A Strategic Assisted Buyback Scheme of North Korean Debt[*]

Shi-Yong Lee[**]

This paper considers a strategic assisted buyback scheme that could result in a large benefits for both North and South Koreas at a relatively small cost. We claim that the implementation of this scheme by the South could lead to large benefits in the form of foreign capital inflowing into North Korea. Hence, the assisted buyback scheme can be mutually beneficial under a certain condition. The probability of collapse of the current North Korean regime that supports the mutually beneficial buyback tends to expand as the North Korea's benefit-cost from reforms expands. Furthermore, as the probability of collapse increases, the probability of reform success increases. This indicates that crises may be necessary to induce the North to undertake reforms.

I. Preliminary Remarks

The future of North Korea is one of the great political uncertainties in the post Cold War world. It is also, naturally, one of the greatest challenges for South Korea, for any change taking place in the destitute North Korea would profoundly affect the South. The most serious eventuality is the collapse of the North Korean regime, which could impose an enormous burden on the South Korean economy. Despite calls for the need to prepare for this eventuality, the South Korean authority has considered only a few options, thus far offering only small amounts of direct aid to the North.

This paper suggests an alternative aid scheme that could result in large benefits for both the North and the South at a relatively small cost, namely an assisted buyback of North Korea's outstanding external debt.[1] We provide a descriptive model which specify the precise conditions under which an assisted buyback scheme would lead to a mutually beneficial outcome.

As of 1994, the total amount of the North Korean external debt was about $10 billion and reached approximately 50% of its 1994 GNP.[2] (Emerging Market Debt Research on North Korea (1995)) Since the mid 1980s, North Korea has been unable to service its external debt and thus been excluded from the international capital market. As the historical evidence

1. An assisted buyback scheme refers to a practice in which donor (the South) provides funds required for the repurchase of a debtor's (the North) external debt at its current discounted price. On the other hand, a self-financed buyback scheme refers to a devise where a defaulted debtor uses its own resources to repurchase its own debt. This paper assumes that North Korea does not have enough funds to engage in a self-financed buyback scheme.

2. Some portion of this subsection draws heavily from Lee (1998a) and Lee and Hong (1998).

of sovereign debt defaults and lending resumptions demonstrates, nations in default are unable to re-borrow from international capital market unless they make settlements with creditors.[3] However, North Korea will be unable to do so any time soon because of the ongoing economic crisis and a chronic shortage of foreign reserves. The North Korean economy has been shrinking since 1990 (Lee (1997)), and this trend is unlikely to be reversed unless drastic measures are taken. A natural policy option for the North would be to seek foreign assistance in order to rescue itself from the current economic crisis. The North Korean debt has recently been traded at a discounted (average) price of 0.2 to 0.3 dollars to a dollar as Figure 1 indicates.

Figure 1   North Korean Secondary Debt Market Prices

This means that the current total market value of the North Korean debt would be at most $3 billion.

The North Korean debt is classified as "exotic," (as in case of Vietnam) meaning that it is information-elastic and insensitive to economic fundamentals (Emerging Market Debt Research on North Korea (1995)). Any "political" news concerning or affecting the status of the current North Korean regime may influence its price substantially. For example, the U.S. decision to lift sanctions against the North or the introduction of a reform package by

---

3. Cole, Dow, and English (1991) reported some stylized features from historical evidence of sovereign debt defaults and lending resumptions. They observed that even after very long periods of defaults, in one case exceeding 50 years, countries have had to settle old debts before obtaining new loans.

the current North Korean regime would affect its discounted price significantly, rather than changes in macroeconomic indicators (whose credibility is in serious doubt in any case).

In the meantime, South Korea must prepare for a potential collapse of the current North Korea regime, in which case the South may have to "absorb" the North, or at least assist its reconstruction. In both cases, South Korea would have to incur substantial unification cost. For the purposes of this paper, unification cost is defined as the cost of adjustment and restructuring in transforming the centrally planned North into a market-oriented economy.[4] Such a cost would include paying off the defaulted debt of North Korea. Although this component may be trivial compared to the unification cost of as a whole, it is one of the very few options available for the South in reducing the unification cost at this point. But more importantly, we claim that the implementation of an assisted buyback scheme by the South could lead to large benefits in the form of foreign capital flowing into North Korea.

The organization of this paper is as follows. The next section describes the model and analyzes the properties of solutions. It also provides justifications for the underlying assumptions in depth. The final section contains the summary and discussion of future research directions.

