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POLICY RESEARCH WORKING PAPER

# Financial Sector Inefficiencies and Coordination Failures

## Implications for Crisis Management

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In a country where financial intermediation is highly inefficient (with the enforcement costs of loan contracts very high, for example), or in one experiencing great volatility and large adverse shocks in output, the likelihood of an inefficient equilibrium is great. In East Asia it may be in the interests of both debtors and creditors to collectively reduce the face value of debt, to reduce inefficiencies in the financial sector.

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## Summary findings

Agénor and Aizenman analyze the implications for crisis management of inefficient financial intermediation in a country (such as Indonesia or the Republic of Korea) where firms are highly indebted.

They base their analysis on a model in which firms rely on bank credit to finance their working capital needs and loan contracts entail high state verification and enforcement costs for lenders.

They find that higher volatility of output, lower productivity, or higher costs for contract enforcement and verification may shift the economy to the inefficient portion of the debt Laffer curve — with potentially sizable losses in employment and output.

What implications does this have for the policy debate on crisis management in East Asia? Debt reduction, in addition to debt rescheduling, may be required to reduce employment and output losses in the presence of inefficiencies in the financial sector.

In practice this may be difficult to coordinate among a large group of creditors because of the free-riding problem: Each creditor has an incentive to refrain from offering debt relief on its own claims and wait for others to do so, thereby raising the expected value of its own claims.

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This paper — a product of Economic Policy and Poverty Reduction, World Bank Institute — is part of a larger effort in the institute to explore the real effects of financial sector inefficiencies. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Tanya Shiel, room J4-282, telephone 202-473-6317, fax 202-676-9810, Internet address [tshiel@worldbank.org](mailto:tshiel@worldbank.org). Policy Research Working Papers are also posted on the Web at <http://www.worldbank.org/html/dec/Publications/Workpapers/home.html>. The authors may be contacted at [pagenor@worldbank.org](mailto:pagenor@worldbank.org) or [j.aizenman@dartmouth.edu](mailto:j.aizenman@dartmouth.edu). September 1999. (23 pages)

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# Financial Sector Inefficiencies and Coordination Failures Implications for Crisis Management

Pierre-Richard Agénor\* and Joshua Aizenman\*\*

## Abstract

This paper analyzes the implications of inefficient financial intermediation for crisis management in a country where firms are highly-indebted. The analysis is based on a model in which firms rely on bank credit to finance their working capital needs and lenders face high state verification and enforcement costs of loan contracts. The analysis shows that higher contract enforcement and verification costs, lower expected productivity, or higher volatility, may shift the economy to the wrong side of the debt Laffer curve, with potentially sizable employment and output losses. The main implication of this analysis for the current policy debate on crisis management in East Asia is that debt reduction, in addition to debt rescheduling, may be required as part of the process of reducing financial sector inefficiencies.

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# 1 Introduction

There is substantial agreement among economists that inefficiencies in financial intermediation and weaknesses in the banking sector exacerbated the economic and financial crisis that erupted in East Asia in the aftermath of the collapse of the Thai baht.<sup>1</sup> High costs of operation, inadequate lending practices, large volumes of nonperforming loans, excessive exposure to some sectors, large unhedged short-term liabilities in foreign currency, and lax supervision were all pervasive features of the financial system in those countries that suffered most from the crisis.

The events in East Asia have led to renewed emphasis on crisis prevention and crisis management. In particular, it has been stressed that the regulatory and supervisory framework of the financial system must be strengthened prior to opening the capital account, and that governments must limit the implicit guarantees that they provide to investors (Dooley, 1998). Adequate bankruptcy procedures must also be in place to allow illiquid but solvent firms to undergo restructuring following a crisis. As recently emphasized by Miller and Stiglitz (1999), debt relief, rather than debt restructuring, may also be an important component of crisis management.

Using a different approach, the present paper also emphasizes the possible need for debt relief in crisis management. The key source of our result is a particular form of financial sector inefficiencies: high costs associated with the enforcement of loan contracts. This is indeed an important issue in the context of the East Asia crisis; limitations in the ability of banks to enforce the provisions of loan contracts (including seizure of collateral) have been viewed by some observers as one of the major weaknesses of the legal infrastructure that characterizes many of the Asian countries that suffered from contagion in the aftermath of the Thai baht crisis.

