What Drives U.S. Outbound Foreign Direct Investment in the Asian and Pacific Region?

Industry-Level Evidence from A Panel Data Study

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Abstract

This paper searches for the determinants/predictors of the U.S. industrial entry into the Asian and Pacific region. The empirical results obtained by static panel data econometric modeling contribute to the literature in two dimensions. First, favoring both location- and internalization-theoretic hypotheses, they demonstrate that the U.S. manufacturing foreign direct investment (FDI) in the region increases as the industry size and intangible managerial resources/advantages increase at home. Second, they evidence strong industry- and time-specific effects (unexplained by explanatory variables included) that enable us to identify industries making greater or smaller FDI than a particular reference industry, and to infer effects on FDI of such time-varying factor as foreign exchange rates by refering to a particular fiscal year. Together, these results portray a fruitful panel data econometric picture of U.S. FDI determinants that sheds light on the theory of multinational corporate FDI behavior, as applied to the Asian and Pacific region.

1 Introduction

The paper attempts to detect and identify determinants or predictors of the U.S. business entry into the Asian and Pacific region, by static panel data econometric modeling of industrial and annual data. The

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particular mode of foreign market entry that is focused on is foreign direct investment (FDI),[1] and thirty manufacturing sectors and five fiscal years, 1999 through 2003, will compose the panel data.

As Blonigen (2006) recently points out, "Despite the obvious importance of FDI and MNCs (multinational companies) in the world economy, research on the factors that determine FDI patterns and the impact of MNCs on parent and host countries is in its early stages." The present paper thus attempts to contribute to the literature on FDI determinants, by presenting industry-level evidence from the panel data econometric study of the U.S. outbound FDI in the Asian and Pacific region.

Five general foreign entry modes that have been studied by the international business researchers are FDI (e.g., wholly owned), acquisition, joint venture, licensing and exporting; the *choice* of the entry mode is a classic issue in international business.[2] As in Kojima (2004), we are here not concerned with the question of entry mode choice per se; rather, the FDI is considered as a given, fixed entry mode chosen by U.S. parent firms. (Exporting enters the analysis not explicitly as a model variable but indirectly when studying its relationship with FDI.)

1.1 Three empirical issues in international business

Two essential problems in international business theory are:[3] (i) why do multinational firms (those spanning two or more nations) exist?;[4] and (ii) why do they increase, or decrease, magnitude of their FDI activity?

The former problem (i) leads to two major empirical questions:

(i-a) Do the U.S. firms' intangible managerial advantages, as measured by larger equity capital, higher value added as against sales, more

[1]Its definition is that of International Monetary Fund (1977, p.136), as referred to in Kojima (1996, p.15, footnote 1): FDI is an "investment that is made to acquire a lasting interest in an enterprise operating in an economy other than that of investor, the investor's purpose being to have an effective voice in the management of the enterprise."

[2]See Buckley and Casson (2001, pp.95-108,119,121) and Kogut (2001, pp.794-797).

[3]The first one is briefly summarized in Kojima (1997, pp.95-98).

[4]That is, what explains the creation and existence of multinational firms, or what causes FDI? In the economy with free trade system, there would be no reasons for their presence; only under imperfect competition in the goods and inputs markets would multinational firms be created and expanded (see Rugman 1981, pp.39-40).

For the evolution of the theory of the multinational firms see Hennart (2001, pp.128-131).

solid research and development and so on, contribute to the firms *initiating* their FDI in the Asian and Pacific region?

(i-b) Where do the U.S. firms locate their multinational business activity? In particular, how is the U.S. outbound FDI in the Asian and Pacific region related with the exporting activity? Is the (host country-based) FDI a *substitute* for or a *complement* to (home country-based) exporting? A related question here is: do exchange rates (fast-moving financial asset prices) affect the relationship between FDI and exporting (slow-moving macroeconomic variables)?

The second problem (ii) leads to the third empirical question which is (i-a) but with "parent" inserted and "initiating" replaced by "promoting:"

(ii-a) Do the U.S. parent firms' intangible managerial advantages contribute to the parent firms *further promoting* their FDI already in the Asian and Pacific region?

The first two questions (i-a) and (i-b) are quite difficult to empirically explore due to the nature of data required, whereas (ii-a) requires only data more readily available. Thus, the present paper does not address either of (i-a) and (i-b), but rather attempts to focus on the third question (ii-a), though indirectly refering to (i-b) when interpreting estimated industry- and time-specific effects unexplained by the varibales included.

And yet, theoretical foundations of (i-a) and (i-b) are important enough to be summarized as below and the hypotheses derived there will be those related to our main concern (ii-a) as well.

Question (i-b) is an issue of where business facilities will be *located*. The question is addressed to explore *location advantages*: viewed as national border-related determinants of FDI, location advantages will enable the firms to benefit more from basing their operations (such as research, production, and distribution activities) in the host country as well than from producing only in the home country to export to the foreign market. (The present paper will not explicitly investigate the location advantage issue, since the desired export data "by country" are not available from the data source we rely on. Yet, the exchange rate effects as added in (i-b) will be studied in the context of time-specific effecs of the panel data modeling.)

Turning back to question (i-a), it is an issue of who will *own* the international business facilities. The question may be, in the framework of *internalization* theory, paraphrased as follows:[5] why would a firm that own facilities in the U.S. wish to own facilities in the Asian and Pacific region as well?

The theory of internalization emphasizes two distinct gains that would result within a *single* firm: those from internalizing *knowledge flow* (i.e., flow of all such economically useful intangible inputs as administrative/managerial techniques) and those from internalizing *product flow* (i.e., vertical flow of material products such as components and raw materials).[6] These benefits of internalization would result in a U.S. firm owning facilities both in the U.S. and the Asian and Pacific region, as long as they surpass the costs of internalization.

Both theories, location and internalization, play complementary role in explaining the creation and presence of multinational firms,[7] and lead to several interesting hypotheses to be tested. Under the location-theoretic approach, the hypothesis will be:

L: The U.S. FDI in the Asian and Pacific region is a *substitute* for exporting to the region.

In the present study, this hypothesis L will not be directly tested but rather studied as industry- and/or time-specific effects unexplained by the varibales included.

On the other hand, the internalization-theoretic framework yields two hypotheses to be directly tested in the present paper:

I_1: Industrial/corporate growth in size will likely result in U.S. (parent) firms initiating, or further promoting, thier outbound FDI in the Asian and Pacific region.

I_2: The intangible managerial resources/advantages available and allocated within U.S. (parent) firms contribute to initiating, or further promoting, the outbound FDI in the Asian and Pacific region.

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[5] "Internalization is the process of making a market within a firm. The internal market of the firm substitutes for the missing regular (or external) market and solves the problems of allocation and distribution by the use of administrative fiat. The internal prices (or transfer prices) of the firm lubricate the organization and permit the internal market to function as efficiently as a potential (but unrealized) regular market." See Rugman (1981, p.28).

[6] See Buckley and Casson (2001, p.114). For alternative arrangements of 'internalization vs *externalization*' of knowledge and/or product flows, see Buckley and Casson (2001, p.120).

[7] See Rugman (1981, p.48).

As we attempt to test hypotheses I_1 and I_2 from the viewpoint of question (ii-a) raised earlier, FDI is our ciritical variable whose variations are to be empirically explained. It is, therefore, important to study multiple indices of FDI, and the paper will look at those three alternative proxies for FDI as listed in Panel A of Table 3 in a subsequent section: Salesratio (ratio of sales of foreign affiliates to sales of U.S. parents), LsubSales (logged sales of foreign affiliates) and LsubWrkr (logged number of employees of foreign affiliates). Table 3 has been constructed based on Horaguchi (1992, Chapter 4), Mathieu (1996) and Yeaple (2003), who provide a useful set of those proxies for FDI[8] and also of variables related to both internalization-based hypotheses, I_1 and I_2. Proxies for industrial size in I_1 are LparentTA (logged total assets of parents) and LparentWrkr (logged number of employees of parents); and those for the intangible managerial resources/advantages in I_2 are OwnCapratio (ratio of owners' equity to total assets of parents), VAratio (ratio of value added to sales of parents), LVAperWrkr (logged value added per one thousand employees), RDratio (ratio of R&D performed to sales of parents), all as defined in Panel B of Table 3. We would expect these proxies for parent firms' intangible managerial advantages to further promote outbound FDI.

1.2 Literature review

The previous literature exploring location and internalization advantages to search for determinants or predictors of FDI includes: the cross-sectional studies of the Japanese manufacturing firms by Horaguchi (1992), Fukao et al. (1994) and Hasegawa (1996); the multivariate time-series attempts at the Japanese industry level by Kojima (1996, 1997) to complement the contributions of the preceding cross-sectional research; the industry-level, cross-sectional study by Yeaple (2003) searching industry and country characteristics for U.S. outward FDI determinants; and panel data econometric studies of the industry-level Japanese FDI by Kojima (2004). More recently, Blonigen (2005) critically reviews the empirical literature on FDI determinants, and Blonigen (2006) gives a summary report of the most recent (from the second half of 1990s up to 2005) literature on FDI determinants.

[8]Yeaple(2003, p.728) studies three proxies including export-related ones (to explore the question (i-b)): sales; intra-industry exports; ratio of exports to foreign affiliates' local sales.

While the industry-level study of the U.S. outward FDI in 39 countries by Yeaple (2003) is cross-sectional using the Bureau of Economic Analysis (BEA) Benchmark Survey of 1994 (but without using time series data), the industry-level work in the present paper is a panel data analysis of the U.S. outward FDI in a particular area from 1999 through 2003. To my knowledge, Kojima (2004) is the only extensive panel econometric study of FDI determinants, attempting to find possible industry- and/or time-specific effects that are *not* explained by the variables included in the regression models.[9] And those effects could be likely related to the internalization theory and/or the location theory (including exchange rate effects as referred to in (i-b)) and, therefore, constitute essential determinants of FDI. Panel data econometric modeling is thus, again, employed in the present paper so as to find, if any, industry-level and time-specific (especially, exchange rate) factors behind the U.S. outbound FDI in the Asian and Pacific region.

Kojima (2004) documents evidence on factors that determine Japaenese FDI in North American markets, by estimating and examining both fixed- and random-effects models. The present paper only employs fixed-effects modeling for the U.S. FDI in the Asian and Pacific region, following approaches A and B as summarized by Kojima (2004, Appendix B). Another reason for focusing on fixed-effects models is because it is fixed-effects modeling that will enable us to specifically identify industry names that would have statistically significant industry-specific effects.

The paper is organized as follows: in Section 2, panel data and their sources are described along with the data descriptive statistics and the variable definition for the panel data econometric models; the panel data are tabulated in Table 12 in Appendix B. The three types of panel data models (those with only individual effects, with only time effects, and with both effects) are estimated and their statistical features are extracted in Section 3. By examining both-effects models from the location- and internalization-theoretic viewpoints, Section 4 attempts to identify the determinants of the U.S. outbound FDI in the Asian and Pacific region. Several concluding remarks are made in the final section. Appendix A summarizes essentials of panel data econometric

[9]Studying explicitly such effects is made possible indeed by panel data econometric modeling.

fixed-effects modeling.[10]

2 Data and Panel Data Models

Our panel data consist of 30 industrial sectors, "Food" through "Miscellaneous manufacturing" and 5 fiscal years, FY1999 to FY2003. The whole panel data set used in the present analysis is being compiled and laid out in Table 12 in Appendix B.

Ignoring those data variables (e.g., CE_AP and CE_J) not actually used in the estimation, the panel data as complied in Table 12 are balanced in the sense that every individual/sector has data for exactly the same set of time periods, though with some missing values being included.[11] The missing values are detailed below (and in the note of Table 12).

2.1 Data sources

Table 12 has been compiled and constructed from the website of the Bureau of Economic Analysis, an agency of the U.S. Department of Commerce, at http://www.bea.gov/bea/ai/iidguide.htm#link12b. From this page we move on to: I. U.S. Direct Investment Abroad → B. Operations of U.S. parent companies and their foreign affiliates → Comprehensive financial and operating data → Subtitle.[12]

Here are some notes to the tables in "U.S. Direct Investment Abroad: Operations of U.S. Parent Companies and Their Foreign Affiliates" downloaded above, and some related remarks on Table 12:

(i) The estimates are on a fiscal year (FY) basis; an affiliate's fiscal year is defined as the financial reporting year that ended in that calendar year. Unless otherwise specified, all balances are as of the close of, say,

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[10]For random-effects modeling and Hausman specification tests, see Kojima (2004, Appendix A).

[11]See Doan (*RM*, pp.307-308). Those variables in Table 12 that will be actually used in the estimation are listed later in Table 3.

[12]Subtitles are as follows: Preliminary 2003 Estimates XLS (EXE) (ZIP); Revised 2002 Estimates XLS (EXE) (ZIP); Revised 2001 Estimates XLS (EXE) (ZIP); Revised 2000 Estimates XLS (EXE) (ZIP); Revised 1999 Estimates XLS (EXE) (ZIP) – Includes methodology PDF. Spread-sheet tables are downloaded for these years. The Revised 1998 Estimates are also available, but are not analyzed since the industry categories for the U.S. parents quite differ from those for the later period from 1999 to 2003.

FY 1999.

(ii) An asterisk "(*)" indicates a value between -$500,000 and +$500,000, or fewer than 50 employees, as appropriate. (For U.S. parent data: * indicates Less than $500,000.) In Table 12, "(*)" is replaced by -9999.

(iii) A "(D)" indicates that the data in the cell have been suppressed to avoid disclosure of data of individual companies. For employment data, a letter representing a size range is entered in place of a "(D)". (For U.S. parent data: Size ranges are given in employment cells that are suppressed. The size ranges are: A–1 to 499; F–500 to 999; G–1,000 to 2,499; H–2,500 to 4,999; I–5,000 to 9,999; J–10,000 to 24,999; K–25,000 to 49,999; L–50,000 to 99,999; M–100,000 or more.) In Table 12, "(D)" is replaced by -9998, and other letters -9997.

In our panel dataset analyzed, those data with -9999, -9998 and -9997 are treated as missing values.

2.2 Firms, industries, and area/countries studied

2.2.1 Types of firms

Parent firms studied are nonbank U.S. parents (whose foreign affiliates are located in *any* area or country); foreign affiliates (located in a *particular* area or country indicated) to be studied are majority-owned nonbank foreign affiliates (MOFAs) of nonbank U.S. parents.[13]

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[13]The following description is quoted from "U.S. Direct Investment Abroad: Operations of U.S. Parent Companies and Their Foreign Affiliates: Preliminary 2003 Estimates":

A "U.S. parent company" is the person, resident in the United States, that owns or controls 10 percent or more of the voting securities of an incorporated foreign business enterprise or an equivalent interest in an unincorporated foreign business enterprise. "Person" is broadly defined to include any individual, branch, partnership, associated group, association, estate, trust, corporation or other organization (whether or not organized under the laws of any State), or any government entity. If incorporated, the U.S. parent is the fully consolidated U.S. enterprise consisting of (1) the U.S. corporation whose voting securities are not owned more than 50 percent by another U.S. corporation, and (2) proceeding down each ownership chain from that U.S. corporation, any U.S. corporation (including Foreign Sales Corporations located within the United States) whose voting securities are more than 50 percent owned by the U.S. corporation above it. A U.S. parent comprises the domestic (U.S.) operations of a U.S. multinational company.

A "foreign affiliate" is a foreign business enterprise in which there is U.S. direct investment, that is, in which a U.S. person owns or controls 10 percent of the voting securities or the equivalent. Foreign affiliates comprise the foreign operations of a U.S. multinational company over which the U.S. parent is presumed to have a degree

One remark on data availability is in order: parent firms are those whose foreign affiliates are located in *any* area or country, not just in the Asian and Pacific region. It would be desirable (and essential) to extract parent firms whose foreign affiliates are located *only* in the Asian and Pacific region. Unfortunately, no such regionally segmented parent data sets are available at the website referred to above. (This might cause difficulties in interpreting the panel model estimation results later.)

2.2.2 Industries and area/countries

Industries of MOFAs studied match those of their U.S. parents and their names are listed in Table 1. The source of industry names is Tab2A2.xls downloaded as mentioned earlier.

