"The Determinants of Foreign Direct Investments into Japan"

by

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Abstract

Foreign Direct Investment inflows into Japan have remained low in comparison with FDI outflows, and with FDI inflows of other leading developed countries. However, a steady increasing trend has been noticed since the latter half of 1980’s. Despite the rise and the importance of FDI in the current marasmus of the Japanese economy, there is little literature focusing on FDI inflows while FDI outflows are intensively examined. In the present paper, we attempt an econometric analysis of the determinants of FDI inflows into Japan. We find that the size of the market, the volatility of exchange rates, price movements, the cost of establishing greenfield plant and deregulations of the environment for investments are important determinants.

Key words: determinants of FDI, volatility of exchange rates, deregulations, firesale FDI.

JEL classification: F21, F23

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1. Introduction

The level of Foreign Direct Investment into Japan has always been considered low compared to other leading developed countries. Both the ratio of inward FDI to GDP and the ratio of foreign investments into Japan to Japanese investments abroad have remained far smaller than the average of the latter countries. In 1999, inward FDI amounted to 0.7% of the GDP whereas the ratio reached 9.3%, 9.5%, 11.7% and 23.3% for Germany, the United States, France and England, respectively. Inward foreign investments amounted to 13% of Japanese investments abroad while the ratio attained 54%, 96%, 61% and 59% for the four developed countries, respectively. Furthermore, in 1999, Japanese investments abroad accounted for 6.2% of the world stock of outward investments; in contrast, FDI in Japan stayed at 0.8% of the world stock of inward investments. The observed fact has commonly been attributed to the higher cost of production, and social and economic structure including more restraining regulations.

However, from the latter half of the 1980's, inflows of FDI into Japan have steadily increased. Although the average level of the developed countries has not yet been reached, the ratios have considerably raised. The enhancement of the inflow of FDI into Japan has been particularly impressive from the second half of the 1990's till now. The continuous increase is reflected in Panel (a) of Figure 1. FDI inflows increased from 3,837 millions US$ in 1995 to 28,276 millions US$ in 2000. Foreign Direct Investments are shown to have extensively contributed to economic performances of host countries. Hence, FDI can be regarded as one of the few factors that can allow the recovery of the Japanese economy from the current marasmus, and avoid the hollowing-out. While Japanese FDI outflows have been extensively scrutinized, there is relatively little empirical work on inflows of foreign investments into Japan.

The lack of literatures, the crucial role of FDI in the current Japanese economy and the remarkable increase of FDI inflows motivated the present analysis. We attempt to investigate empirically the main factors that determine incoming Foreign Direct Investments into Japan.

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2. Survey of literatures and theoretical background

We present, hereafter, potential determinants of FDI inflows that have been vastly used in the literatures.

Most analyses of determinants of FDI inflows have included the size of the host market measured with GDP. The market size has been widely found to be an, or even the most, important incentive for FDI. A larger market allows a more efficient utilization of resources and the exploitation of economies of scale, therefore a higher return to investment (Moore 1993, Wang and Swain 1995, Raggazi 1973). Chakrabarti (2001) offers a relatively comprehensive enumeration of literatures that have proved the size of the economy to be a considerable determinant of FDI inflows for developed as well as developing economies. However, the market size might be less influential, or even insignificant, if FDI are using the host country only as a production base, taking profit of the cost advantage of the host economy in order to export their production, more competitively, to a third or home markets (Agarwal 1980).

A second potential determinant is the movements in the price level. A large and uncontainable increase in the price level, or high inflation, might reflect instability of the macroeconomic policy of the host country. Such instability creates uncertain environment for investments (Bajo-Rubia and Sosvilla-Rivero 1994, Yih Yun Yang et al. 2000). High inflation discourages specifically re-exporting FDI since the relative costs of production in the host country rise. In contrast, decreases in the price level, leading to shrinkage in economic activities, might bring about a deflationary spiral and eventually bankruptcy of firms. This might push local investors to sell their ownerships in host country's companies to foreign investors at low prices, and would result in an expansion of FDI inflows.

