

**INTRA-FIRM TRADE AND NON-TRADE INTERCOMPANY TRANSACTIONS:
CHANGES IN VOLUME AND STRUCTURE DURING 1990–2007**

Paweł Folfas M.Sc.

pawel.folfas@doktorant.sgh.waw.pl

Warsaw School of Economics

Institute of International Economics

Al. Niepodległości 164

02-554 Warszawa

phone and fax: +48 22 564 86 32

Abstract

The fundamental goal of this paper is to scrutinize changes in the size and structure of intrafirm exchange during 1990–2007.

The size is determined not only by the value of the intercompany transactions, but also by geographical spread of transnational corporations (TNCs). Consequently, analyzing the various aspects and degree of transnationality of TNCs become the topics of paper.

Therefore, the share of intrafirm trade vs. share of non-trade intercompany transactions in intrafirm exchange is studied.

Moreover, there is presented in brief a wide spectrum of roots of changes in intrafirm exchange. These roots are present in the world economy (e.g. globalization, semi globalization, economic integration) and as well as in TNCs as well (e.g. offshoring, creation of financial conglomerates, and theory of granularity of growth).

Research is conducted based on UNCTAD's (World Investment Reports) and selected TNCs' data, but also on national statistics.

Keywords: intra-firm exchange, intra-firm trade, transnational corporations (TNCs), degree of transnationality, foreign direct investments (FDI)

JEL: F23, F21

1. Background studies on intra-firm exchange

Intra-firm exchange is an issue which has not been being often scrutinized. Some general overview of intra-firm exchange can be found in literature focusing on transnational corporations [e.g. Dunning 1992; Cantwel, Molero 2003; Kleinert 2004; Zorska 2007].

Therefore, there are studies concentrating on intra-firm trade. One group brings basis measures and statistical data of intra-firm trade in selected OECD countries [e.g. Zeile 1997, OECD 2007, pp. 182–183]. Other studies scrutinize determinants of intra-firm trade also via econometric models [e.g. Bonturi, Fukasaku 1993; Zeile 2003; Egger, Pfaffermayr 2005].

2. Intra-firm exchange: definition and structure

Intra-firm exchange includes all flows of goods, services and factors of production within companies, in other words includes related-party transactions. The bulk of intra-firm exchange occurs within transnational companies (TNCs), namely transactions between parent company and its subsidiaries or between affiliates. These transactions can be cross-border (e.g. between parent company and its foreign subsidiary) or domestic (e.g. between two foreign subsidiaries located in one country). Data and conclusions presented in this paper focus on cross-border intra-firm exchange within TNCs.

Table 1. Structure of intra-firm exchange

| | |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Intra-firm trade | trade in goods: in finished goods, in semi products, in raw materials |
| | trade in services (intercompany services) |
| Non-trade intercompany transactions | capital movements: short-term intercompany loans, long-term intercompany loans, leasing, cash pooling, bonds, foreign direct investments |
| | exchange of intangibles (e.g. royalties, licence, franchising, know-how, trade marks, trade names, brand names, goodwill) |
| | intercompany R&D |
| | exchange of information, documents |
| | employees migration |

Source: Own study

Intra-firm exchange encompasses: intra-firm trade in goods and services and non-trade intercompany transactions (see table 1). The structure of intra-firm exchange is changing, namely the share of trade in services and non-trade transactions has increased (see table 2).

Table 2. Estimated^a structure of global intra-firm exchange in 1980, 1990, 1995, 2000 and 2005 (%)

| | 1980 | 1990 | 1995 | 2000 | 2005 |
|------------------------------------|---------|---------|---------|---------|---------|
| Trade in goods | 80.3646 | 75.0266 | 74.5686 | 64.5807 | 72.6931 |
| Trade in services | 16.2589 | 18.0520 | 17.8588 | 15.0898 | 17.0958 |
| FDI | 3.0242 | 6.2847 | 6.9848 | 19.6792 | 9.3696 |
| Royalties and licence fee receipts | 0.3523 | 0.6367 | 0.5878 | 0.6503 | 0.8415 |

^a Estimations do not include all elements of intra-firm exchange (e.g. migration, capital movements other than FDI are not included).

Source: Own study on the basis of [Zorska 2007, s. 107–112] and data of [UNCTAD *Statistical databases online*, <http://www.unctad.org/Templates/Page.asp?intItemID=1888&lang=1>]

3. Size of intra-firm exchange

There are two determinants of the intra-firm exchange's size: the geographic scope of exchange and the value of intercompany transactions. The first determinant is directly linked with the degree of transnationality of TNCs. This topic is scrutinized in section 4.

The second aspect of size can be measured by the share of intra-firm exchange in global flows of goods, services and factors of production. Intra-firm trade currently accounts for at least¹ 35% of all global trade. Therefore, the TNCs' share in international transfer of technology is about 80% and 65–70% takes place in intra-firm exchange. Almost all foreign direct investments are under control of TNCs [Zorska 2007, pp. 107–112].

Additionally, estimation of number of potential channels for intra-firm exchange can also brings vital conclusions. Channels' number is a function of number of transnational corporations (parent companies) and foreign subsidiaries controlled by them.

Table 3. Number of TNCs parent companies and its foreign subsidiaries (1990–2007)

| Year | 1990-1995 ^a | 1996-2000 ^a | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|------------------------------|------------------------|------------------------|--------|--------|--------|--------|--------|--------|--------|
| Number of parent companies | 37530 | 63312 | 64592 | 63834 | 61582 | 69727 | 77175 | 78411 | 78817 |
| Number of foreign affiliates | 206961 | 821818 | 851167 | 866119 | 926948 | 690391 | 773019 | 777647 | 794894 |

^a Average number per year

Source: Own study on the basis of [UNCTAD 1997, pp. 6–7]; [UNCTAD 2001, pp. 239–240]; [UNCTAD 2002, pp. 270–271]; [UNCTAD 2003, pp. 222–223]; [UNCTAD 2004, pp. 273–274]; [UNCTAD 2005, pp. 284–285]; [UNCTAD 2006, pp. 270–271]; [UNCTAD 2007, pp. 217–218]; [UNCTAD 2008, pp. 211–212]

¹ Some WTO's estimates claims that even 50%.

