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ABSTRACT

In analyzing the distinctive contribution of foreign subsidiaries and domestic firms to productivity growth in aggregate Belgian manufacturing, this paper shows that foreign ownership is an important source of firm heterogeneity affecting productivity dynamics. Foreign firms have contributed disproportionately large to aggregate productivity growth, but more importantly reallocation processes differ significantly between the groups of foreign subsidiaries and domestic firms.

INTRODUCTION

In recent years a large number of studies have demonstrated the importance of firm heterogeneity for productivity growth, in contrast to earlier growth accounting that traditionally started from the presumption of an aggregate production function based on the representative firm (Bartelsman and doms (2000)). Theoretical models of firm dynamics have formalized the concept of firm heterogeneity and discussed the effects of learning, innovation, investment, entry and exit on firms' productivity level and evolution (Jovanovic (1982), Pakes and Ericson (1987), Hopenhayn (1992)). Accordingly, recent empirical work has decomposed aggregate productivity into the effects of intra-firm productivity changes, market share allocations among firms with different levels of productivity, and changes in the population of firms. A common finding of this line of research is that large-scale ongoing reallocation of outputs and inputs across individual firms including the entry and exit of firms, contributes to a large extent to productivity growth in industries and countries. Additionally, it is found that this reallocation reflects merely within rather than between industry reallocation (Baily et al (1992), Bartelsman and Drymes (1994), Griliches and Regev (1995), Olley and Pakes (1996), Haltiwanger (1997), Foster et al (1998), Levihnson and Petrin (1999)).

Alternative decompositions have been used in order to assess the contributions of different categories of firms to aggregate productivity growth (Baldwin (1995), Baily et al (1996)), surprisingly however the distinctive contribution of foreign firms and domestic firms have not yet been analyzed. Productivity dynamics within the group of foreign firms and domestic firms can expected to be different given that foreign subsidiaries in host countries are typically found to be more productive than domestic firms (Dunning (1993), Caves (1996)), and that firm dynamics especially entry and exit are reported to differ

considerably between foreign and domestic firms (Siegfried and Evans (1994), Geroski (1995)). This paper introduces foreign ownership as an additional source of firm heterogeneity in the analysis of productivity growth and illustrates its importance with reference to a small open country that has attracted large inflows of foreign direct investment.

DATA AND METHODOLOGY

This paper empirically assesses the distinctive contribution of foreign firms and domestic firms to productivity growth in Belgium, a small open country where foreign subsidiaries are nowadays responsible for more than 40% of industrial employment and create more than half of value added in the manufacturing industries. The firm-level data used in the empirical analysis come from a unique database that was obtained by merging two datasets: at the one side the files of the Central Balance Sheet Office (National Bank of Belgium) collecting the annual reports of all firms active in Belgian manufacturing (16,743 firms in 1995), and at the other side the foreign firms database of the Federal Planning Bureau identifying firms active in Belgium that were at least 50% foreign owned (923 firms in 1995).

In this paper we have opted to use labor productivity as measurement of productivity, given the inaccuracy of information on firms' capital service flows making other measures like total factor productivity relatively prone to measurement error. Labor productivity is defined as value added divided by employment, where value added figures are expressed in real terms using the price deflators of individual manufacturing industries. In order to take fully into account differences in working time between firms and industries, employment is

expressed in full-time equivalents as a precise measure for the volume of labor. The index of industry-level productivity in period t is given by:

$$\ln PROD_{IND,t} = \Sigma_i \; s_{i,t} * \ln PROD_{i,t} \qquad (1)$$

with $s_{i,t}$ being the share of firm i in year t in industry employment[1], $PROD_{i,t}$ the labor productivity of firm i in period t and $PROD_{IND,t}$ the productivity of the industry in period t.

Following Griliches and Regev (1995), aggregate productivity growth in individual manufacturing industries over the period 1990-1995 is then decomposed according to[2]:

