Space and International Business

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1 Introduction

One of the most remarkable aspects of the global economic system is the unequal distribution of population and economic activity across the earth. Millions of people are living close together in New York, Moscow, and Beijing. At the same time, there are large, virtually empty spaces available in the USA, Russia, and China. This unequal distribution of economic activity also has consequences for firm interaction in an international business environment.

One of the major actors in the present era of globalization is no doubt the multinational firm (multinationals for short). These firms are probably the most mobile among all firms, with sufficient ‘international’ knowledge to seize a profitable opportunity when it presents itself. Without specific cultural ties to individual nations, they can seemingly rapidly move in and out of countries, with only economic incentives to act upon. Traditionally, international trade theory focused on trade between countries and regions, with only limited attention for individual firms. The modern literature, however, has taken a strong micro-economic turn and the availability of micro firm data has revealed many interesting stylized facts that eluded earlier research. These stylized facts are the main topic of this contribution.1

The footloose nature of multinationals is strengthened by the fact that such firms no longer produce ‘under a single roof’. Richard Baldwin (2006) calls this process the second unbundling. The first unbundling was initiated by the transportation revolution of the industrial revolution (1750-1900) that made it possible to spatially separate production from consumption, thereby facilitating international specialization on an unprecedented scale. The second unbundling really took off after 1980 and spatially separates the different stages of the production process itself, where parts of the production process are organized in the most efficient location.

Recent advances in geographical economics argue that the continued decline of spatial interaction costs referred to above (falling transport costs, declining trade barriers, and new communication technology) are the primary cause of the unequal spatial distribution of economic activity, leading to a ‘spiky’ core-periphery world with large income differences between rich and poor countries.2

This chapter combines the above observations and illustrates its consequences in three parts.3 Part A (sections 2 and 3) analyzes recent characteristics of firm heterogeneity, trade, and multinational activity. Part B (sections 4-6) focuses on recent information regarding trade in value-added, trade links, and global supply chains. Part C (sections 7-8) reviews the geographical economics approach and the consequences for the distribution of economic activity and global trade flows. Section 9 concludes. We first discuss the three main parts in more detail.

Part A starts in section 2 by discussing firm heterogeneity and trade by showing that only a small fraction of all firms engage in trading activities, that this share varies per sector based on comparative advantage, and is firm-specific. We also note that trading firms are larger, more productive, use higher skilled workers, and pay higher wages. Section 3 analyzes trade and multinationals. First, by showing that the majority of trading firms only trade one or two goods

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1 See also Beugelsdijk, Brakman, Garretsen, and van Marrewijk (2013) and Beugelsdijk, Brakman, van Ees, and Garretsen (eds., 2013).

2 Rather than a ‘flat’ world as some other people argue (Friedman 2005).

3 Our work is partially based on van Marrewijk (2017) and Brakman and van Marrewijk (2017).
with one or two other countries. Only a small fraction of (multinational) firms trade a range of different goods to a range of different countries. This small fraction of large firms is, however, responsible for the large majority of trade value. Second, we show that a large share of trade flows is ‘related party’ trade. Sections 2 and 3 use American data and mostly focus on exports, but similar results hold for imports and other OECD countries.

Part B starts in section 4 by introducing the new data on trade in value added, which tries to estimate the extent to which a country’s gross export flows incorporate domestically produced value-added and imported foreign value-added. As national production processes become increasingly intertwined with foreign production processes the share of value-added trade in gross trade flows has been steadily declining. Section 5 analyses these trade linkages at the global level by identifying backward linkages (incorporated foreign value-added), forward linkages (domestic value added used as foreign intermediate input), direct domestic content (created in the sector itself), and indirect domestic content (created in other sectors). Section 6 shows the consequences for the participation in global supply chains. The extent to which countries participate in global supply chains varies substantially, but is rising for virtually all countries.4

Part C starts in section 7 by providing a brief overview of the ‘core’ model of geographical economics, which gives rise to a core-periphery structure of the world economy as spatial interaction costs fall. Section 8 concludes by illustrating the consequences of these developments for the structure of global regional trade flows.