U.S. MOFAs located in Japan have quite a few missing values, as is typically true with a pair of CE_J and sector 4 in Table 12, while those located in the Asian and Pacific area as a whole (including Japan and Australia) have sufficient data available that the panel data will be balanced. We thus choose the whole Asian and Pacific region as the location of U.S. MOFAs.

The Asian and Pacific area includes the following countries (whose source is Tab2A1.xls downloaded earlier): Australia, China, Hong Kong, India, Indonesia, Japan, Republic of Korea, Malaysia, New Zealand, Philippines, Singapore, Taiwan, Thailand, Other (Bangladesh, Bhutan, Brunei, Burma, Cambodia, Fiji, French Islands-Indian Ocean, French Islands-Pacific, Laos, Macau, Marshall Islands, Micronesia, Nauru, Nepal, Pakistan, Papua New Guinea, Sri Lanka, Tonga, Vanuatu, Vietnam).

2.2.3 Constructing the panel dataset

First, the spreadsheet file, PDset_bytime.xls, is constructed from those yearly tables downloaded; it is grouped by time (year). This file is comprehensive in that the whole world is included: All countries; Canada; Europe (Total; Of which: France, Germany, Netherlands, United Kingdom); Latin America and Other Western Hemisphere (Total; Of which:

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of managerial influence.

A "majority-owned nonbank affiliate" (MOFA) is a foreign affiliate in which the combined direct and indirect ownership interest of all U.S. parents exceeds 50 percent.

The tables cover only nonbank parents and affiliates. Nonbank parents (affiliates) exclude parents (affiliates) classified as depository institutions, which consist of commercial banks, savings institutions, and credit unions.

Table 1 Industries Studied

	Industries Studied	Subsectors Included
1	Food	
		Animal foods
		Grain and oilseed milling
		Sugar and confectionery products
		Fruit and vegetable preserving and specialty foods
		Dairy products
		Animal slaughtering and processing
		Seafood product preparation and packaging
		Bakeries and tortillas
		Other food products
2	Beverages and tobacco products	
		Beverages
		Tobacco products
3	Textiles, apparel, and leather products	
		Textile mills
		Textile product mills
		Apparel
		Leather and allied products
4	Wood products	
5	Paper	
		Pulp, paper, and paperboard mills
		Converted paper products
6	Printing and related support activities	
7	Petroleum and coal products	
		Integrated petroleum refining and extraction
		Petroleum refining excluding oil and gas extraction
		Asphalt and other petroleum and coal products
8	Basic chemicals	
9	Resins and synthetic rubber, fibers, and filaments	
10	Pharmaceuticals and medicines	
11	Soap, cleaning compounds, and toilet preparations	
12	Other chemicals	
		Pesticides, fertilizers, and other agricultural chemicals
		Paints, coatings, and adhesives
		Other chemical products and preparations
13	Plastics and rubber products	
		Plastics products
		Rubber products
14	Nonmetallic mineral products	
		Clay products and refractories
		Glass and glass products
		Cement and concrete products
		Lime and gypsum products
		Other nonmetallic mineral products
15	Primary metals	
		Iron and steel mills and ferroalloys
		Steel products from purchased steel
		Alumina and aluminum production and processing
		Nonferrous metal (except aluminum) production and processing
		Foundries
16	Fabricated metal products	
		Forging and stamping
		Cutlery and handtools
		Architectural and structural metals
		Boilers, tanks, and shipping containers
		Hardware
		Spring and wire products
		Machine shops, turned products, and screws, nuts, and bolts
		Coating, engraving, heat treating, and allied activities
		Other fabricated metal products
17	Agriculture, construction, and mining machinery	
18	Industrial machinery	
19	Other machinery	
		Commercial and service industry machinery
		Ventilation, heating, air conditioning, and commercial refrigeration equipment
		Metalworking machinery
		Engines, turbines, and power transmission equipment
		Other general purpose machinery
20	Computers and peripheral equipment	
21	Communications equipment	
22	Audio and video equipment	
23	Semiconductors and other electronic components	
24	Navigational, measuring, and other instruments	
25	Magnetic and optical media	
26	Electrical equipment, appliances, and components	
		Electric lighting equipment
		Household appliances
		Electrical equipment
		Other electrical equipment and components
27	Motor vehicles, bodies and trailers, and parts	
		Motor vehicles
		Motor vehicle bodies and trailers
		Motor vehicle parts
28	Other transportation equipment	
		Aerospace products and parts
		Railroad rolling stock
		Ship and boat building
		Other transportation equipment
29	Furniture and related products	
30	Miscellaneous manufacturing	
		Medical equipment and supplies
		Other miscellaneous manufacturing

Brazil, Mexico); Africa; Middle East; Asia and Pacific (Total; Of which: Australia, Japan).

Then, the RATS program (Doan, *RATS*), PDset_createByIndivid.prg, extracts from PDset_bytime.xls those data only for the Asian and Pacific (Total; Of which: Australia, Japan) area, to construct PDset_AsPac.xls, a panel dataset grouped by individual (industry).[14] PDset_AsPac.xls is tabulated in Table 12 in Appendix C.

Further, compiled in Table 2 are simple yearly averages of monthly average exchange rates (per U.S. dollar) for the sample period.[15] The exchange rate might be critical when searching for reasons behind possible time effects that are individual-*in*variant by definition. A study of the Japanese FDI in the North American markets by Kojima (2004, pp.70-73 and Table 19) shows that a statistically significant time effect detected in FY2000 is apparently due to the sharp yen appreciation against U.S. dollar in the fiscal year (as compared to FY1997). We will explore whether the similar observation could be found for the U.S. FDI in the Asian and Pacific region.

Table 2 Yearly Averages of Monthly Average Exchange Rates (per U.S. dollar)

Year	Japanese Yen	Australian Dollars	Chinese Renminbi	Hong Kong Dollars	South Korean Won
1999	113.70	1.550	8.278	7.759	1188.5
2000	107.83	1.727	8.278	7.792	1130.9
2001	121.50	1.936	8.277	7.800	1289.0
2002	125.26	1.841	8.277	7.799	1246.3
2003	115.90	1.541	8.277	7.787	1191.5

2.3 Panel data econometric models and descriptive statistics

2.3.1 Panel data econometric models

The static panel data econometric models studied in the paper are given formally in vector form in Appendix A:[16]

[14]This is the only form that RATS can handle.

[15]The data source for monthly average exchange rates (per U.S. dollar) is the Database Retrieval System (v2.11), available at http://fx.sauder.ubc.ca/data.html.

[16]See Kitamura (2003) for most recent, extensive survey of panel data econometrics and its applications.

Models with neither individual nor time effects, (2);
Models with only individual effects: Fixed-effects model, (7);
Models with only time effects: Fixed-effects model, (10);
Models with both individual and time effects: Fixed-effects model, (12).
In all these models, the dependent variable, y_{it}, represents U.S. outbound FDI and will be one of the three alternative proxies as defined in Panel A of Table 3: Salesratio (ratio of sales of MOFAs to sales of U.S. parents), LsubSales (logged sales of MOFAs) and LsubWrkr (logged number of employees of MOFAs). We set the K column vector of the explanatory variables (i.e., proxies for size and intangible managerial resources/advantages), $\boldsymbol{x}'_{it}$ = (LparentTA, OwnCapratio, VAratio, LVAperWrkr, RDratio)$'$ or $\boldsymbol{x}'_{it}$ = (LparentWrkr, OwnCapratio, VAratio, LVAperWrkr, RDratio)$'$, where each variable is defined in Panel B of Table 3. Moreover, as remarked in the first section, Table 3 relates each variable to those internalization-theoretic hypotheses, I_1 and I_2.

Table 3 Variable Definition for Panel Data Models

Related Hypotheses	Variable Name in Tables 4 - 10	Variable Name in Table 12	Definition[a]
A. Dependent Variable y_{it}: Three Alternative Proxies for U.S. Outbound FDI			
I_1, I_2	Salesratio	100×SALS_AP/S_P	ratio of Sales of MOFAs to Sales of U.S. parents[b]
	LsubSales	log of SALS_AP	logged Sales of MOFAs[c]
	LsubWrkr	log of NEMP_AP	logged Employment of MOFAs[d]
B. Independent Variables $\boldsymbol{x}'_{it}$: U.S. Parents Variables			
I_1	LparentTA	log of TA_P	logged Total Assets
	LparentWrkr	log of NEMP_P	logged Number of Employees
I_2	OwnCapratio	100×OE_P/TA_P	ratio of Owners' Equity to Total Assets[e]
	VAratio	100×VA_P/S_P	ratio of Value Added to Sales
	LVAperWrkr	log of (VA_P/NEMP_P)	logged Value Added per One Thousand Employees
	RDratio	100×RD_P/S_P	ratio of R&D Performed to Sales

[a]See note of Table 12 for units of raw data.
[b]See Mathieu (1996, pp.836-837).
[c]See Yeaple (2003, p.728).
[d]See Horaguchi (1992, pp.97-101) on raw, and Kitamura (2003, pp.84-5) on logged.
[e]See Horaguchi (1992, p.94).

The terms "sub" and "parent" in Table 3 represent, respectively, U.S. MOFAs located in the Asian and Pacific region and their nonbank U.S.

parent firms. Recall from the previous section that "parent" includes parent firms of all those MOFAs located not only in the Asian and Pacific region but also in all other regions. This is due to the limited availability of data. "parent" should ideally include parents of those MOFAs located only in the Asian and Pacific region.

2.3.2 Descriptive statistics of model variables

The descriptive statistics of each of three dependent variables in Panel A of Table 3 and each of independent (parent) variables in Panel B are reported, respectively, in Tables 4 and 5. Table 4 shows that Salesratio appears non-normally distributed (skewed to the right, in particular), while other dependent variables could be normal (though slightly skewed to the left). Histograms and scatter diagrams are drawn in Figs. 1-3, which are consistent with Tables 4 and 5.

Table 4 Descriptive Statistics: Dependent Variables[a]

Panel(4) of Annual Data From 1//1999:01 To 30//2003:01

	Salesratio	LsubSales	LsubWrkr
Observations	141[b]		
Sample Mean	12.434 (0.000)[c]	8.400 (0.000)	2.970 (0.000)
Variance[d]	177.278	2.268	1.406
Skewness [e]	1.990 (0.000)[f]	-0.534 (0.010)	-0.577 (0.006)
Kurtosis (Exc)	3.822 (0.000)[g]	-0.210 (0.620)	0.009 (0.982)
Jarque-Bera	178.829 (0.000)[h]	6.966 (0.031)	7.818 (0.020)
Minimum	0.550	4.431	-0.916
Maximum	66.703	11.480	5.123
Median	7.732	8.671	3.174

[a]Salesratio, LsubSales and LsubWrkr are expressed, respectively, as a percentage, in (logged) millions of dollars and in (logged) thousands of employees.

[b]141 = 150 Total - 9 Skipped/Missing.

[c]P-value: the probability-value, with the null of mean=0.

[d]Computed by the usual formula for unbiased estimation involving the division by the sample size minus one. See Doan (2004, *RM*, p.395).

[e]For skewness, kurtosis (exc) and Jarque-Bera (1987) normality tests, see Doan (2004, *RM*, pp.393-395).

[f]P-value: the probability-value, with the null of sk=0.

[g]P-value: the probability-value, with the null of ku=0.

[h]P-value: the probability-value, with the null of JB=0.

Table 5 Descriptive Statistics: Independent (Parent) Variables[a]

Panel(5) of Annual Data From 1//1999:01 To 30//2003:01

	LparentTA	LparentWrkr	OwnCapratio
Observations		150	
Sample Mean	11.269 (0.000)[b]	5.333 (0.000)	38.157 (0.000)
Variance	1.341	0.903	181.289
Skewness	-0.659 (0.001)	-1.444 (0.000)	0.374 (0.064)
Kurtosis(Exc)	1.301 (0.001)	3.981 (0.000)	0.228 (0.578)
Jarque-Bera	21.438 (0.000)	151.177 (0.000)	3.827 (0.148)
Minimum	7.281	1.435	6.766
Maximum	13.799	7.050	84.036
Median	11.371	5.461	34.689
	VAratio	**LVAperwrkr**	**RDratio**
Observations	150		140[c]
Sample Mean	34.744 (0.000)	4.566 (0.000)	4.290 (0.000)
Variance	149.890	0.188	18.614
Skewness	5.066 (0.000)	1.243 (0.000)	1.289 (0.000)
Kurtosis(Exc)	43.505 (0.000)	2.492 (0.000)	0.695 (0.102)
Jarque-Bera	12470.766 (0.000)	77.415 (0.000)	41.579 (0.000)
Minimum	15.607	3.800	0.287
Maximum	144.456	6.209	16.755
Median	34.466	4.481	2.894

[a]Variables with L attached are expressed in (logged) millions of dollars, except for LparentWrkr in (logged) thousands of employees. Ratio variables are expressed as a percentage, See also notes in Table 4.

[b]P-value.

[c]141 = 150 Total - 10 Skipped/Missing.

Table 6 shows that two parent variables, LparentTA and LparentWrkr, are highly enough correlated to cause a serious multicolinearity problem in the estimation. Only one of the two will be included in the model as an explanatory variable. Two other variables, OwnCapratio and RDratio, appear somewhat correlated but not so high to cause a serious multicolinearity problem.

Also documented in Table 6 are the correlations between dependent and independent variables, most of which appear reasonably high; we would then anticipate some satisfactory estimated results from the panel data econometric estimation.

Table 6 Correlation Matrices[a]

Panel(5) of Annual Data From 1//1999:01 To 30//2003:01

	Dependent Variable	Explanatory Variables				
	Salesratio	LparentTA	LparentWrkr	OwnCapratio	VAratio	LVAperWrkr
LparentTA	0.063	1.000				
LparentWrkr	-0.190	0.830	1.000			
OwnCapratio	0.603	-0.381	-0.478	1.000		
VAratio	0.075	-0.424	-0.421	0.278	1.000	
LVAperWrkr	0.385	0.259	-0.184	0.199	0.390	1.000
RDratio	0.646	-0.029	-0.280	0.666	0.324	0.369
	LsubSales					
LparentTA	0.777					
LparentWrkr	0.484					
OwnCapratio	0.059			Same as above		
VAratio	-0.259					
LVAperWrkr	0.483					
RDratio	0.359					
	LsubWrkr					
LparentTA	0.780	1.000				
LparentWrkr	0.651	0.806	1.000			
OwnCapratio	0.012	-0.335	-0.456	1.000		
VAratio	-0.177	-0.429	-0.409	0.273	1.000	
LVAperWrkr	0.281	0.317	-0.174	0.226	0.301	1.000
RDratio	0.287	-0.061	-0.274	0.648	0.343	0.259

[a]The bottom panel differs from the first two in correlations due to the presence of missing values in the dependent (and, possibly, independent) variables. See Tables 4 and 5.

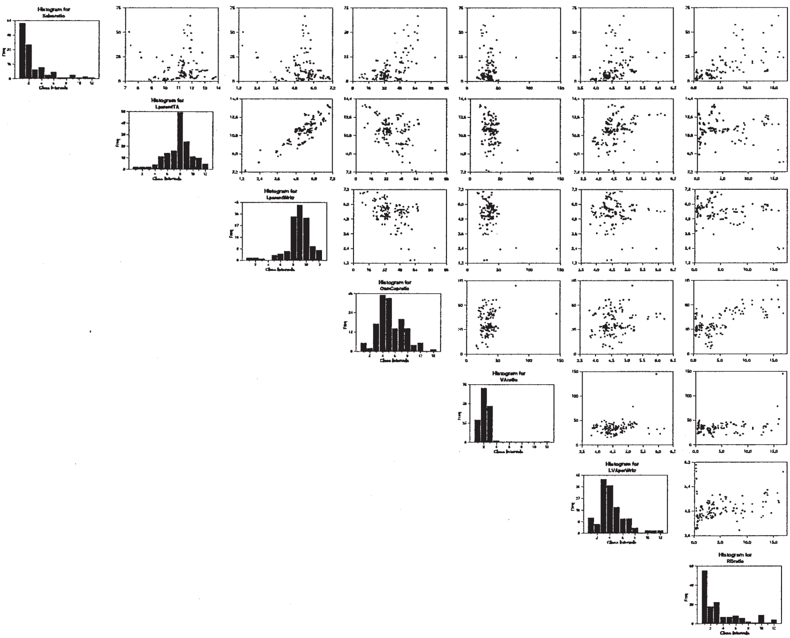

Figure 1 Histograms and Scatter Diagrams. From top left to bottom right: Salesratio, LparentTA, LparentWrkr, OwnCapratio, VAratio, LVAperWrkr, and RDratio.

