Variations in Service Trade

Elena Biewen* and Sven Blank*

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Abstract

Using comprehensive micro-level information on service trade for the years 2001 to 2012 in Germany, one of the largest service traders in the world, we analyze how firm-level patterns shape variations in aggregate service trade along three dimensions: cross-sectional variation, variations over time, and variations in growth rates. We find the extensive margin to be the main contributor to the cross-sectional variation of service trade. In contrast, the intensive margin is most important for explaining variations along all other dimensions analyzed. While this is also true for variations over time, the extensive margin positively contributes to aggregate service exports growth during the great collapse in 2008 to 2009. Firms trading larger volumes seem to have been better able to cope with trade crisis, however, smaller firms performed better in the previous years. Looking at the determinants of service trade volatility, we find the impact of firm-specific shocks to be most relevant on average. The relative impact of shocks at the aggregate level becomes more important during the great trade collapse and the subsequent debt crisis in the Eurozone.

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*Contact: Deutsche Bundesbank, e-mail: elena.biewen@bundesbank.de; sven.blank@bundesbank.de

The views expressed in this paper are those of the authors and do not need to reflect the opinions of the Deutsche Bundesbank.

1 Introduction

International trade in services has become crucial for countries' competitiveness in the last decades. Global service trade relative to world GDP grew from nearly eight percent in 1990 to more than twelve percent in 2012 with a total value of 24 percent relative to world's goods trade.[1] However, these figures obscure the actual impact of services for overall trade performance. For all EU countries in 2009, the share of value added of services embodied in gross exports in the manufacturing sector alone accounted on average for 33 percent, with a share of value added of imported services in gross exports of 16 percent.[2] Hence, when assessing a country's competitiveness in terms of export performance it is essential for policy makers not only to focus on goods trade alone but also take a country's ability to trade efficient services into account.

In this paper, we analyze the microeconomic underpinnings of service trade, *i.e.* we ask, what role do individual firms play in shaping variations in aggregate service trade. We disentangle the potential drivers of variations in service trade along three dimensions: cross-sectional variation, variations over time, and variations in growth rates. To this end, we use the International Trade in Services Statistics compiled by the Deutsche Bundesbank that provides a comprehensive picture of German firm-level service trade for the years 2001 to 2012. According to the WTO (2013), Germany is among the top three of the largest exporters and importers of services. We are thus able to study the drivers of service trade for one of the most important service traders worldwide.

Our paper is related to several strands of the literature. First, we contribute to the small but fast growing number of studies analyzing service trade outcomes using firm-level data, *e.g.* Kelle and Kleinert (2010) as well as Kelle (2012) for Germany, Walter and Dell'mour (2010) for Austria, Ariu (2012) for Belgium, Federico and Tosti (2012) for Italy, and Breinlich and Criscuolo (2011) for the UK. We confirm previous findings that there are significant differences across firms engaged in service trade with regard to traded volumes, services, trading partners and number of transactions with the bulk of activity concentrated on a few firms. We also find a strong heterogeneity of the importance of services and trading partners within firms. In addition, most of the cross-sectional variation at the country-level occurs at the extensive margin while the intensive margin explains nearly half of the cross-sectional variation at the firm-level.

Second, we provide evidence on how firm-level activities shape service trade over time. Since our data cover the years 2001 to 2012 we are able to shed light on firm-level adjustments during the great trade collapse in 2008 to 2009 and the subsequent Eurozone debt crisis. We find the downturn in services during the crisis to be rather modest with the intensive margin being the

[1] See http://unctadstat.unctad.org (accessed January 2014).

[2] See the OECD-WTO Trade in Value Added database (TiVA), http://stats.oecd.org (accessed January 2014).

most important contributor to the decline. The dominance of the intensive margin during the trade collapse is also found for firm-level goods trade by Bricongne et al. (2012) for France and by Behrens et al. (2013) for Belgium. Behrens et al. (2013) also report a rather minor impact of the extensive margin. For service exports, we even find the extensive margin to have contributed positively to growth which alleviated the decline.

Third, our paper is more generally related to a research theme that tries to understand how shocks at the firm-level contribute to aggregate fluctuations. Gabaix (2011) finds that idiosyncratic shocks to firms do not vanish in the aggregate if the firm-size distribution is fat-tailed but lead to considerable macroeconomic fluctuations. Carvalho (2010) and Acemoglu et al. (2012) show that microeconomic shocks may propagate through the economy via input-output linkages and contribute to aggregate volatility. In this paper, we follow a recent contribution by di Giovanni et al. (2014) and decompose service trade growth into shocks stemming from the aggregate and the firm-level. With the contributions at the macro- and micro-level in hand, we are able to disentangle the impact of each for aggregate service trade volatility. Consistent with the findings of di Giovanni et al. (2014), we find firm-specific shocks to closely resemble the dynamics of aggregate service trade volatility and to be more important for variations in service trade growth on average than macro-level shocks. However, shocks at the macro-level become relatively more important during the great trade collapse and the following Eurozone crisis. We also find that the main driver of the firm-specific component are shocks that are transmitted across firms through input-output linkages.

The rest of the paper is structured as follows. In Section 2, we present key characteristics of the data we use. Section 3 and Section 4 present the results for the firm-level contribution on the cross-sectional and the time variation of service trade, respectively. Section 5 analyzes the impact of shocks originating at the aggregate and the firm-level to variations in service trade growth. Section 6 concludes.

2 Data Description

We use a unique micro dataset on international trade in services (ITS) by the Deutsche Bundesbank. The database covers service transactions between German residents (firms, individuals, public authorities) and non-residents above a threshold of 12,500 Euro and contains comprehensive information on each reported service transaction.[3] As the reporting threshold is rather low, the data almost span the entire population of German service traders, only excluding service trade conducted through foreign affiliates (mode 3 of the General Agreement on Trade in

[3]Many firms, however, also report transactions below this threshold.

Services).[4]

The data comprise information on the value of each exported or imported transaction, individual type of service traded, destination or source country, and sector of the firm. Though we do not have any further information on firm characteristics, the dataset allows us to get a comprehensive picture of the nature of service trade, its composition and differences in trading patterns at the country- as well as the firm-level. Since our focus is on firms' activities and their role in shaping service trade, we exclude private transfers, and transactions undertaken by international organizations, federal and communal institutions as well as households. Our sample covers more than 75 percent of Germany's aggregate service trade as reported in the Balance of Payments Statistics in an average year and 73 individual services which are listed in Table A.1.

To get a first impression of the data we use, Figure 1 shows the number of German service exporters and importers as well as the volume of exports and imports in billions of Euro for the years 2001 to 2012.[5] As can be seen in Figure 1 the number of importers is remarkably stable over time with an average of 27,000 firms per year. In contrast, the number of exporters steadily increases from roughly 6,000 firms in 2001 to more than 13,000 firms in 2012. The volume of imports and exports grow over the entire time span, with the exception of 2008 to 2009, which coincides with the collapse in goods trade. The volume of imports increases by 67 percent whereas exports increase by nearly 140 percent between 2001 and 2012. Despite the smaller number of exporting firms, the difference in traded volumes is decreasing for the years 2001 to 2008 and is almost vanishing for the subsequent years. Hence, on average, exporters trade greater volumes than importing firms.

In goods trade, the industry a firm belongs to (*e.g.* manufacturer of motor vehicles) and the type of good it is shipping (*e.g.* cars) usually coincide and are often used interchangeably in the literature. In service trade, however, this distinction is essential. Figure 2 shows the average trade of selected service categories by individual German industries for the years 2001 to 2012. The figures for exports and imports are in the top and bottom panel, respectively.[6]

Figure 2 shows that not only pure service industries are engaged in service trade. In fact, every sector is active in trading all depicted service categories (though to a different extent) with

[4]All other modes of the GATS are covered by the ITS, *i.e.* mode 1, cross-border supply where the supplier and the consumer exchange services without leaving the home country, mode 2, consumption abroad in which case consumers move to the country of the supplier, and mode 4, presence of a natural person where suppliers move to the country of the consumer to provide the service. However, the dataset does not provide the information via which mode the transaction was carried out.

[5]Since service trade exhibits a lot of seasonality at lower frequencies, we focus on yearly figures here.

[6]The industry classification is based on Nace Rev. 1.1 (two digits). The service categories are based on the Extended Balance of Payments Services Classification (EBOPS), see Table A.1.

the manufacturing sector being one of the most important players, both, in terms of the extensive and intensive margin which is consistent with the findings of Kelle and Kleinert (2010), Kelle (2012), and Federico and Tosti (2012). While industries like transport or finance clearly dominate exports and imports of the service category they are associated with, the manufacturing sector even trades more construction and business services than the construction and business sectors do, respectively.

These figures are qualitatively very similar for service exports and import across industries. Hence, apart from services that support the ongoing business of a firm (such as back office activities), services do not only enter the value chain as an input in goods productions (such as R&D or design), they also represent part of the output even for firms not belonging to the service industry.[7] This is especially true for the manufacturing sector pointing to a complimentary relationship between goods and services exports. This interdependence indicates that service exports and imports may have a crucial impact on firms' and countries' competitiveness in terms of export performance as a whole.[8]

Having described aggregated characteristics of our data, we next turn to the patterns at the firm-level. Table 1 shows the average number of services traded, trading partners, and the number of transactions per firm for the yearly pooled sample from 2001 to 2012. An average exporter trades 1.6 services, serves 5.5 countries via 27.4 transactions.[9] On average, an importer purchases 2.3 services from 4.5 trading partner through 21.1. transactions. Consistent with Figure 1, the traded volume per firm-service-country observation and transaction as well as total sales per firm are more than twice as large for exporting firms. Behind these numbers Table 1 reveals large differences between firms in the lower and larger percentiles. A firm in the first percentile trades just one service with one country with a total amount of 3,000 Euro to 4,000 Euro. Compared to the first percentile, firms in the 99th percentile export 60,000 times and import 16,000 times more with a higher number of services and trading partners. The finding of a right-tailed distribution of firms' cross-border engagement in services is thus consistent with findings in the goods trade literature, see *e.g.* Eaton et al. (2011), and firms' activities more generally, see *e.g.* Gabaix (2009).

Table 2 shows the percentage share of firms and sales of firms that trade at least one, two,

[7]Carry-along-trade observed in goods trade (see Bernard et al., 2012) is less an issue for service trade since services are non-storable and have to be consumed immediately after their "production".

[8]Note that these numbers are likely to be downward-biased. Especially prices of durable goods often already entail some services to customers, *e.g.* the free maintenance of a machine in the first year after acquisition or regularly software updates of an electronic device, such as a smartphone, sold abroad. Hence, part of goods trade that we observe is actually service trade.

[9]We observe the traded volume of a service with a country in a given month which may comprise several transactions within that month. Actual transactions may thus be larger.

three, etc. service types and firms that have one, two, three, etc. countries as trading partners. Firms that export ten services or more account for nearly one percent of the entire population of service exporters in our sample but generate 24 percent of total exports. Exporting firms with 30 destination markets or more account for just 3 percent of all exporters, but their sales amount to 50 percent of total exports. The picture is similar for importing firms. Only a fraction of 3 percent of all firms import ten different services. However, the volumes traded make up 47 percent of all imports, and 54 percent of total imports fall upon 2 percent of firms trading with at least 30 countries. These results show that service trade is highly concentrated on a few top traders and point to a significant role of large firms in shaping aggregate service trade.

