RESEARCH NOTE

Export performance and foreign affiliate activity in Japan's large machinery firms

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This note examines trends in parent firm export performance and compares them with trends in measures of foreign affiliate activity in Japan's 20 largest machinery firms for the 1986-1994 period. Despite a general trend towards reduced exports and expanded foreign affiliate activity in almost all of the sample firms, simple rank correlation analysis uncovers no evidence that foreign affiliate activity substitutes for parent firm exports. However, the small sample used and the failure to account for other determinants of parent firm export performance mean that these results should be treated as tentative and the focus must remain on how to generate more reliable estimates of this relationship in future research.

The issue

One of the oldest questions related to the activities of transnational corporations (TNCs) is: to what extent does foreign affiliate production substitute for—or complement—exports from the parent firm or, more generally, the home economy? Much of the interest in the answer to this question is spurred by labour unions and other political lobbies which often argue that foreign direct investment (FDI) by TNCs leads to reduced exports and thereby an export of jobs from the home economy. These arguments received some support from early theoretical analyses (e.g. Mundell, 1957)

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which emphasized that factor flows have a strong possibility of substituting for trade under the most restrictive versions of the Heckscher-Ohlin trade model. More recent theory (e.g. Markusen, 1983; Wong, 1986), however, has tended to emphasize that the substitution result can easily be reversed by relaxing key assumptions in the Heckscher-Ohlin model. When applying these analyses to TNCs, the fact that assuming imperfect competition in some markets can generate complementarity is particularly important, as TNCs are generally thought to operate in imperfectly competitive markets. Moreover, when considering the effects of FDI flows from developed economies to developing economies, the fact that differences in technology across countries can generate cases of complementarity is also relevant. In short, the theoretical literature makes it clear that the relationship between foreign affiliate activity and parent firm (or home country) exports cannot be determined a priori, but rather must be examined on a case-by-case basis.

Unfortunately, owing in large part to the paucity of suitable data, the empirical literature on this point is rather scarce. The empirical literature that has rigorously tried to evaluate whether foreign affiliate activity is a substitute for or complement to parent firm (or home country) exports has tended to focus on United States TNCs, with some analysis of the Swedish case also being available (e.g. Lipsey and Weiss, 1981; Blomström *et al.*, 1988; Ramstetter, 1991). The most striking result of these studies is the lack of evidence that foreign sales substitute for parent firm exports at the firm or industry level. On the other hand, Kravis and Lipsey (1988) did find a negative relationship between foreign affiliate employment and parent firm employment for United States TNCs in 1982. Ramstetter (1991) also found that the growth of United States parent firm employment in 1977-1982 is negatively correlated with employment growth in affiliates located in developing economies but not with employment growth in affiliates located in developed economies.

For the Japanese case, there are no known studies that rigorously evaluate the relationship between foreign affiliate production and parent firm exports at the firm level. There are a number of industry-level or aggregate studies, however. For example, in recent reports on the surveys of Japanese TNCs conducted by the Ministry of International Trade and Industry (MITI) (MITI, various years; 1993 survey, pp. 29-41; 1994 survey, pp. 69-80), survey data and input-output-based calculations were combined to estimate the export-creation and export-substitution effects for 1991-1994 and made projections for 1995. These calculations indicated that the export-creation effect dominated the export-substitution effect in the aggregate. In

the 1994 survey, two estimates of export creation and export substitution were presented: calculations of effects on the balance of trade and calculations of effects on gross domestic product (GDP). The latter estimates were much larger in absolute value. In 1994, in terms of export creation, the former estimate was 9.1 trillion yen while the latter was 22.3 trillion yen; in terms of export substitution, the former estimate was -4.6 trillion yen while the latter was -11.6 trillion yen. For 1995 projections, the effects on GDP were further disaggregated by industry. It is of some interest that the combined effect on exports was negative in transport machinery but positive in all other industries. However, the TNC survey data underlying these calculations have substantial sampling problems.[1] Thus, even though these results may seem highly plausible, substantial problems with the underlying data make them questionable. In another study based on the MITI data, Inaba (no date, pp. 15-16; see also Inaba and Morikawa, 1992) emphasized the substitution effects of affiliate activity on Japan's exports in a macroeconometric model that distinguished four manufacturing industry groups and explained the effects of Japan's FDI on the balance of payments. However, the results are not usually statistically significant, samples are quite small and there are important problems with the MITI data as mentioned earlier, thereby making these results questionable as well.

There are other studies that examined Japan's exports to a given country, group of countries, and/or industry as a function of Japan's FDI in that country, group of countries, and/or industry, among other variables. Among these studies, Lii (1994) and Kawai and Urata (forthcoming) are probably the most sophisticated and detailed ones. Their results indicated that Japanese FDI in a given host country or industry tended to stimulate Japanese exports to that country or industry. However, the data problems that tainted these results are probably even more severe than those in studies based on the MITI survey data. This is because the FDI data used in those studies referred only to Japanese FDI as had been reported to or approved by the Ministry of Finance of Japan, whereas much reported FDI has never been implemented. For example, figures on reported FDI revealed markedly different country-wise distributions from those revealed by figures on actual FDI from the balance of payments (Ramstetter, 1996). Thus, it is difficult to argue that figures on reported FDI are a reasonable proxy for figures of

[1] For example, there are large variations in survey coverage over time and across variables in individual years. See Ramstetter (1996) for details.

actual FDI and the results of studies based on these numbers are highly questionable.[2]

Still other studies simply assumed that increasing production of foreign affiliates would substitute for Japanese exports (e.g. Nagata, 1995; Takenaka, 1991, pp. 96-98), with commensurate implications for the trade balance and so-called hollowing out in Japan. Yet, given the results of the more rigorous studies of the United States and Swedish cases, as well as the tentative evidence of a positive relationship between foreign activities of Japan's TNCs and Japanese exports discussed earlier, this is clearly a questionable assumption.