II. The Model

This paper presents a simple one-period, two-stage game-theoretic model. Its focus is one the (possible) interaction between two risk-neutral parties (the North and South) under an uncertain environment. Let State 1 indicate the event of unification (the collapse of the current North Korean regime) with probability p. State 2 refers to the event of survival with probability $(1-p)$. State 2 is sub-divided into the events of reform success with probability q and of no reform (status quo) with probability $(1-q)$. Only in the event of reform success does North Korea fully repay its debt.

First, notice that the probability of collapse of the current North Korean regime, p, is exogenously given. This reflects the assumption that in the case of North Korea, the stability of its regime is determined overwhelmingly by "nature" rather than by its own action. In general, the choice of action taken by the North would affect its survival (or collapse) probability.[5] However, in case of North Korea, we draw two distinct observations. (1) Many North Korea watchers now agree that the dynastic transition of power that took place in 1994 was successful, and that the current North Korean regime is stable.[6] Internal opposition is virtually non-existent, which allows the regime to impose a level of austerity that would not be tolerated in any other country. (2) The actions taken (or not taken) by relevant external parties (surrounding superpowers) may significantly affect its survival probability. Even if the probability of survival (p) is an equilibrium outcome chosen by the North Korean regime given the nature (following

---

4. So far, most of the literature fails to agree on precise definition of the unification cost. Hence, the cost of unification differs substantially according to various authors.

5. On the other hand, Grossman and Noh (1990) and Grossman (1996) endogenize the probability of survival of a political regime.

6. Notice that this is the reason why the events of unification and collapse of the current regime may be treated identical.

Grossman (1996)), we can assume that the regime's choice may be unaffected by any possible action of South Korea.

Second, since p is exogenous, it is also unaffected by q, which is endogenously determined. In fact, the probability of reform success may affect the probability of collapse either positively or negatively for a communist regime like North Korea. At this point, however, its relationship between the events collapse and reform success is ambiguous and thus the independence assumption is preserved. However, we can replace the first two assumptions with an alternative assumption. For example, both p and q can be endogenized such that the result of reform success/failure can affect the probability of survival. This alternative setup has been dealt in Lee and Hong (1998).

Following from the precedence of international law and the recent experience of German unification, we also assume that in the event of unification (collapse of the current North Korean regime), South Korea must fully repay North's external debt. Assuming an efficient secondary debt market, the secondary price of the North Korean debt is then $p + (1 - q)q$. Actions taken by the North and South can influence the average price of North Korean debt; South Korea can engage in an assisted buyback scheme and North Korea can take costly actions for reform success.[7]

The sequence of events is described as follows:

1. Prior to the realization of the status of the current North Korean regime, South Korea decides whether to engage in an assisted buyback scheme or not.
2. After the action taken by the South, North Korea chooses an adjustment effort level for reform before the realization of its status.

Before we develop a model, North Korean reforms deserve some comment. First, we define reform as programs that North Korea adopts in order to transform itself from a centrally planned to a market-oriented economy. These programs may include privatization, introduction of bankruptcy laws, removal of price rationing, liberalization of international trade to any other restructuring policies. It is important to note that North Korean reforms are assumed to be irreversible. Once "investments" in reforms are made in such programs, it is difficult to reverse he course. According to our definition, reforms refer to the introduction of liberalization policies into a society where two generations of extreme control and dynastic ideology prevail. Once the current regime commits to reform policies, it would find it difficult to receive them, despite some frictions along the way.[8] Another reason for the irreversible nature of such reform program is the external influences. Once the current regime undertakes reforms, foreign assistance and its coordination with foreign nations may play important roles in determining the success of reforms. Liberalization may risk its own survival.

With respect to the above point, we justify our one-period two-stages setup. Some may

---

7. In the stark contrast to Bulow and Rogoff (1988), Cohen (1991) reported that a change in the amounts of debt does not change discounted (secondary) prices of debt. However, in our setup, the discounted price of the North Korean debt may be increased with reform success. As it will be specified below, an assisted buyback scheme by the South may start the North's reform and thus increase its discounted price substantially.

8. Even Russia does not reverse its course in spite of strong oppositions.

object this setup since it may suffer from the time-inconsistency problem. However, the repayment is not the issue of the this paper as in Bulow and Rogoff (1988). Instead, the issue of this paper is to determine the condition that the North Korean regime undertakes reforms if South Korea provides an assisted buyback to the North.