The remainder of the paper proceeds as follows. Section II describes the

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<sup>1</sup>For a detailed analysis of the causes, propagation, and policy responses to, the Asian crisis, see Alba et al. (1999), and Radelet and Sachs (1998).

analytical framework. The model used here combines the costly state verification approach pioneered by Townsend (1979) and the model of limited enforceability of contracts used in the external debt literature, as in Eaton et al. (1986), Bulow and Rogoff (1989), and Helpman (1989*a*).<sup>2</sup> It emphasizes the direct link between bank credit and the supply side (through firms' working capital needs), borrowing by domestic banks on world capital markets.<sup>3</sup> In addition to the new debt contracted to finance labor costs during the production period, firms also hold a large initial stock of debt that they must repay out of current revenue. Section III derives the debt Laffer curve that arises in a setting in which firms are highly-indebted and determines the optimal level of debt. Section IV analyzes the effect of a reduction in the efficiency of the financial intermediation process (characterized by an increase in contract enforcement and verification costs), an adverse expected shock to productivity, and higher volatility of productivity shocks, on the optimal level of debt. It is shown that all of these shocks may shift the economy to the wrong side of the debt Laffer curve. Thus, as emphasized by Krugman (1988) and Sachs (1989) in their analysis of the debt overhang in a more general context, reducing the face value of debt would make both parties better off—assuming that coordination failures between debtors and creditors can indeed be eliminated. Section V summarizes the main results of the paper and considers its implications for the current policy debate on crisis management in East Asia.

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<sup>2</sup>See Freixas and Rochet (1997) for a useful description of the costly state verification approach to credit markets.

<sup>3</sup>The general framework on which the model developed here is based was used to examine a variety of issues, including, in particular, the real and financial effects of contagious shocks and the welfare costs of financial openness. See Agénor and Aizenman (1998, 1999), and Agénor, Aizenman and Hoffmaister (1998).

## 2 The Analytical Framework

Consider an economy where risk-neutral banks provide intermediation services. Producers demand credit from banks (lenders) to finance their working capital needs, which consist only of labor costs. Output is subject to random productivity shocks. Following Townsend (1979), the realized productivity shock is revealed to banks only at a cost. In the event of default by any given producer on its bank loans, the creditor seizes a fraction of the realized value of output. Seizing involves two types of costs: first, the cost involved in verifying the actual value of output, as mentioned earlier; second, the cost of enforcing repayment, because enforcement of the terms of loan contracts requires costly recourse to the legal system.

### 2.1 Producers

Following Agénor and Aizenman (1998), we assume that the producers start the period with a large initial level of debt,  $D$ . For simplicity, we will assume that the interest rate on the initial debt is zero; assuming that the debt matures at the end of the period, repayment is thus also equal to  $D$ . The production function is given by

$$y_h = n_h^\beta(1 + \delta + \varepsilon_h), \quad (1)$$

where  $\delta > 0$  and  $h = 1, \dots, N$  refers to producer  $h$ . The idiosyncratic shock  $\varepsilon_h$  is assumed to be distributed symmetrically over the interval  $(-\varepsilon_m, \varepsilon_m)$ .<sup>4</sup>

The representative producer repays the initial debt in good states of nature, and chooses (partial) default in bad states. In case of default on the initial debt, creditors are able to confiscate a fraction  $\chi$  of the realized value of output. Thus, default occurs when

$$\chi n_h^\beta(1 + \delta + \varepsilon_h) < D, \quad 0 < \chi < 1. \quad (2)$$

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<sup>4</sup>Note that, in contrast to the original model in Agénor and Aizenman (1998), we do not account for aggregate shocks.

The left-hand side of equation (2) is the producer's repayment following a default, whereas the right-hand side is the contractual repayment. Equivalently, the producer will service the initial debt according to<sup>5</sup>

$$\min \left[ D; \chi n_h^\beta (1 + \delta + \varepsilon_h) \right]. \quad (3)$$

Let  $\tilde{\varepsilon}^*$  denote the threshold value of the productivity shock below which partial default (at the margin) occurs on the initial level of debt, that is<sup>6</sup>

$$D = \chi n_h^\beta (1 + \delta + \tilde{\varepsilon}^*).$$

Solving this equation for  $\tilde{\varepsilon}^*$  yields  $D/\chi n_h^\beta - 1 - \delta$ . Clearly, this value of  $\tilde{\varepsilon}^*$  can be less than the lower support of the distribution,  $-\varepsilon_m$ . In that case, we impose  $\tilde{\varepsilon}^* = -\varepsilon_m$ . When  $\tilde{\varepsilon}^* = -\varepsilon_m$ , default never occurs because any realization of the shock will always induce full repayment. We can thus write

$$\tilde{\varepsilon}^* = \max \left[ D/\chi n_h^\beta - 1 - \delta; -\varepsilon_m \right]. \quad (4)$$