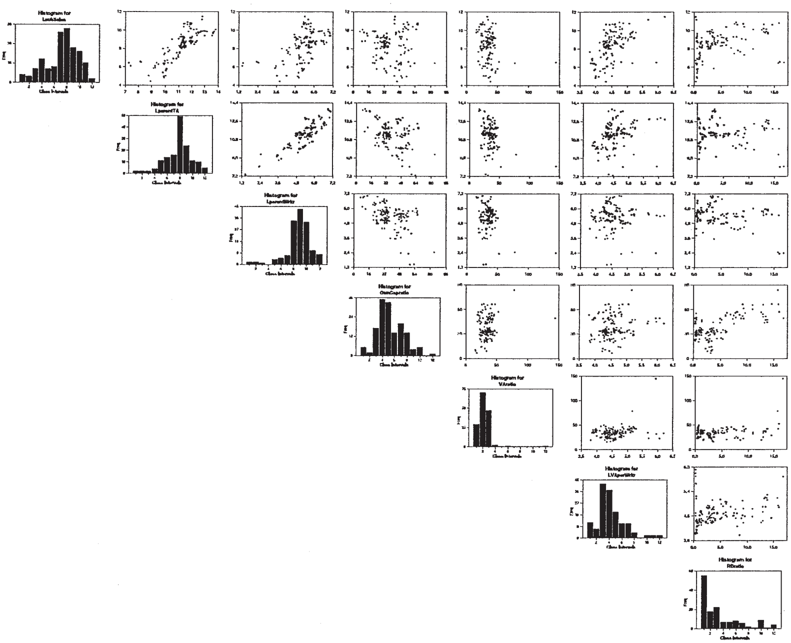

Figure 2 Histograms and Scatter Diagrams. From top left to bottom right: LsubSales, LparentTA, LparentWrkr, OwnCapratio, VAratio, LVAperWrkr, and RDratio.

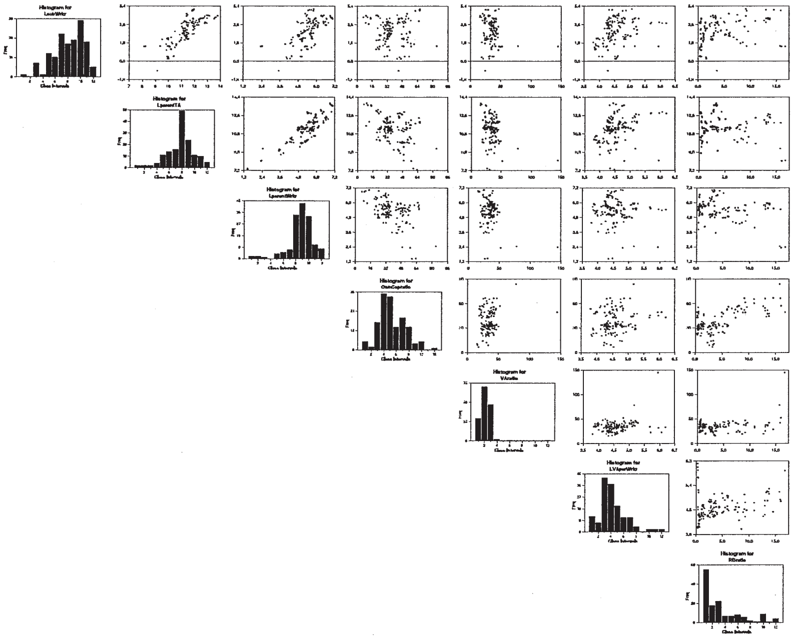

Figure 3 Histograms and Scatter Diagrams. From top left to bottom right: LsubWrkr, LparentTA, LparentWrkr, OwnCapratio, VAratio, LVAperWrkr, and RDratio.

3 Estimated Results: Fixed-effects Models

3.1 Model with neither individual nor time effects, (2)

Table 7 reports the estimated models with neither individual nor time effects (2) with the corresponding residuals plots and histograms charted in Figs. 4, 6, 8, and 10. Many explanatory variables turn out significant; the similar result will be found in the estimated models with individual and/or time effects and with both effects. Which model is most appropriate will be statistically checked and decided in the later section.

In terms of R^2, the estimated models (2) for the dependent variable, Salesratio, perform somewhat poorly; also, their skewness and kurtosis statistics both indicate strong non-normality (the residuals and their histogram in Figs. 4 and 6 suggest that the residuals are skewed to the right and not normally distributed). Also evidenced in Table 7 is that the LsubSales and LsubWrkr models appear to perform better with regard to residuals normality: see also Figs. 8 and 10.

Notice that the estimated results for dependent variables, LsubSales and LsubWrkr, with an explanatory variable, LparentTA, are not reported; the reasons are that in these estimated models as many as two or three explanatory variables turn out statistically insignificant in the both effects model, later estimated, and that the null of absence of time effects in the both effects model is not strongly rejected.[17]

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[17]For LsubSales, both VAratio and RDratio turn out insignificant and in the both effects model the null of absence of time effects is rejected only at the 10-percent level; for LsubWrkr, three explanatory variables, VAratio, LVAperWrkr and RDratio, turn out insignificant and in the both effects model the null of absence of time effects is not rejected at any conventional level of significance.

Table 7 Model With Neither Effects, (2)

Linear Regression - Estimation by Least Squares
Panel(5) of Annual Data From 1//1999:01 To 30//2003:01

Dependent Variable	Salesratio				LsubSales		LsubWrkr	
Model Number	[1]		[2]		[3]		[4]	
Explanatory Variable	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Constant	-43.030	0.001	-45.603	0.001	-5.396	0.000	-7.697	0.000
LparentTA			0.963	0.397				
LparentWrkr	0.790	0.491			0.951	0.000	1.157	0.000
OwnCapratio	0.369	0.000	0.385	0.000	0.007	0.273	0.006	0.286
VAratio	-0.244	0.001	-0.217	0.011	-0.043	0.000	-0.010	0.035
LVAperWrkr	8.949	0.000	7.768	0.004	2.076	0.000	0.884	0.000
RDratio	1.136	0.000	1.081	0.000	0.123	0.000	0.112	0.000
Usable Observations	131		131		131		136	
Total Observations	150		150		150		150	
Skipped/Missing	19		19		19		14	
Degrees of Freedom[a]	125		125		125		130	
$\bar{R}^2$ [b]	0.538		0.539		0.791		0.751	
Standard Error of Estimate[c]	8.856		8.848		0.639		0.581	
Regression F(5,m)[d]	31.274	0.000[e]	31.384	0.000	99.561	0.000	82.411	0.000
Durbin-Watson Statistic	0.842		0.848		0.939		0.758	
Residuals:								
Variance[f]	75.420		75.272		0.392		0.325	
Skewness	0.873	0.000	0.890	0.000	-0.772	0.000	-0.038	0.858
Kurtosis(Exc)	3.000	0.000	3.000	0.000	0.557	0.205	-0.410	0.342
Jarque-Bera	65.750	0.000	66.423	0.000	14.708	0.001	0.984	0.611
Studentized Range[g]	6.062		6.047		4.685		5.135	

[a]The number of degrees of freedom for the residuals is equal to number of usable observations − number of constant term and exlanatory variables.

[b]The coefficient of determination corrected for degrees of freedom.

[c]The realized value of the estimator of the error term standard deviation (i.e., the residual standard deviation) = [Sum of Squared Residuals/Degrees of Freedom above]$^{\frac{1}{2}}$).

[d]This is an F to test the null that all regression coefficients = 0. Its degrees of freedom are 6 (=7-1) =the number of explanatory variables and m="Degrees of Freedom" as computed above.

[e]Right-sided P-value.

[f]See Table 4 for variance, skewness, kurtosis and Jarque-Bera here.

[g]Statistic to test the normality: The normality would be inferred if the statistic turns out approximately between 4.44 and 5.68 [4.72 and 5.96] for "Usable Observations" equal to about 100 [150].

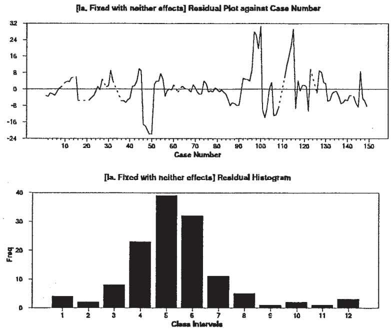

Figure 4 Neither Effects Assumed: Residuals for dependent variable = Salesratio, with LparentWrkr in Table 7

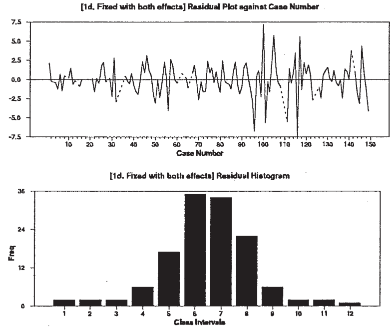

Figure 5 Both Effects Assumed: Residuals for dependent variable=Salesratio, with LparentWrkr in Table 10 (cf. Fig. 4)

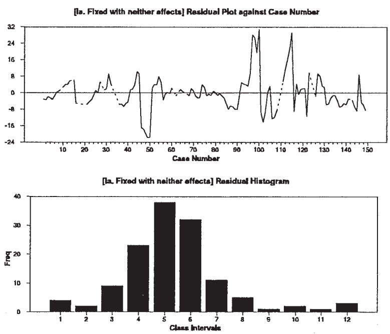

Figure 6 Neither Effects Assumed: Residuals for dependent variable = Salesratio, with LparentTA in Table 7

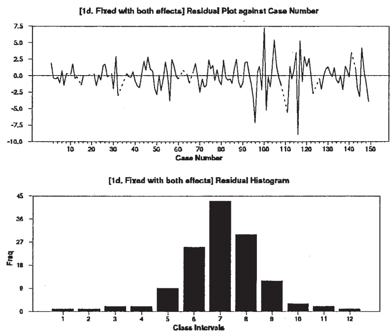

Figure 7 Both Effects Assumed: Residuals for dependent variable=Salesratio, with LparentTA in Table 10 (cf. Fig. 6)

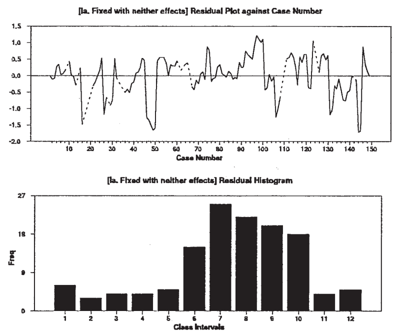

Figure 8 Neither Effects Assumed: Residuals for dependent variable = LsubSales in Table 7

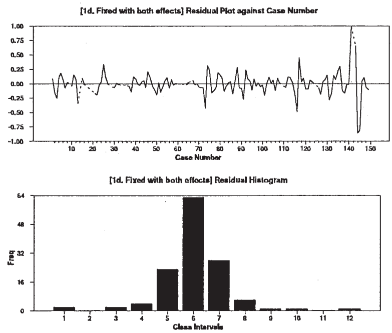

Figure 9 Both Effects Assumed: Residuals for dependent variable=LsubSales in Table 10 (cf. Fig. 8)

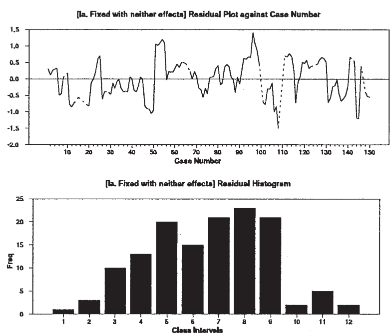

Figure 10 Neither Effects Assumed: Residuals for dependent variable = LsubWrkr in Table 7

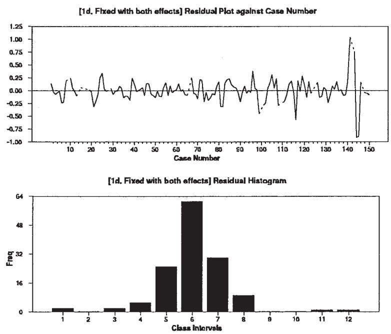

Figure 11 Both Effects Assumed: Residuals for dependent variable=LsubWrkr in Table 10 (cf. Fig. 10)

3.2 Model with only individual effects, (7)

We will next estimate model with only individual effects, and in the subsequent sections move on to model with only time effects and then to model with both individual and time effects.

Table 8 Model With Only Individual Effects, (7)

Panel Regression - Estimation by Fixed Effects[a]
Panel(5) of Annual Data From 1//1999:01 To 30//2003:01

Dependent Variable	Salesratio				LsubSales		LsubWrkr	
Model Number	[1]		[2]		[3]		[4]	
Explanatory Variable	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
LparentTA			2.668	0.025				
LparentWrkr	2.013	0.319			0.962	0.000	1.228	0.000
OwnCapratio	-0.135	0.019	-0.136	0.015	-0.015	0.007	-0.012	0.025
VAratio	-0.234	0.000	-0.185	0.003	-0.023	0.000	-0.015	0.004
LVAperWrkr	12.097	0.000	9.996	0.001	1.196	0.000	0.859	0.001
RDratio	3.382	0.000	3.376	0.000	0.100	0.006	0.039	0.263
Usable Observations	131		131		131		136	
Total Observations	150		150		150		150	
Skipped/Missing	19		19		19		14	
Degrees of Freedom	96		96		96		101	
$\bar{R}^2$	0.950		0.952		0.962		0.947	
Standard Error of Estimate	2.928		2.867		0.273		0.267	
Regression F(34,m)[b]	72.890	0.000	76.133	0.000	97.728	0.000	72.493	0.000
Residuals:								
Variance	6.331		6.071		0.055		0.053	
Skewness	-0.422	0.051	-0.267	0.218	-0.199	0.357	-0.138	0.517
Kurtosis(Exc)	4.030	0.000	3.387	0.000	2.407	0.000	4.744	0.000
Jarque-Bera	92.546	0.000	64.173	0.000	32.493	0.000	127.941	0.000
Studentized Range	7.599		7.366		6.972		8.028	
Inference: Test the null of absence of individual effects.[c]								
F(29,115)[d]	43.275	0.000	45.202	0.000	24.378	0.000	20.194	0.000

[a]This is the method of estimation (i) as described in "Models with only individual effects/Fixed-effects model" in Appendix A.3. Coefficients for IDUM (dummies for industries) will be estimated if the method of estimation (ii) as described also there is employed, with all other slope coefficient estimates remaining the same as those obtained by method (i) employed in the present paper.

[b]34=35-1=the total number of explanatory variables and dummies minus 1; m=Degrees of Freedom above.

[c]Tested is the null that coefficients for IDUM are all equal (to some individual-invariant constant).

[d]An F computed by (8) in Appendix A.3.

Table 8 reports the estimated fixed-effects models with only individual effects, (7). Several remarks are in order:

While R^2 has improved significantly as compared to the "neither" models in Table 7 (and skewness has improved, too), the residuals statistics such as Jaque-Bera and Studentized range have not improved but rather worsened for all dependent variables. The apparent non-normality of residuals here is indeed due to kurtosis observed; in particular, compare Tables 7 and 8 with regard to kurtosis for LsubSales and LsubWrkr. It is not clear why, in the model with only individual effects, kurtosis has behaved in a non-normal manner (while skewness has improved).

The bottom panel of Table 8 tests the null of absence of individual effects: tested is the null that coefficients on IDUM (dummies for industries) are all equal (to some individual-invariant constant).[18] The null is rejected for every dependent variable, implying consistent presence of individual (i.e., industry-specific) effects.

What are plausible industry-specific effects that are unexplained by variables included in the model? A set of industry characteristics as discussed by Yeaple (2003, ps.726, 728-729), which are actually included in his model but omitted in the present paper, includes transport cost (e.g., freight and insurance cost), plant scale economies (e.g., size of a plant in terms of production workers), corporate scale economies (e.g., number of nonproduction employees) and factor (e.g., skilled-labor) intensities.[19] These industry characteristics most likely constitute industry-specific effects detected in Table 8.