In order to derive a solution, we solve backward, and, hence, start with the analysis of North Korea.

1. North Korea

This subsection describes the North Korea's choice by introducing the probability of reform success. Many factors may affect the probability of reform success but we propose that the probability of reform success depends on adjustment effort of the current North Korean regime and the level of assisted buyback. Dornbusch (1990) claimed that the arrival of aid may be the occasion of reform since it creates a sufficient probability of reform success. Similarly, an assisted buyback may substitute for costly adjustment reform effort that the North can take. Furthermore, the settlement of the defaulted debt with the existing creditors is the precondition for foreign capital inflow. (Cole, Dow, and English (1991)) An assisted buyback scheme acts as the settlement, and in return, it may induce foreign capital inflow and help the North to start reforms. In order to derive an explicit solution, we adopt the following functional form for the probability of reform success:

$$q(a, \theta) = \frac{a}{a + (1 - \theta)},$$ (1)

where a represents the North's adjustment effort for reform and θ indicates the level of assisted buyback by the South. Notice that two choice variables (a, θ) are normalized such that they are expressed in terms of debt overhang.

At this point, we explore an interesting possibility: what if the current North Korean regime may not be interested in reforms regardless of the provision of foreign aid? In contrast to Dornbusch (1990), Becker and Becker (1997) pointed out that economic aid tends to postpone rather than to contribute to reforms. This depends largely upon the type of aid package. For example, the food aid provided by the South may not contribute to increase the probability of reform success. Noland (1997) predicted that the current regime may not undertake any significant reform (**before some rapprochement with South Korea**) even though it has recently begun "some modest and hesitant reforms." An assisted buyback scheme, however, reduces fully or partially North Korea's indebtedness, and allows resumption of new loans. This creates an opportunity for potential investors to reinvest in the North. Then foreign capital may flow in. With this scheme, the benefits from reforms may outweigh the costs, and it helps the North to start off reforms. Due to this capital inflow, the probability of reform success improves substantially. As aforementioned argument goes, the purpose of this aid scheme is to remove barriers to capital mobility.[9]

9. When the North invited potential investors to a newly established special economic zone, one of the main reasons

Adjustment effort for reform success must be costly to the current North Korean regime. For instance, the adjustment cost of reforms, generally speaking, can be high if the society that undertakes reforms is highly polarized. Here, the adjustment cost to the regime (of undertaking reforms) may arise due to the divergence between the old and new system. In other words, due to the dynastic and homogeneity tradition that have prevailed in the North, it is costly for the current regime to convince and mobilize its party (and power elites) to adopt the market-oriented economic system. Taking account of the nature of the current regime, we can easily figure out that the introduction of the new system (a market-oriented economic system) imposes some constraints on the current regime. The cost function for adjustment effort is simple $C(a) = ka$, where k is a positive constant. k indicates the North's marginal cost of adjustment effort.

North Korea's problem is to select a. In solving this problem, the North takes θ as given. Hence, the North maximizes the following expected payoff function, Equation (2) with respect to a:

$$\text{MAX}_{A \in [0,1]} U_N = qV_1 + (1-q)V_2 - C(a). \tag{2}$$

U_N indicates North Korea's expected payoff from reform. Denote V_1 as the current North Korean regime's benefits from reform success and V_2, the benefits from status quo. Let $V_1 - V_2$ be V and assume that it is a non-negative number and $0 < V \leq 1$.[10]

The solution to North Korea's problem is,

$$a^* = \begin{cases} \sqrt{(1-\theta)\dfrac{V}{k}} - (1-\theta) & \text{if } \theta > \theta_C, \\ 0 & \text{if } \theta \leq \theta_C \text{ or } \theta = 1. \end{cases} \tag{3}$$

Let θ_c be $1 - (V/k)$ and indicates a cut-off point. From now on, for the sake of notational simplicity, let $(V/k) = v$. For instance, if we let the ratio of net benefit to cost of reform for the current North Korean regime (benefit-cost ratio, hereafter), v, equal to 1, then the solution becomes

$$a^* = \begin{cases} \sqrt{1-\theta} - (1-\theta), & \text{if } \theta \in (0,1), \\ 0 & \text{if } \theta = 0 \text{ or } 1. \end{cases} \tag{3'}$$

Notice that if $\theta = 0$, then the current debt overhang is too large for the North to undertake reform. This highlights the fact that the foreign aid is essential for the North to start reform. Alternatively, if the South wipes out North Korea's external debt ($\theta = 1$), the North again does not supply any effort. To conceptualize this point more thoroughly, we present the North's reaction curves when V is equal to 1 or (1/2) in Figure 2.

that they were reluctant to invest was the unsettlement of the existing defaulted debt.
10. That is, the relative benefits of reform to status quo are not too high for the current regime.