Table 3 shows the distribution of services and trading partners within firms. The table presents the fractions of service sales of an average firm attributable to the first, second, third, etc. most important service and market, respectively. The first row in the left top panel gives the results for the overall sample for services. As a large part of firms trade only one service, the average share on the first most important service in overall exports and imports is very pronounced. Firms that export more than one service strongly concentrate their activities on one "core" service. The average share is decreasing for multi-service firms, but still amounts to 60 percent if exactly ten services are exported. The average fraction of sales of the second, third etc. most important services is exponentially decreasing, with an average share of only 0.1 percent on the tenth service exported. As can be seen in the left bottom panel of Table 3, this within-firm distribution is quantitatively very similar in the case of services imports and also for the distribution of export and import volumes at the country-level (right top and bottom panel, respectively). If anything, the concentration of markets within firms is slightly lower compared to services.

In sum, we find the micro patterns of German service trade to be consistent with findings in the goods trade literature as in *e.g.* Arkolakis and Muendler (2013) and also for service trade as in *e.g* Breinlich and Criscuolo (2011), Kelle and Kleinert (2010), Kelle (2012), and Federico and Tosti (2012). There are significant differences across firms engaged in service trade with regard to volumes, number of services traded, transactions, and trading partners with the bulk of activity conducted by a few, potentially large, firms. In addition, we find a strong heterogeneity of the importance of services and trading partners within firms.

3 Cross-Sectional Variation

In this section we look at the cross-sectional variation of service trade across countries as well as across firms. To this end, we decompose total trade (exports and imports, respectively)

into extensive and intensive margins and estimate the individual impact on the cross-sectional variation of trade.

3.1 Country-level Margins

We follow Bernard et al. (2009, 2011) and decompose aggregate trade with country c, x_c, into the extensive margin of the number of firm-service observations for which trade with country c is positive, o_c, and the intensive margin of the traded value with country c per firm-service observation, x_c/o_c. The number of firm-service observations, o_c, can be further split up into three extensive components: the number of firms that are trading with country c, f_c, the number of traded services with country c, s_c, and trade density with country c, $d_c = o_c/(f_c s_c)$, where $f_c s_c$ is the number of all possible firm-service observations. Density measures the extent to which each firm trades each service. As noted by Bernard et al. (2009) and confirmed by our findings in the pervious section, the bulk of firms do not export or import the full range of services, but focus their trading activities on specific services. Thus, if the number of firms that trade with country c increases, the number of all possible firm-service combinations increases by more than the actual firm-service trades observed causing density usually to decline.

We can further extract an additional extensive component from the intensive margin, x_c/o_c, by introducing a term which we label activity, and is given by $a_c = tr_c/o_c$. Activity measures to what extent observed firm-service combinations, o_c, are actually utilized through the number of transactions with country c, tr_c, *i.e.* how active firms are in trading specific services with country c within a period of time.[10] Given activity, the intensive margin can intuitively be expressed as the average volume traded with country c per transaction, $\bar{x}_c = x_c/tr_c$.[11] Total trade with country c for a given period t can then be expressed by the following identity:

$$x_{ct} = f_{ct} s_{ct} d_{ct} a_{ct} \bar{x}_{ct}. \tag{1}$$

In order to disentangle the impact of the intensive and four extensive margins on trade, we regress the logarithm of each margin on the logarithm of total trade with country c in period t in a pooled OLS using yearly data. As equation (1) holds by definition, the estimated elasticities capture the average percentage contribution of each margin for the cross-sectional variation in trade with country c over the sample period 2001 to 2012.

[10] Ariu (2012) also points to the importance of transactions for explaining the cross-sectional variation in service trade. He includes the number of transactions as an additional extensive margin directly.

[11] We only have information on the monthly volume traded at the firm-service-country level. Hence, at monthly frequency activity, a_c, and number of firm-service observations, o_c, are equal and the specification naturally collapses to the decomposition in Bernard et al. (2009, 2011).

Table 4 reports the relative contribution of each margin for exports and imports, respectively, for different sub-samples. The first column in Table 4 gives the results for total exports to all countries in the sample. Taken together, the four extensive margins account for nearly 70 percent of the cross-sectional variation in country-level exports, in which firm and service margins explain 59 and 31.6 percent of the total variation, respectively. These figures are in line with the findings of Breinlich and Criscuolo (2011) for UK services exports. The coefficient on density, the extent to which each firm trades each service is negative as expected with an elasticity of -0.294. Activity explains 7.7 percent of the cross-sectional variation across countries. Further, the sum of the coefficients for density and number of services gives the contribution of the variation of services exported per firm, $s_c d_c = o_c/f_c$, and is only 2.2 percent. However, adding the coefficient for activity to this number, *i.e* $s_c d_c a_c = tr_c/f_c$, reveals that transactions per firm play a more important role with a contribution of 9.9 percent. This difference in firms' export performance shows that it might be misleading to focus on the number of services traded per firm alone and ignore the number of actual trades that are conducted at the firm level when evaluating its impact on aggregate trade.

31.2 percent of the cross-sectional variation is driven by the intensive margin. This appears to be in contrast to Breinlich and Criscuolo (2011) who find the influence of the intensive margin to be relatively unimportant to explain the cross-sectional variation in country-level service trade. Their measure of the intensive margin is based on the product of the number of trading firms and the number of traded services rather than on the number of transactions. Summing the coefficients for density, activity, and the intensive margin, $d_c a_c \bar{x}_c = x_c/(f_c s_c)$, yields a measure for the intensive margin that is consistent with their decomposition and reveals a smaller contribution of 9.5 percent.

As can be seen from the second column in Table 4, the decomposition of total exports to member countries of the European Monetary Union (EMU) yields similar results for the impact of the number of firms and the intensive margin. Services only contribute with 8.4 percent to the variation of exports indicating that demand across EMU countries is more homogenous than from the rest of the world. However, since our data only comprises a limited number of types of services traded, this figure is likely to be downward-biased. In addition, the contribution of density, the share of actual firm-service exports in all possible firm-service combinations, is much smaller in absolute terms compared to the full sample with an elasticity of -0.05 which shows that also supply of services by firms across EMU countries is similar compared the rest of the world.

As the previous section showed that a small fraction of firms plays a dominant role in shaping aggregate service trade, as a next step, we restrict our sample to top traders, *i.e.* firms whose

export volumes lies in the top percentile of all firms' exports in a given sector and year. Column three in Table 4 reports the estimates for this sample. As the group of top traders export more services and serve many countries, we would expect the extensive margin to explain less of the variation in service exports across destination markets. As can be seen in the third column in Table 4, the intensive margin is indeed more important with a relative contribution of 48.6 percent. The number of firms contribute only 34.8 percent to the total variation. However, the contribution of the number of services exported per firm, $s_c d_c$, and transactions per firm, $s_c d_c a_c$, is higher compared to the full sample, with elasticities of 0.070 and 0.166, respectively.

Results for country-level service imports (columns four to six in Table 4) show similar patterns to that of exports for the respective sub-samples for the number of services traded. The intensive margin is five to nine percentage points smaller in magnitude in favor of the contribution of the firm margin compared to service exports across samples. This is consistent with lesser concentration of importers' activities and a higher number of firms engaged in service imports, as shown in the last section. In contrast to previous results density contributes positively to imports from EMU countries (column five), *i.e.* density is positively correlated with the number of firms and the number of services. The reason is that in many EMU countries the full set of services is traded. If at the same time the number of firms that source many services increases, the number of firm-service observations increases by more than the product of the number of firms and services and density is increasing in the volume sourced from these countries. Compared to exports to the EMU the elasticity of density of 0.04 for imports is similar in magnitude. The impact of activity is negligible.

In unreported regressions, we also split our sample into selected industries and service categories traded. We find similar results for the manufacturing and the wholesale sector. This is consistent with Figure 2 as both industries are active in virtually all type of services exported and imported. For the construction sector and financial intermediaries, the extensive margin, though still the largest contributor to the cross-sectional variation, is less important. For service categories we also find the extensive margin to account for most variation across countries.

3.2 Firm-Level Margins

To get a sense of the drivers of the cross-sectional variation of service trade at the firm-level, we proceed analogously to the previous subsection and decompose total trade of an individual firm f in period t as

$$x_{ft} = c_{ft} s_{ft} d_{ft} a_{ft} \bar{x}_{ft}. \tag{2}$$

The extensive margins are captured by the number of countries firm f is trading with, c_f, the number of services firm f is exporting or importing, s_f, trade density of firm f, d_f, and activity a_f. Given the number of country-service observations with positive trade for firm f, o_f, firm-level density is defined as $d_f = o_f / (c_f s_f)$. Activity of firm f, *i.e* the number of transactions, tr_f, it conducts per country-service relationship within a time interval, is captured by $tr_f/o_f = a_f$. The intensive margin is thus defined as $\bar{x}_f = x_f/tr_f$.

Results for this decomposition for the pooled sample from 2001 to 2012 are presented in Table 5. In the full sample, the intensive margin accounts for nearly 50 percent of the total variation in exports across firms. The number of countries served accounts for 29 percent, and the contribution of the number of services is rather small, 9.1 percent, indicating that firms do not differ much in the range of traded service products. As the previous section showed that the majority of firms export only one service (see Table 1), trade of individual firms should be very dense, *i.e.* $d_f = 1$ for the bulk of firms. Hence, for the full sample, we would expect the elasticity of density to be very small. We indeed find that the elasticity of density is only -0.058. As the number of transactions is more dispersed across countries (see again Table 1), activity contributes more to the firm-level variation, with an impact of 18.5 percent. The number of services traded per country, $s_c d_c$, accounts for only 3.3 percent while the number of transactions per country, $s_c d_c a_c$, contributes with 21.8 percent to the firm-level variation.

We again analyse the contribution of each margins for different sub-samples. The contributions are very similar for the EMU sample (second column), with a small increase in firms' activity and a decline in the remaining extensive margins, particulary in the number of countries. The intensive margin accounts for 53.1 percent of the variation. Larger differences can be observed in the case of top service exporters (third column) that serve multiple markets and trade many services. Table 5 shows that the number of trading partners and the number of services varies considerably across top traders with contributions of 38.2 and 27.2 percent, respectively.

In the case of imports the contribution of the number of services doubles compared to exports, explaining 20.6 percent of the total variation for the full sample and 18.5 percent for the EMU while the impact of the intensive margin is lower with contributions of 37.3 and 39.7 percent for the full sample and the EMU, respectively. This is in line with the finding that importers trade lower volumes per transaction than exporters (see Table 1). The elasticities for top importing firms are very similar compared to top exporting firms with two exceptions The impact of the number of services is 9.2 percentage points smaller compared to top exporter which is exclusively compensated by an increase in density. Hence, the variation of the number of services traded per firm, $s_c d_c$, is the same with an elasticity of 0.11.

