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11 Liberalization of Capital Flows in Korea: Big Bang or Gradualism?

Dongchul Cho and Youngsun Koh

11.1 Introduction

Economic liberalization and deregulation has become a general trend in the era of globalization. The Korean economy is no exception to this trend. Despite the miraculous performances under the government-led growth strategy, Korea began to terminate some regulatory policies in the 1980s and accelerated the liberalization process in the 1990s. With respect to external sectors of the economy, the Korean government introduced a market-based exchange rate system in 1990 and began to open the official capital markets in 1992 by partially allowing foreigners to invest directly in Korean stock markets. Since then, the process of capital market deregulation has become irreversible. The only remaining matter seems to be how quickly the liberalization process will, or should, be carried out.

With the current level of interest rate differentials between Korea and developed economies, drastic full-scale liberalization would certainly induce a large amount of capital inflow and appreciate the Korean won. This would affect the price competitiveness of Korean products in international markets, which could bring about significant macroinstability in an economy like Korea's, which relies heavily on external transactions. An urgent question among Korean policymakers is whether there exists any policy combination that could minimize the macroinstability associated with the unavoidable trend of capital market liberalization.

This paper attempts to provide some quantitative, though very crude, assess-

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ments of several alternative policy choices. In order to perform simulation exercises, we set up a structural macromodel based on neoclassical long-run convergence and Keynesian short-run dynamics. Since the economic environment of the future, particularly in relation to external capital transactions and exchange rate determination, will be completely different from that of the past, there are undoubtedly limitations to what we can learn from past data.¹ For this reason, we employ theoretical relationships rather than only utilizing regression results for some parts of the model.

We do not believe that the exercises performed in this paper can significantly improve general understanding of this rather well-known subject; the simulation results are qualitatively predictable. By applying general theories to the specific data, however, the quantitative results in the paper may help readers to anticipate future dynamic paths of the key macrovariables in the Korean economy. In addition, the paper provides evidence for the convergence of the neoclassical growth model from the Korean data, to which the simulation model anchors.

Section 11.2 reviews recent developments in the exchange rate system and capital market liberalization in Korea as well as the movements of some relevant macrovariables. Section 11.3 briefly explains the econometric macromodel used in this paper, and section 11.4 presents the simulation results. Section 11.5 provides concluding remarks.

11.2 Capital Flows and Related Macrovariables in Korea

11.2.1 Exchange Rate System

With the abandonment of the fixed exchange rate system in 1980, the exchange rate began to float by being pegged to a basket of multiple foreign exchange rates. Nevertheless, the government continued to exercise great discretionary power in the name of “policy considerations,” the most important of which seemed to be maintenance of the current account balance.²

It was recognized, however, that operation with the exchange rate as an independent policy tool would not be possible since Korea’s capital markets would no longer be insulated from the gigantic world capital market. To prepare for the forthcoming capital account liberalization process, the multiple basket peg system was finally replaced, in March 1990, with the “market average rate” system. Under the new system, the exchange rate is determined by demand for and supply of Korean won vis-à-vis foreign exchange, and the government can affect the exchange rate only indirectly through the market. Although the Korean government still appears to be a major player in the exchange market for

1. As a leading example, one can think of Lucas’s critique (1976).

2. For details of Korea’s exchange rate movements, see Oum and Cho (1995).

the Korean won, its relative market power will certainly diminish as the Korean capital market becomes integrated with the world market.

11.2.2 Capital Market Liberalization to Date

In Korea, capital market liberalization proceeded gradually, taking into account such factors as the current account balance, money supply, and exchange rate. For example, when the current account showed large deficits in the first half of the 1980s (see fig. 11.1), capital outflows were strictly restricted to slow down the pace of foreign debt accumulation. This situation was completely reversed in the latter half of the 1980s. A large current account surplus, reaching 7.8 percent of GDP in 1988, forced the Korean government to decontrol capital outflows. As a result, the net level of foreign debt plunged from 37.7 percent of GDP in 1985 to 1.4 percent in 1989. But the increased capital outflows were insufficient to contain the growth of reserve money (see fig. 11.2). Hence, private credits were restricted, and massive sterilization was conducted through monetary stabilization bonds (MSBs).³

However, controls on capital flows became increasingly difficult as the Korean economy got more integrated into the global economy. Foreign investors, as well as domestic companies, constantly demanded greater opening of Korean markets to exploit the big interest differential with overseas markets. To meet their demands to a certain degree, a capital account liberalization plan was finally announced in 1993.⁴

Korean residents now have a great deal of freedom as far as capital outflows are concerned,⁵ but considerable restrictions still remain on capital inflows.⁶ These restrictions on capital inflows are not expected to be removed in the near future unless the interest rate differential substantially narrows.

11.2.3 Capital Flows and the Interest Rate Differential

Since external capital flows were tightly controlled in Korea, the capital account balance was extremely insensitive to the uncovered interest differential.⁷

3. The outstanding MSBs amounted to 88 percent of reserve money at the end of 1995.

4. This plan was superseded by the foreign exchange reform plan in 1994, which in turn was revised in late 1995. Further liberalization was announced in April 1996. For a survey of Korea's liberalization process, see Park (1992).

5. Individuals, as well as institutional investors, can make unlimited investments in overseas securities. Institutional investors can hold deposits in foreign banks up to \$100 million, while lower limits apply to legal entities and individuals. Outward foreign direct investment (FDI) was to be completely liberalized by 1997.

6. The regulations are as follows: nonresidents as a whole can hold up to 20 percent of the outstanding shares of each company, and each nonresident up to 5 percent; bond holding by nonresidents is allowed indirectly through the Korea Trust and Country Fund; direct holding is allowed only for convertible bonds issued by small and medium-sized enterprises; domestic companies can use foreign commercial loans within certain limits only for the import of capital goods and for FDI; delayed payment for imports is currently permitted for up to 120 days.

7. Since futures or forward markets are not yet established in Korea, we could not test covered interest parity.

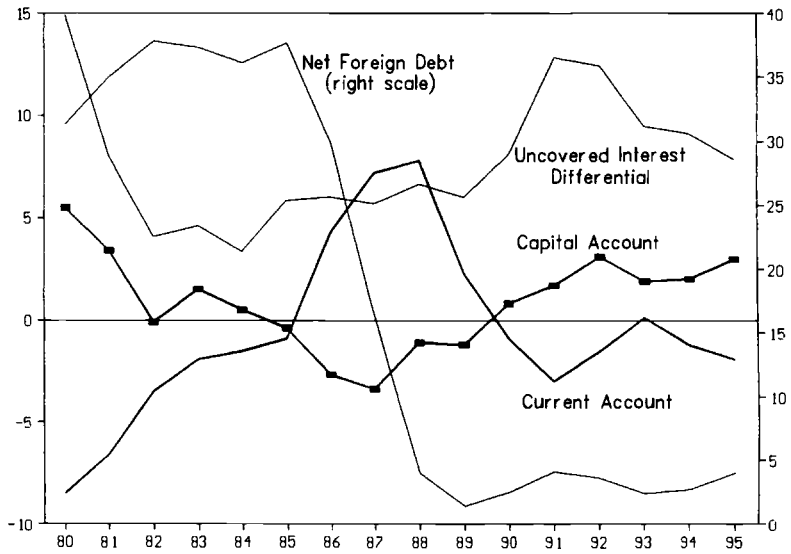


Fig. 11.1 External balances (percent of GDP)

