p<0.01, ** p<0.05, * p<0.1

The OLS regressions include HS-6 fixed effects

The reported coefficients for the probit regressions are marginal effects

6.1.3 Gravity and trade volume

The importance of the issue of temporary trade is best illustrated by looking at the *aggregate* behaviour of temporary trade. To see this, we estimate gravity equations to detect the different behavioural pattern of temporary and permanent trade. If there were important differences between these two types of international trade, it would suggests that there are different mechanisms behind them. Also, by showing that the gravity coefficients of temporary trade are different from the coefficients of permanent trade, this paper argues that the two types of trade should be distinguished in empirical work.

The specification of the gravity equation is the following:

$$logexp_{ij} = \alpha + \beta * \mathbf{X}_j + \gamma * temp_{ij} + \delta * \mathbf{X}_j * temp_{ij} + \mathbf{D}_j + \mu_i + \epsilon_{ij} \quad (3)$$

where $logexp_{ij}$ is the log export value in USD if product i to destination j in 2000, $\mathbf{X}_{ij}$ represents the vector of gravity variables and $temp_{ij}$ is a dummy showing whether the trade flow was temporary. We include the interaction of this dummy and the gravity variables to test whether temporary and permanent trade flows differ in there behaviour. We take into account Anderson and van Wincoop (2003) who argued that bilateral trade flows would not only depend on individual country customs but also on trade barriers across all trading partners. To capture this "multilateral resistance term", we added a set of dummy variables, $\mathbf{D}_j$ for capture destination country's involvement in

major trade blocks in Europe, Asia and North America (plus a dummy for being landlocked). The variable for EU25 is the most important as Hungary is also part of the European free trade zone in manufacturing goods since 1993. For this estimation we use the same sample as in the previous probit model and also include a full set of product (HS-2) dummies, μ_i to control for product heterogeneity. Table 5 reports our estimates with different sets of gravity variables.

Basic results (column (2)) on distance, GDP and GDP/capita all confirm international evidence on trade flows being positively related to market size, wealth and negatively related to distance capturing trade costs as well as a number of other cultural and institutional barriers. Sharing a trade block (the EU25) also has positive impact.

Cross terms with the temporary trade dummy lies in the limelight of this exercise. Indeed all cross terms with key variables are seen with a significant coefficient of opposing sign. For temporary trade, the effect of distance is significantly different with a combined effect of close to zero. The impact of market size is much less smaller for temporary trade. Also, while the effect of EU15 dummy is strongly significant and positive for permanent trade, the effect of the common market is about zero for temporary trade.

To evaluate the effect of adding temporary trade considerations, one may compare coefficients of the gravity variables between the standard equation in column (1) and the one controlling for temporary trade in column (3). While signs are unchanged, magnitudes differ, especially for the distance variable (-0.239 vs - 0.403). Thus, omitting the temporary trade variables may lead to misspecification in the standard gravity equation - for example in instances whenever stability of trade is implicitly assumed.

All these results show that gravity variables will affect trade of temporary nature at weaker fashion. This fact points to a fundamentally different behaviour of temporary trade from permanent trade, suggesting that a gravity model is less able to effectively describe this type of trade. Firm-level motivations behind these flows may differ from those usually described in models of international trade. Besides theoretical interest, this characteristic structural break in gravity parameters may have relevance for empirical work.

Some robustness checks are presented in 7. One possible concern is that the previous results are a consequence of small-value trade rather than temporary trade, as temporary trade is likely to be small-volume. To address this concern, we check whether a restricting the sample at a higher threshold (applying a