4 Time-Series Variation

4.1 Margins over Time

In this section we analyse to what extent the micro-level patterns contribute the variation of aggregate service trade along the time dimension. To this end, we again decompose aggregate service trade flows into different extensive and intensive margins. We follow the methodology of Davis and Haltiwanger (1992), and Bricongne et al. (2012) and use mid-point growth rates to identify the impact of individual margins. The individual mid-point growth rate of a transaction of firm f between t and $t-1$ is given by the ratio of the total change in trade of service s with country c to the average traded value of firm f with country c of service s between t and $t-1$:

$$\gamma_{fcst} = \frac{x_{fcst} - x_{fcst-1}}{0.5\,(x_{fcst} + x_{fcst-1})}\,. \tag{3}$$

The mid-point growth rate for total trade between two periods is the weighted sum of individual growth rates:

$$\gamma_t = \sum_{fcs} w_{fcst}\gamma_{fcst}\,, \tag{4}$$

where the weight w_{fcst} is given by

$$w_{fcst} = \frac{x_{fcst} + x_{fcst-1}}{\left(\sum_{fcs} x_{fcst} + \sum_{fcs} x_{fcst-1}\right)}\,. \tag{5}$$

Each individual growth rate at the firm-country-service level can be attributed to one of the following sets: the set of entering and exiting firms, and the set of incumbents. Incumbents' growth rates can be further decomposed into new and retired trade relationships, added and dropped services and growing and shrinking growth rates of ongoing country-service relationships. We thus end up with six extensive and two intensive (gross) margins. Note that this hierarchy implies a pecking order. Trade with a new country may occur through a new or an already existing service, *i.e.* the set of added services only captures service creation among existing trading partners. The same downward bias of service switching in favor of the country margin holds for service destruction.

We decompose total services exports and imports for monthly, quarterly and yearly frequencies for 2001 to 2012. The results of this decomposition are given in Tables 6 and 7. The first three columns report the averages of growth rates for the period 2001 to 2008 for the respective frequencies. The subsequent columns give growth rates for individual years where monthly and quarterly growth rates are averages over the respective period. The aggregate growth rates for the different time intervals are reported in the last row.

For the years 2001 to 2008 the average mid-point growth rate of services exports is 10 percent with positive net contributions of all margins. The most important contributor among the extensive margins across all frequencies is firm entry, followed by trade relationships and service switching which may partially reflect the ordering of margins when calculating mid-point growth rates as noted above. At monthly frequency, the extensive margins account for 77 percent on average of the overall growth. However, their influence is decreasing at lower frequencies. For yearly growth rates, the intensive margin is the main driver for aggregate export growth with an average contribution of nearly 60 percent. This can be seen as the flipside of the findings in Section 3: lower frequencies conceal transactions within a period attributed to the extensive margin in favor of the intensive margin and thus blur firms' actual activity.

In addition to the impact of net contributions, we find a lot of dynamics when looking at the gross margins. For instance, at monthly frequency, the growth rates for increasing and shrinking service exports amount to 25.5 and -23.1 percent, respectively, leading to a net growth of 2.4 percent. Although the gross contributions of new and retired trading partners as well as service adding and dropping of incumbents are smaller in magnitude, they point to the importance of within-firm reallocation of trading partners and services, which is consistent with findings for goods trade, *e.g.* Bernard et al. (2011).

During the collapse in goods trade in the years 2008 to 2009, aggregate service exports experienced only a moderate decline of not even 3 percent at all frequencies. This decline can exclusively ascribed to the intensive margin which is similar to findings in studies for exports of goods, *e.g.* in Behrens et al. (2013) for Belgium and Bricongne et al. (2012) for French exports. The contribution of shrinking exports exceeds (in absolute terms) the still considerable growth in increasing export sales (-28.4 and 21.5 percent at a monthly frequency, respectively) indicating a relatively modest decline in demand. In contrast, the net contributions of all extensive margins are positive and thus even alleviated the decrease in service exports.

For the years following the goods trade collapse, aggregate export growth is positive and all extensive and intensive margins contribute positively (with minor exceptions). The intensive margin again is the main driver for the recovery in 2009 to 2010 with a growth rate of roughly 8 percent which may also reflect a catch-up effect after the downturn. For aggregate service exports we cannot deduce any significant effect of the Eurozone debt crisis on service exports for the years 2009 onwards. If anything, there is a slight reduction in the contribution of service-switching for the periods 2009 to 2010 and 2010 to 2011 compared to previous years.

Table 7 presents the results for service imports. We find similar patterns to that of service exports for the years 2001 to 2008. Services imports fell by roughly 5 percent from 2008 to 2009 with the main driver again being the intensive margin. One argument for the relatively

stable evolution of service trade compared to global goods trade during that period is that firms outsourced services associated with there ongoing business to reduce costs (*e.g.* Borchert and Mattoo (2010)). As Table 7 shows, if this argument is true, it only holds for incumbent firms especially with respect to services from already established markets, which exhibit a higher net contribution compared to average of the year 2001 to 2008. The net impact of new trade relationship is small but positive at monthly and quarterly frequency and slightly negative for the yearly growth rate. In addition, net firm entry is slightly negative. For the subsequent years, this negative trend in firm entry continues and the intensive margin is most important in explaining aggregate service imports at all frequencies. Hence, import growth is mainly driven by transactions with established trading partners and already existing services for the years 2009 onwards.

4.2 Services, Countries, and Firm Size

To gain further insights what where the drivers during the crisis, we next look at the contribution and the relative performance of services, countries, and size classes of firms. To this end, we use a similar approach as Bricongne et al. (2012), who focus on French goods exports during the trade collapse, and decompose mid-point growth rates by means of a dummy variable regression.

For expositional reasons, we cluster services according to the EBOPS classification given in Table A.1. By the same token, we sort each country into one of six groups. The first two groups contain countries belonging to the European Monetary Union and countries belonging to the Eurozone, respectively. To see whether there is an effect on countries that suffered most during the government debt crisis in the Eurozone, we group Greece, Italy, Ireland, Portugal, and Spain, denoted GIIPS. We include the US as Germany's most important trading partner as a separate entity. Brazil, Russia, India, and China, abbreviated BRIC, are also separated from other countries to analyze the impact these strong expanding emerging economies. All other countries are denoted as rest of the world, RoW. To capture different size classes, we rank firms of each industry by their total weight, *i.e.* the sum of their traded volume in $t-1$ and t relative to the sum of aggregate trade volume in $t-1$ and t, as given in equation (5) and build quantiles.

We regress individual mid-point growth rates on a set of service category, country group, as well as size class dummies to disentangle the performance of each. A regression model with a full set of dummy variables along each dimension leads to collinearity and usually one effect (in each set) is dropped to identify the system. The resulting estimates can only be interpreted relative to the omitted base effects. To deal with this shortcoming, we apply a restricted weighted least squares regression. Within this framework the estimation is carried out subject to additional independent linear constraints on the dummy variables, one restriction for

each set of dummies, which, combined with the regressors, overcome the problem of collinearity and enable the identification of the system, see *e.g.* Greene and Seaks (1991). In addition, given a proper formulation of the restrictions, the constrained model facilitates a meaningful interpretation of the estimated effects of each set as deviations from the weighted average of all country, industry, and service effects, respectively.[12] For each period t, we thus estimate the following system:

$$\gamma_{fcst} = \alpha_t + \delta_{st} + \delta_{ct} + \delta_{qt} + \varepsilon_{fcst} \quad \text{s.t.} \tag{6}$$

$$\sum_n w_{nt}\delta_{nt} = 0 \quad n \in \{s, c, q\}\,, \tag{7}$$

where α_t is a constant and δ_{st}, δ_{ct}, and δ_{qt} denote service categories, country groups, and quantile dummies in period t, respectively. Equation (7) restricts the weighted sum of dummies to be equal to zero, where w_{nt} with $n \in \{s, c, q\}$ denotes the weight of a service, country, or size class in total exports or imports in period t, *i.e.* $w_{nt} = \sum_{fsc \in n} w_{fsct}$.[13]

Figure 3, Figure 4, and Figure 5 summarize the results for the yearly sample for service categories, country groups and size classes, respectively. Each group of bars represents the estimated contribution for the respective period. Thinner bars over main bars correspond to the 95 percent confidence interval. The first group of bars represent simple averages of estimated effects over 2001 to 2008. Results for exports and imports are given in the top and bottom panels, respectively. In addition to this relative performance measure, we also add the absolute contribution to service trade growth for each period depicted by a grey circle.

For the years 2001 to 2008 on average, none of the service categories show significant performance relative to the average for both, exports and imports as shown in Figure 3. The figures for exports and imports are qualitatively very similar for all subsequent years. As expected, transport services fell more than the average during the great trade collapse in 2008/2009 due to their direct connection to goods trade. However, they contribute positively from 2009 to 2010 mirroring the recovery of international goods trade. Construction services show a lower relative performance in all years after 2008. This may in some part be explained by bursts of real estate bubbles as *e.g.* in the USA, Spain or Ireland. Even though the global trade collapse is also associated with a tightening in credit, trade in financial and insurance services did not suffer

[12] See Kennedy (1986) for an early application of a restricted weighted least squares regression.

[13] Bricongne et al. (2012), building on Cheptea et al. (2005), use this equivalent approach. First, the authors regress individual mid-point growth rates on a set of country and sector dummies in an unrestricted weighted regression. In a second step, the estimates are normalized by subtracting the weighted sum of the estimated coefficients from each effect (including the omitted base effects). While this leads to identical results, standard errors for the resulting effects are more readily available when applying the restricted weighted least squares framework directly.

relative to the average as they have performed better for exports and not significantly different than the average for imports. Recall, however, from Section 2 that financial services are not traded by financial intermediaries alone but by many industries (though to a lesser extent). Hence, the better performance for exports may also reflect the cross-border shifting of financial resources among firms themselves to cope with domestic liquidity shortages. However, their absolute contribution to growth is slightly positive for exports and negative imports. IT and other business services contributed positively to service exports and import growth during 2008 to 2009, in line with the hypothesis that firms outsourced backoffice services to lower costs during the trade crisis. While this also holds for IT services for the following years, the performance of other business services is less than the average for exports in 2009/2010 and only slightly larger than the average for imports. Export and imports of royalties, which also incorporate licenses, strongly outperformed trade in other service categories and show the largest absolute contribution to growth during the trade collapse. This indicates that in times of rising global uncertainty, firms might prefer to serve a foreign market through licensing rather than trade goods directly or conduct FDI. The relative contribution is negative for the following years, however.

Figure 4 shows the relative impact of country groups. As can be seen, the best performing group from 2001 to 2008 are the BRIC countries, while the performance the US has been less than average. During the great trade collapse, the US was most harmed as a trading partner both, for exports and imports reflecting the high uncertainty after the burst of the housing bubble and the following financial crisis. Firms seem to have concentrated more on neighboring countries as the EMU and EU were performed better than the average during that time. This picture changes during the outbreak of the government debt crisis in the Eurozone, where all European countries show an underperformance. The US, the rest of the world and especially the BRIC countries contributed more than average. Exports to Greece, Italy, Ireland, Portugal, and Spain continue to underperform in subsequent years. However, since Figure 4 shows a similar pattern also for the years 2001 to 2008, this underperformance does not appear to be specific to crisis.