2 Trade and firm heterogeneity (part A)

We start by providing some basic empirical information on firm heterogeneity and trade, largely based on data from Bernard et al. (2015).5 Figure 1 shows on the horizontal axis that, on average, only 35 percent of the US manufacturing firms export their products. This differs widely for the 21 manufacturing sectors identified in the figure (bubbles proportional to the number of firms in the sector), ranging from 15 percent for Printing and Related Support to 75 percent for Computer and Electronic Product. We make four observations. First, on average it is relatively rare to be an exporting firm as only one in three firms engage in exporting activities. Second, the share of exporting firms differs per sector. Third, assuming that the US has a ‘traditional’ (technology or factor-abundance based) comparative advantage in computers, the share of exporting firms is positively related to traditional sources of comparative advantage. Fourth, firm heterogeneity is substantial; even for the strongest sectors not all firms are exporting, while for the weak sectors there are still some firms that do export.

Figure 1 also indicates (on the vertical axis) the mean exports as a share of total shipments. The average export share is only 17 percent, considerably less than the 35 percent of firms that engage in exporting activities. The lowest share of export revenue is for Paper Manufacturing (6 percent) and the highest share for Electrical Equipment, Appliance (47 percent). Beverage and Tobacco

4 Using an alternative measure, van Marrewijk (2017, Ch. 15) shows that participation rises with income level and the least developed countries hardly participate in global supply chains at all.

5 See also Mayer and Ottaviano (2007, 2008), Bernard and Wagner (1997), and Aw and Hwang (1995). The relative recent availability of micro-firm data make this type of research possible. The theoretical basis for all this research was developed by Melitz (2003).
Products is the only sector where the mean exports as a share of total shipments (30 percent) is not less than the fraction of firms in the sector that exports (also 30 percent). For the majority of firms the domestic market seems to be more important, but there is substantial variation among the different sectors.

Figure 1 Exporting activities in different sectors; USA, 2007

Since not all firms engage in exporting activities it is worthwhile to investigate to what extent exporting firms differ from non-exporting firms. One way to do this is to analyse information for thousands of firms using regression analysis to estimate the size of the differences. This is done in Figure 2 which reports exporter premia over non-exporters in percent. Let’s first focus on the simple regressions (the ‘none’ bars). Panel b of the figure shows that exporting firms are larger than non-exporters; they employ about 128 percent more people and shipments are about 172 percent larger. Panel a shows that they have other characteristics as well; the skill per worker is about 6 percent higher, the capital per worker about 28 percent higher, the wages they pay about 21 percent higher, the value added per worker about 33 percent higher, and the firm’s total factor productivity is about 3 percent higher. Interestingly, the causality runs from productivity to exporting, and not the other way around (Melitz, 2003). This is remarkable, as it is often stated that international competition forces firms to become more competitive.

The simple regressions lump all firms in all sectors together. To control for differences between sectors we should look at the ‘FE’ bars, which allow for sector-specific fixed effects. In general, the estimated premia are a little bit lower (except for total factor productivity), but all still strong and highly significant (except for skill per worker). Finally, we can also control for the size of the firm by looking at the ‘FE+Empl’ bars, which control for sector fixed effects and employment size. As expected, this reduces the estimated shipment premium (from 135 to 24 percent, see panel b). All other estimated firm characteristic premia in panel a, however, become larger and are highly significant (including skill per worker). Finally, we want to point out that there is overwhelming evidence of large differences in productivity between firms of similar type.
Section 2 provides evidence that exporting firms tend to be larger and more productive. Recent research confirms that this linkage between firm productivity and internationalization also holds for multinationals; only the most productive firms can afford to become a multinational; investing abroad is expensive and only productive firms can afford this. Empirical research has confirmed this linkage between productivity and doing business abroad and detected a clear ranking between firms: Less productive firms are active domestically, more productive firms can afford to become exporters, and only the most productive firms become multinationals (Helpman et al., 2004). But micro-data reveal more than only this linkage.