However, to understand more accurately the relationship between exports from Japan or Japanese parent firms and the activity of Japanese affiliates abroad, substantial data problems must be addressed. This study attempts to take a first step in that direction by assembling a sample of firm-level data and examining the possible correlations between measures of parent firm activity and that of affiliate activity. The scope is more limited than most of the previous studies reviewed earlier in that it focuses narrowly on the parent-affiliate relationship. Only simple correlations are examined and other relevant factors are ignored. Moreover, this study has its own substantial data problems.

Parent firm exports and affiliate activity in Japan's largest machinery companies

The data used for this exercise come from two sources: data on parent firms from Nihon Keizai Shimbunsha (various years (a), various years (b)); a compilation of reports by corporations in Japan that must be filed with the Ministry of Finance of Japan; and data on the activities of Japanese firms abroad from Toyo Keizai (various years (a), various years (b), various years (c)).

The sample period for which data were collected is from 1983 to 1994, with the 1986-1994 period being focused upon in the following analysis. A major reason for focusing on this period is that Japan's FDI stocks abroad increased relatively rapidly in the late 1980s, an annual average of 36 per

[2] Kojima (1990, pp. 53-57) and Ramstetter (1986, chaps. 5-7) used similar approaches and obtained similar results, using host country data from selected Asian trading partners, which are in some cases more reliable (e.g. Republic of Korea, Thailand). However, these results are probably biased because of a missing variables problem.

cent in 1986-1990, compared with 23 per cent in 1974-1978, 20 per cent annually in 1982-1986 and 1978-1982, and 9 per cent in 1990-1994. This growth vaulted Japan into the ranks of one of the world's leading outward investors by the late 1980s.[3] It is important to realize that actual sales by foreign affiliates increased far less rapidly, 20 per cent annually in 1986-1990, -11 per cent annually in 1990-1992, and 9 per cent annually in 1992-1994 according to MITI surveys.[4] In any case, it is clear that Japanese TNCs expanded their operations abroad rapidly during the first half of the period under study. Moreover, if this expansion were to have effects on parent firm exports, the period under study is long enough to observe them.

The firms chosen for study were Japan's 20 largest machinery firms by sales in the 1994 fiscal year. The sample in principle includes firms in all machinery industries: non-electric machinery, electric (and electronic) machinery, transport machinery and precision machinery (ISIC revision 2 categories 382, 383, 384 and 385). In reality, 18 of the 20 firms are in either electric machinery or motor vehicles, with one firm each in shipbuilding (Mitsubishi Heavy Industries) and precision machinery (Canon). Although it would certainly be desirable to compare the results of this approach with an alternative using a finer degree of industry-wise disaggregation, there are significant advantages to using a more aggregate classification when dealing with the large multiproduct firms that make up the majority of this sample. Small sample size is also a problem here as the use of a larger sample would have the advantage of facilitating more rigorous statistical analyses. However, the 20 firms studied here are in themselves of great interest as they alone accounted for about 44 per cent of Japan's merchandise exports in 1986, 1990 and 1994 fiscal years (table 1).[5] Moreover, the use of a smaller sample makes it easier to highlight activities of individual firms.

However, as important as these firms are in terms of Japanese exports, they are far less important in terms of overall production or employment.[6]

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[3] For this period, FDI stocks are calculated as cumulative balance-of-payments flows from 1965 onward, excluding reinvested earnings (Bank of Japan, various years).

[4] See Ramstetter (1996, table 5) and MITI (various years) for these figures. Note also that Ramstetter (1996) adjusted the MITI estimates through 1992 to account for fluctuations in the coverage in the Ministry of International Trade and Industry surveys over time. The adjusted figures imply annual growth rates of 18 per cent in 1986-1990 and -8 per cent in 1990-1992.

[5] Note that fiscal years in Japan generally end on 31 March of the following calendar year and that the estimated share of sample firms in total exports is approximate because not all firms have the same fiscal years.

[6] In 1994, for example, these 20 firms accounted for 2.6 per cent of employment and 4.0 per cent of all sales by Japanese corporations (Ministry of Finance, various years; Nihon Keizai Shimbunsha, various years (a)).