A third frequently noted factor is the strength of the host country's currency measured with the level of exchange rates. A depreciation of the host country currency might attract FDI for two main reasons. First, a depreciation of the host country currency renders the shares of host country's firms relatively cheap, motivating M&A from foreign firms. Second, if FDI aim at re-exporting to home or third country, following a depreciation of the currency, producing in the host country enhances competitiveness, investors' wealth raises. However, if FDI intend to sell in the host market, a depreciation of the currency might hinder inflows, also for two reasons. First, as FDI are long run horizon projected, the stream of return on investments might become lower in terms of home currency. Second, a depreciation of the currency lowers the relative purchasing power of the host country's consumers. In brief, effects of the
level of exchange rates on FDI inflows are rather ambiguous (Benassy-Quere et al. 2001).

In addition to the level, host country’s exchange rates determine notably the extent of incoming FDI through their volatility. Instability of the currency has been extensively found to be a significant impediment for inflows of FDI. Income stream from a highly volatile currency area is associated, in the long run, with high exchange risk (Chakrabarti 2001). As opposed to portfolio investments that do not pay much attention to the exchange rates variability since they can, in the short run, hedge through the derivative market, FDI attach particular importance to exchange rates volatility because, for a long run horizon, hedging is not possible. This factor is particularly determinant for risk-averse investors (Benassy-Quere et al. 2001). Nevertheless, keeping nominal exchange rates stable leads, very often, to a loss of price competitiveness, that is also an important determinant of FDI inflows. In presence of comparatively high inflation, stable nominal currency hides a cumulated appreciation of the real currency, therefore pushes up real price. On the other hand, a less restrictive policy towards volatility of nominal exchange rates allows eliminating trend in the real exchange rates and permits to keep price competitiveness. Hence, using stability of exchange rates as an incentive to attract FDI involves the trade-off between volatility and price competitiveness. Finally, instability of the host country currency discourages repatriation of investment returns and hence, is detrimental to FDI inflows. On the contrary, a positive relationship between FDI inflows and exchange rates volatility might be found if investment on the local market is used as substitute to exporting. When variance is judged as too high, one possibility to skip the vagaries of the currency market is to engage in FDI in the local market. In the short run, larger volatility will lead to greater FDI inflows. However, from the above-mentioned mechanisms, in the long run, the negative effects of volatility overweight the positive ones in attracting FDI (Harvey 1990).

Other straightforward determinants of FDI inflows would be the cost of establishing greenfield plant and the cost of acquiring firms established inside the host country. The former cost can be proxied by the land price. Land price is vastly found to represent an essential factor in the locational distribution of FDI (Blomstrom et al. 2000). The latter cost can be measured with the stock price. Share price represents a direct motive for investing in one country through a buying of a part or entire ownership of an established firm. Such practice often occurs through Merger and Acquisition.

From the above literatures and theoretical background, we select the variables that might determinesignificantly inflows of FDI into Japan. In section 3.1, we describe
the data and run Unit Root tests for each variable, in section 3.2, we analyze the aggregate inflows of FDI into Japan. Some concluding remarks are offered in part 4.

3. Analysis

Based on the surveyed literatures and theoretical backgrounds, the following variables can be considered as main candidates for the determinants of FDI inflows into Japan: the scale of the economy measured with GDP, strength and stability of the host country’s currency measured with the level and volatility of exchange rates, the cost of establishing greenfield plant measured with the land price, the price of shares measured with the stock price, price movements in the host economy, and the environment for investments such as laws and regulations.

3.1. Data and Unit Root tests

We use annual time series data from fiscal year 1980 to 2001. Sources and details about the data are given in Appendix. Logarithms of the variables are taken. Exchange rates are measured as the value of a unit of US$ in Japanese Yen. For the cost of establishing greenfield plant, we use the land price. For the “law and regulations”, we introduce a dummy variable that takes the value of one from 1998 to 2001. In 1998, strong measures to deregulate and promote competition in the environment for investments were implemented, on a full scale, by the Japanese government.

