# Overshooting of Exchange Rate and New Open Economy Macroeconomics : Some Implications for Japanese Yen and Korean Won

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**Introduction**

After the world financial crisis started, Japanese yen rate and Korean won rate have appreciated or depreciate sharply. Such a sharp fluctuation of foreign exchange rate looks an excess movement other than ordinal arrangement to the equilibrium level. Theoretically this extreme phenomenon has been treated as the overshooting of foreign exchange rate.

In this paper, we survey the typical overshooting theory plainly. We then pay attention to what is called "new open economy macroeconomics". They say that there is no overshooting phenomenon in the new theory. But no one talks about which condition of the model brings the stable character into the theory. We focus on this point.

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## 1. Dornbusch's Overshooting Model

It was Dornbusch [1976] who made an overshooting model for the first time. In his model, two equilibrium conditions are assumed. Firstly this is money market balance.

$$m - p = -\lambda i + \phi y$$

Here *m, p, i* and *y* are money supply, domestic price, domestic interest rate and national income respectively. Greek letters show parameters. As you can notice it at a glance, each variable is expressed in natural logarithm except interest rate. The discussion below follows the same usage of letters till the next chapter.

The other equilibrium condition, interest rate parity, is as follows.

$$i = i^* + f - s$$

Here *s* and *f* are spot and forward exchange rates respectively. Asterisk indicates foreign variable throughout this paper.

These two conditions are common with the next chapter's model.[1] Foreign interest rate $i^*$ and national income *y* are assumed to be given for simplicity here.

Then we introduce dynamic equations of spot exchange rate and domestic price. Firstly dynamism of spot rate is as follows.

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[1]  From these equations, we can diminish *i* and *f*.

$$i = \frac{\phi y - m + p}{\lambda}$$

$$f = \frac{\phi y - m + p}{\lambda} - i^* + s$$

Substitute into the other equations and we can make out how the curves decline on the figures.

$$b^* = \frac{1}{\chi}(\dot{s} - f + s)$$

This equation shows the relation between foreign bond $b^*$ and exchange rates. When do people want foreign bond much? Of course, it is when they earn more than domestic bond. Things in the blanket show extra earnings from holding foreign bond.[2] The left side of the equation above means supply of foreign bond and the right demand of it. This equation is, therefore, equilibrium of foreign bond market.

Finally, Dornbusch [1976] introduces price dynamism.

$$\dot{p} = \pi\{\delta_1(s + p^* - p) + \delta_2(f + p^* - p) - (1 - \gamma)y - \sigma i\}$$

This equation means that excess demand for the goods depends on real spot exchange rate, real forward exchange rate, national income and interest rate. When exchange rate depreciates, export demand will increase. When national income increases, the supply of the goods will increase. When interest rate goes down, investment demand will increase. Here as $\pi < 1$, price $p$ moves slowly unlike $s$, which jumps immediately.

Equilibrium point of this system can be obtain as the intersection of the two lines of $\dot{s}=0$ and $\dot{p}=0$ in $s-p$ plane. The line $\dot{s}=0$ is vertical and the line $\dot{p}=0$ is rising.

Now we shall think about the case that money supply increases permanently.

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[2]  From the equation above, $i^* - i = -f + s$. So the last two terms in the blanket show how high foreign interest rate is than domestic one. If spot exchange rate depreciates in the near future, the earning from foreign bond will increase further. Therefore $s$ is added.

Then both lines shift rightward. New equilibrium point will be at north-west of the original one.

But the economy cannot reach the new equilibrium directly because the price of the goods moves slowly. Instead of the price, spot exchange rate must overshoot the equilibrium level for a while. As the price goes up slowly, spot exchange rate appreciates gradually into the equilibrium level.
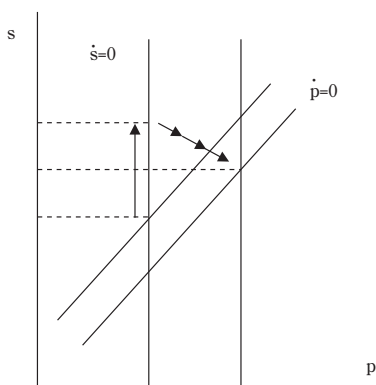


People expect the appreciation of exchange rate during the overshooting period. Therefore domestic interest rate will keep lower level than international rate in that term of period.[3]

## 2. Kouri's Overshooting Model

In Dornbusch's model purchasing power parity is not satisfied during

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[3] This is a very different point from Mundell [1963] and Fleming [1962]. In their model, domestic rate keeps the same as the international rate so long as international capital movement is smooth.

overshooting process. But Kouri's model always assumes it. In other words, the condition $p=s$ is kept if we set $p^*=0$ for simplicity.