Table 6
Gravity model for Hungarian bilateral trade

	(1)	(2)	(3)	(4)
Log distance	-0.239***	-0.403***	-0.322***	-0.348***
	(0.054)	(0.066)	(0.059)	(0.062)
Temporary*log distance		0.349***	0.250***	0.274***
		(0.049)	(0.053)	(0.055)
Log GDP	0.335***	0.408***	0.399***	0.407***
	(0.025)	(0.028)	(0.028)	(0.029)
Temporary*log GDP		-0.251***	-0.244***	-0.250***
		(0.034)	(0.034)	(0.036)
Log(gdp/capita)	0.149***	0.211***	0.164**	0.171**
	(0.056)	(0.077)	(0.067)	(0.068)
Temporary*log(GDP/capita)		-0.159*	-0.102	0.000
		(0.082)	(0.076)	(0.000)
Landlocked	0.093		0.066	0.050
	(0.158)		(0.167)	(0.164)
Temporary*landlocked			-0.143	-0.128
			(0.168)	(0.165)
EU25	0.203**		0.224**	0.215*
	(0.102)		(0.110)	(0.115)
Temporary*EU25			-0.269***	-0.264**
			(0.101)	(0.108)
NAFTA	-0.030			-0.018
	(0.132)			(0.138)
Temporary*NAFTA				-0.019
				(0.162)
ASEAN	0.287**			0.468***
	(0.136)			(0.146)
Temporary*ASEAN				-0.430***
				(0.159)
Temporary		2.793***	3.000***	3.000***
		(0.660)	(0.656)	(0.797)
Constant	4.415***	3.700***	3.600***	3.559***
	(0.671)	(0.671)	(0.684)	(0.639)
(0.757)				
Observations	15478	15478	15478	15478
R^2	0.433	0.426	0.431	0.432

Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Gravity equation for Hungarian trade flows

$5000 instead of the $2000 threshold, thus reducing the sample by 20%) would change our results. Column (1) shows the estimates with a $5000 threshold has hardly any effect on the results.

In columns (2) we study trade flows within the EU only, while extra-European trade flows are taken in (3). The main results are also robust to this distinction. The comparison of the coefficients shows that the difference between temporary and permanent trade is somewhat more pronounced for non-EU destinations. In (4) we analyse whether results are sensitive to the choice of time period. In this specification we use 1995 as the base year. The estimates show that permanent and temporary trade behaved differently even in this earlier phase of transition. Overall, the impact of temporary trade seems to be rather stable across specifications.

Another possible concern, raised by Silva and Tenreyro (2006) is that log-linearization of the level form of the gravity equation

$$Export_{ij} = \beta_1 GDP_{ij} * \beta_2 Distance_{ij} * \epsilon_{ij} \tag{4}$$

can lead to biased estimates if ϵ_{ij} is heteroskedastic. They propose a pseudo maximum likelihood Poisson (PPML) estimator to correct this problem. They also argue that this estimator is able to handle the problem of the large number of zeroes, which is a characteristic of bilateral trade data. Note, that in our specification, in which the unit of observation is a country-product pair, rather than a country pair, the presence of zeroes is even more pervasive than in conventional bilateral gravity models [13]. To check weather our results are robust to correcting for this bias (i.e. by log-linearizing a heteroskedastic equation), we re-estimated our regression with the PPML estimator. The results are presented in Table 8. These specifications yield results which are very similar to our earlier findings.

Finally, we were concerned about the possibility of endogeneity bias. It can be the case, that trade partners perceive that some relationships would be of rather small volume, and as a consequence they invest less to the relationship. If such relationships are more likely to be temporary, the error term of the gravity equation can be correlated with the temporary trade variable and its interactions. This endogeneity bias may explain this paper's findings.

To investigate weather endogeneity of relationship is a problem, we estimated

[13] Martin and Pham (2008), on the other hand, argues that the PPML estimator does not solve the problem if zero trade flows are frequent and not only a result of omission of small transactions. As a consequence, we only rely on the PPML estimator as a robustness check.