3.3 Model with only time effects, (10)

The estimated results for fixed time-effects model, (10), are reported in Table 9. The residuals normality seems to be accepted for the LsubWrkr model in particular.

The bottom panel of the table tests the null of absence of time effects: tested is the null that coefficients on TDUM (dummies for time periods) are all equal (to some time-invariant constant).[20] The null is strongly rejecting for every proxy of the FDI the presence of time effects alone.

[18]Coefficients on IDUM will be estimated if the method of estimation (ii) as described in "Models with only individual effects/Fixed-effects model" in Appendix A.3 is employed, with all other slope coefficient estimates remaining the same as those obtained by method (i) employed in the present paper.

[19]"Higher corporate scale economies should increase FDI by giving entrants into the industry lareger market shares, which tend to boost the impoortance of transport costs" (Yeaple 2003, p.729).

[20]Coefficients for TDUM will be estimated if the method of estimation (ii) as described in "Models with only time effects/Fixed-effects model" in Appendix A.4 is employed, with all other slope coefficient estimates remaining the same as those obtained by method (i) employed in the present paper.

This, however, does *not* necessarily mean that there would be detected no time effects in the model with both effects being considered, to which we are now ready to turn.

Table 9 Model With Only Time Effects, (10)

Panel Regression - Estimation by Fixed Effects[a]
Panel(5) of Annual Data From 1//1999:01 To 30//2003:01

Dependent Variable	Salesratio				LsubSales		LsubWrkr	
Model Number	[1]		[2]		[3]		[4]	
Explanatory Variable	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
parentTA			0.750	0.515				
LparentWrkr	0.773	0.503			0.952	0.000	1.161	0.000
OwnCapratio	0.377	0.000	0.384	0.000	0.008	0.220	0.006	0.269
VAratio	-0.234	0.002	-0.217	0.012	-0.042	0.000	-0.009	0.051
LVAperWrkr	9.123	0.000	8.187	0.003	2.094	0.000	0.890	0.000
RDratio	1.102	0.000	1.065	0.000	0.120	0.000	0.111	0.000
Usable Observations	131		131		131		136	
Total Observations	150		150		150		150	
Skipped/Missing	19		19		19		14	
Degrees of Freedom	121		121		121		126	
$\bar{R}^2$	0.535		0.535		0.790		0.745	
Standard Error of Estimate	8.888		8.889		0.640		0.588	
Regression F(9,m)[b]	17.600	0.000	17.593	0.000	55.444	0.000	44.754	0.000
Residuals:								
Variance	73.522		73.537		0.382		0.323	
Skewness	0.792	0.000	0.816	0.000	-0.829	0.000	-0.030	0.887
Kurtosis(Exc)	2.882	0.000	2.880	0.000	0.905	0.040	-0.294	0.495
Jarque-Bera	59.048	0.000	59.804	0.000	19.474	0.000	0.510	0.775
Studentized Range	6.130		6.120		5.014		5.249	
Inference: Test the null of absence of time effects.[c]								
F(4,140)[d]	0.903	0.464	0.826	0.511	0.994	0.413	0.227	0.923

[a]This is the method of estimation (i) as described in "Models with only time effects/Fixed-effects model" in Appendix A.4. Coefficients for TDUM (dummies for time periods) will be estimated if the method of estimation (ii) as described in "Models with only time effects/Fixed-effects model" in Appendix A.4 is employed, with all other slope coefficient estimates remaining the same as those obtained by method (i) employed in the present paper.

[b]See Table 8.

[c]Tested is the null that coefficients for TDUM are all equal (to some time-invariant constant).

[d]An F computed by (11) in Appendix A.4.

3.4 Model with both individual and time effects, (12)

Notice in Table 10 that there are two time-specific dummies, TDUM(1) (FY1999) and TDUM(5) (FY2003), which turn out significant, respectively, at 5 or 10% and 1% levels: this has indeed resulted in the presence of time effects in the both effects model. (This is in sharp contrast with failure to reject the null of absence of time effects in the model with only time effects, as reported in Table 9.)

Table 10 Model With Both Individual and Time Effects, (12)

Linear Regression - Estimation by Least Squares[a]
Panel(5) of Annual Data From 1//1999:01 To 30//2003:01

Dependent Variable	Salesratio				LsubSales		LsubWrkr	
Model Number	[1]		[2]		[3]		[4]	
Explanatory Variable	Coeff	P-value[b]	Coeff	P-value	Coeff	P-value	Coeff	P-value
Constant	-47.701***	0.003	-38.683**	0.011	-1.138	0.432	-7.217***	0.000
LparentTA			1.317	0.247				
LparentWrkr	3.370*	0.068			1.115***	0.000	1.356***	0.000
OwnCapratio	-0.145***	0.005	-0.148***	0.005	-0.015***	0.003	-0.011**	0.027
VAratio	-0.163***	0.003	-0.138**	0.016	-0.017***	0.001	-0.013**	0.018
LVAperWrkr	8.180***	0.002	7.148***	0.008	0.885***	0.000	0.766***	0.003
RDratio	3.260***	0.000	3.121***	0.000	0.082**	0.012	0.027	0.442
IDUM(1)	1.578	0.445	2.751	0.158	-0.079	0.681	-0.442**	0.036
+ − • [c] IDUM(2)	6.589**	0.022	4.980*	0.066	0.709***	0.009	-0.535*	0.061
+ − • IDUM(3)	7.215***	0.004	6.984***	0.008	-1.004***	0.000	-1.386***	0.000
+ − • IDUM(4)	13.906**	0.010	9.662**	0.033	-1.112**	0.028	-1.142***	0.005
IDUM(5)	2.657	0.181	2.299	0.250	0.158	0.394	-0.111	0.578
+ − • IDUM(6)	7.003**	0.014	5.863**	0.039	-1.610***	0.000	-0.874***	0.003
+o IDUM(7)	21.176***	0.000	19.399***	0.000	2.259***	0.000	-0.239	0.612
IDUM(8)	-1.205	0.679	-3.802	0.117	0.305	0.264	-0.350	0.231
IDUM(9)	1.358	0.656	-1.097	0.681	1.005***	0.001	-0.036	0.907
IDUM(10)	-35.008***	0.000	-34.059***	0.000	-0.097	0.831	-0.023	0.962
+• IDUM(11)	8.354***	0.005	6.257**	0.016	1.285***	0.000	1.176***	0.000
IDUM(12)	0.193	0.931	-1.220	0.551	0.591***	0.006	0.169	0.452
IDUM(13)	3.344	0.110	3.059	0.151	-0.029	0.880	0.034	0.856
IDUM(14)	3.355	0.195	1.147	0.584	-0.539**	0.027	-0.333	0.204
+ − o IDUM(15)	5.896***	0.003	5.206***	0.008	0.208	0.259	-0.894***	0.000
IDUM(16)	4.742**	0.018	4.293**	0.035	-0.251	0.178	-0.220	0.275
IDUM(17)	-0.464	0.851	-2.920	0.133	0.272	0.241	-0.077	0.758
IDUM(18)	-2.356	0.516	-5.092	0.104	0.936***	0.007	0.747**	0.044
IDUM(19)	-0.928	0.624	-0.902	0.665	0.344	0.054	0.004	0.985
+• IDUM(20)	26.051***	0.000	25.414***	0.000	2.227***	0.000	1.474***	0.000
− + o IDUM(21)	-13.166***	0.002	-12.632***	0.003	0.980**	0.011	0.510	0.207
IDUM(22)	4.421	0.330	0.262	0.940	-0.011	0.978	-0.858*	0.064
+• IDUM(23)	14.973***	0.000	15.361***	0.000	1.820***	0.000	1.751***	0.000
IDUM(24)	-1.168	0.676	-1.810	0.516	0.894***	0.001	0.664**	0.019
− + o IDUM(25)	-5.314	0.459	-11.874**	0.040	1.461**	0.031	2.791***	0.000
IDUM(26)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
−• IDUM(27)	-15.708***	0.000	-14.339***	0.000	-0.749**	0.011	-1.243***	0.000
−• IDUM(28)	-11.312***	0.000	-9.558***	0.000	-0.812***	0.000	-0.902***	0.000
+ − o IDUM(29)	11.266***	0.001	9.839***	0.004	-1.123***	0.001	-0.402	0.245
IDUM(30)	-0.004	0.998	-0.544	0.802	0.396*	0.054	-0.142	0.521

(Continued on next page)

[a] This is the method of estimation (i) as described in "Models with both individual and time effects/Fixed-effects model" in Appendix A.5.

[b] ***, *** and * denote significance at 1, 5 and 10% levels, respectively.

[c] +− indicates mixed signs of dummies across models, while + or − unique sign of dummies across all models. • and o indicate, respectively, statistically significant dummies for all four models and only for three models. Underlined are those dummies with unique sign.

Table 10 (Continued)

Dependent Variable	Salesratio				LsubSales		LsubWrkr	
Model Number	[1]		[2]		[3]		[4]	
Explanatory Variable	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
−o TDUM(1)	-1.722**	0.019	-1.675**	0.026	-0.120*	0.079	0.052	0.481
TDUM(2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TDUM(3)	-0.655	0.388	-0.845	0.267	0.030	0.673	0.105	0.165
TDUM(4)	0.548	0.475	0.274	0.722	0.101	0.160	0.145*	0.063
+• TDUM(5)	2.463***	0.002	2.072***	0.007	0.267***	0.000	0.212***	0.007
Usable Observations	131		131		131		136	
Total Observations	150		150		150		150	
Skipped/Missing	19		19		19		14	
Degrees of Freedom	92		92		92		97	
$\bar{R}^2$	0.961		0.960		0.970		0.950	
Standard Error of Estimate	2.579		2.607		0.241		0.261	
Regression F(38,m)[a]	84.899	0.000	83.013	0.000	112.384	0.000	68.174	0.000
Durbin-Watson Statistic	2.290		2.287		1.745		1.555	
Residuals:								
Variance	4.707		4.811		0.041		0.049	
Skewness	-0.207	0.339	-0.446	0.039	0.074	0.733	-0.056	0.793
Kurtosis(Exc)	2.182	0.000	3.054	0.000	8.082	0.000	7.165	0.000
Jarque-Bera	26.922	0.000	55.256	0.000	356.625	0.000	290.956	0.000
Studentized Range	6.739		7.393		9.123		8.831	
Inference: Test the three nulls.								
Test the null: absence of both individual and time effects (model with no such effects).[b]								
F(33,111)[c]	50.532	0.000	49.265	0.000	28.649	0.000	18.988	0.000
Test the null: absence of time effects (model with individual effects only).[d]								
F(4,111)[c]	9.575	0.000	7.268	0.000	9.201	0.000	2.517	0.045
Test the null: absence of individual effects (model with time effects only).[f]								
F(29,111)[g]	55.959	0.000	54.679	0.000	31.595	0.000	21.443	0.000

[a] See Table 8.
[b] Tested is the null that coeffs for both IDUM and TDUM are all equal to zero.
[c] An F computed by (14) in Appendix A.5.
[d] Tested is the null that coeffs for TDUM are all equal to zero.
[c] An F computed by (15) in Appendix A.5.
[f] Tested is the null that coeffs for IDUM are all equal to zero.
[g] An F computed by (16) in Appendix A.5.

Notice further from the Inference panel of Table 10 that, for every FDI proxy, all three null hypotheses are strongly (most weakly at the significance level of 5%) rejected, implying, in particular, that both effects are present.[21] We will study implications of Table 10 about the FDI determinants in the next section.

Interestingly, the remark made on R^2 and the residuals normality for Table 8 applies here, too: the residuals plots and their histograms for the estimated models in Table 10 are drawn in Figs. 5, 7, 9 and 11, giving evidence supportive of the residuals normality, with regard to skewness in particular, whereas the residuals statistics in Table 10 do not seem so supportive, due to kurtosis. It is not clear why, again in the model with both effects here (just as in the individual-effects only model), kurtosis has behaved in a non-normal manner (while skewness has improved);

[21] Recall, however, from Table 9 that, in the fixed-effects model with only time effects, no time effects are detected for any FDI proxy. This suggests that both of individual and time effects need be indeed examined before making any conclusive inferences on the presence/non-presence of each effect.

apparently, including dummies (especially, IDUMs) works to worsen kurtosis, while improving skewness. (Recall from Table 7 for neither effects that both LsubSales and LsubWrkr models have kurtosis statistics consistent with the normality null.)

4 The Industry and Time Determinants

We now explore the industry determinants of U.S. outbound FDI in the Asian and Pacific region, by examining the both-effects models in Table 10 and by refering to the empirical issues raised and the hypotheses constructed earlier in Section 1.1. Discussed in detail in the following subsections are figures asterisked in Table 10 that are statistically significant and/or having different signs than those expected under the hypotheses, I_1 and I_2. Individual and time effects on FDI as detected in Table 10 will be explored later in Section 4.2 as effects unexplained by exlanatory variables included.

4.1 Explanatory variables as possible determinants

4.1.1 Hypothesis I_1: Size factor

With the size proxy being LparentWrkr, the data support hypothesis I_1, while with the size proxy being LparentTA, they do not. For the reason as remarked earlier, the estimated results for dependent variables, LsubSales and LsubWrkr, with LparentTA, are not reported; in the two models, however, LparentTA is statistically significant positive at 1% level, though two or three other variables related to hypothesis I_2 turn out insignificant. We could then infer that the data support hypothesis I_1 that industrial/parent-firm growth in size will likely result in U.S. outbound FDI in the Asian and Pacific region.

4.1.2 Hypothesis I_2: Intangible managerial advantages/resources

Intangible managerial advantages/resources related to hypothesis I_2 are all strongly significant, except for RDratio (an index of solid research and development of parent firms) in the LsubWrkr model.

The signs for OwnCapratio (an index measuring parent firms' solvency) and VAratio, (an index measuring parent firms' productivity) are, however, consistently negative, which is opposite to that postulated in the hypothesis.[22] This is puzzling. Why is this so, and how can we interpret the result? One plausible explanation may be that, as their equity capital ratio and/or value added ratio improve, the U.S. industries are contracting their FDI activity in the Asian and Pacific region, and yet possibly, increasing their FDI in other regions and/or their capital investment at home.

In the meantime, the signs for LVAperWrkr (a measure of parents' productivity per one thousand workers) and RDratio are positive and consistent with I_2.[23] It is thus these industry-specific (parent-firm) characteristics that more likely contribute to the U.S. industries expanding their outbound FDI in the Asian and Pacific region.

4.2 Effects on FDI, unexplained by explanatory variables included

We now turn to individual- and time-specific dummies in the models to investigate those individual and/or time effects unexplained by explanatory variables included.[24] Note that, because of their unobservable nature, those effects detected as possible determinants of FDI are more likely related to the internalization theory than the location theory.[25] It will be often difficult to specify the factors behind the effects, for the gains from internalizing two flows, knowledge flow and product flow, and their costs are all quite qualitative in nature.

One of the null hypotheses rejected in the bottom panel of Table 10 is that coefficients on both individual dummies and time dummies are *all* equal to *zero* with "zero" corresponding to the dummies being deleted;[26] assigned "zero" here are the dummies for sector 26 (electrical equipment, appliances, and components) and for time period 2 (FY2000) when the Japanese yen was more expensive than in other fiscal years of the sample period. Sector 26 and time period 2 as such are considered, respectively, as a reference industry and reference fiscal year to be contrasted with the remainder.

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[22]For the sign of OwnCapratio, Kojima (2004, p.66) also presents the same result for the Japanese FDI in the North American markets.

[23]For the sign of LVAperWrkr, Kojima (2004, p.66) also presents the same result for the Japanese FDI in the North American markets.

[24]See Appendix A.2 on omitted variables problem. See also Approach C in Kojima (2004, Appendix B).

[25]See Section 1.1.

[26]See Appendix A.5.

4.2.1 Respective effects: Strong industry- and time-specific effects across four models in Table 10

Strong respective effects (i.e., effects by industry and by time, separately) are observed.