As in Agénor and Aizenman (1998), each producer finances his labor costs with bank credit. Let  $\kappa$  denote the representative bank's bargaining power on the new debt. There may be a difference between the ability to enforce old debt and the new debt contract (that is, between  $\kappa$  and  $\chi$ ). This difference may reflect the possibility that the new debt is financed mostly by domestic banks, whereas the initial debt is mostly foreign debt.<sup>7</sup>

Let  $\varepsilon^*$  be the threshold value of the productivity shock that induces partial default on the new debt. We assume that, in bad states of nature, the producer would choose to default partially on the old debt, before defaulting on the new one; that is,  $\varepsilon^* < \tilde{\varepsilon}^*$ .<sup>8</sup> This assumption implies that whenever the producer defaults on the new debt (that is, when the realization  $\varepsilon_h < \varepsilon^*$ ),

<sup>5</sup>In what follows indifference on the borrower's part is resolved in favor of the lender.

<sup>6</sup>If default never occurs,  $\tilde{\varepsilon}^*$  is set at the lower end of the support ( $\tilde{\varepsilon}^* = -\varepsilon_m$ ).

<sup>7</sup>The qualitative features of our analysis are basically unchanged if  $\kappa = \chi$ .

<sup>8</sup>As shown in the Appendix, results similar to those derived below continue to hold in the case where the old debt has seniority.



default necessarily occurs also on the initial debt—in which case creditors seize a fraction  $\chi y_h$  of realized output, leaving a fraction  $(1 - \chi)y_h$  of output from which creditors of the new debt can seize  $\kappa$ .

Given these assumptions, debt service on the new debt is determined by

$$\min \left[ (1 + r_L)wn_h; \kappa(1 - \chi)n_h^\beta(1 + \delta + \varepsilon_h) \right], \quad (5)$$

where  $r_L$  denotes the contractual interest rate on the new debt. This condition implies that  $\varepsilon^*$  is given by

$$(1 + r_L)wn_h = \kappa(1 - \chi)n_h^\beta(1 + \delta + \varepsilon^*),$$

or, rearranging terms,

$$\varepsilon^* = \frac{(1 + r_L)wn_h}{\kappa(1 - \chi)n_h^\beta} - 1 - \delta. \quad (6)$$

Using (4) and (6), the assumption that  $\varepsilon^* < \bar{\varepsilon}^*$  is thus equivalent to

$$\kappa \frac{D(1 - \chi)}{\chi} > (1 + r_L)wn_h. \quad (7)$$

Condition (7) is likely to be met for a large enough level of the initial debt  $D$ , or for a relatively large  $\kappa$  and small  $\chi$ .

Assuming that condition (7) holds, and that the price of output is constant and normalized to unity, expected profits of the representative producer are given by

$$\Pi_h = \int_{\bar{\varepsilon}^*}^{\varepsilon_m} [n_h^\beta(1 + \delta + \varepsilon_h) - D]f(\varepsilon_h)d\varepsilon_h + (1 - \chi) \int_{-\varepsilon_m}^{\bar{\varepsilon}^*} n_h^\beta(1 + \delta + \varepsilon_h)f(\varepsilon_h)d\varepsilon_h \quad (8)$$

$$- (1 + r_L)wn_h \int_{\varepsilon^*}^{\varepsilon_m} f(\varepsilon_h)d\varepsilon_h - \kappa(1 - \chi) \int_{-\varepsilon_m}^{\varepsilon^*} n_h^\beta(1 + \delta + \varepsilon_h)f(\varepsilon_h)d\varepsilon_h.$$

The first two terms in this equation represent expected revenue, net of repayment on old debt. The last two terms adjust downward expected profits by expected repayment on the new debt. The first term on the right-hand

side of this equation measures revenue in “good” states of nature (in which case the borrower repays the old debt in full), whereas the second measures net revenue after confiscation in “bad” states (in which case the producer’s repayment on the old debt is only a fraction  $\chi$  of realized output). The third term measures repayment on the new debt in good states of nature and the last term measures the value of output that is confiscated as a result of defaulting on both the old and the new debt.

## 2.2 Banks and New Debt

The representative bank has information about the choice of labor input by producer  $h$ , and determines the interest rate such that the expected net repayment equals the cost of credit. Each bank is assumed to deal with a large number of independent producers, allowing the bank to diversify the idiosyncratic risk,  $\varepsilon_h$ .

In case of default, the bank’s net profit is given by the difference between contractual repayment and the gross cost of funds:

$$(1 + r_L)wn_h - (1 + r_C)wn_h, \quad (9)$$

where  $r_C$  denotes the cost of funds for the bank, assumed given.