Table 1. Parent firm exports and export-sales ratios in Japan's large machinery companies

	Parent firm exports (Billions of Yen)				Annual growth (Percentage)	Parent firm export-sales ratios (Percentage)				Annual growth (Percentage)
Industry, firm	1983	1986	1990	1994	1986-1994	1983	1986	1990	1994	1986-1994
All industries	36 053	34 381	41 715	40 492	2.07	4.70	3.99	3.47	3.21	-2.70
Machinery	26 898	25 582	31 332	30 706	2.31	30.05	23.63	20.05	20.18	-1.96
Sample 1	..	15 178	18 263	17 825	2.03	..	40.62	35.37	35.67	-1.61
Sample 2	14 145	14 291	17 165	16 657	1.93	46.18	40.13	34.81	35.21	-1.62
Canon	318	402	688	852	9.85	85.06	74.45	73.93	78.96	0.74
Fujitsu	266	273	382	309	1.54	26.84	18.43	16.36	13.66	-3.68
Hitachi	977	845	897	833	-0.19	36.89	28.91	23.67	22.25	-3.22
Honda	1 319	1 595	1 726	1 475	-0.97	71.47	68.31	61.65	59.73	-1.66
Isuzu	330	573	585	608	0.74	48.24	56.53	48.94	52.89	-0.83
Matsuindus	1 064	984	1 566	1 567	6.00	39.14	31.36	33.38	35.29	1.49
Matsuworks	34	36	47	48	3.77	6.45	5.94	4.85	4.91	-2.37
Mazda	916	1 080	1 296	982	-1.19	67.14	66.42	58.21	57.75	-1.73
Mitsuelect	492	412	463	531	3.22	30.97	22.86	17.90	21.35	-0.85
Mitsuheavy	597	408	508	637	5.72	31.30	24.90	21.84	25.18	0.14
Mitsumotor	..	887	1 098	1 168	4.01	..	50.60	47.48	44.02	-1.97
NEC	582	602	578	665	1.26	39.89	28.35	19.52	22.12	-3.05
Nippondensu	90	135	255	221	6.39	13.10	13.95	18.46	17.54	2.91
Nissan	2 007	1 915	1 733	1 441	-3.49	58.01	55.85	41.51	42.29	-3.41
Sanyo	546	411	349	337	-2.45	66.60	48.97	31.61	31.62	-5.32
Sharp	496	460	516	608	3.53	65.50	53.01	44.79	48.19	-1.18
Sony	567	669	1 179	1 246	8.09	73.63	66.13	62.70	66.21	0.02

Suzuki	228	378	484	467	2.69	43.41	50.73	47.89	44.55	-1.61
Toshiba	624	727	894	999	4.05	30.82	29.03	27.68	30.04	0.43
Toyota	2 691	2 388	3 017	2 833	2.16	49.17	39.63	35.23	34.47	-1.73

Sources: Bank of Japan (various years); Ministry of Finance (various years); Nihon Keizai Shimbunsha (various years (a), various years (b)).

NOTES:

Machinery includes non-electric machinery, electric (and electronic) machinery, transport machinery and precision machinery. For all industries and machinery, sales data were taken from corporation statistics classified by industry or firm, but export data were taken from balance-of-payments presentation of customs statistics classified by product.

Firm names are abbreviated as follows: Canon=Canon Inc., Fujitsu=Fujitsu Ltd., Hitachi=Hitachi Ltd., Honda=Honda Motor Co. Ltd., Isuzu=Isuzu Motors Ltd., Matsuindus=Matsushita Electric Industrial Co. Ltd., Matsuworks=Matsushita Electric Works Ltd., Mazda=Mazda Motor Corp., Mitsuelect=Mitsubishi Electric Corp., Mitsuheavy=Mitsubishi Heavy Industries Ltd., Mitsumotor=Mitsubishi Motors Co. Ltd., NEC=NEC Corp., Nippondens=Nippondenso Co. Ltd., Nissan=Nissan Motor Co. Ltd., Sanyo=Sanyo Electric Co. Ltd., Sharp=Sharp Corp., Sony=Sony Corp., Suzuki=Suzuki Motor Corp., Toshiba=Toshiba Corp., Toyota=Toyota Motor Corp.

Fiscal years end 31 March of the following calendar year with the following exceptions: Canon—fiscal years end 31 December of the same calendar year; Honda—through 1986 fiscal years end 28 or 29 February of the following calendar year (1987 refers to a 12-month average for the period 1 March 1986 to 31 March 1987); Isuzu—through 1993 fiscal years end 31 October of the same calendar year (1994 refers to a 12-month average for the period 1 November 1993 to 31 March 1995); Matsuindus—through 1985 fiscal years end 30 November of the same calendar year (1986 refers to a 12-month average for the period 1 December 1985 to 31 March 1987); Matsuworks—fiscal years end 30 November of the same calendar year; Mazda—through 1987 fiscal years end 31 October of the same calendar year (1988 refers to a 12-month average for the period 1 November 1987 to 31 March 1989); Nippondenso—through 1993 fiscal years end 31 December of the same calendar year (1994 refers to a 12-month average for the period 1 January 1994 to 31 March 1995); Sanyo—fiscal years end 30 November of the same calendar year; Sony—through 1985 fiscal years end 31 October of the same calendar year (1986 refers to a 12-month average for the period 1 November 1985 to 31 March 1987); Toyota—through 1993 fiscal years end 30 June of the following calendar year (1994 refers to a 12-month average for the period 1 July 1994 to 31 March 1995).

For Mitsumotor, 1987 figures are used instead of 1986; growth adjusted refers to 1987-1994, but sample average growth calculations use the 1987 figures, as a proxy for 1986 likely leads to a small underestimation of growth in sample 1.