In order to specify our model, we run two types of Unit Root tests. We start by testing for the existence of unit root in each variable using the GLS-detrended Dickey-Fuller test, as developed by Elliot, Rothenberg, and Stock (1996). Results of the test for each variable are given in Table 1. FDI inflows are found to be stationary around a deterministic trend, and the level and volatility of exchange rates are found to be stationary around their respective means. One possible source of non-stationarity can be examined through the existence of structural break. Indeed, the plots of the variables displayed in Panels (b), (c) and (d) of Figure 1 might suggest that the variables have been subjected to structural change. Therefore, we perform the Unit Root test with structural change for the levels of all variables that were found to be non-stationary in the first test, following Perron (1989). The specification that we adopt here is the “changing growth model”, where the fiscal year 1989 is taken as the breakpoint.

\[ F.Y \text{ 1989 covers the period from April 1989 to March 1990. The stock price in Japan reached its peak in December 1989 and started to decline sharply thereafter. Hence, we take F.Y 1989 as breakpoint.} \]
choice of the breakpoint is motivated by the vastly accepted view that the collapse of economic bubble in 1989 has altered the structure of the Japanese economy. Results of the test are presented in Table 2. The levels of GDP, stock price and land price are found to be stationary after taking into consideration the structural change. Therefore, we introduce those three variables in level into our model.

From the GLS-detrended Dickey-Fuller test in Table 1, it is verified that the first difference of CPI is stationary. Hence we use the first difference of this variable in our model.

Summarily, FDI, GDP, the level and volatility of exchange rates, stock price and land price are introduced in level form; CPI is introduced in first difference form.

3.2. Total FDI Inflows

We start from the analysis of the aggregate inflows of FDI into Japan and introduce all potential determinants in our regression.

\[
FDI_t = \beta_0 + \beta_1 GDP_t + \beta_2 VEXRT_t + \beta_3 \Delta CPI \\
+ \beta_4 EXRT + \beta_5 STPR_t + \beta_6 LAPR_t + DUM
\]

We estimate the model by Ordinary Least Squares using Eviews 4.1. Trends in the variables are eliminated to control for non-stationarity. We begin by estimating the full model using the entire sample period, 1980 to 2001. Results are presented in Specification 1 of Table 3. Following Hendry's "general to specific" approach (Hendry et al. 1984), we successively drop variables with statistical significance level less than one and obtain the final results displayed in Specification 3. Main findings are put forward as follows.

First, in line with most literatures about determinants of FDI, the results suggest that the size of the economy appears to be a major factor for inflows of FDI. Among the variables that are found as influencing inflows of FDI in the present analysis, GDP exhibits generally the highest coefficient and statistical significance level. The variable remains robust to different specifications. Since logarithms of the variables are taken, the coefficients represent the elasticity of FDI inflows with respect to each variable. Hence, FDI inflows are highly sensitive to changes in the size of the market. An expansion (or contraction) of 1% of the domestic market leads to an increase (or decrease) of approximately 20% of FDI inflows. The importance of the GDP variable
implies that foreign investments being held in Japan are targeting domestic market.

Second, the results show that the volatility of exchange rates stands as an impediment to FDI inflows into Japan. Goldberg and Kolstad (1994) developed a theoretical model linking the variability of exchange rates to foreign investments and presents empirical tests. The analysis considers two-period model. In the first period, the multinational firm makes the decision about the location of its investment based on the maximization of expected profit streams. In the second period, production process is launched and revenues are collected. Since the production process involves medium or long run investment facilities, it cannot be adjusted instantaneously to the variability of exchange rates. It is commonly accepted that exchange rates volatility reduces the certainty equivalent expected exchange rates level. And since the latter enters the profit function of the firm, it can be established that larger variability of the exchange rates hinders inflows of FDI. The model is proved, empirically, to hold for bilateral foreign investments between United States and Canada, Japan and United Kingdom. We found similar effect of exchange rates volatility on incoming FDI into Japan. Furthermore, high volatility of the exchange rates of the host country discourages FDI if the latter uses a large share of imported inputs in their process of production. Instability of the local currency introduces uncertainty in the production planning of such FDI and discourages entry. Indeed, foreign investments operating in Japan import 36.4% of their total purchase. For a comparison, Japanese firms conducting activities abroad import 13.2% of their total buying. The considerable importance of imported purchase for FDI in Japan strengthens the obstructing effect of exchange rates volatility on FDI inflows.