Since 1990 number of potential channels has increased (see table 3), however there were years during number of TNCs' related-parties was stagnating or falling. Size of intra-firm exchange (measured by number of channels) is vulnerable to trends in international flows and recently the rate of size's growth has been significantly lower than in early 1990s.

Table 4. U.S. intra-firm export^a and import^b of goods (1982–2006)

| Rok | U.S. intra-firm export (mln USD) | Share in total U.S. export of goods (%) | U.S. intra-firm import (mln USD) | Share in total U.S. import of goods (%) |
|------|----------------------------------|-----------------------------------------|----------------------------------|-----------------------------------------|
| 1982 | 72.150 | 33.3 | 91.203 | 37.4 |
| 1983 | 71.974 | 35.0 | 98.434 | 38.1 |
| 1984 | 83.778 | 37.4 | 123.244 | 37.3 |
| 1985 | 87.752 | 40.1 | 135.787 | 40.3 |
| 1986 | 82.973 | 38.5 | 148.430 | 40.6 |
| 1987 | 83.925 | 33.0 | 158.034 | 38.9 |
| 1988 | 104.205 | 32.3 | 177.476 | 40.2 |
| 1989 | 119.828 | 32.9 | 194.182 | 41.0 |
| 1990 | 125.552 | 31.9 | 206.916 | 41.8 |
| 1991 | 137.152 | 32.5 | 205.721 | 42.1 |
| 1992 | 148.304 | 33.1 | 215.477 | 40.5 |
| 1993 | 153.068 | 32.9 | 237.903 | 41.0 |
| 1994 | 182.558 | 35.6 | 273.288 | 41.2 |
| 1995 | 203.464 | 34.8 | 300.507 | 40.4 |
| 1996 | 220.903 | 35.3 | 321.277 | 40.4 |
| 1997 | 246.353 | 35.7 | 337.810 | 38.8 |
| 1998 | 229.546 | 33.7 | 349.449 | 38.3 |
| 1999 | 216.960 | 31.2 | 384.090 | 37.5 |
| 2000 | 232.431 | 29.7 | 439.830 | 36.1 |
| 2001 | 231.991 | 28.5 | 417.013 | 36.0 |
| 2002 | 232.459 | 30.2 | 427.666 | 36.5 |
| 2003 | 277.625 | 32.5 | 435.738 | 38.2 |
| 2004 | 284.179 | 33.2 | 485.628 | 38.4 |
| 2005 | 307.097 | 35.0 | 515.494 | 39.0 |
| 2006 | 337.822 | 35.6 | 548.969 | 40.5 |

^a Exports from U.S. parent companies to their controlled affiliates abroad and exports from foreign-controlled U.S. affiliates to their foreign parent groups

^b Imports by U.S. parent companies from their controlled affiliates abroad and imports by foreign-controlled U.S. affiliates from their foreign

Source: Own study on the basis of data of [Bureau of Economic Analysis, U.S. Department of Commerce - <http://www.bea.gov/international/index.htm#trade>]

These facts are confirmed by more particular data from U.S. intra-firm trade of goods (see table 4)². After rapid growth of U.S. intra-firm trade in goods in 1980s and early 1990s, late 1990s brings falls and recently the pace of growth is rather sluggish.

4. How much transnational are TNCs?

This section is aimed at analyzing various perspectives and degree of transnationality of TNCs. According to the intra-firm exchange, it allows to answer for two basic questions:

² Data for intra-firm exchange (trade) are available only for a few OECD countries. The best statistical evidence is conducted by U.S. Department of Commerce.

how large cross-border vs. domestic part of intra-firm exchange is and how large geographic scope of intra-firm exchange is?

4.1. Transnationality: definition and various perspectives

Transnationality is a function of the extent to which a firm's activities are located abroad. The transnationality of TNCs can be considered from a number of perspectives: their operations, stakeholders and the spatial organization of management. From each perspective, various dimensions can be considered:

- from the operations perspective, key dimensions include the intensity or relative importance of a TNC's foreign operations, as a measured of various variable: the geographical spread of its operation, the modalities of foreign operations and the degree of integration of the production process across locations;
- from the stakeholders' perspective key dimensions include the composition of managers or board members, the nationality composition of shareholders by nationality, the international mobility and international experience of managers and the composition of the labour force by nationality;
- from the perspective of the spatial organization of management, key dimensions include: the extent and spread of the location of regional headquarters in host countries and the legal nationalities of TNC.

Given the range of perspectives and dimensions that can be considered for each, the degree of transnationality of a TNC cannot be fully captured by a single synthetic measure. It requires a variety of indicators. Some of these can be expressed as indices calculated or estimated on the basis of empirical data; others may consist of empirical data not expressed as indices; and still others may be expressed in qualitative rather than quantitative form [UNCTAD 2004, p. 37].

Consequently, next chapters bring presentation of wide spectrum of transnationality's measures. All measures refer to TNCs belonging to the group of the largest 100 non-financial TNCs, ranked by foreign assets and to the group of top 50 financial TNCs, ranked by foreign assets or geographic spread index.

4.2. UNCTAD's Transnationality Index

UNCTAD's Transnationality Index (TNI) measures the degree of transnationalization of TNCs from an operations perspective. The TNI is calculated as the average of following three ratios: foreign assets to total assets, foreign sales to total sales and foreign employment to total employment. TNI belongs to [0%; 100%]. The conceptual framework underlying this index is based on the dichotomy between foreign versus home country activities, and helps to assess the degree to which activities and interests of TNCs are embedded in their home economy or in economies abroad [UNCTAD 1998, p. 43; UNCTAD 2004, pp. 37–38].

An advantage of TNI is fact that it uses three variables to measure the intensity of foreign, relative to total, operations. TNI includes operations conducted by TNCs not only directly (via FDI) but also via alliances or trade (especially variable refers to sales but also foreign assets may encompass assets in subsidiaries which are not majority-owned) [UNCTAD 2004, pp. 37–38].

A drawback of this index is that it does not take into account the size of the home economy and does not distinguish between TNCs whose foreign activities are concentrated in a few foreign countries, and TNCs whose activities are spread across numerous host countries. Therefore, the value's interpretation of this index for individual corporation is ambiguous. On one hand, high value could indicate strong international competitiveness on the part of the home country firms. On the contrary, it may raise questions about a home country's locational advantages, particularly if accompanied by low levels of inward investment. Finally, TNI does not encompass the degree of integration of the production process across locations [UNCTAD 1998, pp. 43–44].