This is indicated in table 1 by much larger export-sales ratios in sample firms than in all industries (e.g. 41 per cent versus 4 per cent in 1986, and 36 per cent versus 3.2 per cent in 1994). Note, however, that the difference between sample firms and the average for the machinery industries combined (e.g. 24 per cent in 1986 and 20 per cent in 1994) is much smaller.[7] Part of the reason for the narrower difference is the fact that the sample firms account for large shares of the machinery industry in Japan, about a third of sales and just under three fifths of exports in this industry during the period under study (Ministry of Finance, various years; Nihon Keizai Shimbunsha, various years (a), various years (b)).

Perhaps one of the most striking things revealed by those data is just how much Japan's overall export performance depends on the fate of a relatively few firms. Indeed, if one adds the roughly one third to one half of Japan's exports accounted for by the nine major *sogo shosha* (trading companies), it becomes clear that the vast majority of Japan's exports are accounted for by the top 30 or so exporters.[8] Moreover, within the sample presented in table 1, the top exporters account for the vast majority of the exports in the sample. In 1994, for example, the top six exporters (Toyota, Matsushita Electric Industrial, Honda, Nissan, Sony and Mitsubishi Motors) alone accounted for 24 per cent of Japan's exports, with the next four exporters (Toshiba, Mazda, Canon and Hitachi) accounting for another 9 per cent and the remaining 10 firms for only 11 per cent. However, it is important to note that some of these large exporters do not depend that heavily on exports for their revenues. Export-sales ratios are below the sample average in Hitachi and Toshiba, and roughly equal to the sample average in Toyota and Matsushita Electric Industrial. Among the smaller exporters, export propensities are higher than the average in Isuzu, Sharp and Suzuki.

Of particular concern in this context is the fact that export growth has been relatively slow in recent years, only about 2 per cent annually in nominal terms for all sample firms in 1986-1994 (table 1). This rate of growth is roughly equal to that for all Japanese corporations but slightly below that for

[7] Note that the estimate for machinery industries is only approximate, with the denominator coming from corporation statistics (Ministry of Finance, various years) and the numerator from commodity trade statistics as reported in the balance of payments (Bank of Japan, various years).

[8] Trading company data come from Nihon Keizai Shimbunsha (various years (a), various years (b)) and total export data come from the Bank of Japan (various years). Simple addition of the machinery and trading firm shares as given in the text may overestimate the share of these 29 firms in total exports because there may be some double counting of exports through trading firms.

the machinery aggregate. As a result of this slow export growth, export-sales ratios actually declined by about 1.6 per cent annually in sample firms during this period, though this decline was relatively small compared with both all industries and machinery.

This sample contains not only some of the largest exporters in Japan, but also some of the largest outward investors from that economy. Unfortunately, it is very difficult to measure the extent of foreign affiliate activity precisely, and it is impossible to calculate precise shares of these firms in Japan's FDI or other TNC activities abroad. Toyo Keizai has compiled some information on affiliates by parent firm since 1988, including estimates of FDI stocks and—in recent years—estimates of foreign affiliate sales. However, this information is not available for a number of parent firms or years, and these aggregate figures do not distinguish manufacturing affiliates, the production of which is usually posited to substitute for parent firm exports. It would, in principle, be possible to compile information affiliate by affiliate over time, but affiliate information is often unavailable in some years, with recent surveys appearing more comprehensive than earlier ones. Moreover, the data appear to be adjusted at discrete intervals. As a result, the time paths of available variables are affected by the date of data update.

In view of those problems, data from one year's survey were chosen (i.e. 1995) and affiliates were classified by date of establishment or start-up. This approach has the disadvantage of failing to account for growth over time owing to the expansion of old affiliates. However, it has the advantage of reducing unavailable observations and avoids problems resulting from differences in survey methodology over time. Moreover, because a large portion of Japanese TNC expansion in 1986-1994 was accounted for by the establishment of new affiliates, this classification captures a large portion of the overall expansion of Japanese TNCs abroad during this period.[9]

Three indicators can be compiled in this manner with reasonable comprehensiveness: the number of affiliates, equity stocks and employment. Four of the firms studied here (Fujitsu, Honda, Matsushita Electric Works

[9] Note, however, that the comparison of growth rates of FDI stocks by year of measurement and the growth rates of affiliate equity stocks by year of affiliate establishment does indicate that growth rates of FDI stocks were considerably higher for a number of affiliates in the period under study (appendix, table A1). This indicates that substantial growth in previously established affiliates is not captured here. However, note also that this comparison is not precise because of differences in the periods covered (see table A1) and the measures used differ in important respects (e.g. FDI stocks include loans not included in affiliate equity and affiliate equity stocks include local and third country contributions not included in FDI).