Industry-specific effects The underlined industry dummies in Table 10 have strong industry-specific effects on the FDI activity, across all four proxies for FDI. The corresponding industries are[27]

7 (petroleum and coal products),
11 (soap, cleaning compounds, and toilet preparations),
20 (computers and peripheral equipment),
23 (semiconductors and other electronic components),
27 (motor vehicles, bodies and trailers, and parts), and
28 (other transportation equipment).

The *positive* effects are observed for all but the last two sectors, 27 and 28, whose effects are *negative*: this suggests that the FDI by sectors 7, 11, 20 and 23 tends to be much *geater* than that by the reference sector 26 (electrical equipment, appliances, and components), while the FDI by sectors 27 and 28 will be much *smaller.*[28]

What effects may be plausible here that are unobservable and unexplained by the variables already included? Such possible effects would include those industry characteristics that Yeaple (pp.727-728) explicitly considers in his empirical model but are excluded in the present study: transport cost, plant scale economies, and unit cost of production by sector.[29] All these are variables related to the location-theoretic hypothesis, L: as transport costs rise, firms seek to increase their outbound FDI (while possibly decreasing export activity); FDI will be decreased (e.g., firms will concentrate only on a few locations abroad) as plant scale economies are achieved (possibly at a few locations abroad). As host country's unit cost of production is lowered, more FDI will result. We could thus infer that sectors 7, 11, 20 and 23 are likely to experience *higher* transport cost, *lower* plant scale economies achieved abroad, and/or *lower* unit cost of production abroad, than the reference sector 26, and that the opposite could be true with sectors 27 and 28.

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[27]See Table 1.

[28]See (iv) in Appendix A.5 for interpreting the sign of each dummy this way.

[29]The unit cost here is a function of several variables including an industry's skilled-labor intensity. See Yeaple (p.728).

Time-specific effects Further, the underlined time dummies in Table 10 have strong time-specific effects on the FDI activity, across all four proxies for FDI. Year 1999 (first TDUM) is statistically significant negative and FY2003 (fifth TDUM) positive; this implies that in these fiscal years there occurred a significant decrease and increase, as compared to the reference fiscal year FY2000, (i.e., an upward trend) in the U.S. FDI in the Asian and Pacific region. What triggered the upward trend? One critical time-variant (but industry-invariant) factor is foreign exchange rates. Table 2 shows U.S. dollar *appreciation* against several Asian currencies (other than Chinese Renminbi), especiallly as compared to the rate in FY2000. It could then be that the U.S. FDI in the region is affected by the Asian exchange rate movements, being attracted in the region as a result of the U.S. dollar appreciation.[30] Since time-variant but industry-invariant variables can*not* be included in the panel data econometric models, an additional rigorous analysis must be made to statistically document the possible association between the time effects observed here and exchange rates.

4.2.2 Combined effects in each model in Table 10

Now, the coefficients on IDUM (1) through IDUM (30) and TDUM (1) through TDUM (5) in Table 10 are added up following Table 11 in Appendix A.5, to indicate a magnitude of sector- and time-specific *combined* effects unexplained by variables included.

Salesratio model [1]: Figs. 12-17 and 18-22 The combined effects computed are plotted in Figs. 12-17 for Salesratio model [1], and will be interpreted in a way summarized as "Interpretation of the test results" in Appendix A.3.[31]

First, Fig. 12 charts *cross-sectional* variations of the combined effects for each of five fiscal years: for *every* fiscal year, those industries with statistically significant IDUM in Table 10 are above or below the reference sector 26 (electrical equipment, appliances, and components). To be specific, well *above* the reference sector 26 are sectors 3 (textiles, apparel, and leather products), 4 (wood products), 6 (printing and related

[30]Similar evidence of time effects is presented by Kojima (2004, pp.70-73) on the Japanese outbound FDI in the North Amercian markets: sharp appreciation of yen against U.S. dollar in FY2000, as compared to the reference fiscal year FY1999, appears to lead to more active Japanese FDI in FY2000.

[31]Earlier, the respective effects were interpreted based on (iv) of Appendix A.5.

support activities), 7 (petroleum and coal products), 11 (soap, cleaning compounds, and toilet preparations), 15 (primary metals), 16 (fabricated metal products), 20 (computers and peripheral equipment), 23 (semiconductors and other electronic components) and 29 (furniture and related products), all of which have statistically significant positive dummies; well *below* the reference sector 26 are sectors 10 (pharmaceuticals and medicines), 21 (communications equipment), 27 (motor vehicles, bodies and trailers, and parts), and 28 (other transportation equipment), all of which have statistically significant negative dummies.

Next, Figs. 13-17 charting *time series* variations of the combined effects of each of 30 sectors suggests, first, that sectors 3, 4, 7, 11, 15, 16, 20, 23 and 29 in the figures are located somewhat above sector 26, while sectors 10, 21, 27 and 28 are below sector 26. This coincides with Fig. 12. Second, what applies to *every* sector is that there is present an *upward* trend in the combined effects; this is consistent with the time-specific effects observed earlier. We could infer that in terms of Salesratio the U.S. business entry into the Asian and Pacific region became more active over time during the sample period from 1999 through 2003.

This is evidenced, too, by Figs. 18-22 which draw time series plots of Salesratio and show that upward trend is present in almost all sectors.

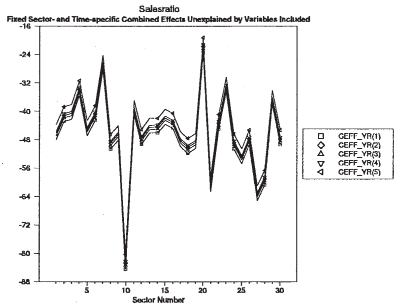

Figure 12 Salesratio, with x1=LparentWrkr: Sectoral Variations in Fixed Sector- and Time-specific Combined Effects Unexplained by Variables Included (Fixed-effects Model With Both Effects [1] in Table 10)

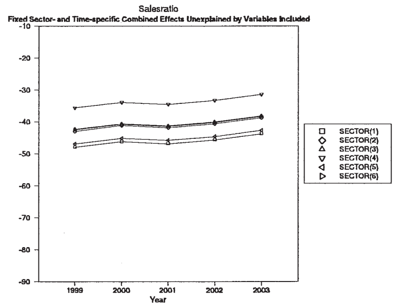

Figure 13 Salesratio, with x1=LparentWrkr: Time Variations in Fixed Sector- and Time-specific Combined Effects Unexplained by Variables Included (Fixed-effects Model With Both Effects [1] in Table 10).

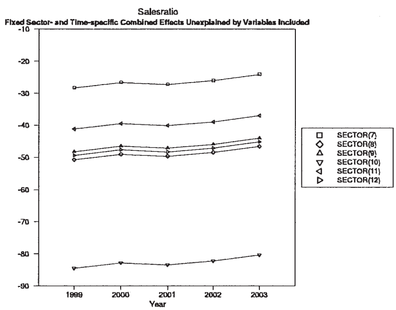

Figure 14 Salesratio, with x1=LparentWrkr: See Fig. 13.

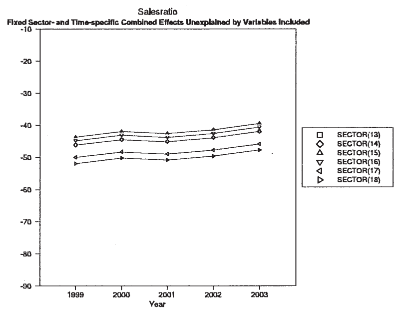

Figure 15 Salesratio, with x1=LparentWrkr: See Fig. 13.

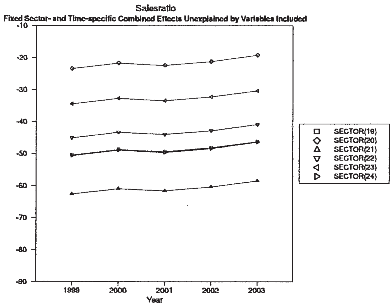

Figure 16 Salesratio, with x1=LparentWrkr: See Fig. 13.

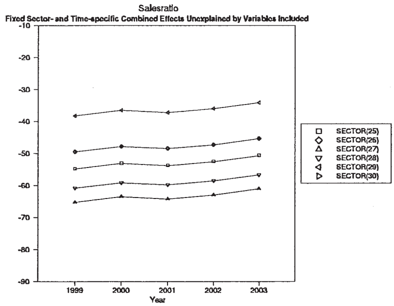

Figure 17 Salesratio, with x1=LparentWrkr: See Fig. 13.

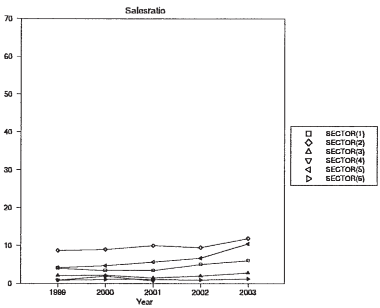

Figure 18 Time Variations of Salesratio (%) by Sector

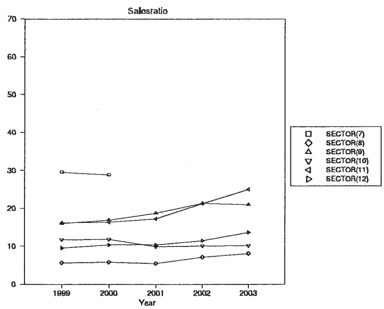

Figure 19 Time Variations of Salesratio (%) by Sector

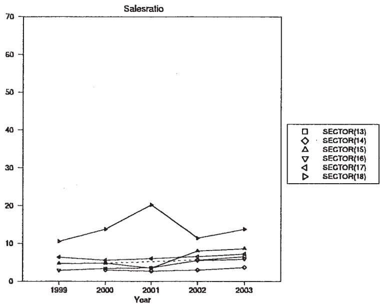

Figure 20 Time Variations of Salesratio (%) by Sector

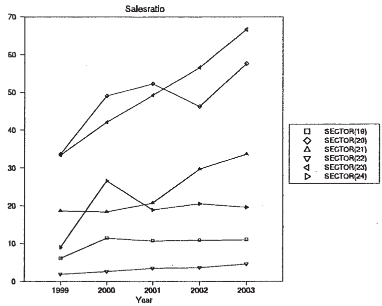

Figure 21 Time Variations of Salesratio (%) by Sector

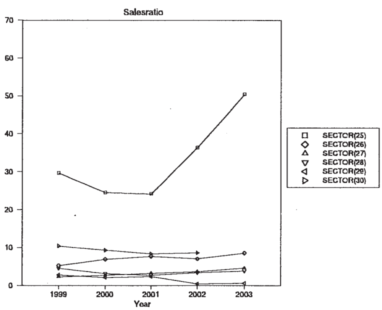

Figure 22 Time Variations of Salesratio (%) by Sector

LsubSales model [3] and Figs. 23-28, 29-33; LsubWrkr model [4] and Figs. 34-39, 40-44 The results are similar to those for Salesratio model. First, Figs. 23 for model [3] and 34 for model [4] chart cross-sectional variations of the combined effects for each of five fiscal years, showing that, for *every* fiscal year, those industries with statistically significant IDUM in Table 10 are above or below the reference sector 26 (electrical equipment, appliances, and components). Second, Figs. 24-28 for model [3] and Figs. 35-39 for model [4] charting time series variations of the combined effects of each of 30 sectors suggests, for *every* sector, that there is present an *upward* trend in the combined effects; this is consistent with the time-specific effects observed earlier. One could infer that in terms of LsubSales and LsubWrkr, too, the U.S. business entry into the Asian and Pacific region became more active over time during the sample period from 1999 through 2003.

The latter (time trend) is in part evidenced by Figs. 29-33 for model [3] and Figs. 40-44 for model [4] which draw time series plots of LsubSales and show that upward trend is detected for about eighteen sectors for model [3] and for about fifteen sectors (a half of the total) for model [4].

Examining the combined effects graphically, by cross section and by time, we now see that the effects are consistent with those strong respective effects as documented earlier.

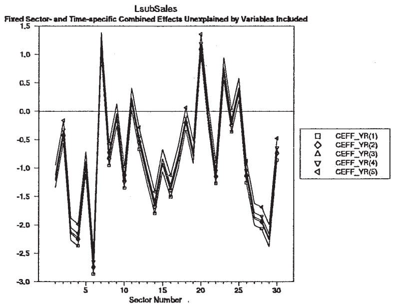

Figure 23 LsubSales, with x1=LparentWrkr: Sectoral Variations in Fixed Sector- and Time-specific Combined Effects Unexplained by Variables Included (Fixed-effects Model With Both Effects [3] in Table 10)

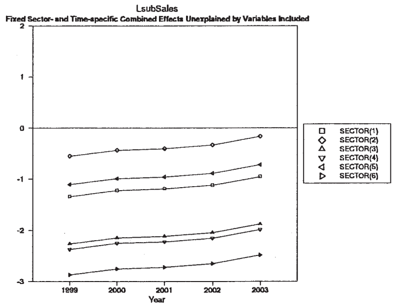

Figure 24 LsubSales, with x1=LparentWrkr: Time Variations in Fixed Sector- and Time-specific Combined Effects Unexplained by Variables Included (Fixed-effects Model With Both Effects [3] in Table 10)

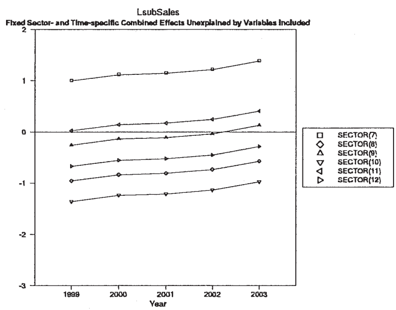

Figure 25 LsubSales, with x1=LparentWrkr: See Fig. 24.

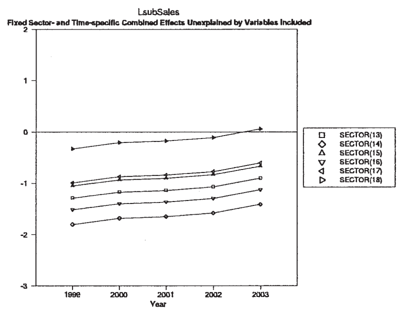

Figure 26 LsubSales, with x1=LparentWrkr: See Fig. 24.

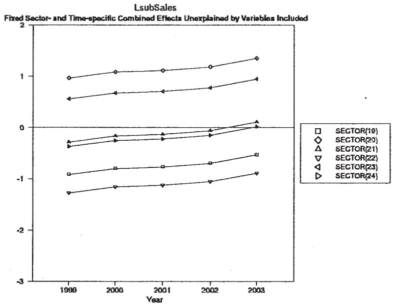

Figure 27 LsubSales, with x1=LparentWrkr: See Fig. 24.

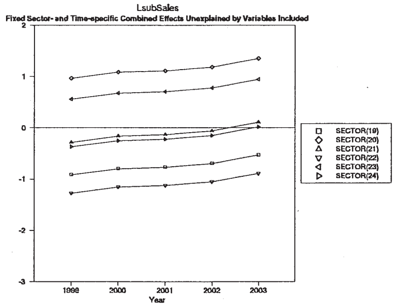

Figure 28 LsubSales, with x1=LparentWrkr: See Fig. 24.