Table 7
Robustness checks for the gravity model

	(1) export>5000	(2) EU25	(3) non-EU25	(4) 1995
Log distance	-0.362***	-0.727***	-0.210***	-0.220***
	(0.067)	(0.151)	(0.066)	(0.054)
Temporary*log distance	0.245***	0.645***	0.133**	0.119*
	(0.066)	(0.147)	(0.051)	(0.069)
Log GDP	0.393***	0.520***	0.295***	0.345***
	(0.029)	(0.037)	(0.030)	(0.023)
Temporary*log GDP	-0.235***	-0.348***	-0.140***	-0.183***
	(0.034)	(0.030)	(0.042)	(0.032)
Log(GDP/capita)	0.189***	0.295	0.136**	0.180**
	(0.066)	(0.189)	(0.057)	(0.070)
Temporary*log(GDP/capita)	-0.116	-0.260	-0.103	-0.269***
	(0.078)	(0.156)	(0.074)	(0.071)
Landlocked	0.030	-0.226	0.136	0.095
	(0.168)	(0.215)	(0.131)	(0.140)
Temporary*landlocked	-0.139	0.139	-0.285	0.077
	(0.197)	(0.259)	(0.189)	(0.159)
EU-25	0.170			0.218**
	(0.113)			(0.108)
Temporary*EU-25	-0.261**			-0.241*
	(0.117)			(0.141)
NAFTA	-0.010		0.192	0.110
	(0.120)		(0.214)	(0.107)
Temporary*NAFTA	0.068		-0.254	-0.092
	(0.175)		(0.253)	(0.151)
ASEAN	0.426***		0.297**	0.391
	(0.139)		(0.148)	(0.281)
Temporary*ASEAN	-0.234		-0.256*	-0.448
	(0.146)		(0.143)	(0.320)
Temporary	3.134***	3.738***	1.805**	4.322***
	(0.865)	(1.331)	(0.842)	(0.898)
Constant	4.205***	2.803*	5.221***	4.271***
	(0.746)	(1.447)	(0.869)	(0.756)
Observations	13006	9958	5520	7440
R^2	0.427	0.507	0.460	0.474

Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table 8
PPML regressions

	(1)	(2)	(3)[1]	(4)[1]
Log distance	-0.365***	-0.547***	-0.178	-0.439***
	(0.057)	(0.057)	(0.124)	(0.113)
Log GDP	0.407***	0.482***	0.336***	0.414***
	(0.050)	(0.049)	(0.070)	(0.068)
Log GDP per capita	0.465***	0.459***	0.728***	0.688***
	(0.083)	(0.071)	(0.123)	(0.123)
Temporary*Log distance	0.397***	0.422***	0.466**	1.038***
	(0.098)	(0.114)	(0.227)	(0.364)
Temporary*log GDP	-0.180**	-0.146	-0.188*	-0.094
	(0.086)	(0.094)	(0.099)	(0.128)
Temporary*log GDP per capita	-0.276	-0.324**	-0.470	-0.948***
	(0.171)	(0.144)	(0.435)	(0.349)
Temporary	1.421	0.951	2.963	1.688
	(2.247)	(2.347)	(3.697)	(3.208)
Constant	3.258***	1.984***	0.935	0.350
	(0.667)	(0.756)	(0.984)	(0.967)
Observations	15478	15478	9958	9958
Zeroes[2]	no	no	yes	yes
HS4 dummies[3]	no	yes	no	yes

*** p<0.01, ** p<0.05, * p<0.1

Gravity equation for Hungarian trade flows

Robust standard errors in parentheses

All equations were estimated by the PPML method suggested by **?**

[1] The sample size was restricted to EU-25 countries for computational reasons

[2] Shows whether the zeroes are included in the estimation

[3] Shows whether a full set of HS4 dummies is included

the simplest model separately for permanent and temporary trade, adding product fixed effects. Results, presented in Table 9 [14], confirm that temporary trade is less influenced by classic GFP and distance variables of the gravity framework [15]. First, GDP matters much more for permanent trade flows (0.356) than for temporary trade (0.083). Second, and even more interestingly, the coefficient of distance is 0.100 for temporary trade versus the usually found large negative figure (-0.304). All coefficients are significant and different from

[14] Poisson models yield very similar results

[15] Note that the reported R^2 of these regressions includes the effect of product dummies. If one omits the product dummies, the explanatory power of the gravity equation is 2.5 times larger for the permanent trade sample. This provides evidence for the fact, that temporary trade varies strongly across product groups.