Figure 5 presents the results for different size classes. While Section 2 shows that firms in the top percentile of the distribution clearly dominate aggregate service trade in terms of traded volume, Figure 5 shows that this outperformance only holds for service import growth. For service export growth, smaller firms below the median clearly outperform larger firms and top exporting firms show the weakest relative performance for export growth. The divergent picture for exports and import growth might be explained by the growing number of firms engaged in exporting whereas the number of importers is more or less stagnant or even declining over time

as depicted in Figure 1. Hence, even though firms in the lower quantiles often only trade small amounts of one service with one trading partner, they are an important contributor to export growth. Firms with trading volumes above the 99th and 90th percentile of the distribution, for exports and imports, respectively, nevertheless seem to have been better able to manage the trade collapse. This changes in the beginning of the Eurozone crisis from 2009 to 2010 where firms within the top percentile of the distribution suffered most.

5 Variations in Growth

In this section we ask, how changes in service trade growth themselves are driven by shocks at the firm-level. To this end, we first decompose aggregate service trade volatility into shocks at the aggregate and firm-level following the recent contribution by di Giovanni et al. (2014). To be able to analyze the contribution of shocks at the extensive and intensive margin, we again stick to mid-point growth rates as our measure for change. Finally, we also disentangle sources of fluctuations stemming from idiosyncratic shocks and network effects.

5.1 Shocks at the Macro-Meso- and Firm-Level

Building on a structural model, di Giovanni et al. (2014) decompose aggregate sales volatility of French firms into an aggregate and a firm-specific component. Since we showed in Section 2 that it is important to distinguish a firm's industry from the services its trading, we slightly augment their framework to account for potential industry shocks. Hence, we dissect the individual growth rate of firm f that is trading service s with country c at time t according to:

$$\gamma_{fsct} = \alpha_t + \delta_{ct} + \delta_{it} + \delta_{sct} + \varepsilon_{fsct}. \tag{8}$$

Equation (8) decomposes individual growth rates of exports and imports into two effects that reflect shocks at the macro- and meso-level, respectively, as well as shocks at the firm-level. The macro-level is given by a time effect, α_t, that captures a domestic aggregate shock common to all firms (a Germany-specific shock) and a shock specific to the country Germany is trading with, δ_{ct}. The meso-level comprises an industry-specific shock, δ_{it}, and a service-country specific shock that is supposed to capture demand and supply shocks for individual services in one country, δ_{sct}. The firm-specific component is given by the residual, ε_{fsct}.[14]

As noted in the previous section, the coefficients in the above regression cannot be identified separately if estimated in one framework unless some effects are dropped or other restrictions

[14]The decomposition in di Giovanni et al. (2014) is based on log-differences which is not feasible in our setup using mid-point growth rates. Hence, our results should be seen as approximations.

are imposed. Variations of the estimated coefficients would then have to interpreted relative to the omitted base effect. We follow di Giovanni et al. (2014) and subsume the time, country, demand and supply, and industry effects into one set of dummy variables, δ_{scit}, that capture all effects at the macro- and meso-level and enables to disentangle macro-meso- from firm-specific shocks. The joint impact of the effects remains the same regardless of the identification strategy. We thus run the following regression:

$$\gamma_{fsct} = \delta_{scit} + \varepsilon_{fsct} \tag{9}$$

Weighting the individual components with their respective weights and summation leads to aggregate trade growth in period t:

$$\gamma_t = \sum_{fsc} w_{fsct} \left(\delta_{scit} + \varepsilon_{fsct}\right) = \sum_{sci} w_{scit}\delta_{scit} + \sum_{fsc} w_{fsct}\varepsilon_{fsct} \tag{10}$$

A natural way to asses the impact of shocks at the macro-meso- and firm-level on service trade volatility would be to decompose the variance based on equation (10) into the sum of the variances of the weighted components and the covariance between them:

$$\text{Var}\left(\gamma_t\right) = \text{Var}\left(\sum_{sci} w_{scit}\delta_{scit}\right) + \text{Var}\left(\sum_{fsc} w_{fsct}\varepsilon_{fsct}\right) + \text{Cov}\left(\sum_{sci} w_{scit}\delta_{scit}, \sum_{fsc} w_{fsct}\varepsilon_{fsct}\right)$$

However, decomposing the variance in this way makes it infeasible to analyze the contribution of shocks at the macro-meso- and firm-level alone, since the above decomposition links the contribution of shocks with the attached weights. To get a better understanding about how macro-meso- and firm-specific components influence fluctuations in aggregate service trade growth, we follow di Giovanni et al. (2014) and treat the weights as non-stochastic and keep them constant in each point in time. Aggregate service trade growth at time t with weights being fixed at their time τ value can then be written as:

$$\gamma_{t|\tau} = \sum_{sci} w_{sci\tau}\delta_{scit} + \sum_{fsc} w_{fsc\tau}\varepsilon_{fsct} \tag{11}$$

We thus end up with $T \times T$ growth rates, where T is the total number of periods.[15] The variance can then be decomposed as

[15] $\sigma^2_{\gamma\tau}$, $\sigma^2_{\delta\tau}$ and $\sigma^2_{\varepsilon\tau}$ can be seen as the variance of T realizations of $\gamma_{t|\tau}$, $\sum_{sci} w_{scit}\delta_{scit}$, and $\sum_{fsc} w_{fsct}\varepsilon_{fsct}$, respectively. di Giovanni et al. (2014) technically show how $\sigma^2_{\gamma\tau}$ relates to aggregate growth volatility.

$$\sigma^2_{\gamma\tau} = \sigma^2_{\delta\tau} + \sigma^2_{\varepsilon\tau} + \text{Cov}_\tau, \text{ with} \tag{12}$$
$$\sigma^2_{\delta\tau} = \text{Var}\left(\sum_{sci} w_{sci\tau}\delta_{scit}\right),$$
$$\sigma^2_{\varepsilon\tau} = \text{Var}\left(\sum_{fsc} w_{fsc\tau}\varepsilon_{fsct}\right), \text{ and}$$
$$\text{Cov}_\tau = \text{Cov}\left(\sum_{sci} w_{sci\tau}\delta_{scit}, \sum_{fsc} w_{fsc\tau}\varepsilon_{fsct}\right).$$

The left hand side of equation (12), $\sigma^2_{\gamma\tau}$, corresponds to the variance of actual mid-point growth rates. Variances of macro-meso- and firm-level shocks are denoted by $\sigma^2_{\delta\tau}$ and $\sigma^2_{\varepsilon\tau}$, respectively. The last term on the right hand of equation (12), Cov_τ, is the covariance between the two levels.

Table 8 presents the results of this decomposition for monthly, quarterly and yearly frequencies. The first column of each block of frequencies presents averages of the standard deviations over the sample. The second column presents averages of standard deviations relative to aggregate volatility. Results for exports and imports are given in the top and bottom panel, respectively.

As can be seen from Table 8, firm-specific shocks are more important in explaining actual service trade growth volatility for all frequencies than macro-meso-level shocks. The impact of shocks to the macro-meso-level, however, are far from being negligible. The volatilities of actual growth rates and the firm-specific component are both increasing with lower frequencies, whereas the standard deviation of shocks at the macro-meso-level are highest at monthly frequency. The finding that firm-specific shocks are an important driver for aggregate fluctuations is consistent with di Giovanni et al. (2014) and Gabaix (2011).

Figure 6 and 7 show the evolution of volatilities for the yearly and monthly sample. Estimates for service exports and imports are given in the left and right panel, respectively. Shaded areas correspond to the 95 percent confidence interval based on an overlapping block bootstrap.[16]

The volatility of service trade growth increases at the beginning of the sample and decreases after 2007. The monthly series reveal that the standard deviation of service trade itself is very

[16] di Giovanni et al. (2014) also provide analytical standard errors. Since we only have 11 observations for the yearly sample, we choose a bootstrap instead to be consistent across frequencies. di Giovanni et al. (2014) show that results based on analytical and bootstrapped standard errors are very similar. The bootstrap is based on the series of $\gamma_{t|\tau}$, $\sum w_{sci\tau}\delta_{scit}$ and $\sum w_{fsc\tau}\varepsilon_{fsct}$. We draw 10,000 overlapping blocks with replacement from each series. The blocksize is determined as the nearest integer to $T^{1/3}$, *i.e.* 5 and 2 for monthly and yearly frequency, respectively.

volatile up until 2006. The series for exports and imports show remarkably similar patterns. Hence, even if we find some divergences in aggregate growth rates in Section 4, there is no large asymmetric effect of aggregate and firm-specific shocks on the volatility of individual growth rates of cross-border service sales and purchases. The firm-specific component closely resembles the behaviour of actual trade volatility, whereas the volatility of shocks at the macro-meso-level remains by and large the same over the sample periods. These patterns are very similar to those found in di Giovanni et al. (2014) for French firms' sales.

Figure 8 shows the evolution of volatilities of shocks at the macro-meso and firm-level relative to the actual standard deviation. As can be seen from this figure, the averages reported in Table 8 cushion a lot of variation over time. We would expect shocks at the macro-meso-level to become more important for aggregate fluctuations during the crisis period after 2007 due to the resulting policy interventions. Figure 8 reveals, that there is an increase in the relative importance of macro-meso shocks since 2006 that sharply increases in the subsequent years and exceeds the relative contribution of the firm-specific component in 2012 (except for yearly imports). While the relative standard deviation of the firm-level component is decreasing after 2005, it again increases for the years 2008 to 2010. This effect is more pronounced for service imports. Hence, also firm-level shocks seem to have had a significant impact on actual volatility during the trade collapse and the beginning of the Eurozone debt crisis.

5.2 Extensive and Intensive Margin

Since our underlying measure of change is based on mid-point growth rates we are also able to disentangle the impact of the extensive and intensive margin on the fluctuations of service trade. More specifically, we decompose the actual variance as:

$$\sigma^2_{\gamma\tau} = \text{Var}\left(\sum_{fsc\in E} w_{fsc\tau}\gamma_{fsct}\right) + \text{Var}\left(\sum_{fsc\in I} w_{fsc\tau}\gamma_{fsct}\right) + \text{Cov}\left(\sum_{fsc\in E} w_{fsc\tau}\gamma_{fsct}, \sum_{fsc\in I} w_{fsc\tau}\gamma_{fsct}\right), \tag{13}$$

where E and I denote the set of individual growth rates belonging to the extensive and intensive margin, respectively.