We now continue this discussion in two steps. First, we will analyse the extent to which trading firms differ regarding the number of products they trade and the number of countries they trade with, the so-called extensive margin of trade flows. Second, we analyse the extent to which trade involves within-firm transactions, so-called related party trade, where a firm in one country trades with a parent or affiliate in another country. We base our discussion on evidence for American firms, but similar observations hold for the structure of trade flows for other advanced countries.

Recall that only about 1/3rd of all American manufacturing firms are active in exporting activities (see section 2). The differences between these exporting firms regarding the number of products they export, the number of countries they export to, and the value of these exports are enormous, as illustrated in Figure 3.
Panel a of Figure 3 shows the distribution of the share of exporting firms over the number of products and the number of countries. By far the largest number of exporting firms (35 percent of the total) export only one product to one other country, visualized in panel a by the high bar in the left corner. Less than nine percent of the firms export one product to two countries, less than four percent of the firms export one product to three countries, and only about one percent of the firms export one product to 11 or more countries. In total, about 53 percent of the exporting firms export only one product. In the other dimension: about two percent of the firms export two products to one country and less than one percent of the firms export three products to one country, four products to one country, and so on. In total, about 38 percent of the exporting firms export only to one country. In the upper right corner of panel a we see the share of firms that export many products to many countries. About 16 percent of the firms export six or more products to six or more countries. We thus observe a clear distinction in this panel: the majority of firms (more than 51 percent) export one or two products to one or two countries (lower left corner), while only a small fraction of firms (less than 6 percent) export 11 or more products to 11 or more countries.

Figure 3 Export distribution by product and country; USA, 2007

Panel a shows the distribution of the share of exporting firms over the number of products and the number of countries. The majority of firms (more than 51 percent) export one or two products to one or two countries, while only a small fraction of firms export 11 or more products to 11 or more countries. In total, about 53 percent of the exporting firms export only one product. In the other dimension: about two percent of the firms export two products to one country and less than one percent of the firms export three products to one country, four products to one country, and so on. In total, about 38 percent of the exporting firms export only to one country. In the upper right corner of panel a we see the share of firms that export many products to many countries. About 16 percent of the firms export six or more products to six or more countries. We thus observe a clear distinction in this panel: the majority of firms (more than 51 percent) export one or two products to one or two countries (lower left corner), while only a small fraction of firms (less than 6 percent) export 11 or more products to 11 or more countries.

Source: panel a-b based on data in Bernard et al. (2015); panel c: Beugelsdijk, Brakman, Garretsen, and van Marrewijk (2013).
Panel b of Figure 3 shows the distribution of the export value over the number of products and the number of countries. This panel is clear: there are only four entries above one percent of export value and they are all in the top right corner for firms that export six or more products to six or more countries; taken together these 16 percent of firms account for more than 86 percent of all export value (about seven times higher than the average value for exporting firms). By far the highest bar in panel b is for the superstar firms that export more than 11 products to more than 11 countries; taken together these 5.5 percent of firms account for about 80 percent of all export value (about 15 times higher than the average value for exporting firms). A small fraction of very large firms is thus responsible for the large majority of export revenue. Most of these firms are multinationals, as we discuss below.

Panel 3c suggests some of the dynamics behind the observations of panel 3a and 3b. Firms start carefully when they decide to become international. Firms first become active in familiar markets and only then move to more ‘foreign’ markets, which are more expensive to enter, because languages are unfamiliar, institutions are different, legal systems are different, and so on. Panel 3c illustrates this for the Swedish firm Ikea. Along the horizontal axis time is depicted, and along the vertical axis a measure of cultural distance. The graph shows that Ikea first became active in familiar (EU) markets (squares), and only later in more unfamiliar markets (circles). The picture suggests that the link between productivity and internationalization extends to firms themselves; only if a multinational firms becomes productive/profitable enough does it become active in more ‘distant’ foreign markets. In general, this relation is confirmed by empirical research. A meta-study, however, also revealed that important differences exist between firms, sectors, and countries of origin. Based on an analysis of 359 studies across 32 countries between 1972 and 2012, Marano et al. (2016) conclude that the overall linkage between internationalization (multinationalization) and performance is positive but small and with large standard deviations.