Table 2. Indicators for foreign affiliates of Japan's large machinery firms in 1994, by industry of affiliates and year of affiliate establishment or start-up

Firm	All affiliates				All, annual growth	Manufacturing affiliates				All, Annual growth
	1983	1986	1990	1994	1986-1994	1983	1986	1990	1994	1986-1994
	Number of affiliates (number and growth in percentage)									
Subtotal	502	629	971	1 218	8.61	195	285	415	538	8.27
Canon	35	40	67	79	8.88	4	7	17	20	14.02
Fujitsu	21	28	41	60	10.00	6	7	10	17	11.73
Hitachi	59	62	71	88	4.47	21	23	28	37	6.12
Honda	42	60	82	93	5.63	17	32	43	52	6.26
Isuzu	7	11	18	19	7.07	3	6	10	10	6.59
Matsuindus	71	84	129	177	9.76	40	54	78	104	8.54
Matsuworks	7	8	19	34	19.83	2	5	6	15	14.72
Mazda	8	10	18	22	10.36	2	4	6	9	10.67
Mitsuelect	35	41	56	60	4.87	11	16	24	27	6.76
Mitsuheavy	14	19	34	53	13.68	5	8	13	19	11.42
Mitsumotor	7	9	14	18	9.05	3	6	7	7	1.95
NEC	34	40	66	78	8.35	15	16	24	31	8.62
Nippondenso	11	16	27	33	9.47	7	10	17	22	10.36
Nissan	23	26	44	60	11.02	9	11	12	16	4.80
Sanyo	25	39	63	81	9.57	13	25	29	41	6.38
Sharp	10	17	33	40	11.29	5	8	13	17	9.88
Sony	31	35	54	59	6.75	10	14	22	23	6.40
Suzuki	8	16	24	35	10.28	6	10	17	23	10.97
Toshiba	34	42	67	82	8.72	9	13	23	31	11.47
Toyota	20	26	44	49	8.24	10	16	23	24	5.20

Equity of affiliates (billions of yen and growth in percentage)

Subtotal	1 725	2 087	3 204	3 647	7.23	569	870	1 583	1 882	10.12
Canon	70	75	107	110	5.03	10	14	45	47	16.57
Fujitsu	113	115	195	216	8.21	36	38	67	83	10.48
Hitachi	55	57	89	102	7.55	34	34	48	57	6.71
Honda	142	207	277	285	4.13	63	125	151	159	3.05
Isuzu	9	13	42	42	16.04	1	1	30	30	47.29
Matsuindus	81	98	182	260	12.99	43	57	139	212	17.91
Matsuworks	4	4	13	32	29.60	4	4	11	30	28.91
Mazda	12	12	89	96	29.83	1	1	72	79	68.86
Mitsuelect	46	50	73	76	5.33	17	21	42	44	9.88
Mitsuheavy	42	43	168	192	20.53	5	5	128	137	51.65
Mitsumotor	40	41	82	96	11.15	5	5	46	46	32.29
NEC	102	108	179	197	7.76	71	71	87	96	3.98
Nippondenso	2	38	76	172	20.90	2	14	42	121	31.31
Nissan	261	290	361	374	3.23	117	142	144	148	0.54
Sanyo	57	65	84	104	6.04	24	30	38	57	8.59
Sharp	35	42	61	66	5.92	27	28	42	46	6.33
Sony	536	537	563	613	1.68	52	53	68	69	3.52
Suzuki	9	15	39	61	19.35	8	12	31	50	19.13
Toshiba	27	41	181	196	21.66	16	29	90	105	17.33
Toyota	82	237	344	355	5.18	33	188	263	264	4.38

Table 2 (*Continued*)

Firm	All affiliates				All, annual growth	Manufacturing affiliates				All, Annual growth
	1983	1986	1990	1994	1986-1994	1983	1986	1990	1994	1986-1994
	Ratios of equity of affiliates to sale of parent firms (per cent and growth in percentage))									
Subtotal	5.42	5.58	6.21	7.30	3.40	1.79	2.33	3.07	3.77	6.19
Canon	18.83	13.84	11.47	10.24	-3.69	2.64	2.53	4.80	4.31	6.90
Fujitsu	11.42	7.75	8.36	9.56	2.66	3.64	2.53	2.88	3.69	4.81
Hitachi	2.06	1.94	2.36	2.72	4.29	1.28	1.16	1.27	1.53	3.47
Honda	7.68	8.85	9.90	11.56	3.40	3.43	5.37	5.41	6.46	2.34
Isuzu	1.38	1.25	3.47	3.63	14.24	0.16	0.13	2.50	2.61	45.00
Matsuindus	2.99	3.12	3.88	5.86	8.18	1.59	1.81	2.95	4.78	12.90
Matsuworks	0.76	0.67	1.31	3.28	21.94	0.73	0.64	1.09	3.02	21.29
Mazda	0.85	0.73	4.00	5.67	29.11	0.06	0.07	3.23	4.65	67.93
Mitsuelect	2.89	2.78	2.83	3.05	1.17	1.07	1.16	1.61	1.78	5.55
Mitsuheavy	2.19	2.63	7.23	7.60	14.17	0.26	0.30	5.51	5.41	43.65
Mitsumotor	3.41	2.35	3.56	3.62	5.54	0.42	0.28	1.98	1.73	24.62
NEC	7.02	5.10	6.04	6.54	3.17	4.83	3.32	2.93	3.20	-0.45
Nippondenso	0.36	3.90	5.49	13.63	16.95	0.28	1.42	3.05	9.59	27.01
Nissan	7.54	8.47	8.65	10.99	3.31	3.37	4.14	3.44	4.35	0.62
Sanyo	6.97	7.76	7.56	9.77	2.92	2.98	3.52	3.47	5.35	5.39
Sharp	4.57	4.83	5.28	5.26	1.09	3.62	3.26	3.65	3.67	1.48
Sony	69.61	53.11	29.94	32.60	-5.92	6.72	5.21	3.60	3.69	-4.21
Suzuki	1.79	1.98	3.84	5.79	14.35	1.58	1.67	3.05	4.81	14.15
Toshiba	1.32	1.63	5.59	5.91	17.42	0.81	1.17	2.77	3.15	13.24
Toyota	1.49	3.93	4.02	4.31	1.18	0.60	3.12	3.08	3.22	0.40