Figure 2   North Korea's Reaction Curves for Various Benefit-Cost Ratios

2. South Korea

This subsection analyzes the choice of South Korea, In choosing θ, the South takes into account how this choice will affect the North's adjustment effort level. Put differently, the South acts as a Stackelberg Leader.

The expected payoff for the risk-neutral South is,

$$\text{Max}_{\theta \in [0,1]} U_S = p(x - \mu(\theta)\theta - \Phi(\theta) + \theta) + (1-p)(x - \mu(\theta)\theta). \tag{4}$$

μ is the discounted price of North Korean debt and equals to $p + (1-p)q$. x is the endowment of the South.[11] Φ represents the unification cost function.

The features of unification cost function deserve some comments. It exhibits the subsequent properties: $\Phi'(\theta) \leq 0$, $\Phi''(\theta) \leq 0$, with $\Phi(0) = \Phi_{Max}$ and $\Phi(1) = \Phi_{Min}$.   We adopt the following functional form that satisfies the above properties:

$$\Phi(\theta) = \sqrt{\frac{(1-\theta)}{\upsilon}} + F. \tag{5}$$

11. Again, all the variables here are expressed in terms of debt overhang of the North.

F refers to the fixed component of unification cost.

First, we examine Equation (5). As indicated in the previous section, the unification cost generally refers to the cost of adjustment and restructuring to transform the North into a market-oriented economy. Hence, the South is likely to suffer from a higher unification cost as the benefit-cost ratio of the North falls. According to Equation (5), the reduction of North Korea's current debt overhang leads to a fall in the unification cost. As a result, this provides an incentive for the South to reduce the debt overhang of the North even before the collapse of the North.

Second, if the South does not intervene, then the average price of North Korean debt remains at $\hat{p}$ since there exists no possibility of reform.[12] As soon as it intervenes via an assisted buyback scheme, it jumps to $\hat{p}+(1-\hat{p})q(\alpha^{*},\theta^{*})$. Notice that this rise is due to a positive probability of reform success. As long as $\hat{p}$ is relatively low, the jump would be higher. As the intervention by the South makes the current North Korean regime to undertake reforms and the probability of collapse is relatively lower, the secondary market price jumps higher. More importantly, this move may attract foreign capital inflow into the North. This effect acts like a signalling. As the South provides more aid to the North, this signalling effect tends to be stronger. Notice that the essence of the unification cost lies on the considerable rise in demand for funds.[13] In this case, foreign capital inflow may substitute for the substantial demand for funds (Norland (1997)). In return, the South's intervention via an assisted buyback scheme may reduce the unification cost significantly. These features are captured in Equation (5).

The South has to take into account how the choice of a level of assisted buyback will affect the North's reaction. Hence,

$$q'(\theta) = \frac{\partial q}{\partial \theta} + \frac{\partial q}{\partial \alpha}\frac{d\alpha}{d\theta}. \tag{6}$$

The first order condition to Equation (4) with the substitution of Equations (5) and (6) is as follow:[14]

$$\frac{\hat{p}}{(1-\hat{p})} + (2-3\theta^{*}) - 2\sqrt{(1-\theta^{*})}v = 0. \tag{7}$$

Notice that its second order condition (SOC, hereafter) holds for $\theta^{*} < 1-(v-9)$. That is, if the benefit-cost ratio is equal to or larger than 9, then its SOC does not hold for the feasible range of θ. This implies that if the returns from reform is substantially huge for the current North Korean regime, then the North can provide enough effort for itself and an optimal

12. Notice that v cannot be greater than 1. Since q cannot be negative, the secondary market price follows as the main text describes.

13. This substantial increase in demand for funds may be due to the need for reconstruction of the North Korean economy.

14. Apart from Equation (7), another solution exists for the feasible range of θ. However, this solution fails to satisfies its SOC and omitted from the analysis.

level of the assisted buyback does not exist for the South. If the benefit-cost ratio is 1, then its SOC holds for $\theta^* \in (0, 8/9)$.