Figure 4 USA total and related party imports and exports, 2002-2014

Source: based on US Census Related Party Database; values in constant 2014 USD billion.

Now that we have established that a few large firms are responsible for a large share of the value of international trade flows we take the next step by analysing the extent to which multinational firms are involved in these trade flows. As an indication of their importance we show in Figure 4 the size of total trade (panel a for imports and panel b for exports) and the size of related party
trade. Note that related party trade underestimates the importance of multinationals in total trade flows as it only records within-firm flows between parents and affiliates and not trade flows between multinationals and other firms.

In real terms (constant 2014 USD), total import value rose from $1,471 billion in 2002 to $2,314 billion in 2014 (an increase of 57 percent), with a substantial dip in 2009 (of more than $600 billion) as a result of the Great Recession, see panel \textit{a} of Figure 4. The related party imports follow the same, but more pronounced pattern as they rose from $700 billion in 2002 to $1,179 billion in 2014 (an increase of 68 percent), also with a substantial dip (of more than $260 billion) in 2009 as a result of the Great Recession. We thus note that, as a consequence of these developments, the share of related party trade in total imports is substantial (about half of all imports) and rose from about 48 percent in 2002 to about 51 percent in 2014.

Panel \textit{b} of Figure 4 depicts the same information for export value. Total export value rose from $802 billion in 2002 to $1,402 billion in 2014 (an increase of 75 percent), with a dip of more than $260 billion in 2009. Note that total exports are considerably less than total imports as the USA has a large trade deficit (in these data of about $670 billion in 2002 and more than $900 billion in 2014). The related party exports follow the same, but less pronounced pattern as they rose from $251 billion in 2002 to $408 billion in 2014 (an increase of 62 percent), with a dip of $74 billion in 2009. We thus note that, as a consequence of these developments, the share of related party trade in total exports is substantial (around 30 percent of all exports), but considerably less than their share in total imports. Related party trade is thus particularly important for US imports. The share of related party exports in total exports declined slightly from about 31 percent in 2002 to about 29 percent in 2014.

\textbf{4 Trade in value added (part B)}

Traditionally, international trade is analysed by using data on gross exports and imports. This is the trade that crosses national borders and is registered by custom officials.\textsuperscript{6} The assumption is that gross trade flows provide sufficient information to analyse the structure of international trade and, for example, comparative advantage. As long as international fragmentation is limited gross trade flows indeed provide this information. This is, however, no longer the case. International fragmentation of the production process has become a salient characteristic of the world economy and international trade flows no longer, or to a lesser extent than they used to be, reflect what a country is producing and exporting (see Brakman, van Marrewijk, and Partridge, 2015).

\textsuperscript{6} Except for intra-EU trade, where it is estimated.
There have been several recent attempts to remedy this shortcoming by constructing estimates of value-added trade flows across countries rather than gross export flows. We first focus on the EU-Groningen constructed World Input-Output Data (WIOD) database and then discuss the OECD-WTO trade in value-added database in the next section. The WIOD trade data identify 40 individual countries and a ‘Rest of World’ (RoW) group of countries to characterize global trade flows in the period 1995–2009. The countries are the 27 countries of the EU (as of January 1, 2007) combined with Australia, Brazil, Canada, China, India, Indonesia, Japan, Mexico, Russia, Taiwan, Turkey, and the USA. Together these countries represent about 85 percent of world GDP. Furthermore, the data cover 35 sectors, and are constructed by combining national Input-Output tables with international trade data.