Employment of affiliates (thousands and growth in percentage)

Subtotal	242.1	282.1	364.5	471.5	6.63	173.5	205.3	278.9	368.3	7.58
Canon	14.6	15.6	18.8	24.7	5.91	2.8	3.4	6.3	12.3	17.2
Fujitsu	..	..	..	..	..	..	..	..	..	..
Hitachi	19.8	22.3	24.0	32.9	5.00	16.9	18.7	19.3	25.2	3.8
Honda	..	..	..	..	..	..	..	..	..	..
Isuzu	2.2	2.6	5.0	7.7	14.42	1.9	1.9	4.0	6.7	17.5
Matsuindus	68.0	71.4	80.4	104.7	4.90	44.1	46.4	54.9	76.3	6.4
Matsuworks	..	..	..	..	..	..	..	..	..	..
Mazda	2.4	2.4	8.1	10.2	19.69	0.9	0.9	6.2	6.8	28.3
Mitsuelect	16.7	17.8	20.2	26.3	4.99	8.0	9.0	11.3	16.6	8.0
Mitsuheavy	6.9	8.0	16.9	22.4	13.74	6.7	7.0	15.7	20.6	14.5
Mitsumotor	6.0	7.0	11.2	15.3	10.25	5.9	6.2	10.3	14.0	10.7
NEC	11.9	16.5	17.8	23.5	4.51	10.6	13.9	14.4	18.7	3.8
Nippondenso	3.4	4.8	7.0	11.5	11.59	2.8	4.2	6.1	10.4	12.1
Nissan	31.3	37.1	41.3	43.7	2.07	26.4	30.6	34.1	34.4	1.5
Sanyo	18.0	22.6	34.2	36.6	6.20	15.0	19.3	29.1	30.1	5.7
Sharp	8.3	12.0	17.6	21.8	7.72	7.1	10.9	14.9	18.6	6.9
Sony	..	..	..	..	..	..	..	..	..	..
Suzuki	2.3	9.4	13.6	22.4	11.46	2.1	9.2	13.2	21.5	11.1
Toshiba	8.7	10.7	14.0	27.6	12.62	6.8	8.0	10.8	22.7	13.9
Toyota	21.6	21.9	34.5	40.3	7.92	15.6	15.7	28.3	33.2	9.8

Table 2 (*Continued*)

Firm	All affiliates				All, annual growth	Manufacturing affiliates				All, Annual growth
	1983	1986	1990	1994	1986-1994	1983	1986	1990	1994	1986-1994
	(Ratios of employment of affiliates to employment of parent firms (percentage))									
Subtotal	36.66	39.94	47.95	61.46	5.54	26.27	29.06	36.68	48.01	6.48
Canon	124.19	101.17	111.75	135.22	3.69	23.87	22.26	37.78	67.08	14.78
Hitachi	26.21	28.57	30.10	42.93	5.22	22.33	23.96	24.16	32.84	4.02
Isuzu	14.59	16.35	37.32	52.57	15.72	12.19	11.53	30.12	45.85	18.83
Matsuindus	179.77	178.07	177.30	220.50	2.71	116.59	115.81	121.11	160.78	4.19
Mazda	8.82	8.49	27.48	37.24	20.29	3.38	3.26	20.92	24.97	28.98
Mitsuelect	34.55	36.19	41.53	54.24	5.19	16.55	18.31	23.17	34.36	8.18
Mitsuheavy	12.73	16.83	38.20	51.86	15.11	12.22	14.67	35.54	47.80	15.91
Mitsumotor	27.36	30.43	43.85	53.13	7.22	26.78	26.92	40.29	48.74	7.70
NEC	34.21	43.08	46.23	57.25	3.62	30.29	36.18	37.53	45.64	2.95
Nippondenso	12.17	14.06	18.23	28.01	8.99	10.12	12.39	15.76	25.67	9.53
Nissan	52.49	94.27	72.53	88.95	-0.72	44.30	77.7	59.89	69.95	-1.31
Sanyo	97.40	106.39	123.26	132.63	2.79	81.38	90.60	104.74	109.09	2.35
Sharp	49.03	69.15	84.34	94.74	4.01	42.23	62.55	71.45	80.74	3.24
Suzuki	20.25	73.21	107.97	166.59	10.83	18.71	71.85	104.45	159.79	10.51
Toshiba	13.01	15.07	19.42	37.53	12.08	10.15	11.29	14.98	30.86	13.39
Toyota	36.35	33.77	47.27	57.73	6.93	26.24	24.28	38.82	47.60	8.78

Source: Toyo Keizai (1995).

NOTES:

All samples exclude affiliates for which date of establishment or start-up is unknown.

Equity sample excludes affiliates for which equity estimates are not available as well as some affiliates in countries with historically high inflation rates (mainly in Latin America) where translating book values at March 1995 exchange rates generates unrealistically high equity stocks.