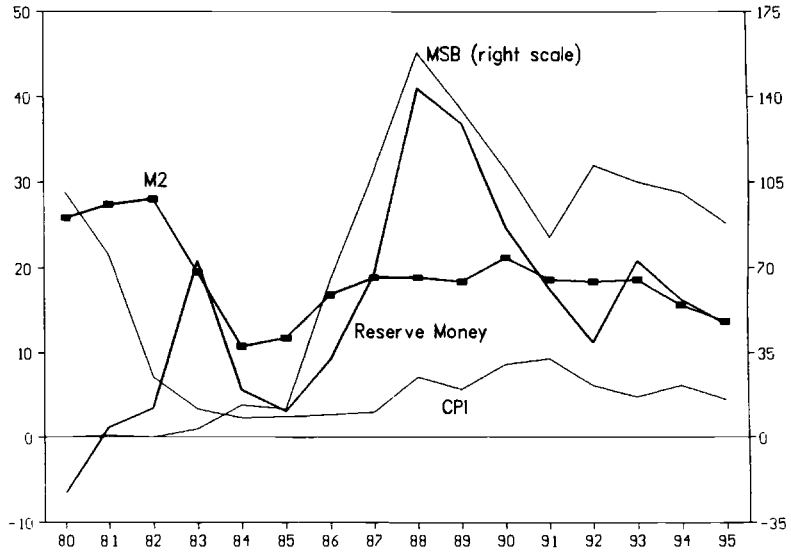


Fig. 11.2 Annual monetary and CPI growth rates (percent)

Table 11.1 Capital Flows and the Uncovered Interest Rate Differential

Capital Account Balance	Constant ($\times 10^{-2}$)	$i_t - i_t^f - \log(e_{t+1}/e_t)$		R^2
		No Time Trend	$t - 1995$	
skb _t	-0.03 (0.13)	0.04 (1.81)		.06
lkb _t	1.26 (2.83)	-0.11 (2.63)		.12
kb _t	1.23 (2.38)	-0.07 (1.47)		.04
skb _t	-0.13 (0.54)	0.09 (2.45)	0.01 (1.69)	.11
lkb _t	0.88 (2.15)	0.09 (1.33)	0.04 (3.76)	.32
kb _t	0.76 (1.63)	0.18 (2.39)	0.04 (4.14)	.29

Notes: skb_t, lkb_t, and kb_t denote short-term, long-term, and total capital account balance (normalized by potential GDP), respectively; and i_t , i_t^f , and e_t denote domestic interest rate (yield rate of three-year corporate bond), foreign interest rate (three-month Eurodollar rate), and won-dollar exchange rate, respectively. The sample period is 1983:1 to 1995:4. Numbers in parentheses are t -statistics. The linear time trend, $t - 1995$, is normalized so that $t = 1995$ yields 0. For further details, see the text.

Using the actual rate of the won-dollar exchange rate depreciation as a proxy variable for the expected rate, $\log(e_{t+1}/e_t)$, table 11.1 shows the results of regressions of the capital account balance (normalized by potential GDP), kb_t, on $i_t - i_t^f - \log(e_{t+1}/e_t)$, where i_t and i_t^f denote the domestic and foreign interest rates at time t , respectively. If capital were perfectly mobile across national borders and there were no uncertainty, this coefficient would in principle approach infinity so that only the exchange rate can, and should, adjust to restore the equilibrium.⁸ While the short-term capital account (skb_t) shows a small but significant positive correlation, the long-term capital account (lkb_t) yields a negative correlation.

Although the correlations between the capital account and the uncovered interest rate differential are not strong, it seems clear that the capital account has become more responsive to the interest differential. As a piece of evidence, table 11.1 reports the results of regressions in which a linear time trend is included in the regression coefficient: the time trend appears significant in both skb_t and lkb_t regressions.⁹ In particular, the estimates for the kb_t regression

8. Considering the forecast error about e_{t+1} at time t , there must be measurement error in the expected appreciation rate, hence a downward bias in the regression coefficient. Nevertheless, there seems no reason to expect that this bias would change the sign of the coefficient estimate, and the increase in the coefficient estimate over time seems to indicate that capital flows are getting more sensitive to the uncovered interest differential.

9. We also tried several other specifications for the coefficient to test if there is any convexity over time, but the results were not very different from the linear time trend.

imply that the coefficient turned positive in 1991, approximately the same time that the stock market began to open to foreign investors.

11.2.4 Secular Trend of the Interest Rate

The annual yield rate of three-year corporate bonds in Korea is still around 12 percent, which implies an approximately 7 percent real interest rate, given the approximately 5 percent annual inflation rate. Under this circumstance, it is clear that for foreign investors, Korea is an attractive market that has not yet been sufficiently explored. Then the most relevant question to our analysis in this paper is what maintains the high (real) interest rate in Korea and how it will evolve over time.

Figure 11.3 plots three series of interest rates: the official bank loan rate, the yield rate of three-year corporate bonds, and the curb market rate, all of which are converted into real terms by subtracting the actual inflation rate. It is well known that the official interest rates on bank loans and corporate bonds were maintained at levels far below the market rate by severe government controls in Korea until the first half of the 1980s. Although the gap between the official rates and the curb market rate substantially narrowed as a result of the continuous financial deregulations in the 1980s, the curb market rate seemed to be a better measure of the market rate at least until the first half of the 1980s. From figure 11.3, it appears clear that the curb market rate has been in a downward secular trend, from over 20 percent in the early 1970s to around 7 percent in 1995. Using the corporate bond rate, which is widely used as the representative market rate in the 1990s, we can also find a similar downward trend if the sample period is restricted to a recent period, say, 1983–95.

We interpret this downward trend of the real interest rate as evidence for transitional dynamics of the neoclassical growth model. In a stylized neoclassical growth model, employing the Cobb-Douglas production function, $Y_t = A_t K_t^\alpha L_t^{1-\alpha}$, where Y denotes potential output, A level of technology, K capital stock, and L labor supply, the interest rate is equated to the marginal productivity of capital, $\alpha Y_t/K_t$, minus the depreciation rate, δ . In an economy with an initial level of K/L lower than the steady state level, the marginal productivity of capital (hence the interest rate) declines over time to converge to the steady state level (say, the world level of the interest rate).

In order to be convinced that transitional dynamics was a plausible description for the secular trend of the Korean interest rate, we also plotted in figure 11.3 rough estimates of $\alpha Y_t/K_t - \delta$ using $\alpha = 1/3$ and $\delta = 0.066$ per year,¹⁰ which appear to aptly describe the trend of the curb rate. It may be worthwhile to note here that the average growth rate of investment has been far greater

10. The estimates of labor income share, $1 - \alpha$, in Korea range from 60 to 70 percent (see table 2 in Hong 1994) and the depreciation rate of capital, δ , is estimated to be 6.6 percent per year by Park (1992).