The variations of the benefit-cost ratio generates level effects. See Figure 3 below. For example, if we assume that $\nu = (1/2)$, then the optimal level of assisted buyback is about .27 even when the probability of unification is close to 0.

Figure 3 Optimal Assisted Buyback Levels with Various Benefit-cost Ratios

We now provide the solution for the optimal assisted buyback for the South

$$\theta^* = \frac{6 + 3\gamma - 2\nu}{9} - \frac{2\sqrt{\nu^2 + 3\nu - 3\gamma\nu}}{9.}$$ (8)

where γ is $p/(1-p)$. Notice that p has to be less than $(\nu + 3)/(\nu + 6)$ to avoid an imaginary solution. If it turns out to be an imaginary solution, then the optimal assisted buyback for the South is 0.

For the benchmark case, we compute θ^* when $\nu = 1$. Then the solution for θ^* becomes,

$$\theta^* = \frac{1}{9} + \frac{1}{3(1-p)} - \frac{2}{9}\sqrt{\frac{4 - 7p}{(1-p).}}$$ (8)'

In this case, θ^* is expressed in the probability of unification, p, alone. From Equation (8)',

35

recognize that β cannot take a value between $((4/7),1)$. Note that if υ is equal to 1, then the optimal assisted buyback for the South, θ^*, is 0 for $\beta \in (4/7, 1)$. This is based on a simple idea. The essence lies on the quadratic form of the South's utility function in θ and the independence of β from q. To see this point, we examine Equation (4) when $\upsilon =1$. As β becomes high, the effectiveness of a positive optimal level of assisted buyback is reduced since the weight assigned to the reform success falls. Therefore, for sufficiently high β, the optimal level of assisted buyback is 0.

We provide the solutions for α^* and q^*.

$$\alpha^* = \sqrt{(1-\theta^*)\upsilon} - (1-\theta^*). \tag{9}$$

$$q^* = 1 - \sqrt{\frac{1-\theta^*}{\upsilon}} \tag{10}$$

With Equations (8), (9), and (10), this setup relates the exogenous probability of unification, β and the benefit-cost ratio, υ, to the probability of reform success, q. The following Corollary summarizes the relationship between the two parameters to the probability of reform success.

Corollary 1A : *An exogenous increase in the probability of unification (collapse of the current regime) within the feasible range leads to an increase in the equilibrium probability of reform success.*

Corollary 1B : *If the probability of collapse lies within the feasible range, an exogenous increase in the benefit-cost ratio, υ, leads to a rise in the equilibrium probability of reform success.*

Proof: See Appendix.

Notice that the optimal assisted buyback is increasing and convex in β for the feasible range. Then a marginal increase in the probability of unification (collapse of current regime) along this line induces the South to finance the buyback more. From Equation (10), this, in return, leads to an increase in the reform success. Drazen and Grilli (1990) provided the similar intuition in a different setup. They claimed that economic reforms are likely to succeed when an economy suffers from a crisis. They used a war of attrition model to derive this result. In their paper, crises may be necessary to induce structural change because economic participants believe that someone else can be forced to bear the burden. In normal periods, such structural changes are resisted, however, the periods of crises facilitate the introduction of economic reforms. Therefore, two different models imply similar results.

Looking more closely at Corollary 1B, an increase in the benefit-cost ratio may affect the probability of reform success via two channels. As a rise in the benefit-cost ratio from reforms implies that the returns from the reforms for the current North Korean regime increase. This effect may increase its equilibrium probability of reform success. However, an increase

in v induces the South to provide "less aid" to the North, and this effect lowers the probability of reform success. Therefore, two conflicting effects interact as v increase. But the former effect outweighs the latter, and this leads to an increase in the probability of reform success. At this point, it is difficult to predict the benefit-cost ratio for the current North Korean regime. However, in order to acquire more "aid" from the South, the current regime needs to hide its true benefit-cost ratio and pretend that it is low.

The subsequent Proposition specifies the optimal assisted buyback range for the South.

Proposition: A mutually beneficial assisted buyback scheme always exists iff p falls within the following range: $(v+3)/(v+6) > p > (1-v)/(2-v)$. As v increases, the probability of collapse that sustains the mutually beneficial range expands.

Proof: See Appendix.