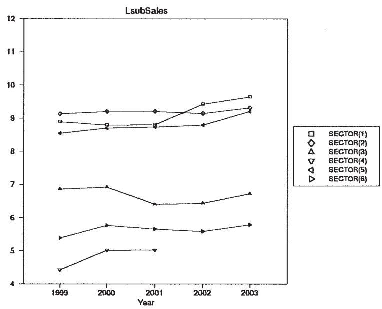

Figure 29 Time Variations of LsubSales by Sector

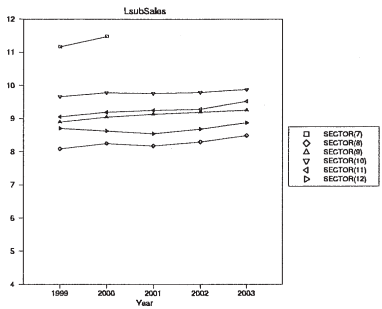

Figure 30 Time Variations of LsubSales by Sector

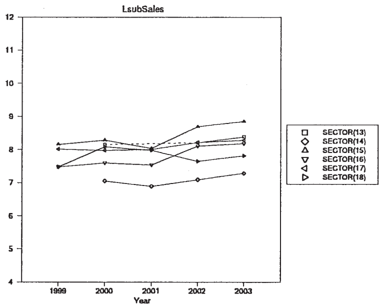

Figure 31 Time Variations of LsubSales by Sector

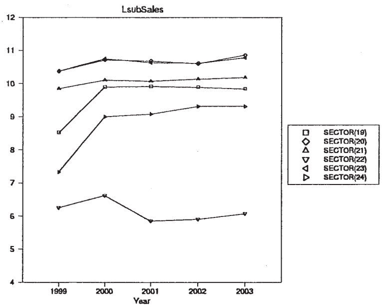

Figure 32 Time Variations of LsubSales by Sector

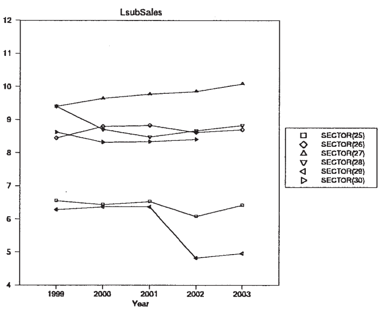

Figure 33 Time Variations of LsubSales by Sector

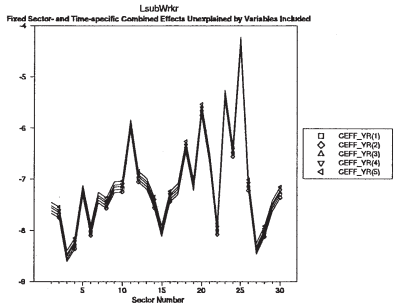

Figure 34 LsubWrkr, with x1=LparentWrkr: Sectoral Variations in Fixed Sector- and Time-specific Combined Effects Unexplained by Variables Included (Fixed-effects Model With Both Effects [4] in Table 10)

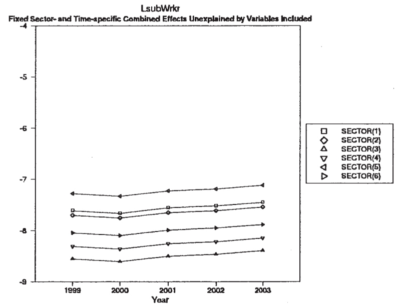

Figure 35 LsubWrkr, with x1=LparentWrkr: Time Variations in Fixed Sector- and Time-specific Combined Effects Unexplained by Variables Included (Fixed-effects Model With Both Effects [4] in Table 10)

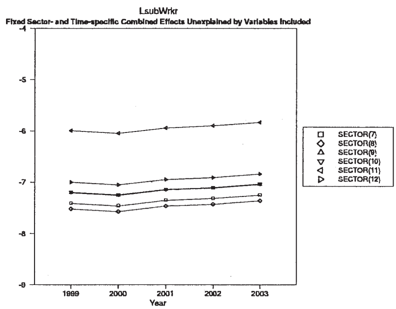

Figure 36 LsubWrkr, with x1=LparentWrkr: See Fig. 35.

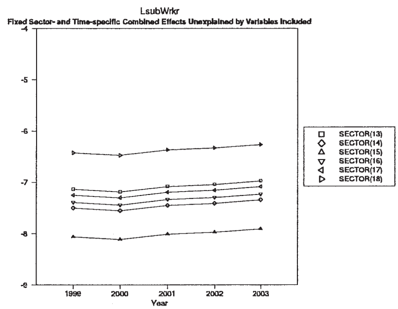

Figure 37 LsubWrkr, with x1=LparentWrkr: See Fig. 35.

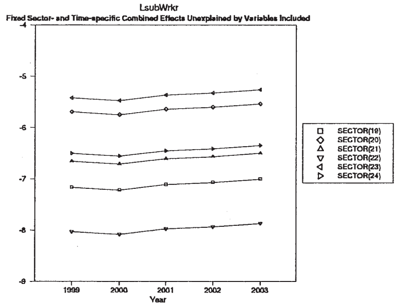

Figure 38 LsubWrkr, with x1=LparentWrkr: See Fig. 35.

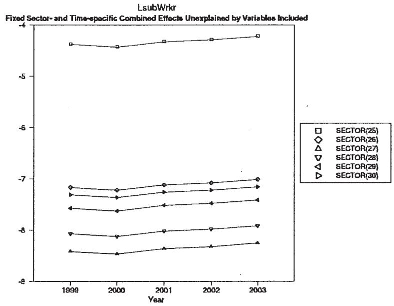

Figure 39 LsubWrkr, with x1=LparentWrkr: See Fig. 35.

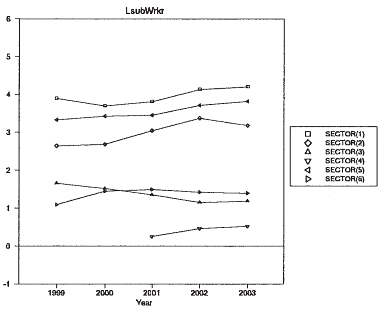

Figure 40 Time Variations of LsubWrkr by Sector

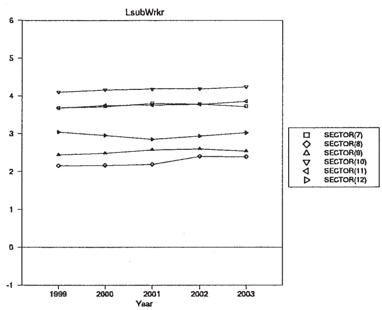

Figure 41 Time Variations of LsubWrkr by Sector

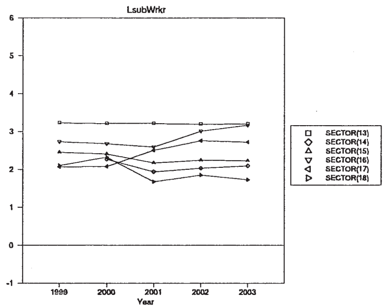

Figure 42 Time Variations of LsubWrkr by Sector

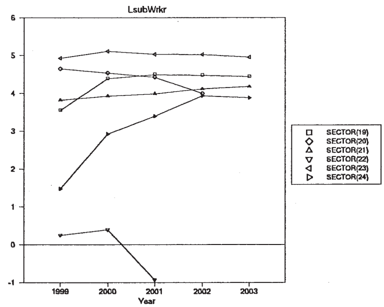

Figure 43 Time Variations of LsubWrkr by Sector

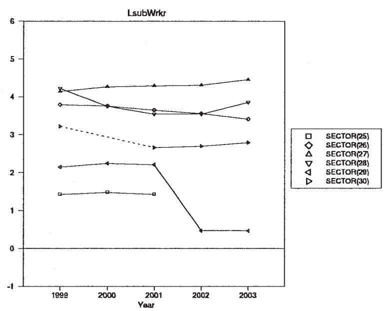

Figure 44 Time Variations of LsubWrkr by Sector

5 Concluding Remarks

In this paper, we have explored industry-level determinants or predictors of the U.S. business entry into the Asian and Pacific region, by panel data fixed-effects modeling. Taken as a whole, our results can be interpreted as favoring both location- and internalization-theoretic hypotheses, L, I_1 and I_2. The industry/parent-firms' size (such as LparentWrkr) and intangible managerial resources/advantages (such as LVAperWrkr and RDratio) are found to further promote the U.S. outbound FDI in the region. The coefficients on another set of intangible managerial resources/advantages (OwnCapratio and VAratio) had the wrong sign, though the result is interpreted as the U.S. parent firms contracting their FDI in the Asian and Pacific region, and yet possibly, increasing their FDI in other regions and/or their capital investment at home.

Our most novel result is that in both-effects models strong industry- and time-specific effects (unexplained by explanatory variables included) are detected and the specific industry names and time trend are identified based on those effects. From this result we infer that (time-invariant) industry characteristics and (industry-invariant) time-varying factors not explicitly embodied in the models appear to affect the magnitude of the U.S. FDI. Those omitted variables would include, for example, transport cost, plant scale economies, unit cost of production by sector, and foreign exchange rates. (All these are variables related to the location-theoretic hypothesis, L.)

Specifically, strong respective effects (i.e., effects by industry and by time, separately) observed are as follows: industry-specific effects on the FDI activity are detected across all four proxies for FDI, in industries 7 (petroleum and coal products), 11 (soap, cleaning compounds, and toilet preparations), 20 (computers and peripheral equipment), 23 (semiconductors and other electronic components), 27 (motor vehicles, bodies and trailers, and parts), and 28 (other transportation equipment). The positive effects are observed for all but the last two sectors, 27 and 28, whose effects are negative: this suggests that the FDI by sectors 7, 11, 20 and 23 tends to be much geater than that by the reference sector 26 (electrical equipment, appliances, and components), whose dummy is being deleted, while the FDI by sectors 27 and 28 will be much smaller. These effects are possibly due to the omitted variables listed above.

Further detected are strong time-specific effects on the FDI activity, across all four proxies for FDI: FY1999 is statistically significant negative and FY2003 positive. This implies that in these fiscal years there occurred a significant decrease and increase, as compared to the reference fiscal year FY2000, (i.e., an upward trend) in the U.S. FDI in the Asian and Pacific region. One critical time-variant (but industry-invariant) factor that most likely triggers the trend here is foreign exchange rates. We infer that the U.S. FDI in the region could be affected by the Asian exchange rate movements and attracted as a result of the U.S. dollar appreciation.

The combined effects are also computed for each of three FDI proxies, by adding up the coefficients on IDUMs and TDUMs, to indicate a magnitude of sector- and time-specific *combined* effects unexplained by variables included. Examining them graphically, by cross section and by time, we find that the combined effects are consistent with those strong respective effects as detected above.

Appendices

A Fundamentals of Panel Data Fixed-effects Modeling

This appendix summarizes panel data methodology focusing on fixed-effects modeling. See Kojima (2004, Appendix A) for a comprehensive panel data econometrics including random-effects modeling as well.

A.1 Model with neither individual nor time effects

Our fundamental model, to be constasted with other alternative models, is a constant-intercept regression model written as below, which may be also called a constrained model in the sense that neither individual nor time variations occur:

$$y_{it} = \alpha + \boldsymbol{x}'_{it}\boldsymbol{\beta} + u_{it}, \quad i = 1, ..., N; t = 1, ..., T \tag{1}$$

where α is the intercept (a scalar), $\boldsymbol{\beta}$ a K column vector of the slope coefficients, $\boldsymbol{x}_{it}$ the it-th observation on K explanatory variables (the K row vector of the explanatory variables), and u_{it} the usual error term. In vector form,

$$\boldsymbol{y} = \alpha \boldsymbol{l}_{NT} + \boldsymbol{X}\boldsymbol{\beta} + \boldsymbol{u} \tag{2}$$

where $\boldsymbol{y}$ is the NT column vector of the dependent variables, $\boldsymbol{l}_{NT}$ is the NT column vector of unity, $\boldsymbol{X}$ the $NT \times K$ matrix of the explanatory variables, and $\boldsymbol{u}$ the NT column vector of the error terms satisfying

$$E(\boldsymbol{u}) = \boldsymbol{0} \text{ and } E(\boldsymbol{u}\boldsymbol{u}') = \sigma_u^2 \boldsymbol{I}_{NT}. \tag{3}$$

See Balestra (1996, p.36).

A.2 Omitted variables problem and model with individual and time effects

Let now the error term u_{it} in (1) consist of two components that vary across individuals and time:

$$u_{it} = \mu_i + \lambda_t + \nu_{it}, \tag{4}$$

so that

$$y_{it} = \alpha + \boldsymbol{x}_{it}'\boldsymbol{\beta} + \mu_i + \lambda_t + \nu_{it}, \quad i = 1, ..., N; t = 1, ..., T \tag{5}$$

where μ_i, λ_t and ν_{it} are the error components of the error u_{it} (ν_{it} is now the usual error term).[32] The individual effects, μ_i, and the time effects, λ_t, so defined are those individual- and time-specific effects that are not included in the regression: Not all the μ_i or λ_t variables are available for inclusion in the regression equation, and each of those effects reflects the omitted, unobservable individual- and time-specific variables. The individual effects, μ_i, reflect individual-variant but time-*in*variant omitted variables, while the time effects, λ_t, time-variant but individual-*in*variant omitted variables. (See Approach C in Kojima 2004, Appendix B.)

The magnitude of the effects that are found significantly different from some individual- or time-invariant constant implies the need for searching specific reasons behind the effects.

Depending on whether the individual and time effects are fixed or random, model (5) will be correspondingly fixed- or random-effects model. Several approaches to the problem of how to choose between "fixed" and "random" are summarized in Kojima (2004, Appendix B).

[32]The vector form will be written out in the later section.

A.3 Models with only individual effects (One-way error component model)

Suppose now $\alpha = 0$ in (5), the reason for which will be given later, and that the individual effects, μ_i, are not random but rather fixed:

$$y_{it} = \boldsymbol{x}'_{it}\boldsymbol{\beta} + \mu_i + \nu_{it}, \quad i = 1, ..., N; t = 1, ..., T \tag{6}$$

This is an alternative, unconstrained model that will be contrasted with the null, constrained model (1). It is also called the individual dummy variables model, and a *full* set of N individual dummies is included in the equation. In vector form,

$$\boldsymbol{y} = \boldsymbol{X\beta} + \boldsymbol{D}_N\boldsymbol{\mu} + \boldsymbol{\nu} \tag{7}$$

where $\boldsymbol{D}_N$ is the $NT \times N$ matrix of dummies containing a set of N individual dummies (with $\otimes$ denoting a Kronecker product, $\boldsymbol{D}_N = \boldsymbol{I}_N \otimes \boldsymbol{l}_T$), $\boldsymbol{\mu}$ the N column vector of the individual effects, and $\boldsymbol{\nu}$ the NT column vector of the error terms.

The properties that $\boldsymbol{D}_N$ has and a set of assumptions for model (7) are given by Balestra (1996, pp.35-36). One of those assumptions is that the $NT \times (N + K - 1)$ matrix $\boldsymbol{D}_N\boldsymbol{X}$ has full column rank, implying that "the $T \times K$ matrices $\boldsymbol{X}_i$, whose t-th row is $\boldsymbol{x}'_{it}$, must *not* contain the constant term (an obvious restriction) nor a column proportional to it (which precludes any variable that is time-invariant for a given individual but varying from individual to individaul)." This is in fact the reason for assuming $\alpha = 0$. For a more intuitive reason, see Doan (*UG*, p.522).

Estimating the model There are two equivalent methods of estimation here: Using the RATS (= Regression Analysis of Time Series software) terminology, (i) "Panel Regression - Estimation by Fixed Effects" and (ii) "Linear Regression - Estimation by Least Squares." The latter estimates individual-varying intercepts in model (7) by doing fixed effects as least squares with individual dummies, whereas the former does not.

Testing for fixed effects The null hypothesis here is the absence of individual effects/variations, i.e., that the coefficients on dummies are *all* equal (to some individual-invariant constant). The null, constrained model is as given by Eq.(1) and the alternative, unconstrained model is Eq.(6).

The test statistic here is distributed under the null as an F-variable with $N-1$ and $NT-N-K$ degrees of freedom:

$$F_{UC1} = \frac{(RSS_C - RSS_{UC1})/(N-1)}{RSS_{UC1}/(NT-N-K)} \tag{8}$$

where RSS_C and RSS_{UC1} are, respectively, the residual sums of squares for the constrained model (1) and the unconstrained model (6). See Balestra (1996, pp.37-38) and Baltagi (2001, p.14).

Interpretation of the test results If the null hypothesis is rejected, then one would observe "spikes" in coefficients on dummies of one or more individuals, while all other individuals would be seen to have some individual-invariant, common constant coefficient on their dummies. The magnitude of those spikes may be interpreted as follows: The corresponding individuals would have significantly *larger or smaller* individual effects on the dependent variable than those individuals with individual-invariant constant would have, depending on whether the spikes are *above or below* the individual-invariant constant.

For the model with only individual, fixed effects (10), where the constant $\alpha = 0$ and a *full* set of N individual dummies is included, remember that the signs of the dummies' coefficients are *irrelevant*: Their signs can*not* be interpreted as positive or negative magnitude of the spikes.[33] (See Section 4.2 for the empirical application of the interpretation here.)