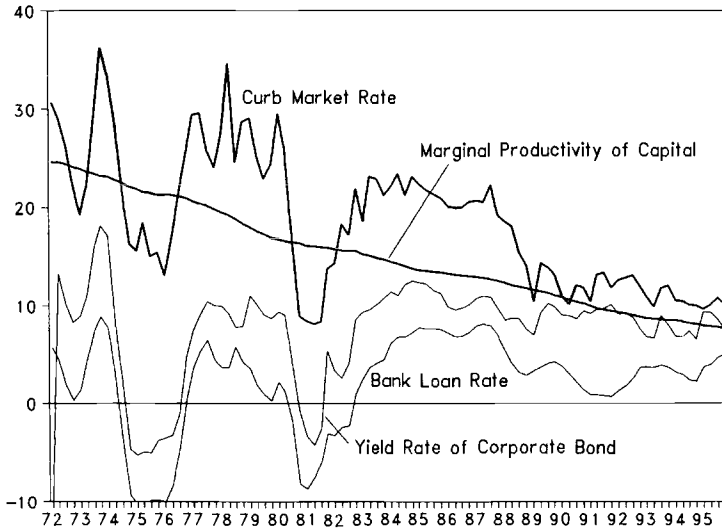


Fig. 11.3 Trend of real interest rate (percent)

than the average growth rate of GDP in Korea since the 1960s.¹¹ This was the main cause of the declining trend of Y_t/K_t , and it seems unlikely that the trend will suddenly reverse its direction. In order to reflect the downward trend in the long run, therefore, we include $\alpha y_t/K_t - \delta$ in the interest rate specification along with other commonly used variables, such as money supply (see the appendix for details).

11.3 A Brief Description of the Empirical Model

The model we used for the simulations is basically neoclassical in the long run, but Keynesian in the short run (details are in the appendix). That is, all the real variables are determined by the supply side in the long run, which follows the transitional dynamics explained in subsection 11.2.4.¹² In the short run, however, demand shocks do matter as in a typical Keynesian model.¹³

Technically, the way we distinguish long-run from short-run phenomena is by employing error correction types of specifications in which only long-run

11. E.g., the average annual growth rate of investment during the period 1970–95 in Korea was approximately 12 percent, while that of GDP was around 8 percent.

12. See Blanchard and Fischer (1989) for a discussion of dynamic responses of a flexible price model in relation to the capital market opening of an economy with higher interest rates than the world rate. We take this case only as a long-run phenomenon because we assume in our model that prices are sticky in the short run.

13. While the long-run neutrality of money holds in the model, superneutrality does not.

Table 11.2 Assumptions about Growth Rates of Exogenous Variables (percent)

Variable	Big Bang(e)	Gradualism(e)	Gradualism(M)
Y_t^f	3.0	3.0	3.0
P_t^f	2.5	2.5	2.5
i_t^f	7.5	7.5	7.5
L_t^*	2.2	2.2	2.2
e_t	–	–	800
\bar{M}_t	14.0 (1996–2000)	14.0 (1996–2000)	–
	13.0 (2001–5)	13.0 (2001–5)	–
\bar{B}_t	14.0 (1996–2000)	14.0 (1996–2000)	–
	13.0 (2001–5)	13.0 (2001–5)	–

Note: See the appendix for definitions of the variables.

determinants are included in the error-correcting terms. That way, the effects of all the other short-run (say, stationary) disturbances eventually disappear, leaving only the effects of long-run determinants. For example, the interest rate is affected by many factors like money supply in the short run, but it will eventually converge to the sum of the inflation rate and capital productivity. What then becomes important for short-run effects is speeds of convergence toward long-run equilibrium levels, which we let the data determine from the regressions.¹⁴

We used quarterly data from 1983:1 through 1995:4 for the regressions,¹⁵ although the simulation results will be presented in annual terms. For the future projection, we took the simplest case of the exogenous variables that are presented in table 11.2. Particularly important is the foreign interest rate in real terms, which we assumed to be 4 percent throughout the simulation period.¹⁶

We are aware of the many limitations of our empirical model in particular as well as of simulation experiments in general. After all, the shortcomings of policy simulations using econometric models have well been recognized since Lucas (1976). Our model is also far from flawless. Perhaps the most important flaw is that it is basically backward looking. For example, the “expected” rate of inflation is simply computed from the past series of the inflation rate, rather than going through the rational expectations of monetary policy reactions. Our

14. In a sense, our model can be viewed as a large vector autoregression system with error-correcting terms. To identify the shocks, we tried to minimize the number of two-way causal relations among contemporary variables. Nevertheless, a few contemporaneous variables remain to cause each other (e.g., consumption and GDP). We did not attempt to correct possible simultaneity bias, hoping that the size of the bias is negligible.

15. The major reason that we restricted the sample period to 1983–95 is to take the longest period in which the corporate bond rate can be used as the representative interest rate.

16. Barro and Sala-i-Martin (1990), e.g., report 3 to 4 percent per year as the acceptable range of the “world real interest rate.” We took 4 percent to allow a slight margin for country risk, so that the capital market will be in balance when the real interest rate in Korea reaches 4 percent.

application of forward-looking behavior to determine the exchange rate may then be considered inconsistent with the other parts of the model. Nevertheless, we hope that the following experiments can provide a useful, though rough, quantitative assessment of the effects of capital market liberalization in Korea.

11.4 Simulation Results

11.4.1 Benchmark Case: No Capital Flows

As shown in figure 11.1, Korea has been maintaining a net capital inflow of about 2 percent of GDP since 1992. Therefore, an abrupt shutdown of external capital markets may be interpreted as a regressive “big bang” case. We experimented with this case to see how the model works and to obtain benchmark values of the relevant variables whose dynamic paths will be compared under different regimes.

In this benchmark case, capital cannot flow freely to seek higher returns, and thus interest parity does not hold. Specifically, we let the exchange rate adjust to restore the current account balance by $e_{t+1} = e_t \exp(-\beta cb_t)$, where cb_t is the current account balance normalized by potential GDP and the parameter for the adjustment speed, β , was estimated from the data. That is, we assume that capital account transactions are just passively adjusted to support current account transactions. This specification of the exchange rate may be interpreted as a policy reaction function that aims at current account balance using current account performance as a measure of exchange rate misalignment, which appears to fit the Korean data in the 1980s.¹⁷

Although we will not report the results for this case, we could get a rough idea of the real exchange rate that would be consistent with current account balance (called the purchasing power parity [PPP] rate hereafter). Given the assumptions about all the exogenous variables, this value appears to be around 800 won per dollar in the beginning of 1996. In addition, we could confirm that the real interest rate gradually declines to 4.3 percent in 2005, which is mainly generated by the projection of the secular downward trend in the model (see the appendix for details). It is also confirmed that the rate of CPI inflation converged to around 3 percent under the assumptions for money supply and labor growth rate.

In the following, the discussion will focus on the results of three cases that differ in the speed of capital market liberalization and exchange rate policy. Table 11.3 summarizes the exchange rate dynamics and associated money supply mechanisms for each of the three cases, and figures 11.4A–11.4L report the simulation results.

17. In fact, the Korean government appeared to manage the exchange rate aiming at current account balance in the 1980s. See Oum and Cho (1995) for details.

Table 11.3 Exchange Rate and Money Supply Determination Mechanisms

Case	Exchange Rate (e_t)	Money Supply (M_t)
Big Bang(e)	$e_{t+1} = e_t \exp(i_t - i_t^i)$	$M_t = \bar{M}_t$ (exogenous)
Gradualism(e)	$e_{t+1} = e_t \exp\{i_t - i_t^i - kb_t/[7.5/(2010 - t)]\}$	$M_t = \bar{M}_t$ (exogenous)
Gradualism(M)	$e_t = 800$	$M_t = \bar{M}_t + 5(KB_t + CB_t)$

Note: We used 5 as the money multiplier in the M_t specification of gradualism.