Table 9 shows the resulting standard deviation of actual service trade and the extensive and intensive margin as well as the respective standard deviation relative to actual service trade volatility. Consistent with the findings in the previous sections, the intensive margin is more important for service trade volatility. At yearly frequency, the relative standard deviation of the intensive margin is 0.57 and 0.56 for exports and imports, respectively, while the relative

standard deviation of the extensive margin only amounts to 0.07 for exports and imports. As expected, the extensive margin becomes more important at higher frequencies. Its relative contribution more than doubles at monthly frequency compared to the yearly sample whereas the impact of the intensive margin is lower with a relative standard deviation of 0.43 for exports and imports. di Giovanni et al. (2014) also find the intensive margin to be more important for aggregate fluctuations. Based on conventional growth rates they even report a relative contribution of 90 percent of the intensive margin. Figure 9 shows the evolution of volatilities for each component. Even though we found the intensive margin to be the main driver for the downturn during the trade collapse in 2008/2009 in Section 4.1, there is no pronounced effect with regard to volatility.

We also decompose shocks at the macro-meso and firm-level into their extensive and intensive components (though we do not detail the results for parsimonious reasons).[17] We find similar patterns: For firm-level shocks, the standard deviation of the intensive and extensive margin relative to total firm-specific volatility is quantitatively very similar to numbers for actual service trade volatility, while both margins are somewhat more important for shocks at the macro-meso-level.

5.3 Idiosyncratic Shocks and Network Effects

In this subsection we further investigate the drivers of firm-specific shocks. We follow Carvalho and Gabaix (2013) and di Giovanni et al. (2014) and decompose the volatility of the firm component as:

$$\begin{aligned}\sigma^2_{\varepsilon\tau} &= \sum_{fsc} w^2_{fsc\tau}\mathrm{Var}\left(\varepsilon_{fsct}\right) + \sum_{fsc}\sum_{\substack{f'\neq f\\ s'\neq s\\ c'\neq c}} w_{fsc\tau}w_{f's'c'\tau}\mathrm{Cov}\left(\varepsilon_{fsct},\varepsilon_{f's'c't}\right) \\ &= Direct^2_\tau + Link^2_\tau\end{aligned} \tag{14}$$

The first term on the right hand side, $Direct^2_\tau$, captures the variances of shocks to individual firms. Gabaix (2011) shows that idiosyncratic shocks to firms do not vanish in the aggregate but lead to considerable macroeconomic fluctuations. He shows that shocks to the 100 largest firms in the USA explain more than 30 percent of aggregate GDP volatility. The second term on the right hand side of equation (14), $Link^2_\tau$, captures the covariance of shocks between firms. Since firms are not isolated entities in an economy but embedded in complex production networks,

[17] In this case, volatility measures are based on the following decomposition of growth rates:

$$\gamma_{t|\tau} = \sum_{fsc\in\{E|f\in i\}} w_{sci\tau}\delta_{scit} + \sum_{fsc\in E} w_{fsc\tau}\varepsilon_{fsct} + \sum_{fsc\in\{I|f\in i\}} w_{sci\tau}\delta_{scit} + \sum_{fsc\in I} w_{fsc\tau}\varepsilon_{fsct}$$

shocks to individual firms may well affect other firms through input-output linkages and lead to aggregate fluctuations, see *e.g.* Acemoglu et al. (2012) and Carvalho (2010).

The resulting decomposition is summarized in Table 10 and graphically depicted in Figure 10. For monthly, quarterly and yearly frequencies the first column in Table 10 shows the average standard deviation of the firm-specific component, the volatility due to idiosyncratic shocks, *Direct*, and the volatility due to comovement, *Link*. The second and third column report the average standard deviation of each component relative to total firm-specific volatility and actual volatility, respectively. For the yearly frequency, Table 10 shows that linkages between firms on average almost exclusively explain firm-specific volatility consistent with the findings of di Giovanni et al. (2014). Volatility due to comovement between firms are 98 percent relative to total firm-specific volatility for both, exports and imports, and 84 and 88 percent relative to actual volatility for exports and imports, respectively. This is true for all years: the top panel of Figure 10 shows that the series of total firm-specific volatility and volatility due to comovement, *Link*, are virtually identical. The volatility due to idiosyncratic shocks, *Direct*, shows a relatively stable pattern over time. Relative to the actual standard deviation, the volatility of idiosyncratic shocks, though non-negligible, only amounts to 16 and 13 percent for exports and imports, respectively. However, this picture significantly changes when looking at the monthly frequency. While linkages between firms still are the dominant driving force, the standard deviation of idiosyncratic shocks relative to actual volatility amounts to more than 40 percent for exports and imports. As can be seen in the bottom panel of Figure 10, the series of the idiosyncratic component is indeed characterized by large spikes over the whole sample. Hence, the aggregation of firms' activities at lower frequencies washes out the actual contribution of idiosyncratic shocks which we find at monthly frequency.

6 Conclusion

International services trade is getting more important for countries' competitiveness. This is not only due to the rising importance of service trade itself but also because of the increasing impact of traded services on goods production for both, downstream and upstream links of the commodity chain. Hence, when assessing a country's competitiveness in terms of export performance it is essential for policy makers not only to focus on goods trade alone but also take a country's ability to trade efficient services into account. Using comprehensive micro-level information of firms engaged in service trade in Germany, one of the largest service traders in the world, we analyze how firm-level patterns shape variations in aggregate service trade along three dimensions: in the cross-section, over time, and in growth.

We provide key stylized facts characterizing the universe of German service traders. Consistent with other studies, we find that firms engaged in service trade are not only belonging to the service sector itself, but spread across all industries. We confirm previous findings that there are significant differences across firms with regard to traded volumes, services, trading partners and number of transactions with the bulk of activity concentrated on a few firms. In addition, there is a strong heterogeneity of the importance of services and trading partners within firms.

We find the extensive margin to be the main contributor to the cross-sectional variation of service trade. In contrast, the intensive margin is most important for explaining variations along all other dimensions analyzed. While this is also true for variations over time, the extensive margin positively contributes to aggregate service exports growth during the great collapse. Firms trading larger volumes seem to have been better able to cope with trade crisis in 2008 to 2009, however, smaller exporting firms performed better in the previous years. Hence, even though large players clearly shape aggregate service trade, policy measures aimed at top-traders alone might be misleading when trying to exploit the full potential of a country's service exports.

Looking at the determinants of service trade volatility, we find the impact of firm-specific shocks to be most relevant on average. However, we find the relative impact of shocks at the macro- and meso- level to become more important during the great trade collapse and the subsequent debt crisis in the Eurozone. Consistent with the finding of di Giovanni et al. (2014), the firm-specific component is mostly driven by the comovement of shocks among firms. Nevertheless, idiosyncratic shocks to firms themselves become relatively more important on average for higher frequencies.

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Figures

Figure 1: Number of Firms and Trade Volume, 2001-2012

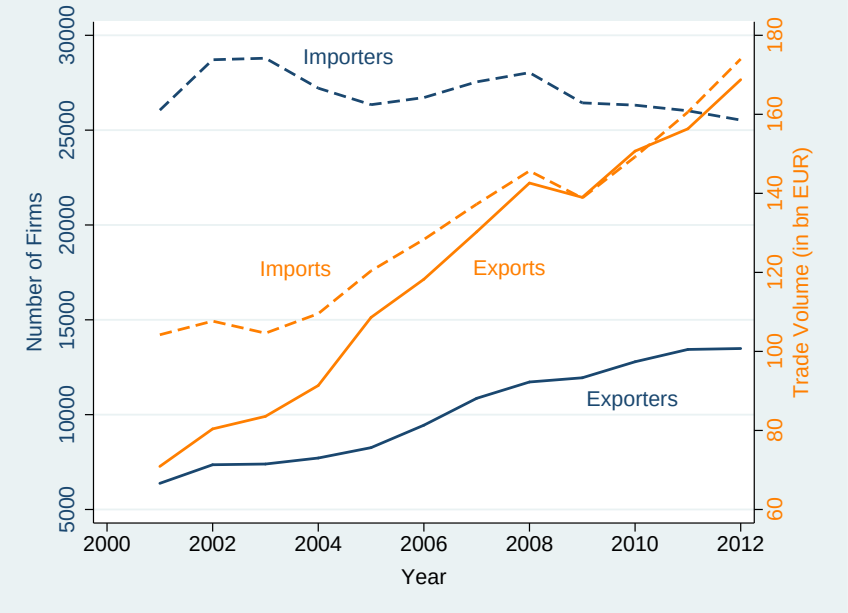


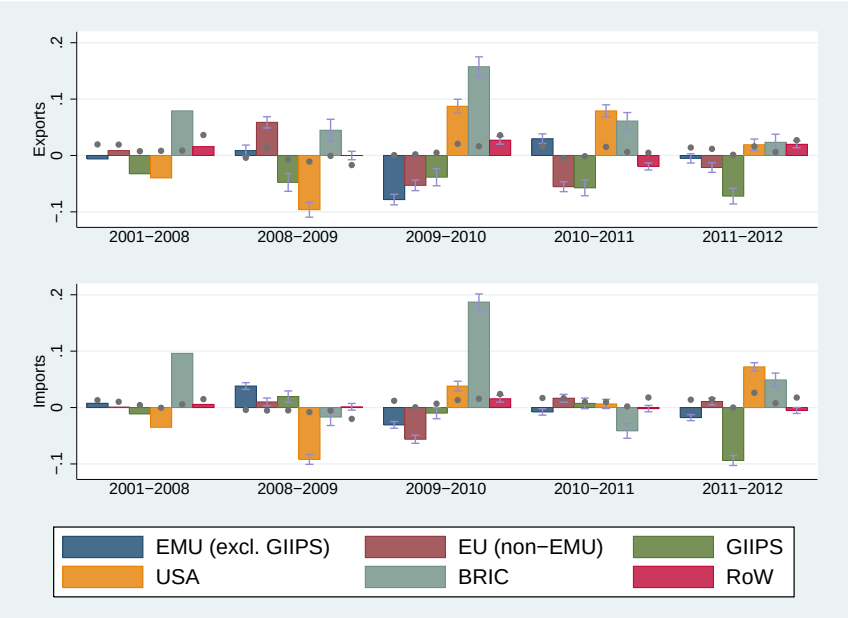
Figure 2: Average Service Trade by Industry, 2001-2012

Notes: This figure shows the average traded volume in bn. Euro of service categories by industries for the yearly sample from 2001 to 2012. For the industries, "Manufacturing" and "Construction" and "IT" denote the respective sectors, "Finance" denotes financial intermediaries and insurance companies, "Wholesale" also includes retail trade, "Transport" also includes storage and the communication sector, and "Business" includes business activities, real estate, and renting. Services belonging to each categories are based on the Extended Balance of Payments Services Classification (EBOPS) and listed in Table A.1. For expositional reasons, numbers over truncated bars denote the actual volume traded.

Figure 3: Relative Performance and Absolute Contribution: Service Categories

Notes: Services belonging to each categories are based on the Extended Balance of Payments Services Classification (EBOPS) and listed in Table A.1. Each group of bars represents the estimated contribution for the respective period. Thinner bars over main bars correspond to the 95% confidence interval. The first group of bars represent simple averages of estimated effects over 2001 to 2008. Mid-point growth of each service category is depicted by a (grey) solid circle.