Next, the analysis displays that price movements markedly determine FDI into Japan. A decline in price level leads to larger inflows of foreign investments. The size of the elasticity of FDI inflows with respect to price movements is large, approximately identical to that of GDP. The influence of price movements on FDI inflows, for the case of the Japanese economy, might be explained as follows. Inflows of FDI into Japan have exhibited a steady increase from the late 1980's, period when the bubble occurred. And the increase in FDI inflows has been impressive from the latter half of the 1990's, period when deflation has appeared to be particularly critical. Decrease in prices, which can be considered as a proxy for economic depression, brings about cut down in outcomes of firms from their sales. Lower performance of firms in the whole economy would result in unresolved or worsening deflation, and the vicious circle goes on. This phenomenon of deflation was first experienced in advanced countries after the Second World War.

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3 JETRO (2001) p.85
Heavily indebted corporations, facing liquidity crisis and credit crunch would resort to sell off factories and subsidiaries at extremely low prices in order to raise cash. For the financial sector, selling assets including stocks and real estates offers a way of proceeding to bad debt disposal. Economic marasmus and deflation, at the extreme, would bring firms to complete bankruptcy. They would end up selling their assets to foreign companies at the so-called “firesale” price. This phenomenon of “fire-sale FDI”, as mentioned by Krugman (2000), has extensively happened, as well, in the East Asian countries following the Asian Crisis in 1997. It is often referred that the possibility of buying foreign companies or assets at firesale prices offers important incentives for multinational firms to engage in FDI in that foreign country. We confirm empirically such statement for the case of Japan.

The following variable that was found to be a major determinant of FDI inflows is the land price. A decrease in land price is associated with an enhancement of inflows of FDI into Japan. The lower size of foreign investments in Japan compared to the standard of leading developed countries has been partly attributed to higher costs of establishing greenfield plant. Such costs include essentially the land price. After the collapse of the bubble, the land price index has substantially fallen, as plotted in Panel (d) of Figure 1. In 2000, the index was around half of its value in 1992. Our results show that the decrease in cost of investment in Japan through the sharp drop of land price encourages significantly foreign direct investments, essentially after the collapse of the bubble. In addition to the cost of establishing greenfield plant, the cost of keeping bureau in the host country might also determine the extent of FDI inflows. We attempted to look for data about office rental but the span of our sample could not be covered. Therefore, we use here, only, the land price. However, for the period where data were available, land price and office rental appear to be highly correlated.

Lastly, we found that the variable “deregulations” bear a positive influence on the inflows of FDI into Japan. A series of deregulations has been implemented by the Japanese government in order to enhance competitiveness in the structure of the environment for investments in Japan. Measures have been gradually carried-out, they were fully and briskly enforced in 1998. An expected by-product of such deregulations would be an expansion of incoming foreign investments. The set of deregulations, presented in our analysis as dummy variable from 1998, among other purposes, aims at allowing foreign firms to operate in fields in which entry was previously difficult, even impossible. As illustrations, in the distribution industry, large-sized retail store law was loosened, permitting the entry of foreign large-sized distribution company. In the telecommunications sector, deregulatory measures such as abolition of the foreign
capital regulation were enforced. In the broadcast sector, the regulation against foreign capital entry into cable television broadcast business was abolished and, more extensive debate on the foreign capital regulation adopted on the program-supplying broadcast business related to communication satellite is being carried out. Concerning the finance/securities sector, the Foreign Exchange and Foreign Trade Law was entirely amended in 1998, leading to deregulations with decontrol in various fields, such as foreign currency settlements between residents and overseas deposit transactions. Furthermore, complete liberalization of stock transaction commissions was implemented. Our results show that such decisive deregulations have indeed attracted foreign investments into Japan.

In the light of the above observations and the results displayed in Table 3, it is emphasized that the size of the coefficients of the statistically significant variables, GDP, CPI, volatility of exchange rates, land price and the dummy variable for deregulations, are stable and robust to any specification.

As shown in Table 3, we attempted to introduce the level of exchange rate and stock price. Discussions on the link between the level of exchange rates and FDI are controversial as pointed out in the above survey of literatures. Generally, an ambiguous net connection between the level of exchange rates and FDI is emphasized. Thus it is expected that the sign on the level of exchange rates might be indeterminate. In fact, the variable is not found to be statistically significant in our results.