Employment sample excludes affiliates for which employment estimates are not available; Fujitsu, Honda, Matsuworks and Sony are not listed in the table, because they do not report employment numbers for most of their affiliates.

and Sony) do not provide employment data for most affiliates and are omitted from the employment samples (table 2). In terms of the number of affiliates, Matsushita Electric Industrial was the largest throughout the period and also had by far the largest number of manufacturing affiliates. Focusing on manufacturing affiliates in 1994, Matsushita was followed by Honda, Sanyo, Hitachi, NEC and Toshiba. In terms of manufacturing affiliate equity, Toyota was the largest in 1994, followed by Matsushita Electric Industrial, Honda, Nissan, Mitsubishi Heavy Industries, Nippondenso and Toshiba. If affiliate equity is taken as a ratio of parent firm sales, Nippondenso had by far the largest foreign presence relative to the size of the parent firm, followed by Honda, Matsushita Heavy Industries, Suzuki, Mazda, Nissan and Canon. Finally, looking at manufacturing affiliate employment in 1994 (excluding those affiliates that do not report these figures), Matsushita Electric Industrial was again by far the largest, followed by Nissan, Toyota and Sanyo. Ratios of manufacturing affiliate employment to parent firm employment were largest in Matsushita Electric Industrial and Suzuki, followed by Sanyo, Sharp, Nissan and Canon. Thus, it can be observed that the size of a firm's foreign affiliates differs greatly, depending on the measure used. The automobile firms and Mitsubishi Heavy Industries tend to have a relatively large foreign presence in terms of equity, and electric machinery firms tend to be relatively large in terms of number of affiliates and employment.

Turning to the growth of the manufacturing affiliates in 1986-1994, Matsushita Electric Works grew most rapidly in number, followed by Canon, Fujitsu, Toshiba, Mitsubishi Heavy Industries, Suzuki, Mazda and Nippondenso (table 2). In terms of affiliate equity, Mazda experienced the most rapid growth, followed by Mitsubishi Heavy Industries, Isuzu, Mitsubishi Motor, Nippondenso and Matsushita Electric Works. When affiliate equity is measured relative to parent sales, growth was again most rapid in Mazda, and then Isuzu, Mitsubishi Heavy Industries, Nippondenso, Mitsubishi Motor and Matsushita Electric Works. Employment growth was also most rapid in Mazda and Isuzu, followed by Canon, Mitsubishi Heavy Industries, Toshiba, Nippondenso, Suzuki and Mitsubishi Motors. Finally, the growth of affiliate employment relative to parent firm employment was again most rapid in Mazda and Isuzu, followed by Mitsubishi Heavy Industries, Canon, Toshiba and Suzuki. Thus, growth in terms of all indicators tended to be more rapid in the automobile firms and Mitsubishi Heavy Industries than in the electric machinery firms, probably reflecting in part that electric machinery firms initiated large-scale FDI somewhat earlier.

Table 3. Spearman rank correlation coefficients between indicators of parent firm export performance by year of activity and indicators of foreign manufacturing affiliate activity in 1994 by year of establishment or start-up

Variables correlated	Spearman rank correlation coefficient	t-statistic	Significance level	Number of observations
XP86 & NA86	0.373	1.70	0.106	20
XP86 & KA86	0.483	2.34	0.031	20
XP86 & EA86	0.335	1.33	0.204	16
XP94 & NA94	0.230	1.03	0.319	20
XP94 & KA94	0.570	2.94	0.009	20
XP94 & EA94	0.420	1.72	0.107	16
XPg & NAg	0.424	1.99	0.062	20
XPg & KAg	0.286	1.26	0.222	20
XPg & EAg	0.388	1.58	0.137	16
XPR86 & NA86	-0.050	-0.23	0.820	20
XPR86 & KAR86	0.260	1.16	0.260	20
XPR86 & EAR86	0.080	0.31	0.760	16
XPR94 & NA94	0.540	2.71	0.010	20
XPR94 & KAR94	0.210	0.91	0.380	20
XPR94 & EAR94	0.370	1.50	0.160	16
XPRg & NAg	0.320	1.41	0.170	20
XPRg & KARg	0.330	1.48	0.160	20
XPRg & EARg	0.570	2.58	0.020	16

Variable definitions:

EA86	=	1994 employment of affiliates established in 1986 or earlier
EA94	=	1994 employment of affiliates established in 1994 or earlier; EAg=[(EA94/EA86)-1]*100
EAR86	=	[EA86/(parent firm employment 1986)]*100
EAR94	=	[EA94/(parent firm employment 1994)]*100
EARg	=	[(EAR94/EAR86)-1]*100
KA86	=	1994 equity of affiliates established in 1986 or earlier
KA94	=	1994 equity of affiliates established in 1994 or earlier
KAg	=	[(KA94/KA86)-1]*100
KAR86	=	[KA86/(parent firm sales 1986)]*100
KAR94	=	[KA94/(parent firm sales 1994)]*100
KARg	=	[(KAR94/KAR86)-1]*100
NA86	=	1994 number of affiliates established in 1986 or earlier
NA94	=	1994 number of affiliates established in 1994 or earlier
NAg	=	[(NA94/NA86)-1]*100
XP86	=	parent firm exports 1986
XP94	=	parent firm exports 1994
XPg	=	[(XP94/XP86)-1]*100
XPR86	=	parent firm export-sales ratio 1986
XPR94	=	parent firm export-sales ratio 1994
XPRg	=	[(XPR94/XPR86)-1]*100