11.4.2 Big Bang

We regard as “perfect capital mobility” the case in which uncovered interest parity holds (or the elasticity of kb_t with respect to $i_t - i_t^i - \log(e_{t+1}/e_t)$ is infinity in table 11.1). In this case, the most active role is assigned to capital account transactions concerning the exchange rate determination, and the current account simply responds to exchange rate movements. We assume that this new regime of exchange rate dynamics suddenly replaced the old one at the beginning of 1996. As will be explained below, the only sustainable policy in this case is to let the exchange rate adjust.

Exchange Rate Adjustment

If the government let the exchange rate absorb the interest rate differential in the case of big bang, the exchange rate dynamics can be specified by

$$e_{t+1} = e_t \exp(i_t - i_t^i),$$

while the money supply is controlled by the government. In order to pin e_t down in the simulation, a terminal condition is needed as in other forward-looking dynamic models. We tried several values for the initial e_t and picked the associated dynamic path of e_t that yielded the most consistent results with the path of i_t at the terminal year, 2005. Since i_t almost converges to i_t^i by 2005 (6.5 percent = 4 percent real rate + 2.5 percent inflation rate in this case), the real exchange rate should also converge to the PPP rate that was roughly calculated in the benchmark case.

A typical sticky-price monetary model (Dornbusch 1976, e.g.) would predict the results for this case. The exchange rate initially jumps to appreciate by approximately 15 percent¹⁸ and then gradually depreciates by the interest differential until it converges to the PPP rate around 2005 (fig. 11.4A). The interest rate declines faster than in the benchmark case because of more active

18. This estimate of 15 percent is roughly consistent with the result of simple algebra using the interest parity and the long-run trend of the real interest rate without considering feedback effects of all the other variables of the macromodel. From the observation that the real interest rate declines by approximately 0.3 percentage points per year, the cumulative sum of interest differentials can be roughly computed by $\sum_{t=0}^{10} (r_t - r_t^i) = 15$, for $r_t = 7.0 - 0.3t$ and $r_t^i = 4.0$.

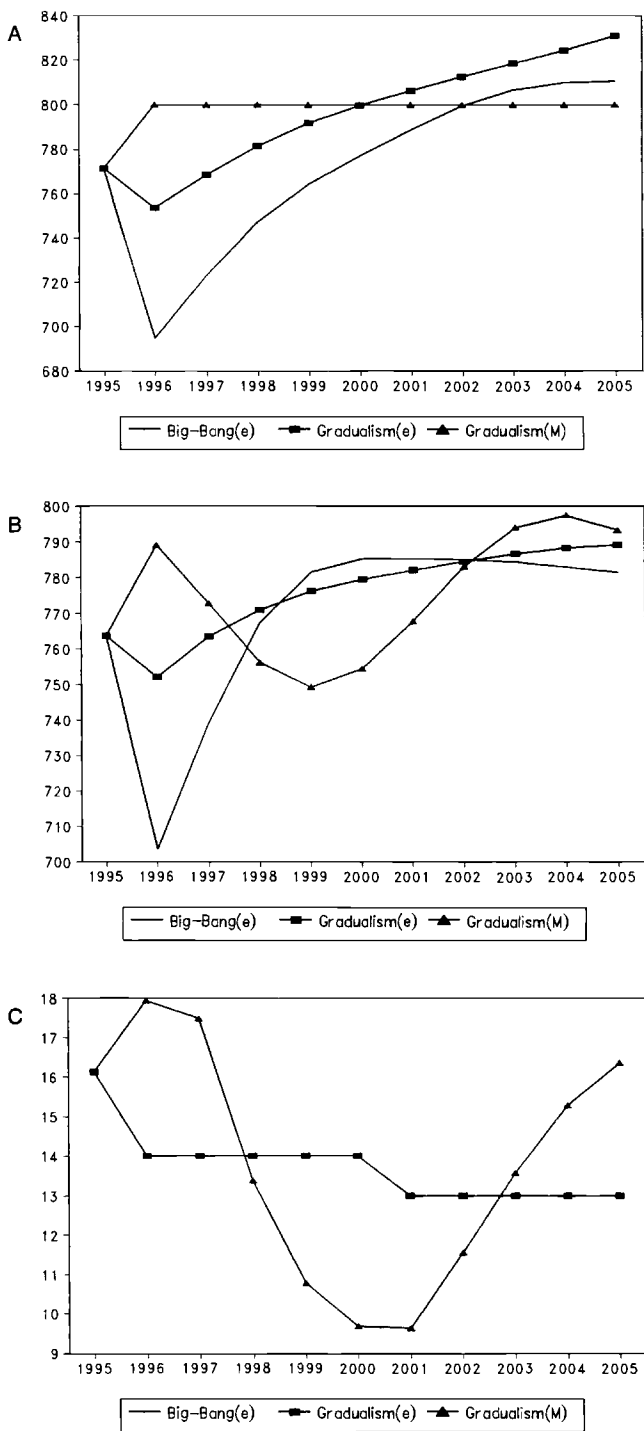


Fig. 11.4 Simulation results: big bang versus gradualism

Note: A, exchange rate (won per dollar). B, real exchange rate (won per dollar in 1990 prices). C, growth rate of money (percent); big bang and gradualism(e) curves coincide.

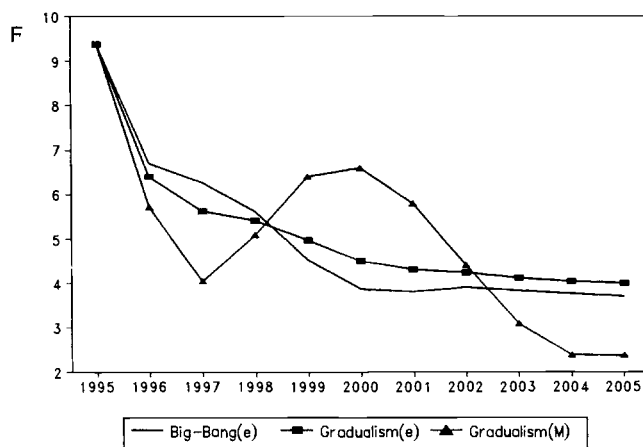
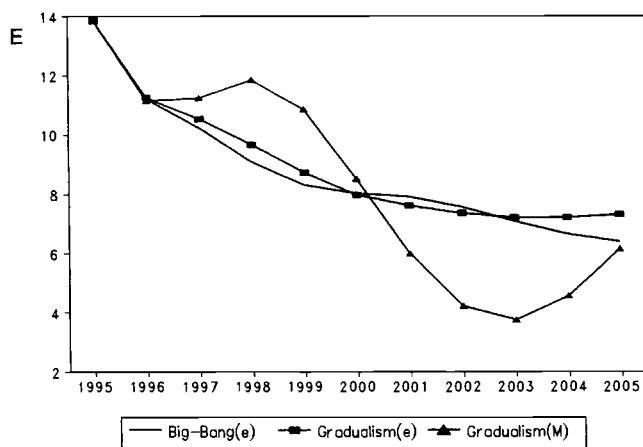
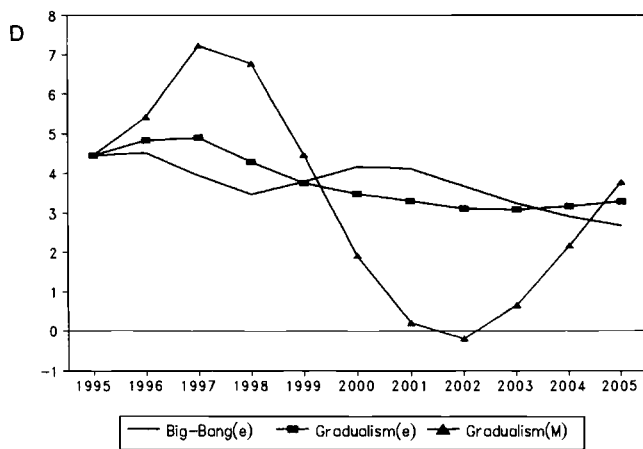


Fig. 11.4 Simulation results: big bang versus gradualism (cont.)