Expressed in constant 2009 US dollars, global gross trade flows increased by about 94 percent in this period (see Figure 6), from $7,305 billion in 1995 to $14,160 billion in 2009.\(^7\) Global gross trade flows peaked in 2008 at $18,315 billion (the drop in 2009 was almost 23 percent). Measured in value-added terms, global trade flows increased in the same period by about 82 percent, from $5,722 billion in 1995 to $10,397 billion in 2009. As illustrated in Figure 6, value-added trade and gross trade move up and down quite closely, although the gap between these flows is gradually increasing since value added trade rises more slowly. As a consequence, the ratio of value-added trade to gross trade is gradually declining over time, from 78 percent in 1995 to 73 percent in 2009 (this ratio is depicted on the right-hand-scale of Figure 5).\(^8\)

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\(^7\) Based on WIOD data; we converted current dollars to constant dollars using the US GDP deflator.

\(^8\) The exception is the rise in the ratio of value-added to gross trade flows in 2009 as a consequence of the Great Recession. This rise appears to be temporary only, see Brakman, van Marrewijk, and Partridge (2015) and Los, Timmer, and de Vries (2015).
5 Global trade linkages (part B)

The trade in value added data is useful for identifying global supply chains, which usually involve the simultaneous importing and exporting of goods and components at different stages of the production process in the same broader sector involving locations in a range of different countries. The streams are usually co-ordinated at the firm level by multinational enterprises. The interdependencies are important, as are the logistic problems. As a consequence, supply chains tend to involve multiple countries at different stages of economic development (which allows for differences in comparative advantages between the countries), but these countries have to be relatively close together in space in order to manage the logistics and coordination problems (see e.g. Baldwin and Venables, 2013). Many large supply chains therefore involve advanced countries and nearby middle income countries, such as the USA and Mexico, Germany and the Czech Republic, or Japan and China. Indeed, it is not too far-fetched to argue that some middle income countries became precisely that (middle income countries) because they benefited from being at the right stage of economic development in the neighbourhood of advanced countries at the right time.

Figure 6 Backward and forward linkages in value-added trade

One way to identify supply chains is by looking at the value-added at each step of the production process. We do that in this section using the OECD-WTO trade in value added database. The most recent version of this database identifies 61 different countries plus a Rest of World combination of other countries and provides information up to 2011. We start by discussing the main concepts involved. Suppose the American economy consists of three sectors, labelled 1, 2, and 3. For simplicity we assume that all American exports consist of sector 2 exports to China,
which is taken to be the only other country in the world. The Chinese economy consists of two sectors, labelled 1 and 3. We focus attention on domestic value-added and so-called backward- and forward international linkages in our discussion below. We use gross exports from America (equated to 100 percent) as our frame of reference, see Figure 6 for details.

**Backward linkages.** Not all value incorporated in America’s gross exports is created in America since part of it is created in so-called upstream sectors that supply intermediate goods to sector 2. More specifically, both China sector 1 and China sector 3 supply intermediate products to the American producers in sector 2; we identify these flows by the arrows \( C_1A_2 \) and \( C_3A_2 \) in Figure 6. As a consequence, part of gross exports represents value-added imported from abroad. It is identified as FVA (foreign value-added) in Figure 6 and consists of the (international) backward linkages of global supply chains. The global average backward linkages were 24 percent of gross exports in 2011, as listed in the figure.

**Domestic value-added.** All value incorporated in America’s gross exports that is not created abroad is domestic value-added. In view of the above, the global average domestic value-added share in 2011 was 76 percent, since the foreign value-added share was 24 percent. Not all of this value-added is created in sector 2, however, since both America sector 1 and America sector 3 supply intermediate products to the American producers in sector 2; we identify these flows by the arrows \( A_1A_2 \) and \( A_3A_2 \) in Figure 6. As a consequence, we can identify three different types of domestic value-added flows.

- **DDC – direct domestic contribution.** This is the value-added incorporated in the gross exports that is created in the exporting sector itself (in this case sector 2); the global average direct contribution was 46 percent of gross exports in 2011.
- **IDC – indirect domestic contribution.** This is the value-added incorporated in the gross exports that originates from domestic upstream sectors (in this case sectors 1 and 3). The global average indirect contribution was 29 percent of gross exports in 2011.
- **RIM – re-imported domestic value-added content of exports.** A small percentage of domestic value-added incorporated in the gross exports of a sector consist of value-added that was first exported from the country to be used as an intermediate input by foreign sectors (in this case China sectors 1 and 3), which is then subsequently re-imported into the country as an intermediate input in the production process. The global average re-imported domestic value-added share was about one percent of gross exports in 2011.