Figure 4: Relative Performance and Absolute Contribution: Country Groups

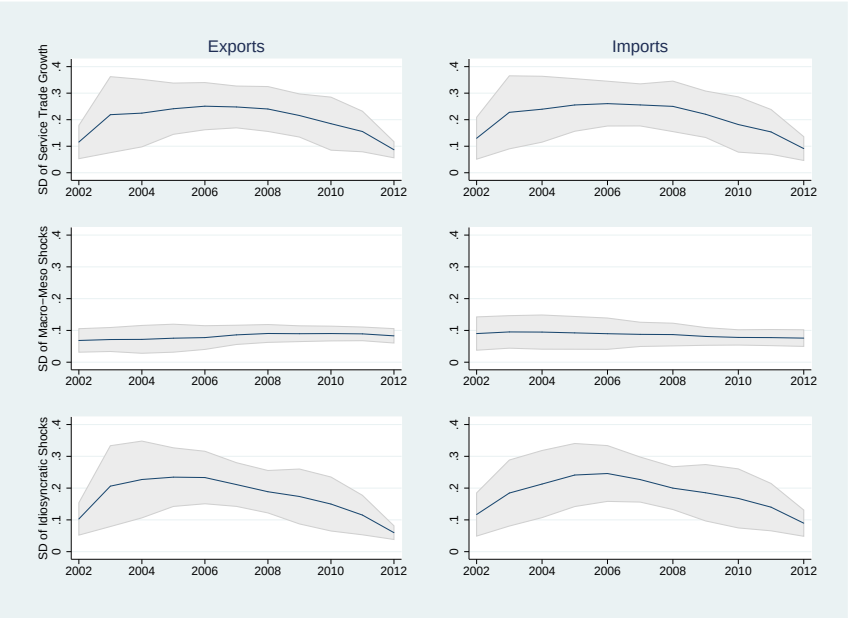


Notes: "GIIPS" denotes Greece, Ireland, Italy, Portugal, and Spain, "BRIC" denotes Brazil, Russia, India, and China, and "RoW" denotes the rest of the world, *i.e.* countries not part of any other group. Each group of bars represents the estimated contribution for the respective period. Thinner bars over main bars correspond to the 95% confidence interval. The first group of bars represent simple averages of estimated effects over 2001 to 2008. Mid-point growth of each country group is depicted by a (grey) solid circle.

Figure 5: Relative Performance and Absolute Contribution: Size Classes

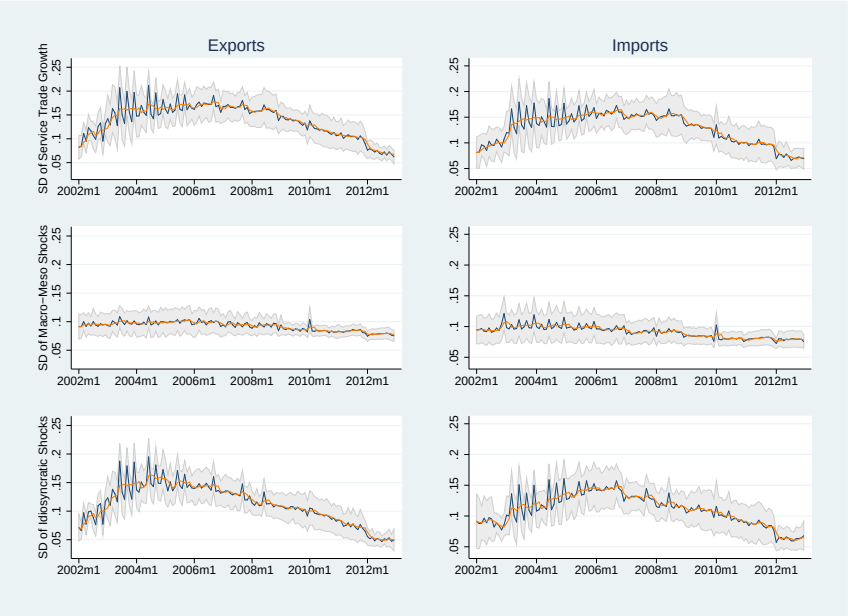
Notes: Notes: Size classes are formed according to the sum of firms' traded volume in $t-1$ and t relative to the sum of aggregate trade volume in $t-1$ and t for each industry. Q_x denotes the x-quantile. Each group of bars represents the estimated contribution for the respective period. Thinner bars over main bars correspond to the 95% confidence interval. The first group of bars represent simple averages of estimated effects over 2001 to 2008. Mid-point growth of each size class is depicted by a (grey) solid circle.

Figure 6: Contribution of Macro-Meso and Firm-Specific Shocks to Yearly Service Trade Volatility



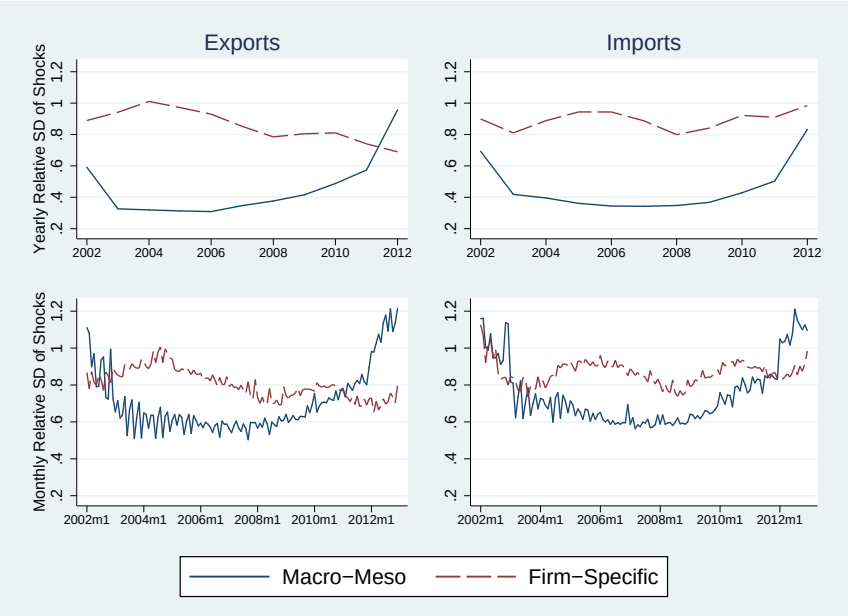
Notes: This figure shows the estimated contribution of shocks to the macro-meso- and firm-level according to equation (**??**). Estimates for service exports and imports are given in the left and right panel, respectively. Shaded areas correspond to the 95 percent confidence interval based on overlapping block bootstraps.

Figure 7: Contribution Macro-Meso and Firm-Specific Shocks to Monthly Service Trade Volatility



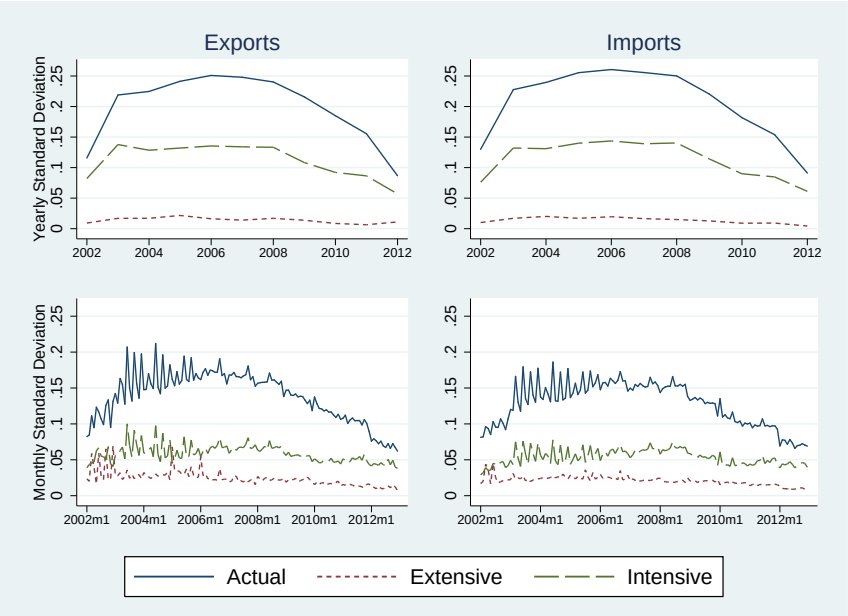
Notes: See Figure 6. The thick (orange) line represents a three-month moving average.

Figure 8: Relative Contribution of Macro-Meso- and Firm-Level Shocks



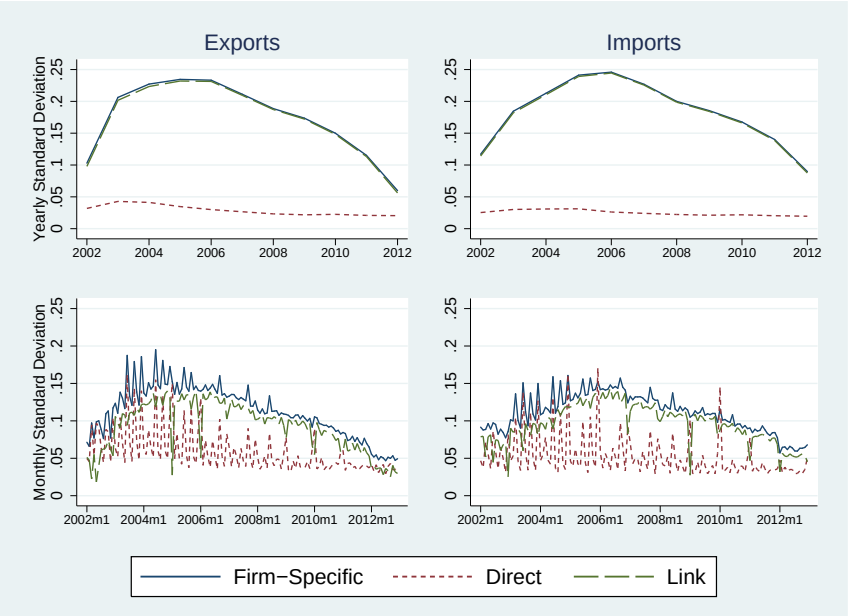
Notes: This figure shows the volatility of shocks at the macro-meso- and firm-level relative to actual trade volatility given by $\sigma_{\delta\tau}/\sigma_{\gamma\tau}$ and $\sigma_{\varepsilon\tau}/\sigma_{\gamma\tau}$ for yearly (top panel) and monthly (bottom panel) frequencies. The series for service exports and imports are given in the left and right panel, respectively.

Figure 9: Contribution of the Extensive and Intensive Margin



Notes: This figure shows the contribution of the extensive and intensive margin for actual service trade for yearly (top panel) and monthly (bottom panel) frequencies. Series for service exports and imports are given in the left and right panel, respectively.

Figure 10: Contribution of Idiosyncratic Shocks and Network Effects



Notes: This figure shows the contribution of individual firm volatilities (Direct) and covariance between firms for total firm-specific volatility based on the decomposition in equation (14). The top panel shows the yearly series, the bottom panel the monthly series. Series for service exports and imports are given in the left and right panel, respectively.