Note: D, rate of CPI inflation (percent). E, nominal interest rate (percent). F, real interest rate (percent).

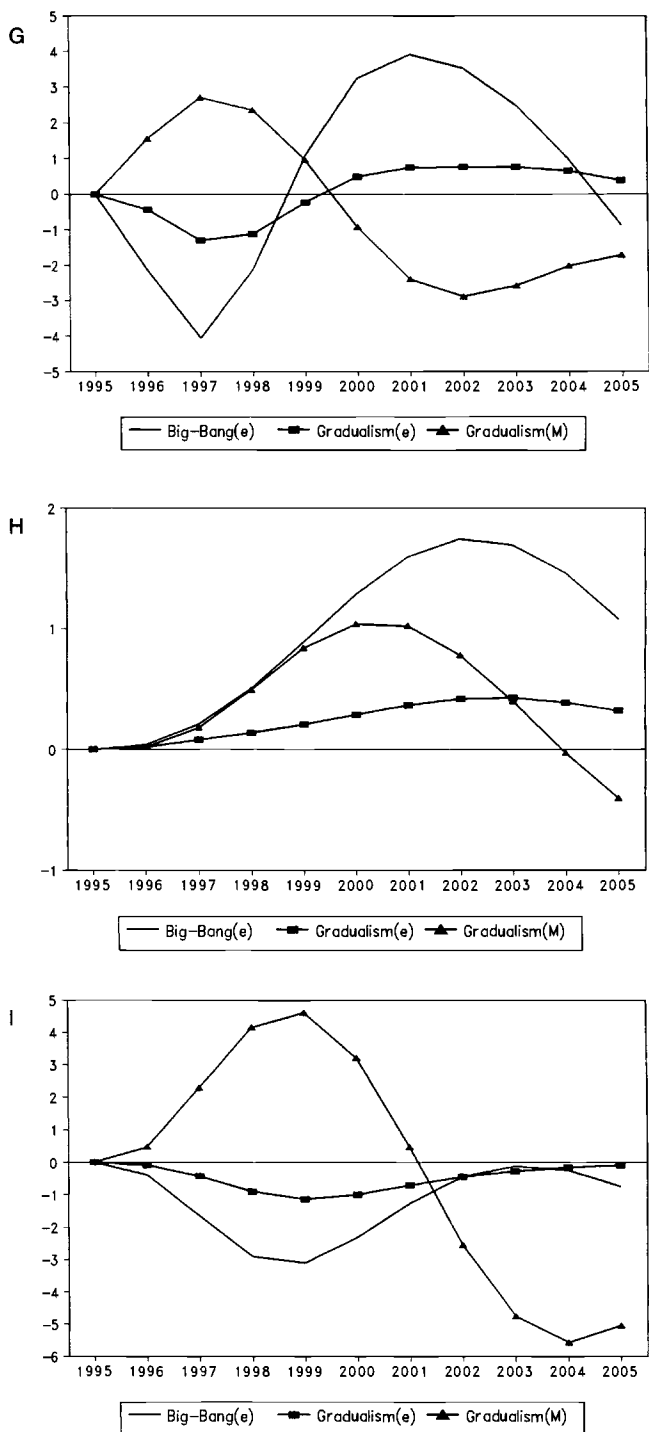


Fig. 11.4 (cont.)

Note: *G*, GDP, deviation from benchmark (percent). *H*, potential output, deviation from benchmark (percent). *I*, CPI, deviation from benchmark (percent).

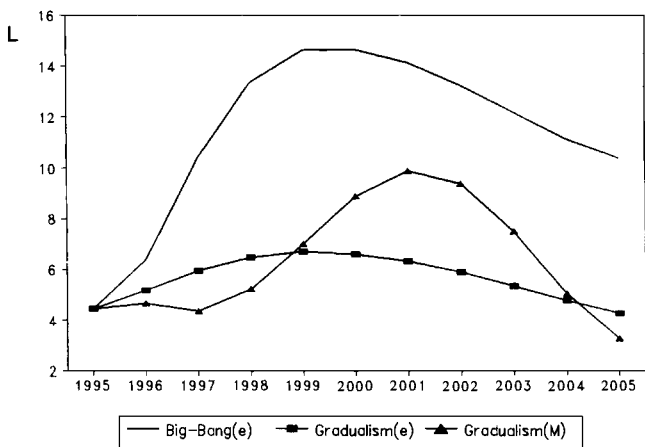
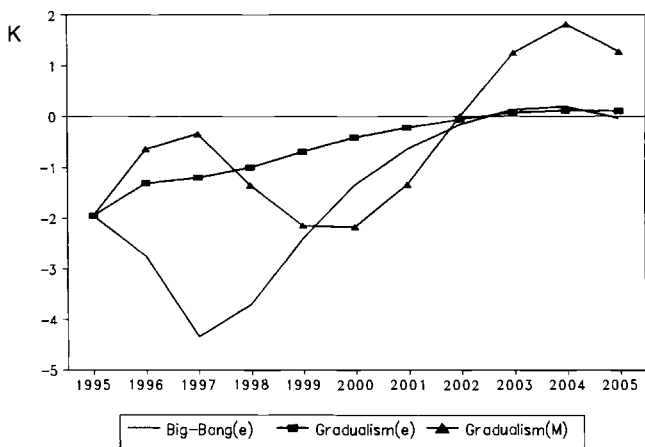
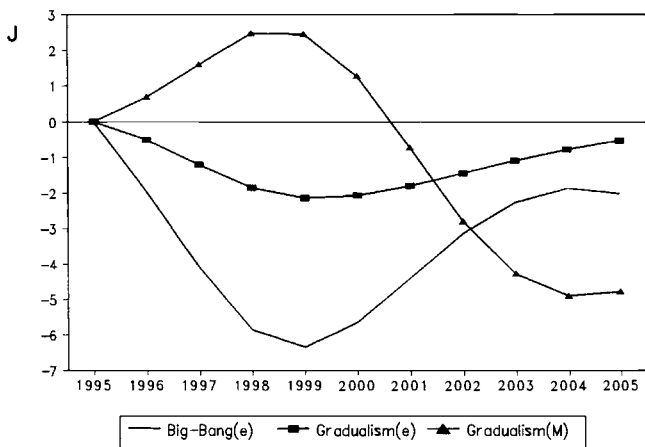


Fig. 11.4 Simulation results: big bang versus gradualism (cont.)

