日本オペレーションズ・リサーチ学会
2004年春季研究発表会

The Panel Data Econometric Modeling of Japanese Business Entry into North America

Model, Estimation, and Entry Analysis

01106726　西南学院大学商学部　小島 平夫　KOJIMA Hirao

1 Introduction

The paper attempts, in Section 2, to build *static* panel data econometric models of the Japanese business entry into the North American market and, in Section 3, to estimate them to isolate the key determinants of the entry, which will be summarized later in Section 4. Eighteen manufacturing and non-manufacturing sectors and five fiscal years 1997 through 2001 will comprise the panel data.

The foreign market entry mode we are concerned with is FDI (e.g., wholly owned).

Empirical issues in international business One essential problem in international business theory is: Why do multinational firms (those spanning two or more nations) exist? Three major hypotheses to be tested in the paper are:

L: The Japanese FDI in North America is a *substitute* for exporting to the region.

I_1: Industrial/corporate growth in size will likely result in the FDI in North America.

I_2: The intangible managerial resources contribute to promoting FDI.

2 Panel Data Models

The static panel data econometric models of foreign market entry by Japanese firms studied in the paper are as follwos:

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:

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

where y_{it}=Japanese FDI in North America and x_{it}=*observable* determinants of the FDI. In vector form,

$$y = \alpha l_{NT} + X\beta + u. \quad (2)$$

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

$$u_{it} = \mu_i + \lambda_t + \nu_{it} \quad (3)$$

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). 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.

Depending on whether the individual and time effects are fixed or random, the model will be correspondingly fixed- or random-effects model.

Models with only individual effects, models with only time effects (one-way error component model) For the individual-only models, fixed-effects:

$$y = X\beta + D_N\mu + \nu. \quad (4)$$

Random-effects:

$$y = \alpha l_{NT} + X\beta + \mu \otimes l_T + \nu. \quad (5)$$

For the time-only models, fixed-effects:

$$y = X\beta + D_T\lambda + \nu. \quad (6)$$

Random-effects:

$$y = \alpha l_{NT} + X\beta + (l_N \otimes I_T)\lambda + \nu. \quad (7)$$

Models with both individual and time effects (two-way error component model) Fixed-effects:

$$y = \alpha l_{NT} + X\beta + D_{N*}\mu_* + D_{T*}\lambda_* + \nu. \quad (8)$$

Random-effects:

$$y = \alpha l_{NT} + X\beta + \mu \otimes l_T + (l_N \otimes I_T)\lambda + \nu. \quad (9)$$

Selecting globally (as well as locally) final hypothesis/model

1. If the locally final hypothesis coincides with the presence of both effects, then the "globally" final hypothesis/model is the one with both effects being present that is accepted by Hausman specification test, (8) for fixed effects or (9) for random effects.

2. If the locally final hypothesis coincides with the presence of only individual effects or only time effects, then return to earlier specification test table(s) and, depending on either fixed or random effects selected there, go further back to table(s) reporting the estimated models to finally decide on the model:

The "globally" final hypothesis/model is the one with individual effects only or time effects only being present that is accepted by Hausman specification test: (4) for fixed effects or (5) for random effects; (6) for fixed effects or (7) for random effects.

Table 1: Determinants of Japanese FDI in North America

	Dependent Variable					
	ratio_sales	Lsubsales	LsubsalesinUSD	Lsubwrkr	Lsubnum	Definition: From left to right
	Only Individual				Both	subsidiary sales/parent sales
	Fixed	Random		Fixed		logged subsidiary sales
Explanatory/Dummy Variables	Sign of Coeff.					logged subsidiary sales in U.S. dollars
Constant						logged number of subsidiary workers
ratio_export [L]	(−)**	(−)	(−)	(−)	(+)	logged number of subsidiaries
Lparent_num [I_1]		(+)***	(+)***	(+)*	(+)***	
owncapratio [I_2]					(−)**	
intpymnt [I_2]	(−)**					
varatio [I_2]		(−)*	(−)*			
Lvaperwrkr [I_2]				(+)*	(+)*	
food (1)	[b]					
textile (2)	[b]				(−)***; [b]	
lumber,pulp,paper (3)						
chemical (4)	[b]					
steel (5)						
non-ferrous metals (6)						
general machinery (7)						
electrical machinery (8)					0.000	
transportation equipment (9)	[a]				(+)***	
precision instrument (10)	[a]					
petroleum and coal (11)	[b]			[b]	(−)**; [b]	
miscell. mfg. (12)	[b]				(−)***	
agriculture, forestry (13)						
mining (14)	[a]					
construction (15)	[b]				(−)**	
commerce (16)						
service (17)					(+)**; [a]	
miscell. non-mfg. (18)						
FY1997 (1)					0.000	
FY1998 (2)						
FY1999 (3)					(+)	
FY2000 (4)					(+)***	
FY2001 (5)						

3 Panel Data and Estimation

Data sources The panel data has been compiled and constructed from two major data sources: Ministry of Economy, Trade and Industry, *Essential Survey on Japanese Overseas Operations*, No. 28 through No. 32; and Ministry of Finance, *Fiscal and Monetary Statistics Monthly*, No. 604, Special Issue on Annual Japanese Corporate Statistics, 2001-2002 Fiscal Year.

Estimation The models are estimated by *RATS* (=Regression Analysis of Time Series) programs.

4 Determinants of Japanese FDI in North America

Location- and internalization-theoretic hypotheses, L, I_1 and I_2 in the first section were tested and the test results based on the globally final models are being put together in Table 1:

First, consistent with L is the observed *negative* relationship that the Japanese entry into North America has with ratio_export (= ratio of parent total export to parent total sales).

Second, consistent with I_1 is the *positive* relationship of Lparent_num (= logged number of parent firms) with the FDI.

Third, consistent with I_2 are the *positive* effect of Lvaperwrkr (= logged value added per worker) and the *negative* sign for intpymnt (= borrowing rate of interest in %).

Fourth, turning now to sector- and/or time-specific effects *un*explained by explanatory variables:

(a-i) The bracketed results [b] in the table indicate that there should be sector-specific factors working to get FDI by such sectors as *food, textile, chemical, petroleum and coal, miscellaneous manufacturing,* and *construction* sectors *less* active than FDI by the remaining sectors such as e.g. electrical machinery.

(a-ii) Sectors such as *transportation equipment, precision instrument, mining,* and *service* (see [a] in the table) appear *more* active in their entry into North America than the remaining sectors.

(b) Based on the signs under Column "Both" in the table: (b-i) The above interpretations (a-i) and (a-ii) apply here, too.

(b-ii) There occurred a significant increase in the Japanese FDI in North America in FY2000, as compared to FY1997.

References

[1] Horaguchi, H., *Foreign Direct Investment of the Japanese Firms*, University of Tokyo Press (1992) (in Japanese).

[2] Hsiao, C., *Analysis of Panel Data*, 2nd ed., Cambridge University Press (2003).

[3] Kojima, H., "The Determinants of Japanese Foreign Direct Investment and Export: The Standard and Structural VAR Analysis," *Seinan Gakuin University Review of Commerce*, 44, Joint Issue of No. 1 and 2, 95-157 (1997) (in Japanese).