In case of default, the bank’s net profit is the producer’s repayment minus the gross cost of funds and minus the cost of state verification and contract enforcement, denoted  $C$ , which is assumed to be independent from the cost (and amount) of funds borrowed by producer  $h$ :<sup>9</sup>

$$\kappa(1 - \chi)n_h^\beta(1 + \delta + \varepsilon_h) - C - (1 + r_C)wn_h. \quad (10)$$

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<sup>9</sup>The analysis can easily be extended to consider the case where  $C$  is proportional to repayment; see Agénor, Aizenman, and Hoffmaister (1998). It would be more involved, however, if some costs were assumed to accrue *after* the information about the idiosyncratic shock is obtained. In such circumstances, banks would refrain from forcing debt repayment when realized productivity is below a threshold of enforcement. For simplicity of exposition, and because they would not modify the key results discussed below, we abstract from these considerations. We also ignore all other real costs associated with financial intermediation.

The first term in this expression accounts for the fact that the producer first repays a fraction  $\chi$  on the initial debt, before servicing the new debt.

Assuming risk neutrality and competitive banks, the rent dissipation condition implies that the interest rate on the new debt,  $r_L$ , is set according to, using (9) and (10):

$$(1 + r_C)wn_h = (1 + r_L)wn_h \int_{\varepsilon^*}^{\varepsilon_m} f(\varepsilon_h) d\varepsilon_h \quad (11)$$

$$+ \int_{-\varepsilon_m}^{\varepsilon^*} [\theta n_h^\beta (1 + \delta + \varepsilon_h) - C] f(\varepsilon_h) d\varepsilon_h,$$

where  $\theta = \kappa(1 - \chi)$ . This expression can be rewritten in the form

$$r_L - r_C = \frac{1}{wn_h} \left\{ \theta \int_{-\varepsilon_m}^{\varepsilon^*} n_h^\beta (\varepsilon^* - \varepsilon_h) f(\varepsilon_h) d\varepsilon_h + C \int_{-\varepsilon_m}^{\varepsilon^*} f(\varepsilon_h) d\varepsilon_h \right\}. \quad (12)$$

Equation (12) shows that the spread between the contractual lending rate and the bank' funding cost is the sum of two terms: the first measures the expected revenue lost due to (partial) default in bad states of nature, and the second the expected state verification and contract enforcement costs.

Applying (11) to (8), we can rewrite the expression for the representative producer's expected profits as

$$\Pi = \int_{\varepsilon^*}^{\varepsilon_m} [n_h^\beta (1 + \delta + \varepsilon_h) - D] f(\varepsilon_h) d\varepsilon_h + (1 - \chi) \int_{-\varepsilon_m}^{\varepsilon^*} n_h^\beta (1 + \delta + \varepsilon_h) f(\varepsilon_h) d\varepsilon_h \quad (13)$$

$$- (1 + r_C)wn_h - C \int_{-\varepsilon_m}^{\varepsilon^*} f(\varepsilon_h) d\varepsilon_h,$$

where  $\varepsilon^*$ , the threshold level of productivity associated with partial default on the new debt (as given in (6)), can be rewritten as

$$\theta n_h^\beta (1 + \delta + \varepsilon^*) = (1 + r_C)wn_h + \int_{-\varepsilon_m}^{\varepsilon^*} [\theta n_h^\beta (\varepsilon^* - \varepsilon_h) + C] f(\varepsilon_h) d\varepsilon_h. \quad (14)$$

### 2.3 Optimal Employment

The optimal level of employment is determined by maximizing expected profits, equation (13), subject to (14).<sup>10</sup> The corresponding first-order condition is obtained by setting  $\Pi_{n_h} = 0$ , that is

$$\beta n_h^{\beta-1} \left\{ \int_{\bar{\varepsilon}^*}^{\varepsilon_m} n_h^\beta (1 + \delta + \varepsilon_h) f(\varepsilon_h) d\varepsilon_h + (1 - \chi) \int_{-\varepsilon_m}^{\bar{\varepsilon}^*} n_h^\beta (1 + \delta + \varepsilon_h) f(\varepsilon_h) d\varepsilon_h \right\} \quad (15)$$

$$-(1 + r_C)w - Cf(\varepsilon^*) \frac{d\varepsilon^*}{dn_h} = 0,$$

where

$$\frac{d\varepsilon^*}{dn_h} = - \frac{\theta \beta n_h^{\beta-1} (1 + \delta + \varepsilon^*) - w(1 + r_C) - \theta \beta n_h^{\beta-1} \int_{-\varepsilon_m}^{\varepsilon^*} (\varepsilon^* - \varepsilon_h) f(\varepsilon_h) d\varepsilon_h}{\theta n_h^\beta \int_{\varepsilon^*}^{\varepsilon_m} f(\varepsilon_h) d\varepsilon - Cf(\varepsilon^*)}.$$

Substituting (14) into the right-hand side of  $d\varepsilon^*/dn_h$  we infer that

$$\frac{d\varepsilon^*}{dn_h} = \left( \frac{1}{n_h} \right) \frac{(1 - \beta)(1 + r_C)wn_h - \beta C \int_{-\varepsilon_m}^{\varepsilon^*} f(\varepsilon_h) d\varepsilon_h}{\theta n_h^\beta \int_{\varepsilon^*}^{\varepsilon_m} f(\varepsilon_h) d\varepsilon - Cf(\varepsilon^*)}$$

Hence, as long as  $C$  is not too large,  $d\varepsilon^*/dn_h > 0$ .