Table 9
Separate gravity regression for permanent and temporary trade

VARIABLES	(1) temporary	(2) permanent	p-value[1]
Log distance	0.100***	-0.304***	0.000
	(0.026)	(0.021)	
Log GDP	0.083***	0.356***	0.000
	(0.019)	(0.015)	
Log GDP per capita	-0.031	0.201***	0.000
	(0.033)	(0.026)	
Constant	7.475***	4.198***	
	(0.378)	(0.276)	
Observations	3331	12147	
R^2	0.282	0.248	

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

[1] p-value for the difference between the parameters estimated for permanent and temporary trade

each other. This suggests, that the earlier findings are not only a consequence of the endogeneity bias. The results are especially striking in case of the distance variable, which has a positive coefficient for temporary trade, as the share of temporary transactions increases with distance.

As a consequence, when gravity regressions are estimated to study the effect of trade costs on trade volume, temporary trade can bias the results.

6.2 Extensive and intensive margins of trade

Recent contribution to the heterogeneous firm trade theory (Eaton et al., 2004, 2005; Helpman et al., 2004, 2007; Chaney, 2008) emphasize the role of the extensive margin of trade. In these models heterogeneous firm productivity and market-specific fixed costs lead to a large increase of new trade relationships when trade cost decrease. The models decompose the effect of trade liberalization to the extensive and intensive margins. The extensive margin means the number of new trade relationships, while the intensive margin shows the increase of the average sales in a trade relationship.

As a consequence, empirical studies testing or building on the properties of these models frequently decompose the increase in trade to extensive and intensive margins. While methods vary in details, most authors such as An-

dersson (2007) and Crozet and Koenig (2007)) define extensive margin as the number of trade relationships, and intensive margin as the ratio of export value and the number of trade relationships. When analysing the effect of trade liberalization, they decompose the change in total trade volume to change in the extensive and intensive margins.

While the theoretical distinction between the extensive and intensive margin is quite clear-cut, temporary trade can distort such a decomposition in practice. The decomposition of trade growth into the two margins relies on the assumption that all trade is permanent. If permanent and temporary trade react differently to trade liberalization, the average trade value per relationship (the intensive margin) can show primary the changing share of temporary trade, rather then the increased trade in existing trade relationships. This kind of bias can change substantially the relative importance of the extensive and intensive margins.

To illustrate this, we decompose trade growth in Hungary between 1995 and 2000, a period of substantial trade liberalization, and present our results in table 10. The extensive margin measures the number of bilateral trade relationships (country*hs6) in both years. The intensive margin is the average trade in one relationship, in thousand USD. The upper panel of the table shows the decomposition for the total trade flow of Hungarian manufacturing firms. The number of relationships (the extensive margin) increased with 80.3 percent, while the average export in one relationship (intensive margin) increased with 65 percent, from 244 to 404 thousand USD. As a consequence, between 1995 and 2000, total trade increased to (1.65*1.8)*100=298 percent of its volume in 1995. The bottom panel shows the same decomposition for permanent trade, and the bottom panel of the table presents it for temporary trade.

The table reveals an interesting pattern. First, temporary and permanent trade reacts differently to trade liberalization. As we have seen earlier, the share of temporary relationships dropped during the period under study. The intensive margin of temporary trade also decreased. The increasing share of the (on average) much larger permanent trade relationships affects strongly the decomposition of total trade. The estimated extensive margin for the total Hungarian trade volume is 1/3 smaller than the permanent trade extensive margin, and there is a 50% difference between the intensive margins as well. Ignoring the difference between permanent and temporary trade leads to a significant overestimation of the importance of the intensive margin in our example.