Data concerning transnationality of world's top 100 non-financial TNCs (see table 5) bring a number of conclusions. Firstly, during 1990–2006 average TNI was not increasing permanently. There were periods of falls (1991–1993, 1997–1999 and 2001–2003); however recent value of average TNI is higher than its value in early 1990s. But the value higher than 60% was achieved not so long ago (in 2006). Therefore, the increase of average TNI was driven mostly by growth of frequency of groups [40; 60) and [60; 80). The number of TNCs which TNI is higher than 80% has not outstripped 20 out of 100 companies yet. Secondly, measures of dispersion illustrate quite high variability of TNI among the world's top 100 non-financial TNCs. Despite of recent fall in dispersion, this group of TNCs remains quite heterogeneous.

Table 5. Transnationality Index of the world's 100 largest non-financial TNCs, ranked by foreign assets during 1990 – 2006: descriptive statistics (%)

| Statistics/Year | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | |
|--------------------------------------|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----|
| Number of TNCs which TNI belongs to: | [0; 20) | na. | na. | na. | 6 | 7 | 5 | 3 | 1 | 2 | 6 | 2 | 3 | 1 | 2 | 0 | 0 | |
| | [20; 40) | na. | na. | na. | 39 | 25 | 25 | 24 | 24 | 27 | 24 | 22 | 16 | 15 | 17 | 14 | 11 | 8 |
| | [40; 60) | na. | na. | na. | 28 | 38 | 38 | 32 | 37 | 32 | 36 | 32 | 36 | 37 | 42 | 42 | 41 | 42 |
| | [60; 80) | na. | na. | na. | 18 | 19 | 21 | 28 | 27 | 28 | 22 | 24 | 29 | 31 | 29 | 30 | 36 | 33 |
| | [80;100] | na. | na. | na. | 9 | 11 | 11 | 13 | 11 | 11 | 12 | 17 | 17 | 14 | 11 | 12 | 12 | 17 |
| Arithmetic mean | 51.00 | 51.50 | 51.00 | 47.23 | 48.88 | 51.55 | 54.79 | 55.33 | 53.86 | 52.60 | 55.68 | 58.14 | 57.00 | 55.76 | 56.82 | 59.96 | 62.05 | |
| Standard deviation | na. | na. | na. | 20.41 | 21.26 | 20.37 | 21.15 | 19.73 | 20.89 | 21.12 | 22.40 | 20.97 | 21.05 | 18.45 | 18.62 | 16.79 | 15.73 | |
| Range | na. | na. | na. | 78.50 | 81.50 | 79.30 | 81.50 | 82.10 | 81.30 | 82.50 | 94.20 | 95.40 | 91.80 | 91.20 | 91.20 | 72.10 | 68.00 | |
| 1 st quartile (Q1) | na. | na. | na. | 31.25 | 30.30 | 34.30 | 37.55 | 39.68 | 36.08 | 36.63 | 39.70 | 43.73 | 43.05 | 44.10 | 45.00 | 49.15 | 51.00 | |
| Median | na. | na. | na. | 44.10 | 47.10 | 50.15 | 54.70 | 56.60 | 54.55 | 53.70 | 56.40 | 57.75 | 57.10 | 53.80 | 55.65 | 57.75 | 60.00 | |
| 3 rd quartile (Q3) | na. | na. | na. | 63.13 | 64.00 | 65.10 | 71.08 | 69.13 | 69.48 | 65.30 | 73.65 | 72.83 | 72.10 | 69.98 | 71.83 | 72.75 | 74.50 | |
| Interquartile range (IQR) | na. | na. | na. | 31.88 | 33.70 | 30.80 | 33.53 | 29.45 | 33.40 | 28.68 | 33.95 | 29.10 | 29.05 | 25.88 | 26.83 | 23.60 | 23.50 | |
| Quartile deviation (QD) | na. | na. | na. | 15.94 | 16.85 | 15.40 | 16.76 | 14.73 | 16.70 | 14.34 | 16.98 | 14.55 | 14.53 | 12.94 | 13.41 | 11.80 | 11.75 | |
| SD/AM | na. | na. | na. | 0.43 | 0.43 | 0.40 | 0.39 | 0.36 | 0.39 | 0.40 | 0.40 | 0.36 | 0.37 | 0.33 | 0.33 | 0.28 | 0.25 | |
| IQR/Median | na. | na. | na. | 0.36 | 0.36 | 0.31 | 0.31 | 0.26 | 0.31 | 0.27 | 0.30 | 0.25 | 0.25 | 0.24 | 0.24 | 0.20 | 0.20 | |

Source: Own study based on: [UNCTAD 1995, pp. 20–22]; [UNCTAD 1996, pp. 30–32]; [UNCTAD 1997, pp. 29–31]; [UNCTAD 1998, pp. 36–38 and p. 43]; [UNCTAD 1999, pp. 78–80]; [UNCTAD 2000, pp. 72–74]; [UNCTAD 2001, pp. 90–92]; [UNCTAD 2002, pp. 86–88]; [UNCTAD 2003, pp. 187–188]; [UNCTAD 2004, pp. 276–278]; [UNCTAD 2005, pp. 267–269]; [UNCTAD 2006, pp. 280–282]; [UNCTAD 2007, pp. 229–231]; [UNCTAD 2008, pp. 220–222] and computations made in MS Excel.

Next step is to analyze the transnationality of the world's top 100 non-financial TNCs by industry in which they operate and by country of their origin (see table 6 and 7). Transnationality by industry varies to a great extent. Media topped the list, followed usually by food and beverages, and chemicals and pharmaceuticals, while trading was at the bottom.