Tables

Table 1: Heterogeneity Between Firms, pooled 2001-2012

		percentiles				
	mean	1st	25th	50th	75th	99th
Exports						
Number of services	1.6	1	1	1	2	9
Number of countries	5.5	1	1	2	6	45
Number of transactions within a year	27.4	1	2	8	20	324
Avg. exports per firm-service-country	271	1	18	41	124	3,668
Avg. exports per transaction	276	1	28	63	177	3,543
Total exports per firm	11,928	3	95	517	2921	181,087
Number of observations (firm-year)	120,791					
Imports						
Number of services	2.3	1	1	1	3	13
Number of countries	4.5	1	1	2	5	37
Number of transactions within a year	21.1	1	1	4	14	267
Avg. imports per firm-service-country	131	1	14	26	64	1,610
Avg. imports per transaction	122	2	21	38	80	1,173
Total imports per firm	4,882	4	50	187	837	66,881
Number of observations (firm-year)	323,714					

Notes: Sales are reported in thousand Euro.

Table 2: Distribution of Services and Trading Partners, pooled 2001-2012

	At least ... services				
	1	2	3	5	10
% of exporters	100	27.2	13.0	4.7	0.7
% of exports	100	70.5	57.0	41.9	24.2
% of importers	100	44.7	26.3	12.0	2.6
% of imports	100	90.1	80.0	66.8	46.9
	At least ... countries				
	1	2	3	5	10	30
% of exporters	100	57.8	43.4	29.9	15.7	2.6
% of exports	100	93.7	90.8	86.5	78.3	50.4
% of importers	100	55.9	39.9	25.2	11.7	1.7
% of imports	100	94.2	91.7	87.9	78.9	53.9

Table 3: Heterogneity Within Firms, pooled 2001-2012

	Rank of service							Rank of country					
	1	2	3	4	5	10		1	2	3	4	5	10
% of exports													
All firms included	93.4	19.2	7.4	3.6	2.0	0.3	All firms included	76.0	20.6	10.6	6.8	4.9	1.6
Exact 2 services	81.4	18.6	–	–	–	–	Exact 2 countries	77.8	22.2	–	–	–	–
Exact 3 services	74.3	19.4	6.3	–	–	–	Exact 3 countries	68.3	22.5	9.2	–	–	–
Exact 5 services	67.7	20.2	7.7	3.1	1.2	–	Exact 5 countries	58.4	21.6	10.7	5.9	3.3	–
Exact 10 services	59.9	20.8	9.1	4.5	2.5	0.1	Exact 10 countries	46.5	19.5	11.4	7.4	5.1	0.8
% of imports													
All firms included	86.4	21.5	9.3	4.9	2.9	0.5	All firms included	77.3	22.0	11.1	6.9	4.8	1.5
Exact 2 services	77.8	22.2	–	–	–	–	Exact 2 countries	75.5	24.5	–	–	–	–
Exact 3 services	70.0	21.5	8.5	–	–	–	Exact 3 countries	66.2	23.4	10.4	–	–	–
Exact 5 services	62.5	21.1	9.5	4.7	2.3	–	Exact 5 countries	56.6	22.1	11.3	6.4	3.6	–
Exact 10 services	54.2	20.4	10.5	5.9	3.6	0.3	Exact 10 countries	46.0	20.2	11.6	7.5	5.1	0.8

Notes: This table shows the average shares (in percent) of exports/imports for the services and countries ranked first, second, third, etc. and firms that trade types exact 2, 3, 5 or 10 services or with 2, 3, etc., markets, respectively.

Table 4: Country-Level Margins for German Trade in Services, 2001-2012

	Exports			Imports		
Margin	Full Sample	EMU	Top Traders	Full Sample	EMU	Top Traders
Firms	0.590	0.609	0.348	0.650	0.659	0.439
	(0.010)	(0.036)	(0.005)	(0.009)	(0.059)	(0.007)
Services	0.316	0.084	0.296	0.318	0.051	0.324
	(0.006)	(0.012)	(0.005)	(0.008)	(0.012)	(0.007)
Density	-0.294	-0.050	-0.226	-0.287	0.040	-0.224
	(0.007)	(0.013)	(0.006)	(0.009)	(0.009)	(0.010)
Activity	0.077	0.045	0.096	0.052	0.005	0.062
	(0.004)	(0.011)	(0.004)	(0.004)	(0.018)	(0.006)
Intensive	0.312	0.312	0.486	0.266	0.246	0.399
	(0.010)	(0.039)	(0.007)	(0.008)	(0.073)	(0.009)
Obs	2,645	152	2,381	2,719	152	2,493

Notes: Pooled estimates of the contribution of margins to cross-sectional variation in country-level exports and imports for the years 2001 to 2012. The sub-sample denoted "Top Traders" corresponds to firms in the top percentile within their industry with respect to trade volume. Coefficients for constants are omitted. Clustered standard errors are in parentheses.

Table 5: Firm-Level Margins for German Trade in Services, 2001-2012

	Exports			Imports		
Margin	Full Sample	EMU	Top Traders	Full Sample	EMU	Top Traders
Countries	0.290	0.205	0.382	0.345	0.227	0.391
	(0.003)	(0.002)	(0.043)	(0.002)	(0.002)	(0.031)
Services	0.091	0.084	0.272	0.206	0.185	0.180
	(0.002)	(0.002)	(0.047)	(0.002)	(0.002)	(0.031)
Density	-0.058	-0.040	-0.162	-0.139	-0.095	-0.070
	(0.001)	(0.001)	(0.028)	(0.001)	(0.001)	(0.017)
Activity	0.185	0.220	0.135	0.191	0.212	0.129
	(0.002)	(0.002)	(0.019)	(0.001)	(0.001)	(0.012)
Intensive	0.492	0.531	0.373	0.397	0.472	0.370
	(0.003)	(0.003)	(0.046)	(0.002)	(0.002)	(0.034)
Obs	120,791	80,580	1,301	323,714	186,780	3,327

Notes: Pooled estimates of the contribution of margins to cross-sectional variation in firm-level exports and imports for the years 2001 to 2012. The sub-sample denoted "Top Traders" corresponds to firms in the top percentile within their industry with respect to trade volume. Coefficients for constants are omitted. Clustered standard errors are in parentheses.

Table 6: Contributions to Mid-point Growth in Service Exports

	2001-2008			2008-2009			2009-2010			2010-2011			2011-2012		
	mth	qrt	yr	mth	qrt	yr	mth	qrt	yr	mth	qrt	yr	mth	qrt	yr
Firm Entry and Exit															
Entry	10.4	7.1	4.5	7.0	4.9	2.8	5.9	4.0	2.5	4.9	3.2	1.4	4.4	2.6	1.5
Exit	−6.5	−4.0	−2.2	−5.0	−3.3	−1.8	−4.3	−2.5	−1.3	−3.7	−2.2	−1.1	−3.6	−2.0	−0.9
Net Entry	3.9	3.1	2.3	2.0	1.6	1.0	1.6	1.5	1.2	1.2	1.0	0.3	0.9	0.6	0.5
Trade Relationships															
Born	12.1	7.8	3.4	10.6	6.3	2.7	10.2	6.2	3.1	10.3	6.1	3.0	11.2	6.8	3.4
Retired	−9.4	−5.6	−2.3	−9.8	−5.3	−2.4	−9.7	−5.6	−2.0	−8.5	−4.5	−1.9	−8.7	−4.7	−1.9
Net Country	2.8	2.2	1.1	0.8	1.0	0.4	0.5	0.7	1.1	1.8	1.5	1.1	2.5	2.0	1.5
Service-Switching															
Added	6.1	5.0	3.4	6.4	5.5	4.3	5.5	4.2	2.3	5.5	3.6	2.3	6.4	5.0	3.6
Dropped	−5.0	−3.9	−2.6	−5.1	−4.0	−2.4	−5.4	−3.8	−2.6	−5.2	−3.9	−1.8	−4.8	−3.3	−1.7
Net Service	1.1	1.1	0.8	1.3	1.5	1.9	0.1	0.4	−0.3	0.3	−0.2	0.5	1.6	1.7	1.9
Intensive Margin															
Increases	25.5	25.6	25.1	21.5	21.0	19.6	28.0	27.3	25.2	23.2	22.8	20.5	23.7	23.1	20.8
Decreases	−23.1	−22.0	−19.3	−28.4	−27.8	−25.5	−21.9	−21.8	−19.1	−22.9	−21.5	−18.7	−20.8	−19.7	−17.1
Net Intensive	2.4	3.7	5.8	−6.9	−6.7	−5.9	6.1	5.5	6.1	0.4	1.4	1.8	3.0	3.4	3.7
Total Growth	10.1	10.0	10.0	−2.8	−2.6	−2.6	8.3	8.1	8.1	3.7	3.7	3.7	7.9	7.8	7.6

Notes: Percentage contribution of each margin to changes in total exports calculated as simple averages of mid-point growth rates over the respective time interval (with the exception of yearly figures for 2008/2009 to 2011/2012).

Table 7: Contributions to Mid-point Growth in Service Imports

	2001-2008			2008-2009			2009-2010			2010-2011			2011-2012		
	mth	qrt	yr	mth	qrt	yr	mth	qrt	yr	mth	qrt	yr	mth	qrt	yr
Firm Entry and Exit															
Entry	8.1	5.4	3.0	5.0	3.2	1.6	5.4	3.1	1.6	4.7	2.8	1.4	3.7	2.1	1.0
Exit	−7.6	−5.1	−2.7	−5.5	−3.5	−1.6	−6.7	−4.6	−1.6	−4.5	−2.9	−1.5	−3.9	−2.3	−1.2
Net Entry	0.5	0.3	0.3	−0.6	−0.3	−0.0	−1.3	−1.4	−0.0	0.2	−0.0	−0.1	−0.2	−0.1	−0.2
Trade Relationships															
Born	11.8	7.4	3.8	10.3	6.2	3.0	10.4	6.4	3.5	9.4	5.6	2.7	9.5	5.6	2.6
Retired	−10.2	−6.5	−3.3	−9.9	−6.0	−3.2	−8.7	−5.6	−3.8	−8.4	−4.9	−2.2	−7.8	−4.5	−1.9
Net Country	1.6	0.9	0.5	0.5	0.2	−0.2	1.7	0.9	−0.3	1.0	0.7	0.5	1.7	1.1	0.6
Service-Switching															
Added	9.8	7.8	5.1	10.4	8.2	5.4	9.5	7.6	4.9	10.0	7.1	4.0	9.4	6.2	3.6
Dropped	−9.2	−7.0	−4.5	−8.7	−6.7	−4.0	−8.9	−6.4	−4.1	−8.1	−5.9	−3.1	−7.5	−5.0	−2.9
Net Service	0.6	0.8	0.5	1.7	1.5	1.4	0.6	1.2	0.9	1.9	1.3	0.9	1.9	1.2	0.7
Intensive Margin															
Increases	26.4	26.6	25.9	22.4	22.2	20.9	27.4	27.1	25.9	26.9	26.4	25.5	26.7	26.3	24.2
Decreases	−24.2	−23.9	−22.5	−29.1	−28.5	−26.9	−20.9	−20.5	−19.1	−22.5	−21.0	−19.5	−22.0	−20.5	−17.2
Net Intensive	2.1	2.7	3.4	−6.7	−6.3	−6.0	6.5	6.6	6.7	4.3	5.4	6.0	4.7	5.9	6.9
Total Growth	4.8	4.8	4.8	−5.1	−4.8	−4.8	7.5	7.2	7.2	7.5	7.3	7.3	8.1	8.1	8.0

Notes: Percentage contribution of each margin to changes in total imports calculated as simple averages of mid-point growth rates over the respective time interval (with the exception of yearly figures for 2008/2009 to 2011/2012).