Such biased estimates can lead to problems, when predictions of trade models are tested empirically. As temporary and permanent trade behave differently, estimating one structural model on total trade can be misleading if the applied empirical measures are sensitive to the difference between the two kinds of trade flows. The problem can be eliminated by restricting the sample to permanent trade, or by using definitions based on trade volumes, which are less sensitive to the presence of temporary trade.

Table 10
Decomposition of Hungarian trade growth, 1995-2000

		1995	2000	change (percent)
Total trade	Volume (m usd)[1]	4465	13316	198.23%
	Number of relationships (extensive margin)[2]	18272	32942	80.29%
	Average size ('000 USD, intensive margin)[1]	244	404	65.42%
Permanent trade	Volume (m usd)[1]	4208	13066	210.50%
	Extensive[2]	8447	18268	116.27%
	Intensive[1]	498	715	43.57%
Temporary trade	Volume (m usd)[1]	257	250	-2.72%
	Extensive[2]	9825	14674	49.35%
	Intensive[1]	26	17	-34.87%

[1] Total trade volumes and the intensive margin are measured in million USD and thousand USD, respectively

[2] The extensive margin is the number of trade relationships

7 Conclusions

In this paper, temporary trade was presented to be surprisingly important in overall trade activity - being responsible for about a half of all bilateral trade relationships in Hungary. This phenomenon is not restricted to a specific groups of firm, nor is it a consequence of exporting large and lumpy goods periodically. It is, however a consequence of few trading firms behind most of the cells in the bilateral trade matrix. A part of it can also be explained by the fact that firms in a small open economy often sell their assets and inventories abroad, when they want to replace them.

Temporary trade has interesting theoretical consequences. As most firms trade some goods temporarily, trade theories assuming a simple structure of fixed cost may be too simple to explain real-word trading data. Theories assum-

ing flexible trading technologies or 'starting in small' as an optimal response to asymmetric information or uncertainty may be supported by the evidence presented in this paper. The great magnitude of temporary trade within multinational groups may also help in forming theories about trade within these groups of firms.

On the empirical side, this paper has shown that ignoring a different behaviour of temporary trade may lead to bias in cases when the unit of observation is a trade relationship rather than one dollar worth of trade. The gravity equations suggest that distance and GDP affects differently permanent and temporary trade, and the share of temporary trade is higher for smaller and more distant trade partners. Also, when decomposing trade into intensive and extensive margins, the relative weight of the two margins may be distorted by the changing share of temporary trade.

Findings may also have policy relevance. The great significance of temporary trade may provide strong arguments against export subsidies that lead to a temporary response only. The complex and flexible structure of trading cost implies that firms may be able to export temporarily as a response to the subsidy without 'paying' out the sunk cost of a stable relationship. This is especially important in case of multinationals: they may be able to generate trade between two countries without much lasting effect. As a result, subsidizing temporary trade may have no effect at all on employment or firm growth. Thus, trade promotion should concentrate on helping the formation of prolonged, stabile trade relationships.

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8 Appendix

The Appendix serves for several purpose. First, we present an alternative definition for temporary, approaching the issue from a rather different angle: yet with the same results. Second, the method to identify assets and inventories are presented. Third, a set of additional descriptive statistics are presented as well graphical representations on role temporary trade plays.

8.1 An alternative definition of temporary trade

In this appendix, we study an alternative definition of temporary trade: it is defined in regards to a country and a product as an occasion when trade occurred at least once but not in all years during a given period. We consider the four year long period of 2000-2003. Permanent trade is defined a spell of at least four years of un-interrupted trade in a product-country category. We find that our results are robust to modifying the definition this way.