Note: *J*, PPI, deviation from benchmark (percent). *K*, ratio of current account balance to GDP (percent). *L*, ratio of net foreign debt to GDP (percent).

investment¹⁹ and the resulting capital accumulation (fig. 11.4E). Potential output also increases rapidly (fig. 11.4H), but the economy goes through a short-run recession for the first two to three years (fig. 11.4G) due to the contraction of foreign demand that is caused by the exchange rate appreciation. Prices, particularly PPI, which is far more affected by import prices, become very stable (figs. 11.4I and 11.4J). But the current account deficit reaches almost 5 percent of GDP in 1997 (fig. 11.4K) and then approaches balance, rapidly accumulating (net) foreign debt, 15 percent by 1999 (Fig. 11.4L).²⁰

Exchange Rate Targeting

Policymakers often fear the rapid accumulation of foreign debt and therefore seek exchange rate stability. To see the effects of this policy, we set the nominal exchange rate at 800 won per dollar, which appears to be approximately consistent with the current account balance at the beginning of 1996. Since interest parity should hold in this big bang case, the only way to support nominal exchange rate stability ($e_{t+1} = e_t$ for all t) is to equate the domestic interest rate with the foreign rate ($i_t = i_t^f$ for all t).²¹

If expansionary monetary policy were used to lower i_t to the level of i_t^f , we could easily confirm unsustainability: the model explodes no later than 1998 with more than 100 percent inflation.²² The initial monetary expansion to set $i_t = i_t^f$ brings about inflation, hence i_t begins to rise, which requires accelerating monetary expansion to keep $i_t = i_t^f$. If the interest rate gap is not so wide and the gap is expected to narrow soon due to a third factor, then a temporary expansion of the money supply may be a reasonable choice. But Korea's current situation does not seem to be such a case. To save space, we did not report the results of this experiment.

Another, though arguable, way to lower i_t may be to run an extremely large budget surplus.²³ From many regressions of the interest rate on public bonds, however, we only found an extremely small and statistically insignificant elasticity. The interest rate equation in the appendix is the one that yielded the largest elasticity with respect to public bonds. Even with this largest elasticity, a simple calculation shows that the required amount of outstanding bond reduction to equate i_t to i_t^f would be 30 to 50 percent of GDP, or two times larger than the current level of total government expenditure, which would be impossible to achieve.

11.4.3 Gradual Liberalization

The general consensus of the empirical literature seems that while covered interest parity holds, uncovered interest parity does not exactly hold even

19. More active investment is mostly induced by the relatively low interest rate.

20. Net foreign debt is simply computed as the accumulation of the current account deficit.

21. The reason that i_t should be equal to i_t^f is that we assumed perfect foresight of investors.

22. The model explodes no matter where the target level of exchange rate is set.

23. How sensible this statement is depends on whether Ricardian equivalence holds.

among the countries maintaining the most liberalized capital markets.²⁴ Considering this empirical finding, it may be rather reasonable to assume that the elasticity of kb_t with respect to $i_t - i_t^f - \log(e_{t+1}/e_t)$ is finite. Particularly for the case of Korea, in which the capital markets are expected to open gradually, we assume that this elasticity (denoted $f(t)$ below) will be increasing at a gradual pace over time:

$$kb_t = f(t)[i_t - i_t^f - \log(e_{t+1}/e_t)],$$

where $f(t) > 0$ and $f'(t) > 0$ for all t . One can regard the big bang case as the limiting case in which $f(t)$ goes to infinity from the beginning. We have experimented with many specifications of $f(t)$. As can be easily reasoned, the general rule of thumb is that the more rapidly $f(t)$ increases, the closer the results are to the big bang case: the initial appreciation of the exchange rate is larger, or the model is more likely to explode with exchange rate targeting.

In this paper, we only present the results for $f(t) = 7.5/(2010 - t)$, which is one of the most gradual processes we have tried, so gradual that exchange rate targeting does not explode. The rationale of this specification is that (a) the Korean government will completely open capital markets by the year 2010, when the Korean interest rate is expected to be sufficiently close to the world rate ($f(t)$ goes to infinity for $t = 2010$), and (b) $f(1995) = 0.5$ is close to the actual elasticity in 1995.²⁵

While this specification is tractable, the most critical question behind this gradual process is how sustainable the gradualism itself would be under the potential threat of speculative attacks. The assumption that capital flows are only partially responsive to the interest rate differential hinges on the presumption that potential speculators are limited in their amount of foreign currency transactions. That is, the big proviso of a successful gradualism appears to be the controllability of the quantity of foreign currency inflows until the interest rate differential narrows, say, by the year 2000.

Exchange Rate Adjustment

This case is basically the same as the case of big bang with exchange rate overshooting, except for the magnitudes. The exchange rate determined by $e_{t+1} = e_t \exp\{i_t - i_t^f - kb_t/[7.5/(2010 - t)]\}$ initially jumps to appreciate to a relatively mild extent and then depreciates over time until it reaches the PPP rate (gradualism(e) in figs. 11.4A and 11.4B). The directions of all the other results are the same as in the big bang case, but the magnitudes are smaller.

Exchange Rate Targeting

Perhaps a more interesting case of gradual liberalization is the one in which the government policy to fix the nominal exchange rate is sustainable. Since

24. This may be due to either the risk-averse behavior of the investors or the "irrational" formulation of the agent's expectations, or something else. See Taylor (1995) for a recent survey.

25. In 1995, kb_t was about 3 percent and the interest differential was about 6 percent.

kb, is not only finite but rather insensitive to the interest rate differential, the government is given much more room for policy making.

We fixed the exchange rate at 800 won per dollar, as in subsection 11.4.2, and let the central bank accommodate additional money demand to the same extent as the overall balance surplus. Since the level of the exchange rate initially yields approximately the current account balance (gradualism(M) in fig. 11.4K), the money supply expands almost as much as the capital account surplus, which will inevitably generate faster inflation.

This inflation has opposite effects on the subsequent money supply. On the one hand, it raises the nominal interest rate and thus induces more capital inflow, which increases the money supply. On the other hand, the inflation appreciates the real exchange rate and the current account turns to deficit, which decreases the money supply. The relative size of the two effects depends on the specification of $f(t)$, but in the case of very gradual liberalization, $f(t) = 7.5/(2010 - t)$, the latter effect dominates and the money supply declines (fig. 11.4C).²⁶ The monetary contraction then pushes the economy, which is about to enter a recession in 1999 after the boom generated by the initial monetary expansion, deeper into recession (fig. 11.4G). The deep recession further decreases the rate of inflation (fig. 11.4D), and the nominal interest rate finally drops below the world rate in 2001 (fig. 11.4E), which brings about capital flight from the country, along with current account surplus starting in 2002 (fig. 11.4K). While foreign debt accumulates less than in the big bang case (fig. 11.4L), the potential level of output is smaller (fig. 11.4H) and the economy goes through a similar magnitude of macroinstability in the opposite direction (fig. 11.4G).

Under this gradual liberalization plan and the expected downward trend of the interest rate, sterilized intervention for exchange rate stability appears to be sustainable as well as sensible for macrostability.²⁷ In order to avoid the initial recession and current account deficit, however, the government should bear the burden of public debt. In other words, the external debt that would otherwise accumulate is replaced by internal debt of the government (incurring higher interest rates). The benefit is gaining macrostability, while the cost is forgoing the opportunity to exploit foreign savings to enhance the potential capacity of the economy.

11.5 Conclusion

We have presented rough estimates of the dynamic paths for important macrovariables under several different liberalization scenarios. Fully admitting the limitations of our experiments, we believe that they can provide more concrete ideas of where the economy will be heading for each case.

26. If $f(t)$ is less gradual, the model explodes as in the case of big bang with exchange rate targeting.

27. As mentioned earlier, the effect of government bonds on the interest rate is negligible.

Among very many possible combinations of policies, including the speed of market opening, we are not able to pick an “optimal” one that totally depends on the objective function of policymakers. If the objective is simply to maximize the potential capacity of the economy with price stability, the big bang in conjunction with exchange rate overshooting should be recommended. But in this case, policymakers have to convince people that a sweet boom will arrive after a painful recession for the first couple of years and that the current account will turn into surplus after, say, 10 years.