Table 8: Contribution to Service Trade Volatility: Macro-Meso and Firm-Specific Shocks

	monthly		quarterly		yearly	
	SD	Rel. SD	SD	Rel. SD	SD	Rel. SD
Service Exports						
Actual	0.1384	1.0000	0.1588	1.0000	0.1985	1.0000
Macro-Meso Shocks	0.0919	0.7031	0.0828	0.5615	0.0812	0.4561
Firm-Specific Shocks	0.1128	0.8059	0.1366	0.8489	0.1730	0.8569
Service Imports						
Actual	0.1282	1.0000	0.1560	1.0000	0.2061	1.0000
Macro-Meso Shocks	0.0912	0.7474	0.0838	0.5721	0.0863	0.4578
Firm-Specific Shocks	0.1107	0.8681	0.1378	0.8902	0.1828	0.8936

Notes: This table shows the contribution of macro-meso and idiosyncratic shocks to actual service trade volatility for monthly, quarterly and yearly frequencies according to the decomposition in equation (12). The first column of each block of frequencies presents averages of the standard deviations over the sample (*i.e.* $1/T \sum \sigma_{n\tau}$ for $n \in \{\gamma, \delta, \varepsilon\}$). The second column presents averages of standard deviations relative to aggregate volatility (*i.e.* $1/T \sum \sigma_{n\tau}/\sigma_{\gamma\tau}$ for $n \in \{\gamma, \delta, \varepsilon\}$). Results for exports and imports are given in the top and bottom panel, respectively.

Table 9: Contribution to Service Trade Volatility: Extensive and Intensive Margin

	monthly		quarterly		yearly	
	SD	Rel. SD	SD	Rel. SD	SD	Rel. SD
Service Exports						
Actual	0.1384	1.0000	0.1588	1.0000	0.1985	1.0000
Extensive Margin	0.0241	0.1767	0.0185	0.1190	0.0138	0.0722
Intensive Margin	0.0584	0.4345	0.0726	0.4667	0.1116	0.5732
Service Imports						
Actual	0.1282	1.0000	0.1560	1.0000	0.2061	1.0000
Extensive Margin	0.0212	0.1686	0.0178	0.1140	0.0137	0.0651
Intensive Margin	0.0535	0.4268	0.0730	0.4770	0.1138	0.5591

Notes: This table shows actual volatility for the full sample, as well as for sub-samples of growth rates belonging to extensive and intensive margin, respectively, for monthly, quarterly and yearly frequencies. The first column of each block of frequencies presents averages of the standard deviations over the sample. The second column presents averages of standard deviations relative to actual volatility for the full sample. Results for exports and imports are given in the top and bottom panel, respectively.

Table 10: Contribution to Firm-Specific Volatility: Idiosyncratic Shocks and Network Effects

	monthly			quarterly			yearly		
	SD	Rel. SD (Firm)	Rel. SD (Actual)	SD	Rel. SD (Firm)	Rel. SD (Actual)	SD	Rel. SD (Firm)	Rel. SD (Actual)
Service Exports									
Firm-Specific	0.1128	1.0000	0.8059	0.1366	1.0000	0.8489	0.1730	1.0000	0.8569
Direct	0.0586	0.5297	0.4276	0.0379	0.2933	0.2488	0.0287	0.1839	0.1559
Link	0.0923	0.8129	0.6537	0.1308	0.9516	0.8080	0.1703	0.9801	0.8404
Service Imports									
Firm-Specific	0.1107	1.0000	0.8681	0.1378	1.0000	0.8902	0.1828	1.0000	0.8936
Direct	0.0524	0.4731	0.4110	0.0341	0.2562	0.2285	0.0248	0.1443	0.1296
Link	0.0949	0.8621	0.7484	0.1331	0.9640	0.8580	0.1810	0.9888	0.8834

Notes: This table shows the contribution of firm-specific volatilities (Direct) and the square root of the covariance between firms (Link) to total firm-specific volatility for monthly, quarterly and yearly frequencies according to the decomposition in equation (**??**). The first column of each block of frequencies presents averages of the standard deviations over the sample. The second column presents averages of standard deviations relative to total firm-specific volatility. The third column presents averages of standard deviations relative to actual volatility. Results for exports and imports are given in the top and bottom panel, respectively.

Appendix

Table A.1: Service Categories

Services
Transport
Receipts from freight transport by land between third counties (80)
Receipts from rail freight between third countries (80)
Receipts from inland waterway transport between third countries (80)
Receipts from sea freight between third countries (81)
Receipts from air freight between third countries (82)
Expenditure on sea freight in connection with German imports (210)
Expenditure on sea freight in connection with German exports (220)
Receipts and expenditure of resident airlines for air freight services in connection with Germanys external trade (225)
Receipts for providing pipelines/transmission through pipelines for transport through Germany (without withdrawals) (215)
Receipts from and expenditure on inland freight water transport including towage charges and the cost of pushing barges in connection with Germanys external trade (216)
Receipts from and expenditure on the transmission of electricity (217)
Receipts from and expenditure on the bilateral movement of rail freight (233)
Receipts of resident rail companies from transit (234)
Expenditure on freight transport by land in connection with Germanys external trade (240)
Payments to non-resident transport enterprises for air freight in connection with Germanys external trade (244)
Receipts and expenditure on transport by pipeline in connection with Germanys external trade (226)
Expenditure on freight transport by land between third countries (260)
Expenditure on rail freight between third countries (260)
Expenditure on inland waterway transport between third countries (260)
Expenditure on sea freight between third countries (260)
Expenditure on air freight between third countries (260)
Receipts from and expenditure on air freight within Germany (270)
Receipts from and expenditure on freight transport by land within Germany (271)
Receipts from and expenditure on rail freight within Germany (271)
Receipts from and expenditure on inland waterway transport within the economic territory (271)
Receipts from and payments by resident rail companies for the cross-border transport of passengers and for carrying passengers between third countries (13)
Receipts from and expenditure of resident airlines for the cross-border transport of passengers and for carrying passengers between third countries (14)
Receipts from the cross-border transport of passengers from carrying passengers between third-party countries by resident road transport companies (e.g. coach holidays) (15)
Receipts from cross-border passenger transportation and from inland waterway transport between third countries (15)
Payments to non-resident airlines for the cross-border transport of passengers and for carrying passengers between third countries (15)
Expenditure on the cross-border transport of passengers and on carrying passengers between third-party countries (e.g. coach holidays) (16)
Payments to non-resident rail companies for the cross-border transport of persons and for carrying passengers between third countries (16)

Services
Expenditure on cross-border passenger transportation and on inland waterway transport between third countries (16)
Expenditure on cross-border passenger transport and on sea transport between third-party countries (16)
Expenditure on the transport of passengers by non-resident airlines within the economic territory (20)
Receipts from seaports and firms operating there (300)
Expenditure on ancillary transport services in shipping (310)
Expenditure on ancillary transport services provided by road haulage companies (except fuel and other vehicle supplies) (320)
Payments by inland waterway enterprises for ancillary transport services (except for fuel and other ship supplies) (320)
Expenditure on ancillary transport services by other resident enterprises (330)
Receipts from ancillary transport services provided within Germany for non-resident rail operators (340)
Payments by resident rail companies for ancillary transport services provided by non-residents abroad (340)
Receipts from ancillary transport services in air transport (360)
Expenditure of resident airlines e.g. for take-off, landing and overflying charges as well as air traffic control (360)
Expenditure of resident airlines on the purchase of goods such as fuels, on-board catering and on-board sales (361)
Expenditure on road haulage companies for fuel and other vehicle supplies (362)
Receipts from supplying goods to meet the needs of foreign land craft equipment (e.g. fuel) (362)
Payments by inland waterway enterprises for fuel and other ship supplies (362)
Receipts from supplying goods to meet the need of foreign inland waterway ships (e.g. fuel) (362)
Receipts from freight transport by land and other forms of transport (that cannot be assigned to any other item or cannot be divided up) as well as receipts arising from refunds of freight advances in connection with Germanys external trade (370)
Travel (17)
Communication services, postal services
Communications services (518)
Postal and courier services (591)
Construction services
Construction sites in Germany payments made to non-resident firms in the economic territory (excluding payment for imports of goods) (570)
Construction sites in Germany receipts from goods deliveries to non-resident firms in the economic territory commissioned by residents (580)
Construction sites abroad expenditure of resident firms on construction work abroad commissioned by non-residents (580)
Construction sites abroad receipts from construction work abroad commissioned by non-residents (excluding export proceeds) (570)
Financial and insurance services
Financial services (533)
Resident policy holders
Expenditure on premiums/receipts arising from claims
Life insurance (400)
Secondary life insurance market (401)
Transport insurance for German imports and exports (410)
Other insurance transactions (420)
Resident insurance corporations, direct insurance contracts with non-residents
Premium receipts / expenditure arising from claims
Life insurance (440)

Services
Transport insurance for German imports and exports (441)
Other insurance transactions (442)
Direct insurance contracts with residents
Expenditure arising from claims
Life insurance (443)
Transport insurance (imports and exports) (444)
Other insurance transactions (445)
Receipts from and expenditure on reinsurance
Outgoing business (450)
Incoming business (451)
Other receipts from recoveries etc. (460)
IT services (513)
Royalties and license fees
Patents, licences, inventions, processes (technical know-how) (502)
Other rights (e.g. trade marks, franchise fees, marketing rights and rights to use a name) (503)
Emission rights (e.g. EU allowances, assigned amount units) (507)
Other business services (without merchanting)
Research and development (511)
Engineering and other technical services as well as architects fees (512)
Commercial, organisational and administrative services (516)
Payments for other entrepreneurial work (519)
Advertising and trade fair expenses (540)
Disposal services (534)
Commission fees (523)
Subsidies to subsidiaries, branches and operating plants (530)
Overhead expenses (531)
Repairs to means of transport (560)
Repairs to buildings and other immovables (561)
Repairs to goods imported and exported for the purpose of repair (562)
Other services (595)
Personnel, cultural, recreational services
Artistic copyrights (501)
Film and television industry (510)
Other firm-related services not allocated elsewhere
Freelance work (514)
Personnel leasing (517)
Compensation of employees (521)
Rents/operational leasing (594)

Note: The service categories (in bold) are based on the Extended Balance of Payments Services Classification (EBOPS). Numbers in brackets correspond to the coding list of the Deutsche Bundesbank.