According to this definition, 69% of active cells were temporary in this period: more than two thirds of all trade relationships were not stable for a period of four years. We consider several robustness checks to see if this figure is reasonable in general. We consider five possible checks: number of years, period of time chosen, composition of goods (the role of agriculture), dropping nuisance (i.e. very small) deals, and dropping far-away countries. First, for the 3-year period between 2001 and 2003, the share of temporary trade relationship is 60.5%, and it is 74.7% for the 5-year period between 1999 and 2003. For the more turbulent earlier period between 1996 and 1999, the ratio is 74.3%. Second, the share and size of temporary trade is is certainly sizeable for all product categories, and it is not only a consequence of agricultural fluctuations: if one restricts the sample to manufacturing products [16] , the ratio of temporary trade is very similar (67.2%). Third, if we restrict the bilateral matrix only to important trading partners and products, the share of such fragile trade relationships decreases somewhat (to 61.3%), but it still remains extremely important. Fourth, the importance of temporary trade flows depends on the economic distance between Hungary and its trading partners, but the fundamental pattern is very similar to all country groups. For example, for EU-25 countries the share of temporary trade flows is 61.4% and it is 76.8% for other countries. Trade flows seem to be somewhat more fragile for more

[16] ISIC-rev2 headings 311-390.

distant trading partners.

8.2 Identifying assets and inventories

In this paper, we use a plain method to catch asset and inventory exports at the firm level. For this, we first identify the *profile* of the firm, i.e. whether the firm is producing consumer, intermediate or capital goods. By using the Broad Economic Categories (BEC) table of the United Nations, we aggregate exports of the firm in all three large categories (consumer, capital, intermediate). A particular firm is classified as a consumer-goods producer, if the value of its consumer-good exports is larger than its intermediate and capital goods export. Firms are classified to be capital-good producers and intermediate goods producers as a similar way. With this procedure we can identify the profile of the firm at a considerable security.

Having classified firms into these categories, we calculate the share of exports which differ from the profile of the firm. In particular, we classify an exported capital good as an *asset sale*, if the profile of the firm is consumer- or intermediate good producer. Similarly, an *inventory sale* means exporting an intermediate good if the profile of the firm is not intermediate goods. By this procedure [17] , we are able to classify all exported goods to be

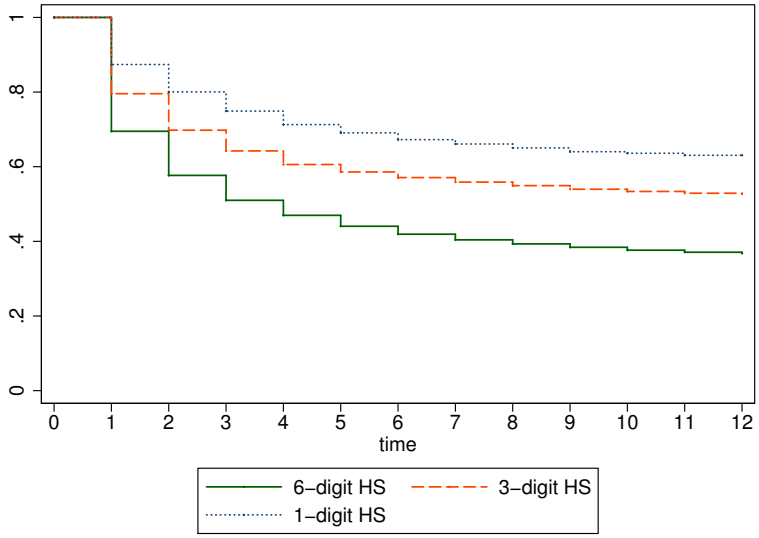
- consumer goods
- capital goods, when the product is a capital good and the profile of the firm is capital goods
- intermediate goods, when it is the profile of the firm
- assets
- inventories

Relating this firm-level classification to the bilateral level, however, is not straightforward in cells where more than one firm exports. As a consequence, we consider only one-firm cells of the bilateral matrices in this subsection

[17] Of course, this procedure is not without weaknesses. First, it is possible that capital or intermediate goods producers also export assets and inventories, which we can not identify. This would lead to an underestimation of the importance of asset and inventory sales. Second, it is possible that a firm produces more than one type of good, because there are some goods in different broad categories can be produced with very similar technology. If this problem would be important, we would overstate the importance of asset and inventory sales. The magnitude of this problem, however, can be assessed by calculating the share of asset and inventory sales in permanent trade - if this share is similar in permanent and temporary trade, then our definition is too noisy. If, on the other hand, the importance of asset and inventory sales is minuscule in permanent trade, then we can rely on our definition.