Perhaps the time horizon here is too long for policymakers, and even when based on economic criteria it is not clear whether maximizing the potential level at the expense of a recession is the best choice. If it is not, a gradual liberalization process can be recommended. A critical justification for gradualism is then the secular downward trend of the interest rate, and the key to a successful gradualism seems to be control over the quantity of foreign currency inflows. In any case, we leave completely unanswered the question: how gradual is “optimal”?

Appendix

The Model

Variables

A	technical level
B	public bond
C^G	government consumption expenditure
C^P	private consumption expenditure
e	exchange rate
I	gross fixed capital formation
KB	capital balance
K	capital stock
L	total labor employed
M	money supply (M2)
MG	imports
MPK	marginal productivity of capital
MPL	marginal productivity of labor
P^c	CPI
P^p	PPI
P^x	unit value index of exports
P^m	unit value index of imports
P^f	foreign WPI
P^o	unit import price of oil
i	interest rate
i^f	foreign interest rate
t	time trend (quarterly)

W	wage
XG	exports
Y	GDP
Y^f	foreign GDP
π	CPI inflation rate
τ	tax rate

An asterisk denotes potential level. Δ denotes first difference.

Identities

Definition of capital stock (annual depreciation rate of 0.066)

$$K_t = (1 - 0.066/4)K_{t-1} + (1/4)(I_t + I_{t-1} + I_{t-2} + I_{t-3})$$

Trend of labor force (annual growth rate of 0.028)

$$L_t = \exp(0.02837 \cdot t/4 - 46.6687)$$

Aggregate production function (capital income share of 1/3)

$$Y_t^* = A_t \cdot K_t^{1/3} \cdot L_t^{2/3}$$

Technology progress rate (annual growth rate of 0.022)

$$A_t = \exp(0.02254 \cdot t/4 - 44.9738)$$

Productivity of labor

$$MPL_t = (2/3)Y_t^* / L_t$$

Productivity of capital (4 to be annualized)

$$MPK_t = (4/3)Y_t^* / K_t$$

Trend of capital productivity²⁸

$$MPK_t^* = 0.10 + (4/3)\exp(-0.06447 \cdot t/4 + 125.355)$$

Trend of capital stock²⁹

$$K_t^* = [(3/4)A_t / MPK_t^*]^{3/2} \cdot L_t$$

Trend of consumer price level

$$P_t^* = (M_t / Y_t^*)\exp(-0.03157 \cdot t/4 + 67.0944)$$

28. This is obtained by regressing $\log(MPK_t - 0.10)$ on t so that MPK_t and the real interest rate converge to 10 percent and 3.4 (= 10.0 - 6.6) percent, respectively.

29. K_t^* is determined by the exogenous time trend alone.

Definition of the inflation rate

$$\pi_t = \log(P_t^c / P_{t-4}^c)$$

Definition of GDP

$$Y_t = C_t^p + C_t^g + I_t + XG_t - MG_t$$

Regression Equations

$$\Delta \log(C_t^p) = 0.26 \cdot \Delta \log((1 - \tau_t)Y_t) + 0.17 \cdot \Delta \log(M_t / P_t^c)$$

(8.09)

(1.70)

$$- 0.09 \cdot [\log(C_{t-1}^p / Y_{t-1})] - 0.06.$$

(2.23)

(2.27)

$$\Delta \log(I_t) = -0.31 \cdot \Delta \log(I_{t-1}) + 0.26 \cdot \Delta \log(XG_t) + 0.29 \cdot kb_t$$

(2.65)

(1.98)

(1.10)

$$- 0.53 \cdot (i_t - \pi_t - MPK_t) - 0.30 \cdot [\log(K_{t-1} / K_{t-1}^*)] - 0.28,$$

(1.44)

(1.34)

(7.04)

$$\Delta \log(XG_t) = 0.30 \cdot \log(P_{t-2}^f / P_{t-2}^x)$$

(2.33)

$$- 0.16 \cdot [\log(XG_{t-1}) - 3.04 \cdot \log(Y_{t-1}^f)] - 0.12.$$

(2.11)

(36.75)

(9.73)

$$\Delta \log(MG_t) = 0.21 \cdot \Delta \log(I_t) + 0.27 \cdot \Delta \log(I_{t-1})$$

(1.72)

(2.32)

$$+ 0.64 \cdot \Delta \log(C_t^p + C_t^g) + 0.17 \cdot \Delta \log(XG_t)$$

(0.83)

(1.19)

$$- 0.24 \cdot \log(e_t \cdot P_t^m / P_t^p) - 0.15 \cdot [\log(MG_{t-1} / XG_{t-1})]$$

(1.83)

(2.03)

$$+ 1.67.$$

(1.92)

$$\begin{aligned}
 i_t &= 0.79 \cdot i_{t-1} + 0.02 \cdot \Delta \log(I_t) - 0.12 \cdot \Delta \log(M_{t-1}/P_{t-1}^c) \\
 (11.51) \quad & \quad (1.51) \quad \quad (1.98) \\
 & - 0.01 \cdot \log(M_{t-1}/B_{t-1}) + 0.21 \cdot [(\pi_{t-1} + \text{MPK}_{t-1} - 0.066)] \\
 & \quad (1.31) \quad \quad (3.03) \\
 & + 0.0002. \\
 & \quad (0.04)
 \end{aligned}$$

$$\begin{aligned}
 \Delta \log(W_t) &= -0.34 \cdot \Delta \log(W_{t-1}) + 0.35 \cdot \log(Y_t/Y_t^*) \\
 (2.43) \quad & \quad (3.34) \\
 & - 0.05 \cdot [\log(W_{t-1}/P_{t-1}^c) - \log(\text{MPL}_{t-1})] + 0.36. \\
 & \quad (1.42) \quad \quad (1.31)
 \end{aligned}$$

$$\begin{aligned}
 \Delta \log(P_t^c) &= 0.19 \cdot \Delta \log(P_{t-1}^p) + 0.09 \cdot \log(Y_t/Y_t^*) \\
 (1.54) \quad & \quad (3.39) \\
 & - 0.07 \cdot [\log(P_{t-1}^c/P_{t-1}^*)] + 0.02. \\
 & \quad (1.97) \quad \quad (11.07)
 \end{aligned}$$

$$\begin{aligned}
 \Delta \log(P_t^p) &= 0.04 \cdot \Delta \log(W_{t-1}/\text{MPL}_{t-1}) + 0.39 \cdot \Delta \log(P_t^c) \\
 (1.82) \quad & \quad (4.01) \\
 & + 0.12 \cdot \Delta \log(e_t \cdot P_t^M) \\
 & \quad (4.23) \\
 & - 0.09 \cdot [\log(P_{t-1}^p) - 0.26 \cdot \log(P_{t-1}^c) - 0.74 \cdot \log(e_{t-1} \cdot P_{t-1}^M)] \\
 & \quad (2.49) \quad \quad (3.53) \quad \quad (13.53) \\
 & - 0.004. \\
 & \quad (2.14)
 \end{aligned}$$

$$\begin{aligned}
 \Delta \log(P_t^x) &= 0.05 \cdot \Delta \log(\text{XG}_t) + 0.60 \cdot \Delta \log(P_t^p/e_t) \\
 (2.26) \quad & \quad (3.56) \\
 & - 0.11 \cdot [\log(P_{t-1}^x) - 0.85 \cdot \log(P_{t-1}^p/e_{t-1})] + 0.002. \\
 & \quad (1.37) \quad \quad (17.61) \quad \quad (0.73)
 \end{aligned}$$

$$\begin{aligned}
\Delta \log(P_t^M) &= 0.46 \cdot \Delta \log(P_t^f) + 0.08 \cdot \Delta \log(P_t^o) \\
(3.02) & \qquad \qquad (3.43) \\
&+ 0.40 \cdot \Delta \log(P_{t-1}^p / e_{t-1}) - 0.17 \\
(2.50) & \qquad \qquad (2.18) \\
&\cdot [\log(P_{t-1}^M) - 0.82 \cdot \log(P_{t-1}^f) - 0.18 \cdot \log(P_{t-1}^o)] \\
(49.51) & \qquad \qquad (10.74) \\
&- 0.001. \\
(0.27)
\end{aligned}$$

Seasonal dummies were included but are not reported. Numbers in parentheses are *t*-statistics, and variables in brackets are error-correcting terms.