**Forward linkages.** The domestic value-added incorporated in gross exports can be used to satisfy the demand for final goods or it can be used as an intermediate input in the production process of a foreign sector. In this case, America sector 2 supplies intermediate goods to both China sector 1 and China sector 3; we identify these flows by the arrows \( A_2C_3 \) and \( A_2C_3 \) in Figure 6. These substantial deliveries of intermediate goods to international downstream sectors represent the forward linkages in global supply chains. The global average forward linkages were 49 percent of gross exports in 2011, which implies that the global average domestic value-added incorporated in the demand for final goods was 27 percent of gross exports in 2011.

**6 Global supply chains (part B)**

Regarding the participation in global supply chains the OECD – WTO identifies two important international linkages, as explained in section 5. An overview of the backward and forward
linkages in 2011 is provided in Figure 7. The countries with the highest scoring forward linkages are the oil exporting nations Saudi Arabia and Brunei (87 percent of gross exports). This reflects the fact that most of the exported oil is subsequently used as an intermediate input in virtually all sectors of the importing countries. Other countries with high forward linkages are Russia and Rest of World (70 percent of gross exports). The global average forward linkage is 49 percent of gross exports, which is about equal to the value for the UK and close to the values for USA (51 percent) and Germany (46 percent).

**Figure 7 Backward and forward linkages, 2011**

Source: based on data from OECD – WTO trade in value added database (EXGR-DVASH); 61 countries plus Rest of World; EXGR-FVASH and EXGR-INTDVASH; bubble size proportional to gross exports.

The highest backward linkage by far is provided by Luxembourg (59 percent). This reflects the fact that many sectors in Luxembourg intensively use imported intermediate inputs in the production process. The backward linkages are, of course, equal to one minus the domestic value-added share, as analysed in Figure 6. This implies that the countries scoring high in domestic value-added, such as Saudi Arabia, Brunei, Rest of World, and Russia, score low in backward linkages. The global average backward linkage is 24 percent, which is close to the value for the UK, India, and Canada (the latter two are not identified separately in the figure). The USA has clearly lower backward linkages (15 percent), while Germany and China have higher backward linkages (26 and 32 percent, respectively), reflecting the fact that German and Chinese sectors more intensively use imported components from other countries in their production processes than UK and USA.

The sum of the backward and forward linkages is generally taken as an indication of the intensity with which a country participates in global value chains, see Koopman et al. (2010). Taking \( \log(1 + \text{backward}) + \log(1 + \text{forward}) \) as an indicator does not affect our discussion below.
and explains about 65 percent of the variance in forward linkages. There are, nonetheless, substantial differences between countries. The global average sum of backward and forward linkages is 73 percent, ranging from a low of 47 for Croatia to a high of 91 for Brunei.

**Figure 8 Sum of backward and forward linkages in 1995 and 2011**

Source: based on data from OECD – WTO trade in value added database (sum of EXGR-FVASH and EXGR-INTDVASH); 61 countries plus Rest of World; bubbles proportional to percent of gross exports in the respective year.

To conclude our discussion of value-added measures of global supply chains, Figure 8 shows the sum of backward and forward linkages for both 1995 and 2011. This clearly shows that participation in global value chains is rising over time: the values for the 2011 score tend to be above those for the 1995 score. In fact, the global average sum of backward and forward linkages increased from 65 percent in 1995 to 73 percent in 2011. The values were higher for all individual countries except for Saudi Arabia (minus zero percent), Cambodia (minus one percent), and Croatia (minus ten percent). The rise was above ten percentage points for 12 countries, with an increase of 15 percentage points for Hungary and Iceland and of 16 percentage points for India. The large drop for Croatia clearly puts it in a rather special (low) position in 2011 compared to the other countries. The ranking tends to be rather persistent over time, with Germany and Rest of World moving up a bit while USA and China are moving down. Also note the increase in bubble size for China and Rest of World, indicating their rapidly rising importance in global trade flows.