(78% of temporary cells). For these cells we can unambiguously identify the category of the trade flow. Restricting our investigation to one-firm cells is not very restrictive however when studying the importance of asset and inventory sales in temporary trade, as most temporary trade cells are also one-firm cells (see Table 3).

Fig. 6. **Survival functions for bilateral trade flows at different levels of aggregation**



8.3 Graphs

In what follows, a set of graphs are presented. Using Hungarian data, figure 6 shows the survival functions at the 6-digit, 3-digit and 1-digit Harmonised System level. Figure 7 shows the share of different cells in the Hungarian trade flow matrices. The matrices are constructed from all trade partners and manufacturing exports of Hungary between 1997 and 2003. In Figure 8 we study whether temporary trade is restricted only to a small fraction of firms. The graph shows the fraction of firms that trade at least one good either temporarily or permanently. Finally, Figure 9 shows the shares of various types of trade relationships by three categories, the 2-digit level of Harmonised Systems (HS2), Broad Economic Catergories (BEC) and the Rauch typology.

Fig. 7. **Number of cells with zeroes, permanent and temporary trade flows in Hungarian bilateral trade matrices**

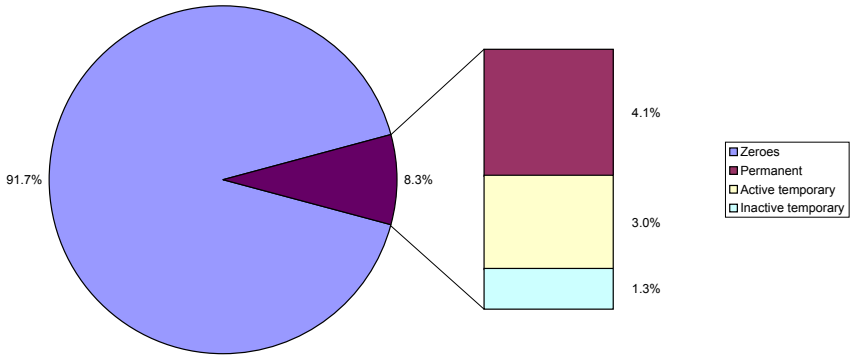


Fig. 8. **Share of firms trading permanently and temporarily**

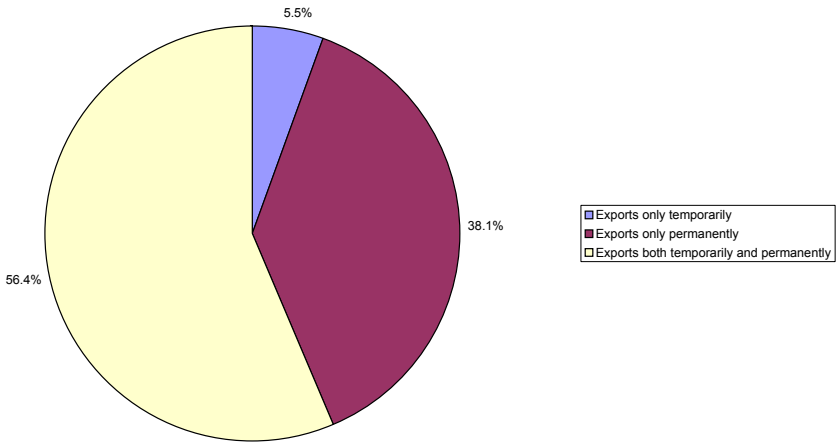


Fig. 9. **Permanent and temporary trade in different products**