First, the right hand side (RHS) of the above inequality must be non-negative since we assume that v is less than or equal to 1. Then, RHS refers to the lower bound: p has to be greater than this number to sustain a mutually beneficial assisted buyback. Moreover, the left hand side (LHS) implies the upper bound: p has to be less than this number in order to avoid an imaginary solution that may leads to no assisted buyback. It is important to realize that the probability distribution of collapse that may leads to a mutually beneficial buyback range expands as v increases. To see this point, if $v=1$, then p only has to be less than (4/7) for the existence of a mutually beneficial assisted buyback. (The only restriction is the upper bound.) Moreover, since the RHS approaches (1/2) as v approaches 0. This implies that as v approaches 0, the mutually beneficial range becomes extremely slim. The results described above are presented in Table below.

Table 1 Mutually Beneficial Assisted Buyback Range of p and v

v	mutually beneficial range of p
1	0 < p < .57
(3/4)	.2 < p < .55
(1/2)	.33 < p < .54
(1/4)	.42 < p < .52
(1/6)	.45 < p < .51

The incentive for the South to engage in an assisted buyback scheme is to reduce the unification cost. In order to reduce the unification cost, the South can engage in the assisted buyback scheme. It can reduce the North Korean external debt burden and the general unification cost in the event of collapse. The North's payoff is unambiguously better off due to the South's assisted buyback scheme as it provides sufficient incentive for the North to undertake reforms in the event of survival.

If the benefit-cost ratio of the current regime is high (close to 1), then the probability distribution of collapse that supports the mutually beneficial assisted buyback expands. Given

β, the South has to provide less aid to the North if ν is relatively low. As the reform may generate large returns to the current regime, this implies that the South may not necessarily provide large aid to the North. Even if β is low, the large benefit-cost ratio provides enough incentive to support the mutually beneficial assisted buyback.

To provide the median case, notice that if $\nu=(1/2)$, then the mutually beneficial range falls between (1/3) and (7/13). This implies that β cannot be too low to sustain a mutually beneficial assisted buyback. Suppose that β is less than (1/3). Then the weights attached to the event of unification is relatively low. Then ν has to be relatively high to support a mutually beneficial buyback. However, the benefit-cost ratio is not high enough and, as a result, the South has to provide large aid which may be too costly. Hence, it is not effective for the South to provide an assisted buyback in this case.

On the other hand, if ν is low, then β has to be sufficiently high to generate such mutually beneficial assisted buyback scheme. If ν becomes an extremely low number, β has to be sufficiently large for the existence of the mutually beneficial buyback. However, it can be too costly for the South to finance such a scheme.

III. Concluding Remarks

Instead of restating the main results derived from this paper, we explore a direction of future research. We can examine whether preplay communication between the North and South can arise or not. The investigation of this possibility has policy relevance since this model can specify the condition of cooperation between the two seemingly hostile parties. The previous subsection demonstrates that an assisted buyback scheme can be mutually beneficial to both parties (North and South) if the probability of collapse is within a certain range. If this is the case, then it seems reasonable that preplay communication between the two parties can arise before they take any action. A cheap talk model asserts that when preferences are similar, preplay communication between two parties may be possible and beneficial. Notice that since the North has an incentive to undertake reforms and the South has interests in provision of aid, this setting is suitable for a cheap talk. This is the subject of Lee (1998b). There, the existing model generalize the aid scheme, and, moreover, the aid provided by the South directly affects the probability of survival of the North Korean regime.

A Strategic Assisted Buyback Scheme of North Korean Debt

Appendix

1. Proof of Corollary 1A:

From Equation (8), we can show that the optimal assisted buyback level for the South is increasing in $\not{p}$. Hence,

$$q'(\not{p}) = \frac{\partial q}{\partial \theta} \frac{\partial \theta}{\partial \not{p}} > 0.$$

From Equation (10), it is easy to obtain the following:

$$\frac{\partial q}{\partial \theta} = \frac{1}{2\sqrt{(1-\theta)\upsilon}} \frac{1}{\upsilon.}$$

Notice that the sign of the above derivative is non-negative for $\theta \in (0,1)$. It can be easily shown that θ is also increasing in $\not{p}$. This completes the proof of Corollary 1A.