Despite the difficulties of measuring supply chains because of data limitations, the evidence illustrates that global trade has changed over time from standard international trade in final products to trade in intermediate products. The second unbundling is visible whatever data source one uses. More and more international active firms specialize in smaller parts of the production chain. The increase in intermediate product trade is clear evidence of this phenomenon; it is increasing over time.

7 Geography and economics (part C)

It has long been evident that the unequal distribution of economic activity cannot be adequately explained using a neoclassical framework. In particular, economies of scale and imperfect
competition, interacting with some form of local advantages, are essential. This implies that it is rather complicated to endogenously determine the size of economic activity in different locations in a general equilibrium framework. Such a framework was only fairly recently developed as it is based on tools that needed to be developed first in other fields of economics (tractable scale economies and monopolistic competition). The path-breaking contribution of the American economist Paul Krugman appeared in 1991. Since then many prominent researchers have published work on refinements, generalizations, and applications in this field now known as ‘geographical economics’ or ‘new economic geography’, which combines elements from international economics, industrial organization, economic geography, spatial economics, urban economics, and endogenous growth.

Krugman’s original ‘core’ model focuses on the role of all sorts of spatial interaction costs (under the short-hand label transport costs $T$) for the endogenous determination of economic activity in a two-region setting where mobile manufacturing workers migrate to the location with the highest real wage rate. The main implications of this model hold quite generally (Fujita, Krugman, and Venables, 1999, and Neary, 2001) and can be summarized as follows.

- For all transport costs below a critical level, labelled the sustain point, complete agglomeration of manufacturing activity in one region is a stable long-run equilibrium. If the transport costs exceed the critical sustain point level, agglomeration is not 'sustainable', that is agglomeration is an unstable equilibrium.

- For all transport costs above another critical level, labelled the break point, spreading of manufacturing activity over the two regions is a stable equilibrium. If the transport costs are lower than the critical break point level, the spreading equilibrium 'breaks', that is spreading is an unstable equilibrium.

- The sustain point occurs at a higher level of transport costs than the break point. There is thus always an intermediate level of transport costs at which agglomeration of manufacturing activity is sustainable while simultaneously spreading of manufacturing activity is a stable equilibrium.

The analysis can be neatly summarized in the so-called Tomahawk diagram of Figure 9, where $B$ is the break point, $S_0$ and $S_1$ are the sustain points, and the arrows indicate the direction of migration of mobile workers as a result of differences in the relative real wage. For each of the three stable equilibria the 'basin of attraction' is indicated, that is the area of initial parameter settings which will converge to this equilibrium, see the explanation below the figure. Under the plausible assumption that international interaction costs fall over time, the main implication of this work is economic activity will agglomerate in certain locations and a core-periphery pattern emerges.
The broad lesson of these models is that firms tend to agglomerate when economies integrate. Firms benefit from market access and local input-output linkages. Evidence indeed points out that especially international oriented firms tend to agglomerate more than domestic firms. Brakman et al. (2016), for example, show that since China joined the WTO in 2001, manufacturing firms show similar clustering patterns as firms in the US, and Chinese firms are more localized than in the UK or Japan. Localization in China increases rapidly, even in the relatively short period between 2002 and 2008. Private Chinese firms, firms from Hong-Kong, Macao and Taiwan, and foreign multinationals are more localized than state-owned firms. These findings are consistent with the notion that in liberalizing economies profit seeking manufacturing firms try to benefit from agglomeration economies and cluster together. This clustering has a not often recognized consequence for world trade, since trade is still localized.