**Proposition 1** *The optimal level of employment,  $\tilde{n}_h$ , is given by*

$$\tilde{n}_h = \tilde{n}_h(\chi, r_C, C, D), \quad (16)$$

*and it depends negatively on the four arguments in (16).*

To establish for instance that  $d\tilde{n}_h/dC < 0$ , note first that

$$sg \left[ \frac{d\tilde{n}_h}{dC} \right] = sg \left[ - \frac{\Pi_{n_h C}}{\Pi_{n_h n_h}} \right].$$

<sup>10</sup>Following our earlier paper (Agénor and Aizenman, 1998) we assume in what follows that each individual producer takes the contractual lending rate as given when determining the optimal level of employment.

Applying the second-order condition for maximization yields

$$sg [\Pi_{n_h C}] = -f(\varepsilon^*) \left( \frac{d\varepsilon^*}{dn_h} \right) < 0,$$

which implies in turn that  $d\tilde{n}_h/dC < 0$ .

Suppose that  $\varepsilon_h$  follows a uniform distribution, so that  $f(\varepsilon_h) = 1/2\varepsilon_m$ , and  $\Pr(\varepsilon_h > x) = (\varepsilon_m - x)/2\varepsilon_m$ . It can then be established that an increase in  $\varepsilon_m$ , which can then be interpreted as a (mean-preserving) increase in volatility, reduces optimal employment ( $d\tilde{n}_h/d\varepsilon_m < 0$ ). To do so, note first that

$$sg \left[ \frac{d\tilde{n}_h}{d\varepsilon_m} \right] = sg [\Pi_{n_h \varepsilon_m}].$$

From (15),  $\Pi_{n_h} = 0$  now yields

$$\beta n_h^{\beta-1} \left\{ \int_{\tilde{\varepsilon}^*}^{\varepsilon_m} \frac{y_h}{2\varepsilon_m} d\varepsilon_h + (1 - \chi) \int_{-\varepsilon_m}^{\tilde{\varepsilon}^*} \frac{y_h}{2\varepsilon_m} f(\varepsilon_h) d\varepsilon_h \right\} \\ - (1 + r_C)w - \frac{C}{2\varepsilon_m} \frac{d\varepsilon^*}{dn_h} = 0,$$

which in turn implies that

$$\Pi_{n_h \varepsilon_m} = \frac{-(1 + r_C)w}{\varepsilon_m} < 0,$$

where from (6)  $d\varepsilon^*/dn_h = (1 - \beta)(1 + r_L)wn_h^{-\beta}/\kappa(1 - \chi)$ .<sup>11</sup>

### 3 The Initial Debt Laffer Curve

Assuming, to simplify notations, a zero subjective discount rate, the *expected* value of the initial debt is given by

$$V = \begin{cases} D & \text{if } \tilde{\varepsilon}^* = -\varepsilon_m \\ \left\{ D \int_{\tilde{\varepsilon}^*}^{\varepsilon_m} f(\varepsilon_h) d\varepsilon + \int_{-\varepsilon_m}^{\tilde{\varepsilon}^*} g_h f(\varepsilon_h) d\varepsilon_h \right\} & \text{if } \tilde{\varepsilon}^* > -\varepsilon_m \end{cases},$$

<sup>11</sup>A more complete Appendix providing exact expressions for all the derivatives shown in Proposition 1 is available upon request. We also show in that Appendix that the effect of  $\kappa$  on optimal employment is positive.