2. Proof of Corollary 1B:

To obtain the proof of Corollary 1B, the sign of the following derivative has to be determined. From Equation (10),

$$q'(\upsilon) = \frac{\partial q}{\partial \upsilon} + \frac{\partial q}{\partial \theta} \frac{d\theta}{d\upsilon.}$$

In order to obtain the sign of the above derivative, the following derivatives have to be computed:

$$\frac{\partial q}{\partial \upsilon} = \frac{\upsilon^{-(3/2)}(1-\theta)^{(1/2)}}{2}$$

$$\frac{\partial q}{\partial \theta} \frac{d\theta}{d\upsilon} = \frac{1}{2}[\frac{(1-\theta)}{\upsilon}]^{-(1/2)}\frac{1}{\upsilon}\frac{d\theta}{d\upsilon.}$$

Notice that $(d\theta/d\upsilon) < 0$ for the feasible range of $\not{p}$ from Equation (8). With further simplification, the substitution of the above two equations into the first boils down to the following inequality:

$$9(1-\theta^*) > 2\upsilon + \frac{\upsilon(2\upsilon+3-3\gamma)}{\sqrt{\upsilon^2+3\upsilon-3\gamma\upsilon.}}$$

Substituting Equation (8) into θ^*, this inequality leads to the subsequent inequality:

$$3(1-\gamma)[v^2+6v-3\gamma v] > 0.$$

The sign of the above inequality is unambiguously positive. This completes the proof of Corollary 1B.

3. Proof of Proposition:

With a positive level of optimal assisted buyback, the South's payoff is

$$U_S(\theta^*)=x-(1-\phi)(1-\sqrt{\frac{1-\theta^*}{v}})-\phi\sqrt{\frac{1-\theta^*}{v}}-\phi F.$$

Then the South has to compare it with the alternative payoff (no intervention) which is,

$$U_S=x-\phi-\phi F.$$

The comparison between two strategies leads the following inequality:

$$\frac{\phi}{(1-\phi)} > \theta^*.$$

where θ^* is obtained in Equation (8). The substitution of Equation (8) into the above inequality leads to the following:

$$9\gamma > 6+3\gamma-2v-2\sqrt{v^2+3\gamma-3\gamma v}.$$

The above inequality can be simplified as below:

$$v(1-\gamma) > (\gamma-1)^2.$$

The above inequality can be further simplified by using $\gamma = \phi/(1-\phi)$:

$$v > \frac{(1-2\phi)}{(1-\phi)}.$$

The above inequality can be easily transformed into the expression of v. Then utilizing the feasible range { $\phi < (v+3)/(v+6)$} in the main text, we can obtain the same expression in Proposition. This completes the proof of Proposition.

References

Becker, G., and G. Becker (1997), *The Economics of Life*, McGraw-Hill.

Bulow, J., and K. Rogoff (1988), "Sovereign Debt Restructuring: Panacea or Pangloss?" NBER WP #2637.

Cohen, D. (1991), *Private Lending to Sovereign States: A Theoretical Autopsy*, MIT Press, Cambridge, Massachusetts.

Cole, H., J. Dow, and W. English (1991), "Default, Settlement, and Signalling: Lending Resumption in a Reputational Model of Sovereign Debt," Federal Reserve Bank of Minneapolis Working Paper #488.

Dornbusch, R. (1990), "Credibility and Stabilization," *Quarterly Journal of Economics*, 837-850.

Drazen, A., and V. Grilli (1990), "The Benefits of Crises for Economic Reforms," NBER WP #3527.

Emerging Market Debt Research on North Korea, published by ANZ Grindlays Bank plc., 1995.

Grossman, H. (1996), "The Economics of Revolution," a manuscript.

Grossman, H., and S. Noh (1990), "A Theory of Kleptocracy with Probabilistic Survival and Reputation," *Economics and Politics*, Vol. 2, 157-171.

Lee, K. (1997), "The Road to the Market in North Korea: Projects, Problems, and Prospects," a manuscript.

Lee, S. (1998a), "A Conservative's Argument on an Assisted Buyback Scheme of North Korean Debt," a manuscript.

Lee, S. (1998b), "Can Cheap Talk Arise between Two Seemingly Hostile North and South Korea?" a manuscript.

Lee, S., and S. Hong (1998), "On an Assisted Buyback Scheme of North Korean Debt: A Strategic Analysis," Forthcoming in *Korea Economic Review*.

Norland, M. (1997), "Why North Korea Will Muddle Through," *Foreign Affairs*, Vol. 76, No. 4, 105-118.

Norland, M., S. Robinson, and M. Scatasta (1996), "Modeling Economic Reform in North Korea," a manuscript.