$$\begin{aligned}\Delta \ln PROD_{IND,t} = {} & \Sigma_{FOR} [\Sigma_{i \text{ in } C} \; \underline{s_i} * \Delta \ln PROD_{i,t} + \Sigma_{i \text{ in } C} \; (\ln \underline{PROD_i} - \ln \underline{PROD_{IND}}) * \Delta s_{i,\,t} + \\ & \Sigma_{i \text{ in } N} \; s_{i,\,t} * (\ln PROD_{i,t} - \ln \underline{PROD_{IND}}) \; - \; \Sigma_{i \text{ in } X} \; s_{i,\,t-1} * (\ln PROD_{i,t-1} - \ln \underline{PROD_{IND}})] \; + \\ & \Sigma_{DOM} [\Sigma_{i \text{ in } C} \; \underline{s_i} * \Delta \ln PROD_{i,t} + \Sigma_{i \text{ in } C} \; (\ln \underline{PROD_i} - \ln \underline{PROD_{IND}}) * \Delta s_{i,\,t} + \\ & \Sigma_{i \text{ in } N} \; s_{i,\,t} * (\ln PROD_{i,t} - \ln \underline{PROD_{IND}}) \; - \; \Sigma_{i \text{ in } X} \; s_{i,\,t-1} * (\ln PROD_{i,t-1} - \ln \underline{PROD_{IND}})]\end{aligned} \qquad (2)$$

where C, N and X, are respectively the group of continuing firms between t-1 and t, the group of entering firms in t and the group of exiting firms in t-1, and underlined variables indicate averages of the variables over t and t-1.

In line with previous research but additionally distinguishing between foreign subsidiaries (FOR) and domestic firms (DOM), the terms ($\Sigma_{i \text{ in } C} \; \underline{s_{i,t}} * \Delta \ln PROD_{i,t}$) are the so-called 'within'-effects and are based on firm-level changes in productivity, weighted by the average share of the firm in the industry. The terms ($\Sigma_{i \text{ in } C} (\ln \underline{PROD_i} - \ln \underline{PROD_{IND}}) * \Delta s_{i,t}$) represent 'between' firm components that reflect changing shares between firms with different productivity levels, weighted by deviation of firm i average productivity from the average industry productivity level. The last terms ($\Sigma_{i \text{ in } N} \; s_{i,t} * (\ln PROD_{i,t} - \ln \underline{PROD_{IND}})$ -

[1] Using value added or sales shares did not alter the results significantly.
[2] Different decompositions have been used in the literature; since in expression (1) the within effect also reflects in part cross/covariance effects, the interpretation may be accordingly be hampered.

$\Sigma_{i \text{ in } X} s_{i,t-1}*(\ln PROD_{i,t-1} - \ln \underline{PROD_{IND}})$ represent the contribution of respectively entering and exiting plants. The 'between firm' term and the 'entry and exit terms' use the deviation between the (individual) firm productivity and the industry productivity, meaning that a continuing firm with an increasing share only contributes to average productivity growth if its average productivity over the period is larger than the average industry productivity. Likewise, entrants (exiters) contribute only if they have higher (lower) productivity than the industry. As such the contribution does not arise because of differences in scale between entering and exiting firms but only because of productivity differences (Haltiwanger (1997)).

RESULTS

The results for all manufacturing firms[3] indicate that especially productivity growth at the firm level and the exit of firms which displayed productivity less than the industry average, have contributed strongly to the aggregate productivity growth in Belgian manufacturing over the period 1990-1995 (table 1). In line with results reported for other countries (Baily et al (1992), Foster et al (1997)), market share reallocations between continuing firms played only a minor role[4]. More importantly however, the results point to important differences between foreign subsidiaries and domestic firms, with foreign firms having contributed disproportionately large to average productivity growth. The results especially

However as Foster et al (1998) show, compared to other techniques of decomposition expression (1) is less sensitive to measurement error.

[3] In order to compute the distinctive contributions of domestic and foreign firms to productivity growth in the total manufacturing industry, the individual industry results were aggregated using the average employment share of the industry in total manufacturing.

[4] This last result may be due to the length of the period considered, as Disney et al (2000) show that share reallocation between continuing firms but also because of entry and exit are typically smaller the shorter the time period.

extend previous research by showing that productivity dynamics within both groups of firms are of a totally different nature.

Insert Table 1 about here

Firstly, within firm productivity growth is almost completely realized within the group of foreign subsidiaries, as productivity change within domestic firms is found to contribute less than 1% to aggregate productivity growth. Secondly, while the positive contribution of net entry (indicating the contribution of entering firms displacing exiting firms) by foreign and domestic firms is approximately the same, analyzing gross entry and gross exit however reveals that different mechanisms are at work within both groups of firms (table 2). Entry by foreign firms happens at a slightly higher productivity level than the industry average resulting in a (small) positive contribution of foreign entry to aggregate productivity growth. Also the contribution of the foreign firms leaving Belgium is marginally positive, reflecting the below average but relative high productivity level at which foreign firms exit Belgium (in some industries significantly higher than the industry average). The turnover among domestic firms is totally different and much larger, with domestic firms entering at a productivity level significantly below the industry average thereby negatively affecting aggregate productivity growth. This negative contribution is however overwhelmed by the exit of domestic firms operating at a productivity level far below the average firm in the industry, resulting in a strong positive contribution of net entry by domestic firms to aggregate productivity growth.