where

$$g_h = \chi n_h^\beta (1 + \delta + \varepsilon_h) - C.$$

This expression assumes, for simplicity, that verification and enforcement costs associated with servicing the new and the initial debt are the same. It shows that when default never occurs ( $\tilde{\varepsilon}^* = -\varepsilon_m$ ), the expected value of the debt is simply its face value; when, by contrast, the possibility of default exists ( $\tilde{\varepsilon}^* > -\varepsilon_m$ ), the situation is more complex. Specifically, it can be established from the above expression that a higher initial debt has an ambiguous effect on the expected value of the debt:

$$\begin{aligned} \frac{dV}{dD} &= \int_{\tilde{\varepsilon}^*}^{\varepsilon_m} f(\varepsilon_h) d\varepsilon - \frac{Cf(\tilde{\varepsilon}^*)}{\chi n_h^\beta} \\ &+ \left\{ \int_{-\varepsilon_m}^{\tilde{\varepsilon}^*} [\beta \chi n_h^{\beta-1} (1 + \delta + \varepsilon_h) f(\varepsilon_h) d\varepsilon + Cf(\tilde{\varepsilon}^*) \frac{\beta D}{\chi n_h^{\beta+1}}] \frac{dn_h}{dD} \right\} \geq 0. \end{aligned} \quad (17)$$

The debt Laffer curve characterized by Equation (17) is depicted in the upper panel of Figure 1 as  $LL$ . It is linear up to a threshold level of debt  $\tilde{D}$  (corresponding to the segment  $LB$ ) given by

$$\tilde{D} = \chi n_h^\beta (1 + \delta - \varepsilon_m),$$

which corresponds to equation (4) with  $\tilde{\varepsilon}^* = -\varepsilon_m$ .

Expected repayment increases one for one with the initial value of debt; the segment  $LB$  is thus along a 45-degree line.

For levels of initial debt (marginally) above  $\tilde{D}$ , equation (17) boils down to

$$\frac{dV}{dD} = 1 - \frac{Cf(\tilde{\varepsilon}^*)}{\chi n_h^\beta} \left\{ 1 - \left( \frac{\beta D}{n_h} \right) \left( \frac{dn_h}{dD} \right) \right\}.$$

Assuming that enforcement costs  $C$  are small enough, that is, that  $C$  is such that

$$1 > \frac{Cf(\tilde{\varepsilon}^*)}{\chi n_h^\beta} \left\{ 1 - \left( \frac{\beta D}{n_h} \right) \left( \frac{dn_h}{dD} \right) \right\},$$

then, for relatively small levels of initial debt above  $\tilde{D}$ , the curve  $LL$  is upward sloping. Note also that a larger level of initial debt increases  $\tilde{\varepsilon}^*$ , thereby

reducing the first term on the right-hand side of equation (17); this term approaches zero for a large enough level of initial debt. Similarly, higher initial levels of debt raise the absolute value of the second, negative term in the above expression, because  $dn_h/dD < 0$ : a higher level of initial debt lowers employment and thus output, making default more probable and lowering the value of claims that creditors can seize in case of default. Hence, for a large enough level of initial debt, the right-hand side of (17) is negative. The “optimal” level of initial debt, denoted by  $D^*$ , corresponds to the value of the stock of debt for which  $dV/dD = 0$  and is obtained at point  $A$ . Beyond point  $B$ , the probability of repayment falls below unity; and below point  $A$ , levels of debt are so high that additional amounts of debt actually lower expected repayments. Consequently, the association between the contractual value of the initial debt and its expected value has the typical inverted U (or concave) shape that characterizes the debt Laffer curve (Krugman, 1989). The difference between the (present) value of the country’s contractual debt obligations and the expected resource transfers that will be made to service that debt,  $V$ , measures the debt overhang (Krugman, 1988). Thus, as long as  $\bar{\varepsilon}^* > -\varepsilon_m$ —that is, as long as the possibility of default is allowed for in bad states of nature—and as long as  $D > D^*$ , the country will suffer from a debt overhang. Creditors would then benefit from a lower contractual value of the initial stock of debt, because it would increase the expected value of their debt claims.

The lower panel of Figure 1 depicts the relation between optimal employment and the initial level of debt, as given by (16). The first segment of curve,  $HH'$ , is flat, because optimal employment, in the absence of default risk ( $\bar{\varepsilon}^* = -\varepsilon_m$ ) does not depend on initial debt. The reason is that the cost of credit depends on expected verification and enforcement costs, which in turn depend on the probability of default; for  $D$  less  $\bar{D}$  that probability is zero and thus the level of initial debt has no effect on the cost of credit, as can be inferred from (12). Beyond point  $H'$  the curve is convex to the origin.

At the optimal level of initial debt  $D^*$ , employment is given by  $\tilde{n}_h^*$  (point  $E$ ).