Table 6. Averages in TNI of the world's 100 largest non-financial TNCs, ranked by foreign assets, by industry, in 1990, 1995, 2000 and 2005 (%)

| Industry/Year | 1990 | 1995 | 2000 | 2005 |
|--------------------------------------|------|------|------|------|
| Oil, petroleum and mining | 47.3 | 50.3 | 70.8 | 55.5 |
| Food and beverages | 59.0 | 61.0 | 70.1 | 73.3 |
| Construction | 58.8 | 67.8 | 57.7 | .. |
| Metals | 55.1 | 27.9 | 57.7 | 62.0 |
| Chemicals and pharmaceuticals | 63.1 | 63.2 | 62.6 | 60.2 |
| Automotive | 35.8 | 42.3 | 59.7 | 55.5 |
| Electronics and electrical equipment | 47.4 | 49.3 | 50.5 | 53.9 |
| Trading | 32.4 | 30.5 | 26.8 | .. |
| Diversified | 29.7 | 43.6 | 51.1 | 80.8 |
| Telecommunications and utilities | 46.2 | 46.3 | 46.6 | 57.0 |
| Machinery and engineering | 54.5 | 37.9 | 75.4 | .. |
| Media | 82.6 | 83.4 | 85.4 | 94.2 |
| Retailing | .. | .. | 57.3 | 56.0 |

Source: Own study based on: [UNCTAD 2000, p. 78]; [UNCTAD 2001, p. 101]; [UNCTAD 2002, p. 96]; [UNCTAD 2007, p. 26].

Note: “..” means that among the top 100 TNCs there was no company representing particular industry

Transnational corporations originating from small countries tend to be more transnationalized than TNCs from large countries. The large size of domestic economies may allow their TNCs to realize some of their competitiveness and growth potential at home. Firms from smaller economies seem to rely on geographically more diversified corporate networks, as well as on a higher degree of transnationality to stay competitive and to compensate for smaller home markets. Consequently, TNI is the highest in TNCs originating from e.g.: Switzerland, UK, the Netherlands, Sweden and Canada.

Table 7. Averages in TNI of the world's 100 largest non-financial TNCs, ranked by foreign assets, by home economy, in 1990, 1995, 2000 and 2005 (%)

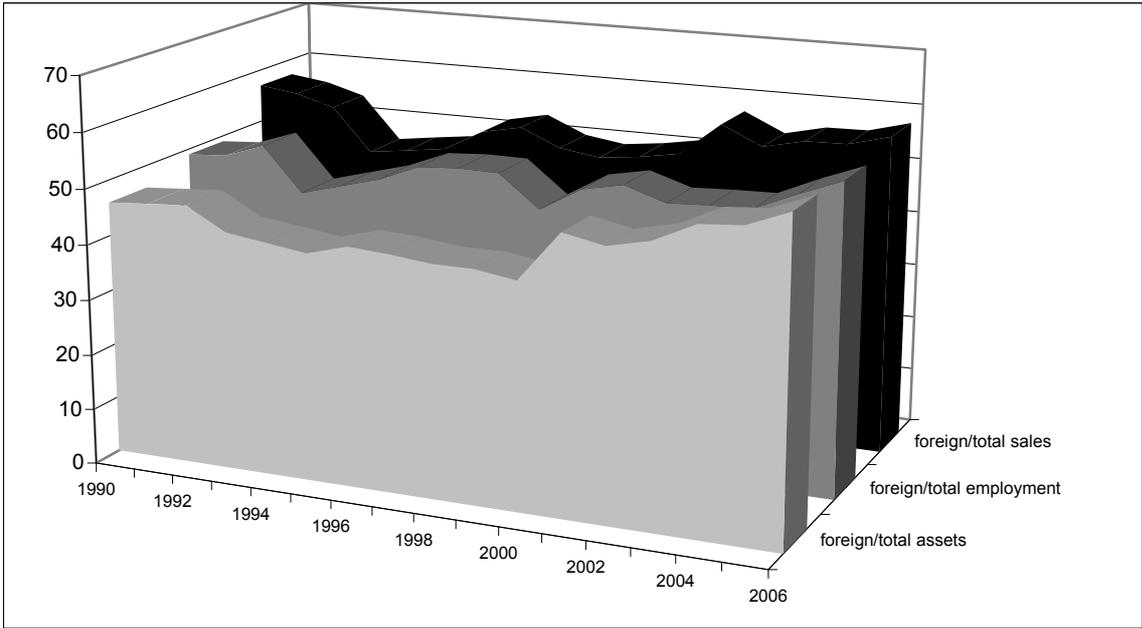
| Home country of TNC/Year | 1990 | 1995 | 2000 | 2005 |
|--------------------------|------|------|------|------|
| France | 50.9 | 57.6 | 63.2 | 62.3 |
| Germany | 44.4 | 56.0 | 45.9 | 52.2 |
| UK | 68.5 | 64.8 | 76.9 | 70.5 |
| The Netherlands | 68.5 | 64.8 | 76.9 | 76.2 |
| Italy | 38.7 | 35.8 | 48.6 | 45.7 |
| Sweden | 71.7 | 80.6 | 75.7 | 75.6 |
| Belgium | 60.4 | 70.4 | 90.2 | 75.6 |
| Finland | .. | .. | 77.3 | 74.3 |
| Spain | .. | .. | 41.6 | 51.1 |
| Norway | 58.1 | .. | 63.5 | 52.1 |
| Switzerland | 84.3 | 83.6 | 89.7 | 72.9 |
| US | 38.5 | 41.9 | 43.0 | 48.2 |
| Canada | 79.2 | 76.5 | 82.9 | 88.6 |
| Japan | 35.5 | 31.9 | 35.9 | 52.2 |
| Australia | 51.8 | .. | 0.8 | 63.7 |
| New Zealand | 62.2 | .. | .. | .. |
| Republic of Korea | .. | 47.7 | 47.5 | 47.3 |
| Mexico | .. | .. | 60.9 | 79.5 |

Source: Own study based on: [UNCTAD 2000, p. 76]; [UNCTAD 2001, p. 95]; [UNCTAD 2002, p. 93]; [UNCTAD 2008, p. 28].

Note: “..” means that among 100 TNCs there was no company coming from particular country

Finally, figure presents trends in 3 components of TNI. The increase of TNI (especially upward trends in recent years) has been driven by the sale component, which values are the highest. Therefore, the sale component tends to vary at most. It may be caused by the fact that decisions in the area of sale characterize higher flexibility to changes in the market than decisions made in the area of employment and assets (FDI) which are long-term and burdened by rigidities.

