

Tobin's q and Today's Transformation of Japanese Economy

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1. Introduction : How we understand the features of Japanese corporate economy?

In Japan, many scholars have tried to explain the features of Japanese economy because it is almost the first country that industrialized itself in the outside of the western world. Japanese economy looks very different from the developed western ones and people tried to explain the causes of its features.

Two schools which are both Marxian disputed each other before the World War II. One was the Kohza School, whose name was derived from a Japanese word meaning lectures. They took the orthodox Marxian position that Japanese people need a civilian revolution first before they reach the socialist one. For the scholars, the peculiarity of Japanese economy totally originates from feudalistic remains. The other part was the Rohnoh School, which was named after the journal that they published. In their position, Japanese economy had already reached the capitalist stage. And they argued that Japanese capitalism's peculiarity came from the condition in which its modern economy had developed.

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Japanese economy, they said, developed on the imperialism stage of the world capitalism. This historical condition gave the peculiar looks to Japanese economy.¹

After the World War II, Japanese economy experienced a rapid economic growth and reached a world-top-class economic state. In the 1980s, Japanese economy faced trade conflicts among western countries, especially the United States. American firms and government complained that Japanese economy keeps unfair trade system and abnormal social institutions. Against this complaint, some economists tried to respond with rational explanations to seemingly irrational institutions in Japanese economy.

They were not Marxist but micro or macroeconomist who were educated through mathematical and theoretical curricula this time.² In spite of that, they also emphasized Japanese economy's institutional peculiarity. Some compared Japanese long-term trade with western spot trade. Others compared Japanese indirect corporate finance with western direct corporate finance. Professor Aoki, one of them, deepened such institutional studies using evolutionary game theory and tried to build the whole structure of Japanese economy consistently collecting separate parts.

But their approach cannot go without a few ad hoc premises because anyone

¹ Kohzoh Uno was educated in this school and established a unique doctrine of Marxist economics. After World War II, many young scholars gathered around him and formed an academic group called Uno School.

² In this same period of time, some Marxists introduced the regulation theory from France. They classified main economies of developed countries by certain macroeconomic schemes and named them after famous auto makers. In their classification, Japanese economy is what is called Toyotism, which gives much allowance to workers income so as to keep effective demand for economic long-term development.

cannot explain peculiarity only through pure logic. We should try to resort such ad hoc premises as little as possible. And no one denies that today's economy ultimately depends on capitalist enterprises. In that meaning, our economy is a corporate economy. Some Japanese economists also tried to explain the peculiarity of Japanese economy theoretically focusing on this point. This is why we almost solely treat managerialist approach to the peculiarity of Japanese economy.

2. A Short History of Tobin's q Theory

Tobin [1969] proposed Tobin's q theory that explains how firms decide whether they make investment of physical capital or not. In Tobin's explanation, firms continue to invest so long as their q exceeds unity. The term of q means the ratio of firm value and reproduction cost of physical capital.

We suppose a normal production function like this ;

$$Q = F(K, L)$$

Q , K and L mean product, capital and labor respectively. As we assume that firms try to maximize their firm values, firms decide employment in order to make this ;

$$\max \int_0^{\infty} (P_t Q_t - W_t L_t) e^{-\rho t} dt$$

Of course, P is price of product and W is wage. Firm's future profit is discounted using capital cost. If the production function's return is constant to scale, we obtain the necessary condition as this ;

$$P \frac{\partial Q}{\partial L} = W, \text{ then } f(k) - f(k)' k = \frac{W}{P}$$

Here,

$$f(k) \equiv F\left(\frac{K}{L}, 1\right), k \equiv \frac{K}{L}$$

After now, we use r instead of $f(k)'$ to indicate the rate of return on physical capital. Then the firm value is as follows ;

$$\int_0^{\infty} PrKe^{-\rho t} dt \equiv \frac{PrK}{\rho}$$

Here we introduce a function called adjustment cost of investment ;

$$\Psi(\alpha), \Psi(0) = 0, \Psi' > 0, \Psi'' > 0, \lim_{\alpha \rightarrow 0^+} \Psi'(\alpha) = 1, \alpha \equiv \frac{\Delta K}{K}$$

If firms' investment were done only once now, new firm value would be this ;

$$\frac{Pr(1+\alpha)K}{\rho} - P\Psi'(\alpha)K$$

Differentiating this, we obtain the condition of optimal rate of investment ;

$$\frac{PrK}{\rho} = P\Psi'(\alpha)K, q = \Psi'(\alpha), q \equiv \frac{r}{\rho}$$

Only when there is no adjustment cost as this, q will be unity. So Tobin's own explanation turns out to be a special case. Such an adjustment cost function was introduced by Uzawa [1968], Lucas [1867] and Gould [1868] separately.

3. Tobin's q Theory and Managerialist Approach

The assumption that firms invest only once now is very unrealistic. In reality firms invest continually each year and they make a decision on the optimal rate of growth. The decision making can be written as this ;

$$\max \int_0^{\infty} (r - \varphi(g)) K e^{-\rho t} dt, \quad g = \frac{\dot{K}}{K}$$

The adjustment cost of investment we introduce here is very similar to the previous section's one ;

$$\varphi'(g) > 0, \quad \varphi''(g) > 0, \quad \varphi(0) = 0, \quad \varphi'(0) = 1$$

It is obvious that the optimal rate of growth g^* must satisfy this equation ;

$$\frac{r - \varphi(g^*)}{\rho - g^*} = \varphi'(g^*)$$

The left hand side of this equation is Tobin's q in a dynamic model's version. So this condition is the same one in the previous static model. In the optimal decision of investment, Tobin's q must be equal to the derivative function of the adjustment cost. Firms invest so that the marginal contribution to firm value should equate with the marginal cost of investment.