The following proposition can be easily established:

**Proposition 2** *Less efficient financial intermediation, as measured by higher state verification and contract enforcement costs (a rise in  $C$ ), or lower expected productivity (a lower value of  $\delta$ ) reduce the optimal value of the initial debt. In both cases the debt Laffer curve shifts downward and to the left.*

To establish that  $dD^*/dC < 0$ , for instance, note that by the implicit function theorem, we have

$$dD^*/dC = -V_{DC}/V_{DD}.$$

Applying the second-order condition for maximization yields

$$sg \left[ \frac{dD^*}{dC} \right] = sg [V_{DC}] = -\frac{f(\tilde{\varepsilon}^*)}{\chi n_h^\beta} \left\{ 1 - \left( \frac{\beta D}{n_h} \right) \left( \frac{dn_h}{dD} \right) \right\} < 0.$$

A diagrammatic illustration of this proposition is also provided in Figure 1. Except for the linear segment  $LB$ , the shape of the debt Laffer curve depends on both the cost of financial intermediation and the expected productivity shock. For instance, an increase in enforcement costs (a rise in  $C$ ) shifts the  $BL$  segment of the curve in the upper panel leftward and inward, to  $BL'$ . The optimal value of initial debt is determined at point  $A''$ . In the lower panel, the relation between optimal employment and initial debt becomes also steeper beyond the threshold value  $\tilde{D}$ ; the new optimal value of employment is determined at point  $E''$ , and is lower than the  $\tilde{n}_h^*$ , as established in Proposition 1.

The figure also illustrates an important implication of the analysis: if, at the initial level of  $C$ ,  $D^*$  is the optimal value of initial debt (that is, the value for which  $dV/dD = 0$ ), at the new value of  $C$  the initial  $D^*$  will be too high because it will be located on the wrong side of the debt Laffer curve (point  $A'$ ). Employment, at  $E'$ , will be also lower than the new optimal value



$E''$ . Thus, less efficient financial intermediation does not only increase the likelihood that the economy may be stuck in an inefficient equilibrium (on the wrong portion of the debt Laffer curve), but it is also associated with (potentially large) employment and output losses in the *short term*.

Finally, it can also be shown that, under the assumption that the idiosyncratic shock  $\varepsilon_h$  is uniformly distributed, an increase in  $\varepsilon_m$ , which is equivalent to a (mean-preserving) increase in volatility, has qualitatively similar effects on the shape of the debt Laffer curve as those associated with an increase in intermediation costs or lower expected output.

## 4 Summary and Policy Implications

The purpose of this paper has been to examine the implications of inefficient financial intermediation for crisis management in a country where firms are faced with a high level of initial debt and contract new borrowing from domestic banks to finance labor costs. The analysis was based on a model of credit market imperfections that emphasizes the costs of contract enforcement and state verification costs. The first part presented the analytical framework and focused on the determination of domestic interest rates on the new debt (which are set as a mark-up over the cost of borrowing, with the size of the mark-up related positively to the probability of default) and optimal employment, which was showed to depend, in particular, negatively on the cost of state verification and contract enforcement, as well as the initial stock of foreign debt obligations held by domestic firms. The second part derived the debt Laffer curve with regard to the initial debt and the optimal level of debt consistent with the absence of a debt overhang. The third part analyzed the effect of an increase in contract enforcement and verification costs, as well as an expected negative shock to output and an increase in the volatility of productivity shocks, on the optimal level of debt. It was shown that, as a result of either shock, the economy may find itself on the wrong

side of the debt Laffer curve, where a debt overhang may emerge. Moreover, the analysis showed that this shift may be accompanied with (possibly large) employment and output losses in the short term.

The key result of the paper, thus, is that in countries where financial intermediation is highly inefficient (in the sense that enforcement costs of loan contracts, for instance, are relatively high), or in a country experiencing large adverse output shocks and higher volatility, the likelihood of an inefficient equilibrium is also high. The policy implications of these results in the context of the current debate on crisis management in East Asia are rather clear. To many observers, one of the surprises that surfaced in the immediate aftermath of the crisis was that the outstanding stock of private debt (particularly in Korea and Thailand) was much larger than previously assumed. This is illustrated in Figure 2, which shows how quickly banks and nonfinancial firms accumulated external liabilities in the early to mid-1990s. The crisis revealed also the precarious state of the private banking system, and the relative high cost of bankruptcy procedures.<sup>12</sup> Furthermore, the deep recession (a sequence of negative output shocks) in the affected countries may have altered the view that the “Far East Tigers” will continue to enjoy sustained high growth rates, escaping the consequences of the law of diminishing marginal productivity. Figure 3, which shows the behavior of the cyclical component of industrial production (based on the use of the Hodrick- Prescott filter to detrend the original series), suggests indeed that expected output shocks may have turned negative after the Thai baht crisis. There was also a significant increase in output volatility in the aftermath of the crisis: the coefficient of variation of industrial production increased from 3.6 percent during the period January 1991-June 1997 to 6.8 percent