Insert Table 2 about here

These empirical results qualify the predictions of theoretical models on firm dynamics. The lower productivity of domestic entrants and exiters relative to the average incumbent (table 2) also typically found in previous research, is largely consistent with a process of noisy selection and passive learning described by Jovanovic (1989), in which firms learn over time about their own potential. This theoretical model of firm dynamics seems however less appropriate in describing productivity dynamics of foreign subsidiaries in host countries, since only significant differences in productivity are found between foreign exiters and foreign continuing firms (and not between foreign entrants and foreign incumbents). In contrast to domestic firms, foreign entrants do not have to go through the learning process described by Jovanovic (1982), as they have already learnt about their true efficiency in their home. Only highly efficient firms decide to start business in foreign countries and become multinational (Caves (1996)), since they know they have to compensate their liability of foreigness.

Looking specifically at the strong intra-firm productivity growth among foreign subsidiaries, it is noticed that most foreign firms (78%) have increased their labor productivity mainly through downsizing their employment. This observation stands in sharp contrast with the results of Baily et al (1994), who showed that in the US rising labor productivity was accompanied by reductions in labor input at the aggregate manufacturing level but not necessarily at the firm level. In Belgium foreign subsidiaries have further driven up their already high labor productivity especially through continued large-scale automation of the production process and relocation of labor intensive activities towards other countries,

Notwithstanding the disproportionate large contribution of foreign firms to aggregate productivity growth, it is very likely that the effect of foreign ownership on productivity growth is even larger. Firstly, this paper only analyzes the contribution of within-industry reallocation among firms to aggregate productivity growth. Comparing the total productivity change in Belgian manufacturing over 1990-1995 with the reported results, shows that between-industry reallocations is (only) responsible for 19% of total productivity growth; however the contribution of foreign firms to this between-industry reallocation is not clear. Secondly, the contribution of foreign subsidiaries to aggregate productivity growth is only measured in an accounting sense in this paper, as the impact of foreign subsidiaries on the productivity (growth) of domestic firms through e.g. increasing competition and spillovers is not taken into account.

CONCLUSIONS

In analyzing the distinctive contribution of foreign subsidiaries and domestic firms to productivity growth in aggregate Belgian manufacturing, this paper has shown that foreign ownership is an important source of firm heterogeneity affecting productivity dynamics. As such it is shown that foreign firms have contributed disproportionately large to aggregate productivity growth, but more importantly that the reallocation processes (specifically within-firm productivity growth and the effect of net entry to productivity growth) differ significantly between the groups of foreign subsidiaries and domestic firms.

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TABLE 1

Productivity growth decomposed in firm productivity growth, share reallocations and net entry, foreign and domestic firms, Belgium, 1990-1995