Concerning the stock price, although it seems to serve as an indicator of the value of domestic firms, this role is not straightforward for the case of the Japanese economy. Japanese firms that fell in bankruptcy due to the economic marasmus, were withdrawn from the stock index. Hence, transactions related to the acquisitions of a part or entire ownership in such firms by foreign investors occur outside the stock market. Moreover, at first sight, the effects of land price and stock price on inflows of FDI would be expected to be similar since both prices simultaneously decreased sharply after the collapse of the bubble. However, we can observe a clear difference between the movements of the two variables; as displayed in Panels (c) and (d) of Figure 1, the stock price followed a zigzagging course while the land price dropped monotonically after the collapse of the bubble. This difference might partly explain the dissimilarity in the statistical results concerning the two variables.

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4 For example, Hamada, K. (2002) discusses the process of the Big Bang in Japan.
5 Blomstrom et al. (2000) point out the importance of deregulations in attracting FDI into Japan. Our results confirm empirically such connection.
4. Concluding remarks

The limited amount of literatures on FDI inflows into Japan, the importance of FDI in the current marasmus of the economy, and the recent sharp increase of inflows motivated the present paper. We found that the size of the market, the volatility of exchange rates, price movements, the cost of establishing greenfield plant and deregulations might be the principal determinants of inflows of foreign investment into Japan.

FDI can contribute to avoid the hollowing out, to expand employment, to promote regional economic development and to enhance the competitiveness and efficiency in the host country, while various issues can also be brought about to the host country along with incoming FDI. Accordingly, from the present analysis, three policy implications could be put forward regarding FDI inflows. Firstly, preventing excessive volatility of the exchange rates through an intervention in the foreign currency market would be desirable for the purpose of attracting FDI. Secondly, further deregulations combined with an improvement of social infrastructure would enhance the competitiveness of the environment of investment and ultimately would increase FDI inflows. Thirdly, if host country’s firms are sold at fire-sale price to foreign firms that are inferior to the domestic firms with respect to efficiency, not only host country’s national wealth is transferred to foreign country but also worldwide misallocation of resources is brought about. In this sense, firesale FDI inflows would be a warning to countries experiencing economic crisis. From the viewpoint of preserving national wealth, it would be advisable that host country’s government induces domestic firms that show high efficient managerial resources to purchase the assets of domestic firms that tend to fall in bankruptcy. Damages from “Vulture Investment” or “Assets Stripping M&A” by foreign firms would be avoided if the inducement comes to be effective.

Finally, we refer to the following two points. First, the sample size is rather small, therefore the accuracy of the results for the purpose of policy implications might be restricted. Although we attempted to enlarge the span and frequency of the sample, data on FDI are not available. Second, we recognize that data on FDI do not reflect exactly the size of inflows and existing foreign investments, however the task to develop adequate data on FDI is rather difficult to be fulfilled. Nevertheless, the available data allow us to observe the trend and outline of FDI and to analyze FDI at a first approach. The data on FDI that we used in the present paper were taken from Japan External Trade Organization (JETRO) White Papers on Investment, developed on the basis of
Statistics on Japanese Foreign Direct Investment, Ministry of Finance, widely accepted as reference for data source.

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Appendix: Data sources

Data on Inflows of Foreign Direct Investment into Japan were taken from JETRO White Papers on Investment, computation based on reports and notifications about Statistics on Japanese Foreign Direct Investment, Ministry of Finance.

Statistics on GDP were taken from International Financial Statistics, International Monetary Fund, October 2002.

The land price is an index number, base year 1990, drawn from “The Japan Real Estate Institute”.

The Consumer Price Indexes were taken from the Statistics Bureau and Statistics Center, Japanese Ministry of Public Management, Home Affairs, Posts and Telecommunications.

The exchange rate and volatility of exchange rate were computed from data provided in International Financial Statistics, International Monetary Fund, October 2002.

Data on stock price were computed from statistics given by Bank of Japan.