Figure 1. Snapshot of the world’s 100 largest non-financial TNCs, ranked by foreign assets, 1990–2006 (%)



Source: Own study based on: [UNCTAD 1999, p. 81]; [UNCTAD 2000, pp. 75–76]; [UNCTAD 2001, pp. 94, 96]; [UNCTAD 2002, pp. 89, 96]; [UNCTAD 2003, p. 5]; [UNCTAD 2004, p. 11]; [UNCTAD 2005, p. 17]; [UNCTAD 2006, p. 31]; [UNCTAD 2007, p. 25]; [UNCTAD 2008, p. 27].

Note: The average TNI of the top 100 TNCs is the average of their individual transnationality indices. As a result, it is possible that the average TNI in some instances could be higher than any of the foreign /total ratios.

4.3. UNCTAD’s Internalization Index

UNCTAD’s Internalization Index (II) measures the intensity of foreign operations according to the number of foreign affiliates. II is the ratio of the number of foreign affiliates to the total number of affiliates and also belongs to [0%; 100%]. Similarly to TNI, II does not distinguish between TNCs whose foreign activities are concentrated in a few foreign countries, and TNCs whose activities are spread across numerous host countries. Therefore, II takes into account abroad operations conducted only by subsidiaries (via FDI). Consequently, II loses some pros of TNI and treats TNCs as a set of subsidiaries [UNCTAD 2004, pp. 37; UNCTAD 2005, p.18].

Table 8. Internalization Index of the world’s 100 largest non-financial TNCs, ranked by foreign assets during 2003–2006: descriptive statistics (%)

| Statistics/Year | | 2003 | 2004 | 2005 | 2006 |
|-------------------------------------|----------|------|------|------|------|
| Number of TNCs which II belongs to: | [0; 20) | 2 | 3 | 0 | 1 |
| | [20; 40) | 8 | 9 | 9 | 6 |
| | [40; 60) | 26 | 23 | 24 | 20 |
| | [60; 80) | 39 | 37 | 34 | 36 |

| | [80;100] | 25 | 28 | 33 | 37 |
|----------------------------------|----------|-------|-------|-------|-------|
| Arithmetic mean (AM) | | 65.60 | 65.88 | 69.47 | 69.97 |
| Standard deviation (SD) | | 18.55 | 19.61 | 18.76 | 18.99 |
| Range | | 90.83 | 89.21 | 77.50 | 92.00 |
| 1 st quartile (Q1) | | 54.39 | 55.15 | 56.83 | 57.75 |
| Median | | 68.69 | 70.33 | 72.75 | 73.00 |
| 3 rd quartile (Q3) | | 79.91 | 80.41 | 83.08 | 84.50 |
| Interquartile range (IQR) | | 25.52 | 25.26 | 26.25 | 26.75 |
| Quartile deviation (QD) | | 12.76 | 12.63 | 13.13 | 13.38 |
| SD/AM | | 0.28 | 0.30 | 0.27 | 0.27 |
| IQR/Median | | 0.19 | 0.18 | 0.18 | 0.18 |

Source: Own study based on: [UNCTAD 2004, pp. 279–280]; [UNCTAD 2005, pp. 267–269]; [UNCTAD 2006, pp. 280–282]; [UNCTAD 2007, pp. 229–231]; [UNCTAD 2008, pp. 220–222] and computations made in MS Excel

The II was published for the first time by UNCTAD a few years ago, consequently any long-term trends cannot be observed. Since 2003, the average value of the II of the world's top 100 non-financial TNCs has increased (see table 8). On the contrary to the TNI, there has been significant growth among TNCs with the highest value of the II. Measures of dispersion illustrate quite high variability of TNI among the world's top 100 non-financial TNCs.

Like the TNI, the II is highest for TNCs from small economies and by industry, electrical and electronics equipment and pharmaceuticals predominates [UNCTAD 2005, p. 18; UNCTAD 2006, p. 33–34; UNCTAD 2007, p. 26; UNCTAD 2008, p. 30].

4.4. UNCTAD's Network Spread Index

UNCTAD's Network Spread Index (NSI) is constructed precisely to reflect the number of host countries in which a firm is established. NSI measures the degree of transnationalization of TNCs also from an operations perspective, but opposite to TNI and II measures whether company spreads its operations over several countries or concentrates in one or two. NSI is a ratio of the numbers of countries in which a company has foreign affiliates to the number of foreign countries in which, potentially, the company could have located affiliates (countries in the world that have inward FDI) [UNCTAD 1998, pp. 43–44; UNCTAD 2001, p. 103].

This concept of transnationality has several aspects: the spread of operations across many countries affects the strategic stance of a company; its also affects its ability to develop and spread knowledge and innovation, as well as its strategies concerning labour or governments [UNCTAD 2004, p. 37].

The main drawback of this approach is that NSI does not take account of the magnitude of a company’s activity in a given host country; each host country is counted once, independently of the amount of assets, sales or employment located in it. This drawback cannot easily be remedied, as corporations do not regularly report assets, sales and employment for each host country. Therefore, this index has the limitation that it takes into account foreign operations only via affiliates. Finally, at the level of corporation, a high NSI can be an indicator of both positive and negative elements. High value may be accompanied by higher costs of managing far-flung operations (transaction costs), but it may also indicate high levels of ownership advantages as well as high levels of knowledge of market conditions in many countries, or a combination of ownership and internalization advantages with a broader portfolio of locational assets [UNCTAD 1998, p. 43].

The value of the NSI tends to be significantly lower than value of the TNI and the II. Average NSI, among the world’s top 100 non-financial TNCs, equaled: 22.54 in 1996; 15.63 in 1999; 14.5 in 2000 and 17.93 in 2002. Low value of the NSI underlines the fact that TNCs can transnationalize considerably without having to spread their foreign assets extensively. Therefore, TNCs from countries with a long history of FDI and also from small countries (e.g. Switzerland, France, UK, Netherlands, Sweden, Germany, Finland) tends to have a higher NSI than average. Industries in which the top TNCs have a higher NSI (e.g. chemicals, pharmaceuticals, food and beverages) are to large extent consumer-oriented industries, and TNCs operating in such industries follow primarily market-seeking strategies with regard to their transnationalization. TNCs from industries which are more-domestic market oriented (e.g. utilities, construction) have a lower-than-average NSI [UNCTAD 1998, p. 44; UNCTAD 2001, pp. 103–104; UNCTAD 2002, pp. 109–110; UNCTAD 2004, pp. 279 – 280, 310].