	ALL FIRMS					FOREIGN FIRMS					DOMESTIC FIRMS				
	total	*within firm*	*between firm*	*entry*	*- exit*	*total*	*within firm*	*between firm*	*entry*	*- exit*	*total*	*within firm*	*between firm*	*entry*	*- exit*
Iron and steel	0,026	0,005	0,015	0,000	0,006	0,008	-0,023	0,017	0,004	0,010	0,018	0,028	-0,002	-0,004	-0,004
Extraction of minerals	0,109	0,052	0,030	-0,004	0,031	0,069	0,045	0,024	0,000	0,000	0,040	0,007	0,006	-0,004	0,031
Non-metallic minerals	0,042	0,022	0,016	-0,001	0,005	0,031	0,004	0,016	0,003	0,008	0,011	0,018	0,000	-0,004	-0,003
Chemicals	0,125	0,106	-0,009	0,002	0,026	0,098	0,086	-0,008	0,014	0,006	0,027	0,020	-0,001	-0,012	0,020
Metal articles	0,038	0,050	-0,039	0,002	0,025	0,030	0,064	-0,050	0,014	0,002	0,008	-0,014	0,011	-0,012	0,023
Mechanical engineering	0,052	0,029	-0,003	0,003	0,023	0,050	0,041	-0,002	0,002	0,009	0,002	-0,012	-0,001	0,001	0,014
Office- data machinery	-0,035	0,045	0,013	-0,059	-0,034	0,057	0,048	0,029	-0,025	0,005	-0,092	-0,003	-0,016	-0,034	-0,039
Electrical engineering	0,097	0,080	0,018	-0,037	0,036	0,097	0,070	0,026	-0,017	0,018	0,000	0,010	-0,008	-0,020	0,018
Motor vehicles	0,030	0,024	0,007	-0,015	0,014	0,034	0,025	0,015	-0,007	0,001	-0,004	-0,001	-0,008	-0,008	0,013
Other transport	-0,037	-0,047	0,033	-0,038	0,015	0,026	-0,023	0,039	0,000	0,010	-0,063	-0,024	-0,006	-0,038	0,005
Instruments	0,150	0,145	0,004	-0,046	0,047	0,155	0,137	0,008	0,000	0,010	-0,005	0,008	-0,004	-0,046	0,037
Food, drink, tobacco	0,104	0,102	-0,017	-0,017	0,036	0,048	0,043	-0,012	0,019	-0,002	0,056	0,059	-0,005	-0,036	0,038
Textiles	0,069	-0,051	0,046	0,032	0,042	0,029	-0,003	0,016	0,006	0,010	0,040	-0,048	0,030	0,026	0,032
Leather and footwear	0,119	-0,033	0,077	0,001	0,074	0,057	0,010	0,046	0,000	0,001	0,062	-0,043	0,031	0,001	0,073
Timber and wood	-0,020	-0,046	0,009	-0,009	0,026	0,002	0,002	0,000	0,000	0,000	-0,022	-0,048	0,009	-0,009	0,026
Paper, printing, publish.	0,090	0,049	0,006	-0,001	0,036	0,031	0,020	-0,004	0,014	0,001	0,059	0,029	0,010	-0,015	0,035
Rubber and plastics	0,059	0,028	0,026	-0,013	0,018	0,058	0,043	0,010	0,001	0,004	0,001	-0,015	0,016	-0,014	0,014
Total manufacturing	*0,071*	*0,043*	*0,005*	*-0,006*	*0,029*	*0,052*	*0,039*	*0,000*	*0,007*	*0,006*	*0,019*	*0,004*	*0,005*	*-0,013*	*0,023*

Note: growth contributions are calculated according to expression (2) using employment shares as weights

TABLE 2

Relative productivity of continuing, entering and exiting firms, foreign and domestic firms, Belgium, 1990-1995

	FOREIGN FIRMS				*DOMESTIC FIRMS*			
	continuing firms '90	***continuing firms'95***	***entering firms '95***	***exiting firms '90***	***continuing firms '90***	***continuing firms'95***	***entering firms '95***	***exiting firms '90***
Iron and steel	1,015	1,016	1,161	0,964	0,986	0,989	0,951	1,037
Extraction of minerals	0,999	1,024	0,000	0,999	0,994	0,997	0,997	0,980
Non-metallic minerals	1,011	1,019	1,102	0,971	0,984	0,984	0,979	0,979
Chemicals	1,001	1,016	1,007	1,004	0,978	0,986	0,935	0,907
Metal articles	1,012	1,021	1,050	0,981	0,995	0,996	0,990	0,987
Mechanical engineering	1,009	1,019	1,021	0,985	0,985	0,982	1,001	0,976
Office- data machinery	0,977	1,018	0,980	1,008	1,009	1,006	0,983	1,027
Electrical engineering	1,003	1,023	0,971	0,964	0,980	0,985	0,952	0,950
Motor vehicles	1,011	1,018	0,950	0,996	0,946	0,946	0,968	0,948
Other transport	1,017	1,014	0,000	0,916	0,982	0,970	0,950	0,998
Instruments	1,012	1,048	0,000	0,972	0,965	0,970	0,952	0,950
Food, drink, tobacco	1,016	1,030	0,989	1,033	0,986	1,001	0,959	0,953
Textiles	1,000	1,011	0,916	0,962	1,003	0,999	1,022	0,977
Leather and footwear	1,014	1,055	0,000	0,927	0,992	0,991	1,001	0,964
Timber and wood	1,011	1,014	0,000	0,913	1,006	0,999	0,990	0,983
Paper, printing, publish.	1,027	1,040	1,060	0,995	0,986	0,995	0,987	0,967
Rubber and plastics	1,001	1,015	1,003	0,992	0,994	0,995	0,975	0,984
Total manufacturing	1,010	1,023	1,020	0,983	0,985	0,988	0,972	0,966

Note: all productivity indexes are calculated according to expression (1) using employment shares as population weights, and are expressed relative to the average industry productivity