A.4 Models with only time effects

Again let $\alpha = 0$ in model (5), the reason for which is as given earlier, and suppose that the time effects, λ_t, are fixed:

$$y_{it} = \boldsymbol{x}'_{it}\boldsymbol{\beta} + \lambda_t + \nu_{it}, \quad i = 1, ..., N; t = 1, ..., T. \tag{9}$$

This is an alternative, unconstrained model that will be contrasted with the null, constrained model (1). It is also called the time dummy variables model, and a *full* set of T time dummies is included in the equation. In vector form,

$$\boldsymbol{y} = \boldsymbol{X\beta} + \boldsymbol{D}_T\boldsymbol{\lambda} + \boldsymbol{\nu} \tag{10}$$

[33] The signs become indeed relevant for models with both individual and time, fixed effects where the constant α is included but only $N-1$ individual dummies and $T-1$ time dummies are included. See Section A.5.

where $\boldsymbol{D}_T$ is the $NT \times T$ matrix of dummies containing a set of T time dummies ($\boldsymbol{D}_T = \boldsymbol{l}_N \otimes \boldsymbol{I}_T$), and $\boldsymbol{\lambda}$ the T column vector of the time effects.

Estimating the model As for the fixed-effects mdel, there are two equivalent methods of estimation: (i) "Panel Regression - Estimation by Fixed Effects" and (ii) "Linear Regression - Estimation by Least Squares." The latter estimates time-varying intercepts by doing fixed effects as least squares with time dummies, which is model (10).

Testing for fixed effects The null hypothesis here is the absence of time effects/variations, i.e., that the coefficients on dummies are *all* equal (to some time-invariant constant). The null, constrained model is as given by Eq.(1) and the alternative, unconstrained model is Eq.(9).

The test statistic here is distributed under the null as an F-variable with $T-1$ and $NT-T-K$ degrees of freedom:

$$F_{UC2} = \frac{(RSS_C - RSS_{UC2})/(T-1)}{RSS_{UC2}/(NT-T-K)} \tag{11}$$

where RSS_{UC2} are the residual sums of squares for the unconstrained model (9). See Balestra (1996, p.38).

Interpretation of the test results The same interpretation as given to individual, fixed effects model in Section A.3 holds here, with 'individual' being replaced by 'time (period).' Here, the signs of the time dummies' coefficients are irrelevant.

A.5 Models with both individual and time effects (Two-way error component model)

The model with both individual and time effects is as given by Eq.(5), and the overall constant term α remains in the model. This is an alternative, unconstrained model that will be contrasted with the null, constrained model (1). It is again a dummy variables model, and note here that a set of $N-1$ individual dummies and $T-1$ time dummies is included in the equation. The notation becomes therefore slightly different in that the asterisk is being attached to the dummies and the corresponding coefficients. In vector form,

$$\boldsymbol{y} = \alpha \boldsymbol{l}_{NT} + \boldsymbol{X}\boldsymbol{\beta} + \boldsymbol{D}_{N*}\boldsymbol{\mu}_* + \boldsymbol{D}_{T*}\boldsymbol{\lambda}_* + \boldsymbol{\nu} \tag{12}$$

Letting $\boldsymbol{D} = [\boldsymbol{l}_{NT}\boldsymbol{D}_{N*}\boldsymbol{D}_{T*}]$ and denoting $\boldsymbol{\gamma}' = \alpha\boldsymbol{\mu}'_*\boldsymbol{\lambda}'_*$, Eq.(12) may be rewritten in a compact way:

$$\boldsymbol{y} = \boldsymbol{X\beta} + \boldsymbol{D\gamma} + \boldsymbol{\nu} \tag{13}$$

Notice this is formally analogous to the individual effect model (7). The value of the intercept for *it*-th observation can be easily computed from Table 11 where it is assumed the Jth individual and the Sth time dummies are deleted and their coefficients μ_J and λ_S are assigned zero.

Table 11 Intercept for for *it*th Observation

	$i = J^a$	$i \neq J$
$t = S$	α	$\alpha + \mu_{*i}$
$t \neq S$	$\alpha + \lambda_{*t}$	$\alpha + \mu_{*i} + \lambda_{*t}$

[a]It is assumed the Jth individual and the Sth time dummies are deleted and their coefficients μ_J and λ_S are assigned zero.

The matrix $\boldsymbol{DX}$ must be of full column rank, meaning that $\boldsymbol{X}$ must not contain individual-invariant variables, nor admit time-invariant variables.[34]

Estimating the model As usual, there are two equivalent methods of estimation: (i) "Panel Regression - Estimation by Fixed Effects" and (ii) "Linear Regression - Estimation by Least Squares." The latter estimates both individual- and time-varying intercepts by doing fixed effects as least squares with individual and time dummies, which is model (12).

Testing for fixed effects The alternative hypothesis common to the three tests below is the unconstrained model (12), as will be clear from the test statistics (14)-(16) below.

a. Test the null that both individual and time effects are absent (model with no such effects) The null hypothesis is equivalent to the null that

[34]See Balestra (1996, pp.39-40).

coefficients on both individual dummies and time dummies are *all* equal to zero with "zero" corresponding to the slope coefficients on the dummies deleted. Note that the null is the initial, constrained model with neither effects, (2).

The test statistic here is distributed under the null as an F-variable with $N+T-2$ and $NT-N-T-K+1$ degrees of freedom:

$$F_{UC3a} = \frac{(RSS_C - RSS_{UC3})/(N+T-2)}{RSS_{UC3}/(NT-N-T-K+1)} \tag{14}$$

where RSS_{UC3} is the residual sum of squares for the alternative, unconstrained model (12) or, equivalently, (13). See Balestra (1996, p.42).

b. Test the null that time effects are absent (model with only individual effects). The null here is equivalent to the null that coefficients on time dummies are *all* equal to zero with "zero" corresponding to the slope coefficient on the dummy deleted. Note that the null here is the earlier model with only individual effects, (7), which is constrained in the sense of absence of time effects.

The test statistic here is distributed under the null as an F-variable with $T-1$ and $NT-N-T-K+1$ degrees of freedom:

$$F_{UC3b} = \frac{(RSS_{UC1} - RSS_{UC3})/(T-1)}{RSS_{UC3}/(NT-N-T-K+1)}. \tag{15}$$

c. Test the null that individual effects are absent (model with time effects only). The null is equivalent to the null that coefficients on individual dummies are *all* equal to zero with "zero" corresponding to the slope coefficient on the dummy deleted. Note that the null here is the earlier model with only time effects, (10), which is constrained in the sense of absence of individual effects.

The test statistic here is distributed under the null as an F-variable with $N-1$ and $NT-N-T-K+1$ degrees of freedom:

$$F_{UC3c} = \frac{(RSS_{UC2} - RSS_{UC3})/(N-1)}{RSS_{UC3}/(NT-N-T-K+1)} \tag{16}$$

How to interpret the test results (i) Rejecting the null in test a, which is more likely than failing to reject it, leads to inferring that at least one of the effects is present.

(ii) If, moreover, the nulls are rejected in both tests b and c as well, then we will infer that both effects are present.

(iii) If, however, only one of the nulls is rejected in tests b and c (for examle, the null in test c is rejected, while that in test b is not), then only that particular effect may be present (for example, the individual effect is present but the time effect is not).

(iv) As noted in "Interpretation of the test results" in Section A.3, the signs of individual and time dummies in the model with both effects (12) here become important, for the constant α is included but only $N-1$ individual dummies and $T-1$ time dummies are included in the model. If a null hypothesis is rejected in one or more of tests a through c, then one would observe "spikes" in coefficients on dummies of one or more individuals and/or time periods, while all other individuals and/or time periods would be seen to have 'zero'-valued coefficient on their dummies.[35] The magnitude of those spikes may be interpreted here as follows: The corresponding individuals and/or time periods would have significantly *positive larger or negative larger* effects on the dependent variable than that individual and/or time period whose dummy is being deleted (i.e., Jth individual and/or Sth time dummy in Table 11) would have, depending on whether the dummies are *positive or negative in sign.* (See Section 4.2.2 for the application of the interpretation here.)

B Panel Data

The panel data used in the present analysis are laid out in Table 12. Only part of the data set is used; how each of the data is actually used in the panel data modeling is described in Table 3.

[35]Recall that in the present model it is assumed the Jth individual and the Sth time dummies are deleted and their coefficients μ_J and λ_S are assigned zero.

Table 12 Panel Data: U.S. Direct Investment Abroad in Asia and Pacific, and U.S. Parents[a]

INO	YEAR	TA_AP	TA_J	CE_AP	CE_J	NEMP_AP	NEMP_J	SALS_AP	SALS_J	TA_P	TL_P	OE_P	CE_P	S_P	NI_P	VA_P	RD_P	COMPEMP_P	NEMP_P
1	1999	8487	303	318	4	49.6	1.1	7373	548	146108	98055	48054	6182	178353	12136	48894	934	25691	629.3
1	2000	7672	329	235	6	40.7	1.1	6663	627	147600	100191	47408	6113	192089	9396	47214	890	25634	639.5
1	2001	7661	287	225	4	45.5	1	6668	610	174030	126439	47591	5873	192211	8592	46934	914	25449	636.5
1	2002	12652	1461	288	4	62.9	2.1	12452	2435	246560	168483	78077	6786	242949	12469	58142	1370	32062	780.7
1	2003	15216	1615	381	6	67.4	2.2	15481	2500	265423	173242	92182	7761	254474	17214	60333	1376	35390	760
2	1999	6525	2399	427	317	14.2	2.5	9327	6868	143451	95648	47803	4702	106055	14368	47316	501	14566	255.1
2	2000	5836	-9998	121	-9998	14.8	2.1	10026	-9998	158093	112517	45576	4030	110757	14874	48239	467	16582	257.4
2	2001	7060	-9998	-9998	-9998	21.3	0.9	9957	-9998	148495	104564	43931	4321	99094	14679	42770	469	14848	228.8
2	2002	8737	1743	361	-9998	29.4	2.3	9390	-9998	156868	112845	44023	4100	97874	18011	45330	-9998	14270	248.4
2	2003	10225	-9998	254	-9998	24.3	2.3	11152	-9998	167840	115588	52252	3970	93431	17584	41430	450	15254	243.3
3	1999	1310	418	50	-9998	5.3	0.7	963	401	40383	28391	11992	2271	44564	643	17887	275	13050	371.3
3	2000	1238	431	49	-9998	4.6	0.7	1022	470	40205	29028	11176	1469	46419	470	16928	248	11603	346.5
3	2001	690	191	8	1	3.9	0.3	606	-9998	35978	28077	7901	1160	39311	-18	13513	125	9644	291.7
3	2002	705	219	9	2	3.2	0.3	629	-9998	27472	21929	5544	844	30528	-357	10607	-9998	7841	226.4
3	2003	869	244	11	1	3.3	0.3	839	-9998	26313	20116	6197	848	29603	396	10176	85	7527	209.1
4	1999	87	-9998	1	-9999	-9997	0.1	84	-9998	7389	4020	3369	362	8824	531	3440	31	2084	45.3
4	2000	158	21	-9998	-9999	-9997	0.1	152	37	6464	3263	3201	335	7562	193	2097	-9998	1417	38.2
4	2001	347	27	3	-9999	1.3	0.1	153	52	22657	12941	9716	878	20491	322	6429	-9998	3615	70.7
4	2002	375	29	3	-9999	1.6	0.1	-9998	47	33194	23400	9793	837	23493	672	7172	78	4139	78.7
4	2003	458	34	2	-9999	1.7	0.1	-9998	55	34069	23116	10953	761	24817	539	7943	84	4895	79.3
5	1999	10368	271	314	11	28.2	0.8	5167	403	154456	95764	58692	6473	120251	7602	46877	1478	24996	430.9
5	2000	11016	251	238	4	31.2	0.7	6055	437	168632	109873	58759	6652	126066	6596	45793	1498	25327	436.2
5	2001	10594	231	254	8	32	0.7	6282	384	145748	95558	50190	5787	108865	2718	38304	1358	22716	367
5	2002	12712	286	276	3	41.5	0.7	6616	368	133488	91617	41871	3924	97186	2137	33575	1376	21323	332
5	2003	16793	-9998	460	35	46.1	3.2	9995	-9998	140063	91079	48985	3643	95209	5501	34983	1327	21981	324
6	1999	267	-9998	4	0	3	-9999	220	-9998	18636	12178	6457	1162	23317	1460	10964	129	7219	150.8
6	2000	354	38	13	-9999	4.3	0.1	321	38	24997	19012	5985	1214	27729	1090	11653	148	8265	217.7
6	2001	284	34	8	-9999	4.5	0.1	288	38	23221	12110	11110	1167	25761	590	10482	-9998	7524	202.6
6	2002	246	36	16	-9999	4.2	0.1	269	37	23189	15365	7824	983	25458	762	12108	157	8666	191.7
6	2003	274	41	21	-9999	4.1	0.1	329	42	24564	16715	7848	1041	25899	1300	12984	174	8849	188.1
7	1999	74577	9544	3232	85	40	3.9	71108	20706	357979	204087	153892	20277	239963	17935	82817	990	20671	281.9
7	2000	83642	-9998	2834	-9998	41.7	-9997	96792	-9998	362398	206397	156001	18989	334700	36957	111858	977	16996	225
7	2001	109980	-9998	3689	-9998	45	-9997	-9998	-9998	367127	201180	165947	20222	288113	26725	91377	1002	17210	234.6
7	2002	140779	-9998	6404	-9998	44.4	-9997	-9998	-9998	384230	208745	175485	18722	327770	14056	74343	1153	20763	247.6
7	2003	159502	-9998	5552	-9998	41.7	-9997	-9998	-9998	417976	210415	207561	17181	411588	39356	94668	1266	21347	218.2
8	1999	3616	900	208	12	8.7	1.2	3284	745	95321	64866	30455	4586	56974	2492	18954	1627	10423	145.9
8	2000	3593	997	136	20	8.8	1.6	3855	1090	100560	69136	31424	4175	64819	1632	18731	1569	10657	152.1
8	2001	3962	958	250	66	9	1.5	3578	937	103033	69169	33864	3888	64750	211	18802	1742	11514	153.2
8	2002	7489	1086	188	24	11.1	1.5	4032	802	93156	62412	30744	2735	55710	221	15079	1456	10201	126.6
8	2003	8572	1239	212	28	11	1.5	4875	942	92204	62472	29732	3064	59573	774	16149	1523	10306	123
9	1999	7657	2741	248	11	11.6	2.6	7357	1898	81300	54468	26832	3065	45681	9519	19121	2784	10625	126.8
9	2000	7913	2847	123	43	12.1	2.5	8557	2099	83778	54927	28851	1998	50250	3681	20177	2963	10534	132.8
9	2001	9207	3256	202	-9998	13.3	3	9345	2348	91922	62263	29659	2049	49648	3399	18019	2972	9646	128.5
9	2002	9849	3401	159	46	13.6	3	9948	2278	86622	66034	20588	2931	46429	-1831	15295	2530	9502	118.5
9	2003	9796	3125	105	33	12.8	2.6	10504	2137	85769	64180	21589	2538	49872	1188	16473	2542	9251	117.7

(Continued on next page)

[a] All are in millions of U.S. dollars, except for employment in thousands employees. The data sources are detailed in the text. The data (estimates) are on a fiscal year (FY) basis; an affiliate' s fiscal year is defined as the financial reporting year that ended in that calendar year. Unless otherwise specified, all balances are as of the close of, say, FY 1999.

In our panel dataset analyzed, those data with "(*)", "(D)" and other letters attached (to employment), as defined in the original tables downloaded, are treated as missing values: "(*)" = -9999, "(D)" = -9998, and other letters = -9997 in the table. Here "(*)", "(D)" and other letters are defined in the original tables as follows: an asterisk "(*)" indicates a value between -$500,000 and +$500,000, or fewer than 50 employees, as appropriate (for U.S. parent data, * indicates Less than $500,000); a "(D)" indicates that the data in the cell have been suppressed to avoid disclosure of data of individual companies; and, for employment data, a letter representing a size range is entered in place of a "(D)" (for U.S. parent data, size ranges are given in employment cells that are suppressed. The size ranges are: A–1 to 499; F–500 to 999; G–1,000 to 2,499; H–2,500 to 4,999; I–5,000 to 9,999; J–10,000 to 24,999; K–25,000 to 49,999; L–50,000 to 99,999; M–100,000 or more).