Informations regarding deregulations of the environment for investment were collected from the “Guidebook for Incorporation and Operation of Company in Japan” published by JETRO, 2001.
References:


Figure 1: Plots of Selected Variables (FDI, GDP, Stock Price, Land Price)
Table 1: GLS-detrended DF (ERS) Unit Root Test

<table>
<thead>
<tr>
<th>Variables</th>
<th>Specification</th>
<th>Test Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total FDI</td>
<td>Constant and trend</td>
<td>-3.031 (1)*</td>
</tr>
<tr>
<td>GDP</td>
<td>Constant and trend</td>
<td>-1.041 (1)</td>
</tr>
<tr>
<td>Exchange Rate</td>
<td>Constant</td>
<td>-1.614 (1)*</td>
</tr>
<tr>
<td>Volatility</td>
<td>Exchange Rate Constant</td>
<td>-3.372 (0)**</td>
</tr>
<tr>
<td>CPI</td>
<td>Constant and trend</td>
<td>-2.791 (8)</td>
</tr>
<tr>
<td>Stock Price</td>
<td>Constant and trend</td>
<td>-0.934 (0)</td>
</tr>
<tr>
<td>Land Price</td>
<td>Constant</td>
<td>-2.114 (1)</td>
</tr>
</tbody>
</table>

Notes: The null hypothesis of unit root could not be rejected at any lag length for CPI. Critical values are tabulated in Elliott, Rothenberg and Stock (1996). Numbers in ( ) represent lag length. *indicates 10% significance level. **indicates 5% significance level. ***indicates 1% significance level.
Table 2: Unit Root Test with Structural Change (Sample 1980-2001, break point 1989)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Test Statistic</th>
<th>10% Critical Value</th>
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<tr>
<td>GDP</td>
<td>-3.665*</td>
<td>-3.61</td>
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<tr>
<td>CPI</td>
<td>-2.915</td>
<td>-3.61</td>
</tr>
<tr>
<td>Stock Price</td>
<td>-8.913***</td>
<td>-3.61</td>
</tr>
<tr>
<td>Land Price</td>
<td>-4.148**</td>
<td>-3.61</td>
</tr>
</tbody>
</table>

Notes: Critical values are tabulated in Perron and Vogelsang (1993)

*indicates 10% significance level
**indicates 5% significance level
***indicates 1% significance level
<table>
<thead>
<tr>
<th>Variables</th>
<th>Spec. 1</th>
<th>Spec. 2</th>
<th>Spec. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-247.34**</td>
<td>-248.46***</td>
<td>-247.696***</td>
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<tr>
<td></td>
<td>(-2.879)</td>
<td>(-3.473)</td>
<td>(-3.752)</td>
</tr>
<tr>
<td>GDP</td>
<td>20.732**</td>
<td>20.845***</td>
<td>20.795***</td>
</tr>
<tr>
<td></td>
<td>(2.797)</td>
<td>(3.603)</td>
<td>(3.838)</td>
</tr>
<tr>
<td>Exchange Rate</td>
<td>0.034</td>
<td>0.024</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.045)</td>
<td>(0.038)</td>
<td></td>
</tr>
<tr>
<td>Volatility Exchange Rate</td>
<td>-0.133*</td>
<td>-0.134*</td>
<td>-0.133**</td>
</tr>
<tr>
<td></td>
<td>(-1.979)</td>
<td>(-2.085)</td>
<td>(-2.350)</td>
</tr>
<tr>
<td></td>
<td>(-1.862)</td>
<td>(-1.988)</td>
<td>(-2.328)</td>
</tr>
<tr>
<td>Stock Price</td>
<td>0.018</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.026)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land Price</td>
<td>-1.935</td>
<td>-1.96**</td>
<td>-1.964**</td>
</tr>
<tr>
<td></td>
<td>(-1.513)</td>
<td>(-2.416)</td>
<td>(-2.541)</td>
</tr>
<tr>
<td>Dummy (1998-2001)</td>
<td>1.359***</td>
<td>1.36***</td>
<td>1.361***</td>
</tr>
<tr>
<td></td>
<td>(4.488)</td>
<td>(4.735)</td>
<td>(4.963)</td>
</tr>
<tr>
<td>R sq. adjusted</td>
<td>0.959</td>
<td>0.962</td>
<td>0.965</td>
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<tr>
<td>F statistic</td>
<td>53.095</td>
<td>65.158</td>
<td>80.662</td>
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<tr>
<td>Durbin Watson</td>
<td>2.913</td>
<td>2.918</td>
<td>2.918</td>
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Notes: numbers in ( ) represent t-statistics
*indicates 10% significance level
**indicates 5% significance level
***indicates 1% significance level