Here we can think the relation of q and g generally. If we measure the value of q by the vertical axis and g by the horizontal axis, the relation will be shown as the inverse U shape curve in the figure below. The simply increasing curve is marginal adjustment cost. Our q - g curve must intersect the marginal adjustment cost curve at its top.³

Several economists called managerialists explained how managers of firms choose the best combination of q and g using this inverse U shape curve. Marris [1971] argued that managers try to make the growth rate of their firms as large as

³ From the equation above, we can obtain the condition as follows ;

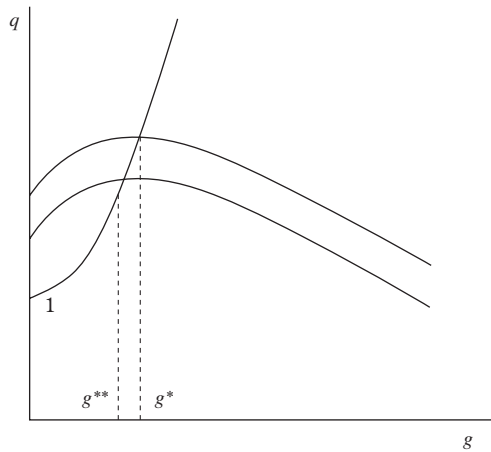
$$r - \varphi(g^*) - \varphi'(g^*)(\rho - g^*) = 0$$

The inclination of our curve is shown like this ;

$$\frac{r - \varphi(g) - \varphi'(g)(\rho - g)}{(\rho - g)^2}$$

So this inclination is null at the point of g^* .

share holders allow them. Because Marris [1971] gave this minimum q exogenously, Odagiri [1981] criticized his model. Odagiri [1981] supposed that managers have a particular utility function that increase when the growth rate of the firms rises. But if a manager tries to make g too large, the probability for which a raider takes over the firm will become larger. From this consideration, he derived a sort of indifference curve between q and g . The contact point of the two curves is the best combination for managers. For all of this generalization of managerialist theory, Odagiri [1981] could not still explain why the larger growth rate is better for managers. We have to say that this is also an ad hoc assumption.



4. A Big Change of Japanese Economy in the 1990s and its Corporate Governance

Japanese economy experienced an excessively huge boom called a bubble economy in the late 1980s. The annual rate of economic growth reached

abnormally high 6% and the average stock prices flew up as high as twice of today's level. But on the contrary, the same economy had to go through very long stagnation in the whole 1990s. The excess physical capital and bad loans that piled up in the bubble economy era caused this hardship.

Although Japanese economy began to recover at the beginning of the 2000s, its rate of economic growth still stayed on definitely lower level than before the recession. Miyajima [2002] tried to explain this amazing change using the q - g curve that we saw before.

Miyajima [2002] raised two possibilities to interpret the cause of Japanese economy's change. One is that managers' choice between q and g has changed through the transformation of Japanese corporate governance structure. On our figure, this means that the indifference curve expressing managers' preference shifted downward. The other possibility is that the q - g curve shifted downward because the investment opportunity was reduced in the 1990s. Miyajima [2002] argued that the latter possibility may be the case.

In Miyajima's explanation, the q - g curve's shift was caused by external change of economic environment. But this interpretation left us a puzzle why the United States' economy kept in a boom in the same 1990s. Concerning this point, the former possibility of Miyajima [2002] is much persuading in that it takes the internal change of Japanese economy into consideration. This explanation, however, assumes the ad hoc character of managers' preference as to the firms growth rate as we saw before.

5. Conclusion : A True Interpretation of the Transformation of Japanese Economy

In our opinion, the peculiarity of Japanese economy should be interpreted from the view point of parameters in the model. All economies have their own historical backgrounds and cultural differences to the others. But nowadays all countries enjoy economic development through the almost same modern market economy system. Their theoretical structures are ultimately the same however different they look. If one tried to explain the peculiarity by other peculiarities, the explanation, we think, would become self-conceit.

Even though managers have their own preference, their interest must coincide with stock holders' maximization of firm values. So firms' choice has to be on the intersection of the q - g curve and the marginal adjustment cost curve.

From that argument, our interpretation as to Japanese economy's transformation is basically similar to Miyajima's second one. Only one important point is, however, different. Miyajima [2002] argued that the profit rate r decreased in Japan in the 1990s. This change, of course, raises the downward shift of the q - g curve. On the contrary, our interpretation is that in the 1990s' Japan, the transformation of corporate governance structure has raised the capital cost.

Traditionally Japanese corporate governance structure explained by the terms like corporate groups, mutual holding of stocks and main banks. Corporate groups were given birth to by the destruction of *zaibatsu* (*chaebol* in Korean). Though they lost their central holding company, they shared stocks among companies in each group after World War II. Of course, the old banks which *zaibatsu* held before remain in each corporate group as main banks. This structure of stock holding and fund lending allows Japanese economy to keep very

low capital cost. This low cost raised the optimal growth rate as we can see on the figure in Section 3.

The rapid economic growth brought by this Japanese governance system prepared in its system the moment that break itself down. Big companies came to be independent of main banks in gathering money for investment. High stock price encouraged liquidation of stock holding. Therefore, stock holders have gradually gained western-style characters even in a country located in the Far East. Thus the new high capital cost has reduced the optimal growth rate of firms and the whole economy.⁴

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⁴ Miyajima [2002] utilized the q - g curve in Odagiri [1981] as it is. In Odagiri's model, the interest rate is used when calculating Tobin's q in the place of our capital cost. For this formation, Tobin's q cannot reflect the change of governance structure in their model.