Ignoring those data variables (e.g., CE_AP and CE_J) not actually used in the estimation, the panel data as complied here are balanced in the sense that every individual/sector has data for exactly the same set of time periods, though with some missing values being included (see Doan, *RM*, pp.307-308). Those variables that will be actually used in the estimation are listed in Table 3.

Table 12 (Continued)

INO	YEAR	TA_AP	TA_J	CE_AP	CE_J	NEMP_AP	NEMP_J	SALS_AP	SALS_J	TA_P	TL_P	OE_P	CE_P	S_P	NI_P	VA_P	RD_P	COMPEMP_P	NEMP_P
10	1999	14693	7230	592	228	61.1	16.8	15796	7693	230266	128125	102142	7733	133080	24753	56060	18382	29313	345.2
10	2000	16379	8028	698	171	64.9	18.1	17874	8789	253252	139754	113498	9097	150170	23537	63245	20591	35335	363.6
10	2001	16663	7377	1127	436	66.1	16.6	17519	7780	284613	158853	125759	10660	175031	32834	66290	23169	35868	387.8
10	2002	18382	8783	737	317	66.7	17.7	17975	8051	315349	164463	150886	9689	176031	37047	74840	24279	37452	378.2
10	2003	23077	11729	788	357	69.9	19.7	19587	8542	335650	177284	158366	9489	190420	27986	68693	25582	38885	384.1
11	1999	7751	2390	363	77	40.1	9.9	8630	2620	59845	37317	22529	2764	52968	5459	18099	1957	8720	145.1
11	2000	8353	2577	652	162	42.8	7.9	9859	3249	88184	58389	29796	2861	59932	5421	19447	2249	10217	169.6
11	2001	11550	3937	728	-9998	43.5	7.3	10548	2973	90504	58627	31877	2789	60925	4939	18676	2153	10291	156
11	2002	11575	4315	321	86	43.9	8.3	10802	3317	67086	43647	23439	1285	50618	7303	19855	1768	8922	122.5
11	2003	12965	3961	351	84	47.8	7.8	13701	3566	72890	40809	32081	1706	54618	7178	19005	2689	8836	115
12	1999	6537	1816	606	33	21.3	3.3	6052	1794	89447	58216	31231	4281	62862	2648	21743	3449	12648	221.1
12	2000	5721	1529	283	24	19.4	3	5639	1688	78133	49200	28933	2799	54177	3168	19726	1841	11409	199.8
12	2001	4814	1194	155	39	17.5	2.4	5175	1410	72601	48134	24468	2036	49668	984	18206	1892	10386	181.8
12	2002	5365	1205	119	18	19.1	2.3	5981	1357	75334	48579	26755	1797	51567	-1102	18341	2239	11559	180.2
12	2003	6093	1324	138	19	20.7	1.9	7176	1675	78186	52239	25948	2056	52217	1990	17444	2312	12026	175.4
13	1999	3169	470	98	12	25.5	1.8	-9998	729	65822	42619	23203	3251	59144	2811	23334	1031	14834	307.5
13	2000	3189	552	122	9	25	1.8	3477	710	79149	51290	27859	3304	72644	1877	25088	955	16751	348.6
13	2001	3418	432	101	12	25	1.8	-9998	629	71942	47474	24468	2574	65519	-289	20806	929	16079	318.8
13	2002	4151	440	82	10	24.6	1.7	3689	552	70387	49964	20423	2371	65537	-2028	21523	937	16039	305.3
13	2003	5146	477	104	12	24.8	1.6	4416	607	72670	49174	23496	2382	66521	1209	22391	1047	15857	290.3
14	1999	2242	-9998	-9998	1	-9997	0.3	-9998	108	54611	36816	17795	2737	34150	2574	13905	371	7072	151.6
14	2000	2019	118	-9998	1	9.8	0.3	1164	115	59519	42272	17247	2939	38009	1067	13575	406	8215	171.3
14	2001	1855	109	-9998	1	7	0.3	991	103	51052	35615	15438	2649	35974	1353	12050	339	7457	155.9
14	2002	2164	149	-9998	2	7.7	0.3	1213	130	56880	45124	11756	2342	39547	-1350	10031	373	8484	156.5
14	2003	2634	254	-9998	-9998	8.2	0.6	1472	193	57766	43970	13797	2106	39184	1153	14217	437	8626	154.2
15	1999	5906	501	570	-9998	11.7	0.7	3530	739	84206	56829	27376	4335	73468	2045	23271	760	14603	287.2
15	2000	5814	490	473	-9998	11.2	1	4003	879	86895	57044	29852	4373	81237	1487	22036	818	15194	296.1
15	2001	3854	406	-9998	-9998	8.9	1	3120	637	95281	65551	29730	4568	86474	-630	23403	484	18412	312.1
15	2002	4432	413	122	-9998	9.5	1	6003	-9998	83276	59079	24197	3550	74137	-2788	18153	498	15407	292.9
15	2003	5682	297	115	1	9.4	0.7	7023	-9998	87274	58888	28386	3307	80295	540	22041	503	17557	299.5
16	1999	2363	141	65	-9998	15.5	0.6	1791	212	64425	41973	22452	2595	60353	2932	23012	560	15879	329.1
16	2000	2334	182	48	-9998	14.7	0.7	2017	236	64561	43426	21135	2231	57266	1913	21889	600	14788	292.8
16	2001	2067	149	-9998	1	13.5	0.6	1898	212	51896	33464	18432	1698	51463	1523	20120	554	13107	265.6
16	2002	3299	302	75	-9998	20.4	0.8	3327	-9998	68246	46278	21968	1965	59506	1080	23502	841	15058	287.4
16	2003	3889	356	149	2	23.9	0.8	3628	-9998	66587	42239	24347	2139	60861	3924	23351	915	15016	305.4
17	1999	3921	102	64	-9998	8	0.4	3056	116	74570	53670	20901	1563	47492	-9999	12686	1340	9382	153.9
17	2000	3640	47	48	-9999	8.1	0.1	2927	55	76229	58491	17738	1865	51790	246	12403	1343	9882	154.7
17	2001	3721	42	65	-9999	12.4	0.1	3035	50	75318	56985	18334	2454	49702	2371	11372	1484	9374	132.4
17	2002	4082	260	178	-9998	15.9	0.3	3727	194	99505	70264	29242	2149	56209	367	12375	1733	10438	161.7
17	2003	5728	594	229	-9998	15.3	0.3	4022	199	103361	65830	37531	2039	55352	1604	12562	1702	10633	150.3
18	1999	1905	939	65	49	8.3	1.9	1789	1068	21535	10141	11394	645	16832	1214	7020	1250	4608	77.4
18	2000	3005	1602	84	24	10.3	2.1	3259	2074	26877	12401	14476	927	23547	3214	10816	1607	5400	85.3
18	2001	1997	992	57	31	5.4	1.6	2927	2152	18589	7339	11251	1002	14417	642	4599	1579	3666	52.1
18	2002	2242	911	43	-9998	6.4	1.9	2130	1112	28015	12988	15027	738	18467	-65	3521	1583	4869	78.8
18	2003	1979	947	-9	-9998	5.7	1.7	2507	1436	30301	13010	17291	653	18085	34	4419	1469	4219	71.6
19	1999	4630	674	143	-9998	35	1.9	5046	841	89944	59808	30136	3129	82157	4306	31336	2662	20690	443
19	2000	46592	32173	500	273	81.3	17.4	19956	9304	362332	280107	82225	9435	173625	17032	51942	4247	28331	594.5
19	2001	54199	33311	829	504	90.5	17.4	20408	9198	427036	336335	90701	13522	189220	15935	56649	5497	34963	644.4
19	2002	65886	36918	604	323	88.7	16.8	19813	9519	459717	367854	91863	11814	179846	15789	53984	5088	34568	553.5
19	2003	54062	20996	871	357	85.5	9.7	18936	6236	517829	405096	112733	8573	170722	18577	54859	4922	35015	529.5
20	1999	19554	1959	706	235	105.5	7.2	32310	3931	87129	40906	46222	4382	95773	5219	19493	5659	12714	190.4
20	2000	28117	2069	613	109	94.2	6.3	45655	5132	94383	54017	40366	4342	92835	7104	21749	6952	16987	216.9
20	2001	29253	2288	466	56	84.4	6.6	44359	5457	88917	42671	46245	3896	84692	2128	18828	7727	15104	205.1
20	2002	26018	2942	379	52	54.8	7.1	40728	4858	114526	49126	65400	2782	87862	1277	20940	7065	15332	211.3
20	2003	33881	3104	513	58	-9997	8.3	52545	5444	116563	51197	65366	2989	91070	1425	23956	7055	15730	207
21	1999	14204	1905	-9998	44	46.1	4.6	19178	3347	125938	61084	64854	5878	102158	6038	34583	13276	23147	330.8
21	2000	15980	2363	630	174	51.2	6	24739	4935	234409	81186	153223	8772	133555	4905	46919	14614	28432	402.7
21	2001	15765	2262	521	92	54.2	5.6	23946	4476	187670	80799	106871	8049	115036	-95360	22877	14526	30714	323.3
21	2002	20794	2087	953	106	61.7	5.9	25494	3685	149117	72184	76933	4715	85484	-21166	32698	11497	21755	258.8
21	2003	21475	2675	-9998	72	65.7	6.5	26904	4681	146696	66650	80047	4783	79791	-670	29878	10344	19187	235.9
22	1999	301	108	3	1	1.3	0.2	526	224	20411	10839	9572	894	25927	409	5503	407	4287	57.9
22	2000	408	104	16	1	1.5	0.2	757	244	21700	11861	9840	889	28359	400	5406	436	4412	55.6
22	2001	148	56	8	1	0.4	0.2	351	157	9305	5182	4123	396	9840	-227	2468	359	1963	33.9
22	2002	170	-9998	7	-9999	-9997	0.2	369	-9998	10530	5960	4570	486	9739	512	3239	-9998	2057	34.4
22	2003	193	-9998	10	2	-9997	0.2	438	-9998	10362	6339	4023	407	9320	-19	2787	-9998	2252	35.6
23	1999	18027	3931	-9998	-9998	139.7	9.7	32410	7079	135303	51989	83314	6727	96922	11611	39053	8997	19581	330
23	2000	27724	4559	3024	495	167.8	10.3	47365	9610	157912	52598	105314	10914	112165	19939	53057	10252	20557	335.3
23	2001	27091	4089	1830	327	153.9	10.8	42168	8216	154689	52580	102109	10819	85555	-4256	21788	11114	17999	287
23	2002	28305	3736	1424	283	152.9	9.8	41378	6886	140951	46796	94155	7921	72992	-9390	21172	10620	16482	252.8
23	2003	31862	4111	1549	319	142.5	9.5	48506	8308	142791	47831	94961	6094	72719	3860	30625	11524	17961	232.8

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Table 12 (Continued)

INO	YEAR	TA_AP	TA_J	CE_AP	CE_J	NEMP_AP	NEMP_J	SALS_AP	SALS_J	TA_P	TL_P	OE_P	CE_P	S_P	NI_P	VA_P	RD_P	COMPEMP_P	NEMP_P
24	1999	1046	686	-9998	22	4.4	2.2	1546	980	20692	10496	10196	857	16985	408	6234	1579	4930	88.3
24	2000	4099	1715	127	30	18.8	4.8	8230	2491	36070	15981	20089	1572	30889	2642	12954	2960	9694	145.6
24	2001	4730	1886	74	23	29.9	6	8904	2922	60826	30811	30015	2117	46790	350	17775	4158	14879	215.6
24	2002	10350	3044	148	35	51.3	7.5	11171	3200	74825	37201	37623	1788	54071	-194	21618	4244	17261	260.1
24	2003	11175	3073	161	38	48.8	6.7	11129	2845	83566	43045	40521	1756	56480	1460	23853	4093	17873	265.5
25	1999	677	285	-9998	-9998	4.2	0.9	707	345	3373	1442	1931	159	2384	-130	1256	381	912	10.2
25	2000	270	72	32	3	4.4	0.3	627	198	11526	1840	9686	172	2557	-1868	2000	402	1043	11.4
25	2001	476	129	29	1	4.2	0.5	683	287	3660	1848	1812	126	2823	-7952	4078	473	915	10.7
25	2002	384	-9998	2	-9999	-9997	0.1	438	-9998	1659	674	985	95	1204	292	325	-9998	308	4.2
25	2003	420	-9998	-9998	-9999	-9997	0.1	617	-9998	1453	531	922	110	1223	65	380	-9998	301	4.3
26	1999	4308	564	140	9	44.7	1.5	4681	893	91760	61585	30174	3900	87822	5090	31528	2958	20527	451.2
26	2000	5233	1349	272	-9998	43.4	2.6	6644	2073	105545	96001	9544	4466	95635	1952	32258	2511	21416	469.2
26	2001	5417	1156	165	-9998	38.5	2.8	6830	1825	158492	139070	19422	5126	88339	617	27260	2008	20417	387.3
26	2002	4765	1126	138	25	35.5	2.5	5569	1363	101489	75894	25596	4260	78303	-9770	25316	1729	18021	348
26	2003	5886	1313	146	27	30.6	2.3	6007	1397	95918	66446	29473	2748	69601	1349	23956	1617	16858	321.1
27	1999	15774	3182	885	77	63.6	3.8	12174	1838	756060	646050	110009	31908	518456	24554	132030	17513	82766	1152.7
27	2000	18585	4126	584	68	71.5	4.8	15482	3173	802836	688974	113862	29422	549689	15279	136046	16223	81465	1110.9
27	2001	19618	4487	726	80	73.4	7.3	17531	3767	816189	727474	88714	28075	522748	-7244	81586	18183	65300	1075
27	2002	22292	4494	783	57	75.1	6.7	19143	3559	873095	814021	59074	23951	514490	1330	92190	16535	63588	990.7
27	2003	27430	4848	1433	58	86.6	6.8	24175	4079	983600	890376	93225	24702	518466	8468	83834	17262	65210	984.1
28	1999	32983	21663	326	174	68.8	18.5	12251	5465	432405	325531	106875	13778	265716	21517	104675	11649	68769	1067
28	2000	5502	839	144	19	42.8	3.8	6049	1151	209993	143068	66925	5703	188981	8429	72557	9611	51799	872.9
28	2001	4531	674	126	23	34.9	3.5	4833	917	196709	134714	61994	5216	174696	6073	61020	6964	43080	756.6
28	2002	4666	677	105	13	34.8	3.6	5833	1043	221919	156337	65582	4757	167678	5251	55558	6632	43659	722.1
28	2003	5904	761	134	22	47.7	3.3	6827	974	237591	163158	74433	4509	175271	6941	60251	6526	47071	712.6
29	1999	614	8	-9998	-9999	8.6	0.1	541	-9998	13465	6796	6670	652	18768	1207	7464	90	4792	136.4
29	2000	575	9	22	0	9.5	0.5	584	22	21564	10870	10695	1175	27520	1684	9936	-9998	6099	189.3
29	2001	538	9	6	-9999	9.2	0.4	584	21	19763	10351	9412	602	23966	859	8303	128	5645	166.4
29	2002	75	8	2	-9999	1.6	0.4	125	18	20518	10172	10346	710	22740	929	8236	130	5526	152.4
29	2003	84	9	2	1	1.6	0.4	144	21	20123	9020	11103	681	22485	1112	8620	116	5764	142.7
30	1999	5153	2169	-9998	-9998	25.2	4.6	5635	2304	76874	60122	16752	3290	53704	2352	22625	1826	13691	307.7
30	2000	3652	1650	99	58	-9997	-9997	4132	2426	61107	31001	30106	2233	44141	3052	19384	2176	11975	240.7
30	2001	3450	1673	83	36	14.4	-9997	4204	2590	69851	36785	33065	2601	49456	3551	21567	2570	13828	253.5
30	2002	3838	-9998	-9998	37	15	-9997	4503	2850	74064	35278	38785	2860	51872	6808	23636	3067	13760	255.6
30	2003	4673	2804	-9998	68	16.5	-9997	-9998	3638	87183	38255	48928	2598	56960	5355	24109	3492	15288	273.4

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