Given the decline in exports by Japanese automobile firms in recent years, the relatively high growth of foreign affiliates of these firms would suggest that foreign production may, indeed, be substituting for parent firm exports in these firms. However, in this sample, simple rank correlation analyses of relationships between measures of parent firm export performance and those of foreign affiliate activity in 1986 or 1994, or between the growth of parent exports and the growth of foreign affiliate activity in 1986-1994, reveal only one negative correlation and that correlation is not even close to being significant statistically (table 3).[10] On the other hand, there were a number of positive and significant correlations at the 0.05 level between the level of parent firm exports and the level of affiliate equity in 1986 and 1994; the parent firm export-sales ratio and the number of foreign affiliates in 1994; and the growth of the parent export-sales ratio and the growth of the ratio of foreign affiliate employment to parent firm employment. The positive correlation between the growth of parent firm exports and the growth of the number of foreign affiliates is also significant if a slightly lower 0.06 level is used.

These correlation results are indicative at best. The biggest problem with this type of analysis is that other factors affecting parent firm exports are not accounted for, creating a potentially severe missing variables problem. The small sample used is also a severe statistical problem and requires caution in interpreting the results. Moreover, in the growth specifications, the failure to account for price movements—that is, to analyse real growth rates instead of nominal growth rates—is another potentially serious problem. The failure to account for growth in previously established affiliates is another potentially important problem. Despite those problems, it is of some interest that such simple correlations fail to provide any support for the view that foreign manufacturing affiliate activity substitutes for parent firm exports in those important Japanese TNCs.

Implications of the patterns observed and a research agenda

This note has examined trends in parent firm export performance and compared them with trends in measures of foreign affiliate activity in

[10] Rank correlations are used here because the presence of some very large firms (e.g. Toyota, Matsushita Electric Industrial) is thought to create a severe outlier problem if straight correlations are used.

Japan's 20 largest machinery firms for the 1986-1994 period. Despite a general trend towards reduced exports and expanded foreign affiliate activity in almost all of the sample firms, simple rank correlation analysis uncovers no evidence that foreign affiliate activity substitutes for parent firm exports. However, as emphasized earlier, the small sample used and the failure to account for other determinants of parent firm export performance mean that these results should be treated as tentative and the focus must remain on how to generate more reliable results in future research. To this end, it seems most important to try and account for other factors affecting parent firm export growth, perhaps using methodologies similar to those of Lipsey and Weiss (1984); or Blomström *et al.*, (1988). Data constraints will present substantial obstacles to such efforts, but the sources introduced here can go a long way towards overcoming those obstacles, albeit at a substantial cost.[11] One data problem that will be particularly difficult to overcome, however, is the measurement of price movements in large diversified companies such as those studied here. To improve the reliability of the estimates, increasing sample size will also be important, though this will introduce a whole new set of problems surrounding how to define the sample and how to treat the large multiproduct firms studied here together with more focused firms in a single sample. Finally, it will also be important to construct better measures of affiliate growth. Despite the difficulties, with the devotion of sufficient resources and effort, these problems should be soluble, making it possible for us to obtain a clearer answer to the question: does foreign affiliate activity substitute for Japanese parent firm exports? ■

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[11] The Nikkei and Toyo Keizai databases are sold in electronic form, as are other versions of the underlying Ministry of Finance reports, but they are very costly and their use can be very time-consuming.

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Appendix: Comparing measures of affiliate activity

Table A1. Growth rates of FDI stocks and growth rates of Japan's largest machinery firms

(Fiscal years and billions of yen)

Industry, firm	Annual growth rates of FDI stocks by date of measure		Annual growth of affiliate equity stocks by date of affiliate establishment 1986-1994	Growth rate differential
	Period	Growth		
Canon	..	..	5.03	..
Fujitsu	1987-1993	-1.56	8.21	-9.77
Hitachi	1988-1994	25.07	7.55	17.52
Honda	1987-1994	8.08	4.13	3.95
Isuzu	1987-1993	23.95	16.04	7.91
Matsuindus	..	..	12.99	..
Matsuworks	1988-1993	53.69	29.60	24.09
Mazda	1987-1994	9.51	29.83	-20.32
Mitsuelect	1988-1994	20.68	5.33	15.35
Mitsuheavy	1987-1992	53.04	20.53	32.51
Mitsumotor	..	..	11.15	..
NEC	1987-1993	9.56	3.23	6.33
Nippondenso	..	..	20.90	..
Nissan	1987-1993	9.56	3.23	6.33
Sanyo	1987-1992	20.74	6.04	14.70
Sharp	..	..	5.92	..
Sony	1987-1993	44.99	1.68	43.31
Suzuki	1986-1994	18.45	19.35	-0.90
Toshiba	1986-1991	30.05	21.66	8.38
Toyota	1985-1992	25.95	5.18	20.77

Sources: Toyo Keizai (various years a, various years b, various years c).

NOTES:

FDI stocks refer to cumulative equity and loans. These estimates include some short-term loans not usually included in FDI flows as defined in the balance of payments.