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Comment Chong-Hyun Nam

I find this paper very interesting. It is not only informative but also very useful, especially for policymakers in Korea.

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As was much discussed in Black's paper (chap. 10 in this volume), a central important issue concerning capital market liberalization policy in Korea is whether there exists a trade-off between the speed of liberalization and the macroeconomic instabilities associated with it. Cho and Koh attempt to provide a quantitative assessment of this issue by simulating the results of alternative policy options, namely, a big bang approach, a gradual approach, and a gradual approach but with exchange rate targeting.

However, they seem to fall short of presenting an explicit model with a detailed discussion, making it difficult to grasp the nature and workings of the model used in the simulations. Nevertheless, Cho and Koh produce some interesting empirical results from their exercises with alternative policy options, although they tend to be modest in making a priority judgment on those policy alternatives, mainly because they do not know the exact objective function of Korea's policymakers.

Though I do not know the exact objective function either, let me try to suggest a set of constraints under which Korea's policymakers might work in ranking the policy alternatives open to them. I believe the first and most important factor for them to consider is the rate of economic growth. As a matter of fact, it has long been considered in Korea that anything less than a 7 percent economic growth rate is a sign of failure of both economic policy and political leadership. I presume that the 7 percent growth rate came from the thought that it provides a kind of bottom line that guarantees full employment with an ever increasing labor participation rate in Korea.

A second factor that policymakers would take seriously is performance in export activities. No doubt, economic and export growth rates are highly correlated, but in Korea any economic growth without corresponding growth in exports is generally believed to be at best transitory and not sustainable, mainly because domestic markets are thought too small to accommodate sustained growth.

A third factor to be considered by policymakers would be the rate of inflation. As Korea becomes more integrated with the world economy, maintaining a stable price level has become more important. I think an upper tolerance limit for the inflation rate is around 5 percent per year at the moment, but it could go lower soon.

A final factor that policymakers would take seriously is the rate of growth in external debt or the rate of accumulation of current account deficits. At the moment, the upper limit of tolerance in the policy-making circle seems to be 2 percent of GNP, implying that net foreign capital inflow should be limited to less than 2 percent of GNP for any particular year.

Figures 11.4*G* (GDP growth rate), 11.4*I* (CPI growth rate), and 11.4*K* (capital account balance) show that the least cost alternative is a gradual approach with no exchange rate targeting.

But many questions remain as to the way the gradual approach is set up in the paper. A major issue may be that the time horizon for complete liberalization by the year 2010 seems a bit too long from both internal and external

points of view. As soon as Korea opens up its bonds markets to foreign investors, the interest rate differential between home and abroad may quickly disappear not only because foreign buying of Korean bonds can be large but also because the interest elasticity with respect to capital account balance could increase significantly as Korea's capital market becomes more efficient with ongoing liberalization. I also wonder whether Korea can delay its liberalization process of capital markets that long, because it embarks on joining the Organization for Economic Cooperation and Development soon.

My final comment is that it would be nice if the authors could make experiments with the model for some more realistic policy packages that reflect, for instance, various levels of liberalization speed, of foreign exchange market intervention, and of sterilization.

Comment Koichi Hamada

Cho and Koh's paper contains a straightforward, simple experiment to assess the effect of possible "big bang" policies for Korea. The strengths of the paper are that the structure is simple and clearly explicated and that the experiment is easily related to theory. On the other hand, its weakness is that the model is too simple and is abstracted from many relevant factors. Accordingly, the computations from the experiment can only be remotely associated with observable data.

The paper presents an overshooting type of exchange rate determination model. It assumes some kind of short-run structure with price rigidity in connection to the Dornbusch dynamic and also a long-run full employment supply side. The relationship between these two aspects is not an easy problem. The authors do not provide such an explanation that they are related. For example, if the long-run income level is moving, the short-run overshooting process would be different because the money demand function would be shifting as well.

Consider figure 11C.1. Graphically, the jumping path corresponding to the big bang where investors face different interest rates is like the solid line, while the path for the gradual process is something like the dotted arrows.

On the empirical side, we are naturally curious about what is going on in the forward market. If we could obtain any information about forward rates or even their proxies, a discussion of interest rate arbitrage should follow. It would make the artificial discussion of approximation of the forward rate by actual

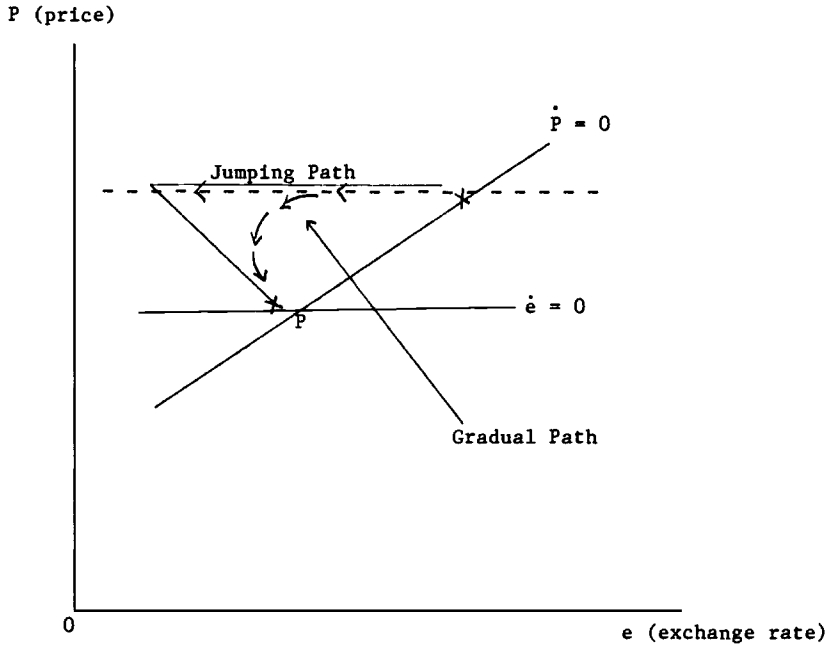


Fig. 11C.1 The big bang and gradualism

exchange rates unnecessary. Then the structure of the model and the works of the internal arbitration exchange market would be much clearer. In summary, this paper has the feeling of an isolated theoretical experiment, somewhat aloof from the complexity of real economic situations.¹

1. In retrospect, after the recent financial turmoil in Korea, I can now understand how drastic and difficult it was for the Korean economy to move from the state where there was no forward market to the state of convertibility, something close to the big bang experiment of this paper.

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