Kouri [1976] uses the same equation as Dornbusch's model except price dynamism. As we see above, the price moves fast in his model. Instead of price stickiness, Kouri [1976] introduced the delay of adjustment in holding of foreign bond.

$$\dot{b}^* = -\eta[\omega_1 m + \omega_s b + \omega_3(s + b^*) - s] + \alpha y$$

Here $\omega_j$ (j＝1, 2, 3) are weights of holding each assets. The first three terms in the large blanket are the total amount of assets expressed in domestic currency. Then dividing by spot exchange rate, the amount in the blanket becomes expressed in foreign currency. If the assets expressed in domestic currency are much, the accumulation of foreign bond slows down. If spot exchange rate depreciates, the accumulation speeds up. But the speed of adjustment is not so fast because $\eta < 1$.

The last term means that when national income is large the accumulation of foreign bond is fast.
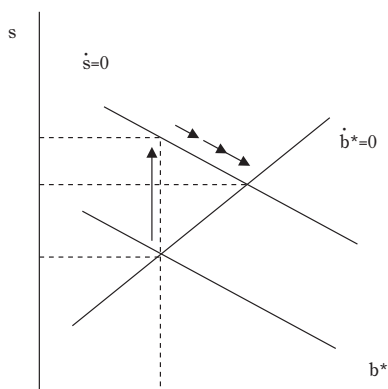
The line $\dot{b}^*=0$ is rising because $\omega_3-1<0$. If the government increases money supply by buying domestic bond, this schedule will not shift even if it increases money supply. But the line $\dot{s}=0$, which is slanting, will shift upward with the increase of money supply.

So the equilibrium point will move toward north-west along $\dot{b}^*=0$ schedule. However, the adjustment of $\dot{b}^*$ is slow. Because of this stickiness, spot exchange rate overshoots its equilibrium level and then approaches it gradually. Of course, domestic interest rate continues to be lower than the international rate during the overshooting period.

## 3. Overshooting in New Open Economy Macroeconomics

Obstfeld＝Rogoff [1995] followed Dornbusch [1976] and built a dynamic exchange rate model with microfoundation. But their two-country model does not produce any overshooting phenomenon. Where does this characteristic come?

Obstfeld＝Rogoff [1995] inherits the model's formation from new Keynesian. They adopt monopolistic competition framework. Each producer＝consumer is producing a different good and commands a monopolistic power. If we express consumption elasticity of substitution as $\theta$, we can define consumption index as follows.

$$C = \left[\int_0^1 c(z)^{\frac{\theta-1}{\theta}}dz\right]^{\frac{\theta}{\theta-1}}$$

The price index corresponding to this can be obtained from minimization of consumption expenditure.

$$P = \left[ \int_0^1 p(z)^{1-\theta} \right]^{\frac{1}{1-\theta}}$$

Domestic producers＝consumers produce a proportion of goods for domestic and foreign markets and foreign producers＝consumers the others.

Imported foreign goods are sold for the same price as in foreign market through exchange rate.

$$p(z) = Ep^*(z)$$

This means that purchasing power parity always holds in this system.[4]　And if domestic and foreign publics have the almost same preference, the equation above means the aggregated purchasing power parity $P = EP^*$ also holds.

The representative consumer＝producer $z$ maximizes the discounted present value of utility under the budget constraint.

$$\max U_t = \max \sum_{s=t}^{\infty} \beta^{s-t} \left[ \log C_s + \frac{\chi}{1-\epsilon} \left( \frac{M_s}{P_s} \right)^{1-\epsilon} - \frac{\kappa}{2} y_s(z)^2 \right]$$

$$\text{s.t.} \; P_t B_t + M_t = P_t(1 + r_{t-1})B_{t-1} + M_{t-1} + p_t(z)y_t(z) - P_t C_t - P_t T_t$$

Here $M$, $B$ and $T$ are money supply, stock of bond and tax respectively.　If one holds bond for a year, this person gets interest at real interest rate $r$.[5]　The second term in the large blanket is the utility from real balance and $\epsilon$ will turn to be

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[4]　This is the most important difference from Dornbusch's model.　In the latter model, real exchange rate can deviate from nominal exchange rate.

[5]　In this model, people don't distinguish foreign bond from domestic bond.　This is most important difference from Kouri's model.　In the latter model, the accumulation of foreign bond takes time in comparison with domestic one.

consumption elasticity of money demand.　The last term of the blanket is disutility of production.　And here subjective discount factor β is introduced.