Additionally, important conclusion brings the analysis of correlation between TNI, II and NSI (see table 9). Values of all three indicators for top 100 non-financial TNCs are available only for one year, namely 2002.

Table 9. Correlation between TNI, II and NSI indexes (top 100 non-financial TNCs; 2002)

| Correlation index | Correlation between | | |
|-------------------|---------------------|------------|------------|
| | TNI and NSI | II and NSI | TNI and II |
| Pearson’s | 0.0528 | 0.4746 | 0.3383 |
| Spearman’s | 0.0885 | 0.4571 | 0.3091 |

Source: Own study based on [UNCTAD 2004, pp. 276–280] and computations made in MS Excel and SPSS

There is very low linear and non-linear correlation between TNI and NSI, which proves that even high share of foreign activities in total activities does not mean high geographical spread of TNCs' activities.

4.5. UNCTAD's Geographic Spread Index

UNCTAD's Geographic Spread Index refers only to financial TNCs and is calculated as the square root of II multiplied by the number of countries. UNCTAD introduced this indicator (which is a combination of II and NSI) instead of TNI. Calculation of TNI is not possible due to lack of data concerning foreign assets, sales and employment for financial TNCs. GSI measures the degree of transnationalization of TNCs from an operations perspective [UNCTAD 2007, pp. 26–27; UNCTAD 2008, p. 31, 226].

Table 10. Geographical Spread Index of the world's 50^a largest^b financial TNCs during 2003–2006: descriptive statistics

| Statistics/Year | 2003 | 2004 | 2005 | 2006 |
|---------------------------|-------|-------|-------|-------|
| Arithmetic mean (AM) | 35.55 | 36.25 | 39.56 | 39.78 |
| Standard deviation (SD) | 15.18 | 14.44 | 12.77 | 12.68 |
| Range | 56.40 | 51.60 | 44.00 | 49.00 |
| 1 st quartile (Q1) | 25.30 | 24.80 | 30.00 | 29.00 |
| Median | 33.90 | 32.65 | 35.00 | 37.00 |
| 3 rd quartile (Q3) | 46.90 | 50.20 | 52.50 | 52.75 |
| Interquartile range (IQR) | 21.60 | 25.40 | 22.50 | 23.75 |
| Quartile deviation (QD) | 10.80 | 12.70 | 11.25 | 11.88 |
| SD/AM | 0.43 | 0.40 | 0.32 | 0.32 |
| IQR/Median | 0.32 | 0.39 | 0.32 | 0.32 |

^a In 2003 data for 49 TNCs and in 2005 for 48 TNCs

^b In 2003, 2004 and 2006 ranked by GSI and in 2005 ranked by the foreign assets

Source: Own study based on: [UNCTAD 2005, p. 273]; [UNCTAD 2006, p. 287]; UNCTAD [2008, p. 226] and computations made in MS Excel

The GSI was published for the first time by UNCTAD a few years ago, consequently any long-term trends cannot be observed. Since 2003, the average value of the GSI of the world's top 50 financial TNCs has increased (see table 10). Measures of dispersion illustrate quite high variability of GSI, however its degree has recently fallen. The average level of GSI is significantly lower than its possible maximal³ level. This is caused rather by quite low number of host economies than by the level of internalization measured by the II.

³ Assuming about 200 possible host economies, maximal value of the GSI equals about 140.

4.6. Measures of regional dimensions of transnationality

NSI and GSI, opposite to TNI and II, distinguish between TNCs whose foreign activities are concentrated in a few foreign countries, and TNCs whose activities are spread across numerous host countries. However, it may be relevant to ask whether the operations of a firm are concentrated in a region or equally spread among several regions and whether the activities are conducted in the same region (continent) where parent company is located. Even NSI and GSI cannot bring adequate answers for these questions. Consequently, in this part of paper, there are presented indicators and data which allow scrutinizing regional dimensions of transnationality.

Firstly, a modification of II is worth taken into consideration, in order to create Weighted Internalization Index (WII). The locations of foreign affiliates, namely how far from parent company subsidiary is placed, become the weights. Consequently,

$$WII = \frac{\text{weighted number of foreign subsidiaries}}{\text{total number of subsidiaries}},$$

where weighted number of foreign subsidiaries is the weighted sum of three ratios:

- number of foreign subsidiaries located in neighboring countries⁴ of TNC's home economy to number of all foreign subsidiaries (weight=1);
- number of foreign subsidiaries located on the same continent⁵ where is placed parent company, but not located in neighboring countries of TNC's home economy, to number of all foreign subsidiaries (weight=2);
- number of foreign subsidiaries located on the other continent than home economy of TNC (weight=3).

Number of comments to the construction of WII is necessary. Presented division of the world is only example. There are possible other modification of WII, concerning e.g. division into regions, OECD and non-OECD countries, developed and developing countries. Moreover, value of weight can be modified⁶. Similarly to II, WII encompasses only foreign operations conducted by subsidiaries (via FDI). Additional drawback of WII is the fact that it still does

⁴ Assumptions for selected countries located on islands: Norway, France and Ireland are neighboring countries of UK; UK is only neighboring country of Ireland; Australia and New Zealand are neighboring countries; Japan has no neighboring countries

⁵ Assumption that there are seven continents in the world: Europe, Asia, Africa, Australia (including Pacific islands), North America (including Caribbean countries), South America and Antarctica

⁶ Weights 1, 2 and 3 are implemented intuitively.

not take into account the disparities in location within each of the group (e.g. weight 3 belongs to subsidiary of British TNC located both in North Africa and in New Zealand).

Secondly, a similar modification of NSI can be made. Weighted Network Spread Index (WNSI) can be denoted as the ratio of weighted (division of the world and weights identical to these in WII) number of host economies in which TNCs operates (via FDI or via alliances, franchising, sale office) to number of potential host countries⁷.