8 Consequences for trade flows (part C)

For illustration purposes, we aggregate countries into global regions based on the World Bank classification after making two adjustments. First, we subdivide the large East Asia and Pacific region (31.3 percent of the world population) into three parts: East Asia (including China, Korea, and Japan), Southeast Asia (including Indonesia and the Philippines), and Pacific (including Australia and New Zealand). Second, we subdivide the Europe and Central Asia region into Europe and Central Asia (including Russia) separately. We thus have ten different global regions, see Table 1.
Table 1 World Bank regions – further subdivided

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<td>Middle East &amp; North Africa</td>
<td>MNA</td>
<td>403</td>
<td>21</td>
</tr>
<tr>
<td>North America</td>
<td>NAM</td>
<td>351</td>
<td>3</td>
</tr>
<tr>
<td>South Asia</td>
<td>SAS</td>
<td>1,671</td>
<td>8</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>SSA</td>
<td>937</td>
<td>48</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>7,101</td>
<td>214</td>
</tr>
</tbody>
</table>

Source: based on World Bank Development Indicators classification, 2015

Total trade within a global region is the sum of all trade flows for the countries that are part of that global region. These flows can be sub-divided into *intra*-regional flows (within the same region; so from a country in the region to another country in the same region) and *inter*-regional flows (between regions; so from a country in the region to a country in some other region). The results of our calculations are visualized in Figure 11. The visualization in the figure uses a map for reference. Circles are located more or less at the geographic centre of a region on that map and proportional to the size of the region’s total trade flows (average of exports and imports). Arrows between the circles show trade flows from one region to another. In order not to clutter the diagram only inter-regional flows of one percent or more are shown in the figure. To get an indication of the importance of these flows the thickness of the line is proportional to the size of the flow. To get an indication of the size of the intra-regional versus the inter-regional trade flows, each circle is sub-divided into a light-shaded part and a dark-shaded part. The intra-regional flows are represented by the dark-shaded part.

A number of important observations can be made by looking at Figure 11.

- Europe is by far the most important region for international trade flows; it represents more than 37 percent of global trade. Other important regions are East Asia (China and Japan) with 20 percent of global trade and North America with 13.5 percent. Together these three regions account for 71 percent of all trade flows.
- There is only a limited number of sizeable inter-regional trade flows. Out of the 90 possible flows only 18 exceed the one percent threshold.
- There are large flows between the three main centres; from East Asia to North America (4.2 percent), from East Asia to Europe (3.2), from Europe to North America (2.9), and so on.
- There are large flows from regions in the vicinity of the main centres to the main centre; from Latin America to North America (2.9 percent), from Southeast Asia to East Asia (2.6), from Central Asia to Europe (2.5), and so on.
Two or three global regions are rather isolated with relatively little interaction with the rest of the world. This certainly holds for Sub-Sahara Africa and South Asia (without any connecting arrow to any other region). To a somewhat smaller extent it also holds for Pacific (with one connecting arrow), which is geographically isolated, but in view of its relatively small population has a reasonable interaction with the world economy, particularly with East Asia (the destination of 59 percent of its export flows).

A large share of international trade flows in the main economic centers (Europe, East Asia, and North America) is within the same region (intra-regional). These flows are related to the development of global supply chains, which requires intensive trade connections between nearby countries, preferably at different stages of economic development.

Figure 11 Global intra- and inter-regional trade flows, percent of total

Source: van Marrewijk (2017); bubbles proportional to size of trade flows in 2011; light-shaded area is extra-regional trade; dark-shaded area is intra-regional trade; weight of inter-regional trade flow is proportional to size (in percent); only flows of 1 percent or more are shown.

9 Conclusions

This chapter briefly discusses some stylized facts on internationally active firms. The increasing availability of micro firm data has revealed some important stylized facts.

Internationalization is expensive. Only relatively productive firms are able to export, and only the most productive firms can become a multinational. Most firms are only active in a limited number of foreign markets with a limited range of products; only the largest multinationals are active in many markets, with a wide range of products. These broad conclusions hold in general, but differ between countries and sectors. These internationally oriented firms are larger, pay higher wages, have a higher value added per worker, and employ more people. Increasingly internationally active firms specialize in fragments of the international supply chain. This process has been dubbed the ‘second-unbundling.’ International active firms tend to cluster together, both within
and between countries. The consequence of this agglomeration tendency is that most of world trade takes place within the EU, the American block, and an Asian block; trade between these blocks is relatively small compared to the within block trade.

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