　The producer＝consumer $z$ faces the demand curve like below.

$$y_t^d(z) = \left[\frac{p_t(z)}{P_t}\right]^{-\theta} (C_t^W + G_t^W)$$

Here $G_t^W$ is the sum of domestic and foreign government.　Each producer sets the price facing downward-sloping demand curve.

　Now we shall start to check the effect of permanent increase of money supply. Because the rise of prices is proportional through every good in domestic area, domestic price level P also rises at the same ratio as money supply while foreign price level stays as before.　This means that exchange rate depreciates at the same ratio as money supply, too.　Namely monetary neutrality holds in this case.

　Obstfeld＝Rogoff [1995] introduced the assumption that producers＝consumers preset the price of their goods a year before and cannot change this year.　This increase of money supply will depreciate exchange rate because the demand of money stays at almost the same level.[6]　Though the prices are sticky, the depreciation of exchange rate raises the domestic prices of foreign goods.　Of course, the foreign prices of domestic goods will go down.

　Thus domestic price index goes up and it increases domestic production while foreign one goes down and it decreases foreign production.　People try to make consumption schedule flat into the future.　Therefore domestic increase of

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　　[6]　In the sticky price case, the consumption will increase as we check soon.　The increase of consumption will raise the demand for money in our utility function. Because of this reason, the depreciation is smaller than the increase of money supply.

consumption is smaller than that of output while foreign increase of consumption is larger than the increase of foreign output.　This brings out domestic surplus of current account.　Because of this, domestic people can obtain income from holding bond permanently.

　Next year domestic producers＝consumers will raise the prices of their products while foreign producers＝consumers will cut the prices of theirs.　But the price indexes include both domestic and foreign goods.　Therefore the indexes keep almost the same value as the previous year.　This means that the exchange rate jumps to the new stable level in the first year of the monetary expansion and stays on that level even after the price change.

　As we have seen above, there does not appear overshooting phenomenon in new open economy macroeconomics model.　Obstfeld＝Rogoff [1995], however, considered an overshooting case in their paper.　In the model, there are one traded good and several non-traded goods.　The traded good market is competitive but the non-traded goods market is monopolistically competitive.　If monetary expansion suddenly happens in this situation, the exchange rate jumps to a new level.　Because the prices of non-traded goods is kept at preset level, domestic producers＝consumers can raise the prices a year later.　So the exchange rate appreciates from the overshot level of the previous year.

　The purchasing power parity does not hold in this case because non-traded goods exist. We can see here that one of the necessary conditions for overshooting is the lack of purchasing power parity.

　Another necessary condition of possible overshooting is the discrimination of foreign bond and domestic bond.　Obstfeld＝Rogoff [1995] lacked this condition, too.　If domestic people prefer domestic bond than foreign one, foreign interest rate has to be higher than domestic rate in order for foreign bond to be bought.

The overshooting of exchange rate brings this effect in the domestic economy.   It makes domestic interest rate go down comparing to international level temporarily.


**Conclusion**


We consider on Dornbusch's and Kouri's models in detail.   And we compared a contemporary new open economy macroeconomics model with the two models. This comparison showed us that the overshooting phenomenon cannot happen if either purchasing power parity or the indifference of foreign and domestic bonds holds.

Japanese economy and Korean economy, however, have many kinds of non-traded goods like agricultural products including rice and various services.   So purchasing power parity doesn't actually seem to hold in both countries.

And especially in Japan, domestic interest rate has kept at lower level than international one for a long time.   This means that domestic bond and foreign bond are continuously discriminated.

Therefore any monetary shocks and even any monetary expansion can possibly raise the overshooting phenomenon in the fluctuation of exchange rate.   Because of this, monetary policy must be carried out giving much attention to such a complex effect in Japan and Korea.


**References**

Dornbusch, Rudiger, "Expectations and Exchange Rate Dynamics," *Journal of Political Economy*, 1976, pp.1161‑1176.

Fleming, J. Marcus, "Domestic Financial Policies under Fixed and under Floating Exchange Rates," *IMF Staff Papers*, 1962, pp.369‑379.

Kouri, Pentti, J. K., "The Exchange Rate and the Balance of Payments in the Short

Run and the Long Run： A Monetary Approach," *Scandinavian Journal of Economics*, 1976, pp.280‑304.

　　Mundell, Robert E., "Capital Mobility and Stabilization Policy under Fixed and Flexible Exchange Rates," *Canadian Journal of Economics and Political Science*, 1963, pp.475‑485.

　　Obstfeld, Maurice and Kenneth Rogoff, "Exchange Rate Dynamics Redux," *Journal of Political Economy*, 1995, pp.624‑660.