WII and WNSI are estimated for the top 45 non-financial TNCs ranked by foreign assets. These 45 TNCs are companies which are present on all lists of top 100 TNCs published by UNCTAD since 1990. WII and WNSI need detailed data which are not available for all 45 TNCs. Instead of presenting incomplete data, WII and WNSI are estimated on the basis of simple random sample. The size of the sample is 10, but for 2 units data are not available, so the results were input using average. The results of WII and WSI estimation are presented in table 11⁸.

Table 11. WII and WNSI of top 45 non-financial TNCs: results of estimation

| | WII ∈ [1; 3] | WNSI ∈ [1; 3] |
|------------------------------------------------------|--------------------------------------------------------------|----------------------------------------------------------------|
| Individual results in sample | 2.33; 2.92; 2.45; 2.5; 2.44; 2.47; 2.61; 2.18; 2.44; 2.05 | 0.89; 0.69; 1.26; 1.52; 1.26; 1.58; 1.67; 1.27; 1.11; 1.34; |
| Arithmetic Mean (AM) in sample | 2.44 | 1.26 |
| Standard Deviation (SD) in sample | 0.24 | 0.10 |
| Confidence interval for AM (significance level: 95%) | [2.38; 2.50] | [1.11; 1.41] |
| Relative standard error | 3.05% | 7.64% |

Source: Own study based on data from TNCs’ websites and computations made in MS Excel

These results bring two fundamental conclusions. Firstly, the WNSI is much lower than WII. Even bonus for some host economies (weight 3) does not manage increase the value of the WNSI. Top TNCs still does not operate in many countries, in which they could, even via alliance or franchising. Secondly, the value of WII does not exceed the level of 2.50, which proves that the concentration of subsidiaries not far from country of origin play significant role in expansion of top TNCs.

Thirdly, presenting list of favourite countries (regions) for the location of foreign affiliates of the top TNCs can brings conclusions concerning the degree of transnationality. According to UNCTAD’s data the largest 100 non-financial TNCs have affiliates in 40 foreign countries [UNCTAD 2006, p. 34]. An adequate measure of how frequently is host country chosen by top TNCs can be location intensity. Location intensity is defined as the

⁷ The number of potential host economies is 206 – 1 = 205.
⁸ Randomness of the sample is confirmed by Stevenson’s test of series.

total number of TNCs having at least one affiliate in the host country, divided by 100, minus the number of TNCs from this country (100 world's largest non-financial TNCs, ranked by the foreign assets, are taken into consideration during calculations of location intensity). Most recent data⁹ (for 2007) list among the top 20 preferred locations: UK, US, Netherlands, Germany, Belgium, China, France, Canada, Italy, Switzerland, Poland, Spain, Brazil, Mexico, Australia, Singapore, Austria, Ireland, Japan and Sweden. 12 out of 20 most TNCs most favoured locations are European countries, therefore only 4 do not belong to the Triad [UNCTAD 2008, p. 28]. These data combined with the fact that more than 90 of top 100 TNCs originate from the Triad bring conclusion that majority of intra-firm exchange is spread within the Triad. This conclusion confirms also data for the world's top 50 financial TNCs. Among the most 20 favoured locations for foreign affiliates of the top 50 financial TNCs in 2005 are 16 countries of the Triad [UNCTAD 2007, p. 27]. However, among 30 favoured locations there are 9 non-Triad countries, including tax havens.

Finally, analyzing the geographical structure of the largest cross-border mergers and acquisitions (M&A) in the world economy also can be helpful in transnationality's studies. Table 12 illustrates different types of cross-border M&A. Variety of cross-border M&A has a different impact on degree of transnationality of TNCs. For example, type No. 6, 8 and 10 appear to enhance the degree of transnationality in a greater extent than type No. 1 and 7.

Table 12. Number and value (mln USD) of different types of cross-border M&A during 1987–2007

| Description of types of cross-border M&A | Number of deals | Value of deals |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------|
| 1. A domestic company in country X acquires (or mergers with) a domestic company in country Y | 66 903 | 5 983 754 |
| 2. A domestic company in country X acquires (or mergers with) a foreign company in country X | 15 872 | 1 230 026 |
| 3. A foreign company in country X, whose parent company is in country Y acquires (or mergers with) a domestic company in country X | 15 817 | 1 075 049 |
| 4. A domestic company in country X acquires (or mergers with) a foreign company in country Y, whose parent company is in country Z | 8 564 | 834 640 |
| 5. A domestic company in country X acquires (or mergers with) a foreign company in country Y, whose parent company is based in country X | 7 943 | 843 752 |
| 6. A foreign company in country X, whose parent company is in country Z acquires (or mergers with) a domestic company in country Y | 4 927 | 288 822 |
| 7. A foreign company in country X acquires (or mergers with) a foreign company in country X, whose parent companies are both in country Y | 1 997 | 150 565 |
| 8. A foreign company in country X, whose parent company is in country Y acquires (or mergers with) a foreign company in country X, whose parent company is in country Z | 1 644 | 113 467 |
| 9. A foreign company in country X acquires (or mergers with) a | 1 499 | 166 766 |

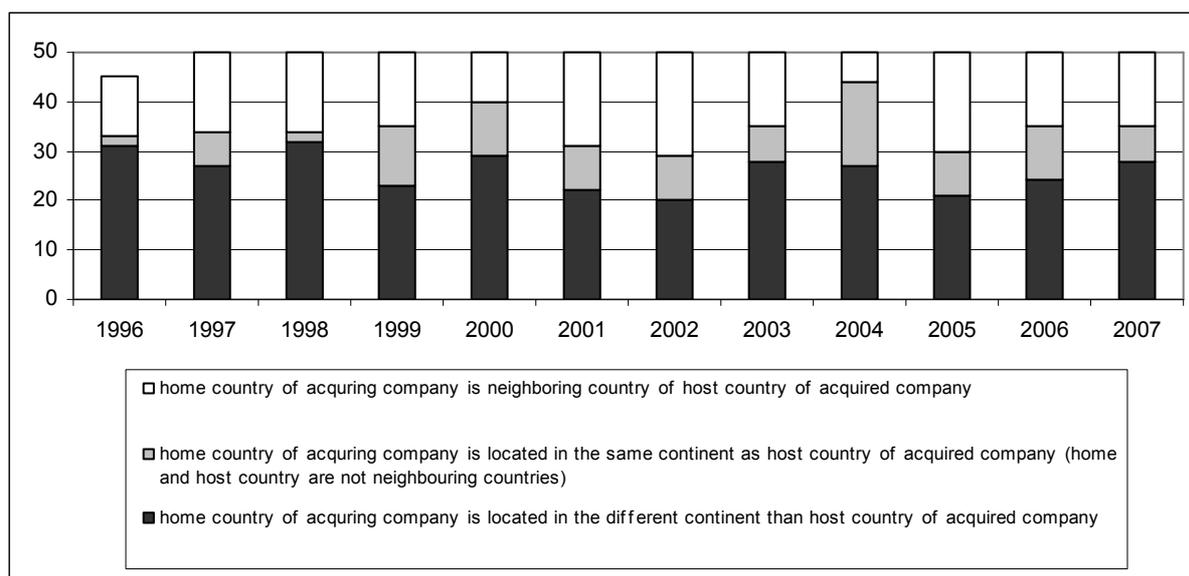
⁹ For earlier data concerning TNCs' most favoured locations see e.g. [UNCTAD 2004, pp. 311–312]; [UNCTAD 2006, p. 34].

| | | |
|----------------------------------------------------------------------------------------------|----------------|-------------------|
| domestic company in country Y | | |
| 10. A foreign company in country X acquires (or mergers with) a foreign company in country Y | 1 710 | 128 823 |
| Total | 12 6876 | 10 815 662 |

Source: Own study based on [UNCTAD 2008, p. 206]

Moreover, during last decade among the world's top 50 cross-border M&A, about a half was transcontinental deals leading to significant increase in transnationality (see figure 2). The rest of M&A deals concentrate within one continent, and majority of them also within one region.

Figure 2. Geographical structure of the world's top 50^a cross-border M&A, ranked by the value of deals, during 1996–2007^b



^a For 1996 top 45

^b Data for 1990–1995 not available

Source: Own study based on: [UNCTAD 1997, pp. 264–265]; [UNCTAD 1998, pp. 315–316]; [UNCTAD 1999, pp. 436–437]; [UNCTAD 2000, pp. 234–235]; [UNCTAD 2001, pp. 244–245]; [UNCTAD 2002, pp. 266–267]; [UNCTAD 2003, pp. 203–204]; [UNCTAD 2004, pp. 271–272]; [UNCTAD 2005, pp. 255–256]; [UNCTAD 2006, pp. 273–274]; [UNCTAD 2007, pp. 212–213]; UNCTAD [2008, pp. 204–205].

4.7. Other measures of transnationality

From the stakeholders' perspectives regional composition of directors from the boards of the top TNCs can be an adequate measure. For example, this composition was published by UNCTAD [2004, p. 313]. Top TNCs originating in Europe have much higher representation

of non-home-country nationals among their directors than do top TNCs from the United States and Japan. The percentages are 33 for EU, 47 for Switzerland, 18 for United States and 2 for Japan. Within the EU, the highest percentage applies to TNCs from the UK (52%). Average for boards of 42 of the top 100 TNCs equals 27%.

Therefore, from the perspective of the spatial organization of management analyzing the corporate strategy and type of corporate governance can bring essentials conclusions (e.g. data and facts available on TNCs websites).

5. Determinants of changes in intra-firm exchange

Intra-firm exchange is determined by a lot of factors. Some of them are present in the world economy (in external environment of TNCs) and some of them are linked with changes within TNCs. These determinants influence on size as well as on the structure of intra-firm exchange. Table 13 illustrates an example of list of these factors.

Table 13. Determinants of intra-firm exchange

| Determinant | Influence on value of transactions (number of potential channels) | Influence on geographic spread | Influence on structure |
|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|--------------------------------|---------------------------------------------------------------------------------------------|
| Globalization | positive | positive | ambiguous |
| Regional integration | positive | negative | ambiguous |
| Knowledge-based economies | positive | positive | growth of the role of intercompany services, technology transfer and financial transactions |
| More fierce competition | positive | positive | ambiguous |
| Foreign economic policy (shift towards liberalism on the global scale instead of protectionism) | positive | positive | ambiguous |
| Offshoring | positive | positive | shift towards services |
| Nearshoring | positive | negative | Shift towards services |
| Outsourcing | positive | ambiguous | ambiguous |
| Insourcing | negative | negative | ambiguous |
| Development of financial conglomerates (integration on financial markets) | positive | ambiguous | growth of the role of financial transactions |

Source: Own study

6. Conclusions

Data presented in section 2 and 3 brings conclusion that changes in volume and structure of intra-firm exchange are similar to changes in international flows. The share of trade in services and non-trade transactions has been increasing, however still intra-firm trade

in goods accounts for majority of total flows. Therefore, the volume of intra-firm transactions is vulnerable to business cycle and fluctuations in international flows of goods, services and factors of production. Consequently, statement that currently intra-firm exchange has been permanently growing is oversimplified.

Additionally, section 4 brings other conclusions. Data and facts presented in this section refer to the group of TNCs (top 100 non-financial and top 50 financial TNCs). This group is not a random sample of all about 79 000 TNCs, in consequence generalization via statistical inference is not possible. However, information for this not-random sample enables to falsify some generalization concerning all TNCs. Firstly, it is not true that in all TNCs high share of foreign activities in total activities means operating in global scale. In other words, high TNI or II do not result in high geographic spread of TNC. Therefore, it is not true that value of TNI (II) is similar across TNCs (quite high disparities are observable). Secondly, it is not true that degree of transnationality in all TNCs has been permanently growing since 1990. There are examples of fall in degree of transnationality. Moreover, it is not true that in all TNCs the share of foreign activities in total activities outstrips 50%. There are still companies oriented at domestic or regional market and they do not deserve to name them “global” players in real sense of this word. To sum up, entitling all TNCs as a “global players” operating worldwide (in different continents) appears to be rather false. The degree of transnationality among TNCs seems to be highly differentiated and only a group of TNCs should be treated as real global companies. Consequently, the geographic scope of intra-firm exchange appears to be limited due to not necessary global geographic spread of TNCs.

Finally, section 5 illustrates how wide a spectrum of determinants of size and structure of intra-firm exchange is. Forecasting the changes in intra-firm exchange seems to be a hard nut to crack and needs further analysis.

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