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<sup>12</sup>We do not have firm evidence, at this stage, that verification and enforcement costs of loan contracts increased significantly in the region in the aftermath of the crisis. However, it is possible that such costs rose indeed. Asymmetric information problems tend to be exacerbated in a more volatile economic environment, thereby forcing banks to expend more resources to assess and verify claims made by borrowers regarding their situation.

for the period July 1997-December 1998 in Korea. For Malaysia, comparable numbers are 4.3 percent and 5.2 percent respectively, and for Thailand 6.3 percent and 6.6 percent. These developments probably increased the perception (and likelihood) that some of these countries—particularly those like Indonesia and Korea, where domestic firms were highly indebted—may now be on the wrong side of the debt Laffer curve. As shown earlier, lower productivity, higher volatility of output, and higher financial intermediation and enforcement costs shift the debt Laffer curve leftward and inward, whereas a larger outstanding stock of debt shifts the economy's position to the right—sufficiently so in some cases to create a debt overhang problem.

A large debt overhang entails well-known economic costs, induced by both illiquidity and disincentive effects.<sup>13</sup> In the context of our analysis, the short-term employment and output costs associated with a debt overhang can also be substantial. Consequently, it may be beneficial to both debtors and creditors to act collectively to reduce the face value of debt. Specifically, in the case of East Asia, attempts to hasten economic recovery may require debt forgiveness, in addition to debt rescheduling. In practice, of course, it is difficult to coordinate debt reduction among a large group of creditors because of the free-rider problem that such operations create: each creditor has an incentive to refrain from offering debt relief on its own claims and wait for others to do so, thereby raising the expected value of its own claims.<sup>14</sup> Such externalities do not, however, create a *prima facie* case for welfare-improving government intervention, in particular because of the well-known moral hazard problems that such intervention creates.

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<sup>13</sup>See Krugman (1988) and Sachs (1989). In particular, a high level of debt creates uncertainty about the country's capacity to service its debt and discourages private (domestic and foreign) investment. Furthermore, high debt service may be perceived by investors as a form of tax on the future income of the country, thus dissuading new investment.

<sup>14</sup>See Sachs (1989). As shown by Helpman (1989*b*), if lenders interact noncooperatively, each of them taken individually may in fact be willing to provide some debt relief—although not as much as they would if they were to act collectively.

## Appendix

This Appendix considers the case in which the initial debt,  $D$ , is senior to new debt. New lending is done by foreign banks. For simplicity, these banks have identical enforcement costs to the senior banks. This cost is paid by the relevant bank in a lump-sum fashion each time that the country defaults on its obligations to that bank. In states of partial default, new (junior) banks get only the residual of the debt service after repaying the initial debt to the senior banks. In this setup, the country will default first on the junior debt at a low enough value of the productive shock,  $\varepsilon^*$ . The country will default on both types of debt at a lower value of the productivity shock,  $\tilde{\varepsilon}^* < \varepsilon^*$ .

The repayment rule for producer  $h$  is given by

$$\min [(1 + r_L)wn_h + D; \chi y_h], \quad (\text{A1})$$

where  $y_h$  is given in (1).

The threshold value  $\varepsilon^*$  is determined by the equality

$$\chi n_h^\beta (1 + \delta + \varepsilon^*) = (1 + r_L)wn_h + D,$$

so that

$$\varepsilon^* = \max \left[ \frac{(1 + r_L)wn_h + D}{\chi n_h^\beta} - 1 - \delta; -\varepsilon_m \right].$$

$\tilde{\varepsilon}^*$  is now given by

$$\chi n_h^\beta (1 + \delta + \tilde{\varepsilon}^*) = D.$$

Expected profits of producer  $h$  are now given by

$$\begin{aligned} \Pi_h = & \int_{\varepsilon^*}^{\varepsilon_m} [y_h - D - (1 + r_L)wn_h] f(\varepsilon_h) d\varepsilon_h \\ & - \chi \int_{-\varepsilon_m}^{\varepsilon^*} y_h f(\varepsilon_h) d\varepsilon_h. \end{aligned} \quad (\text{A2})$$

The net junior debt service from the point of view of the junior banks is given by

$$\begin{cases} \max \{ \chi y_h - D; 0 \} - C & \text{if } \varepsilon_h < \varepsilon^*, \\ (1 + r_L)wn_h & \text{if } \varepsilon_h > \varepsilon^*. \end{cases} \quad (\text{A3})$$

Expected repayment for the bank, which determines the interest rate on the new debt,  $r_L$ , is thus determined by

$$(1 + r_C)wn_h = (1 + r_L)wn_h \int_{\tilde{\varepsilon}^*}^{\varepsilon_m} f(\varepsilon_h)d\varepsilon_h \quad (\text{A4})$$

$$+ \int_{\tilde{\varepsilon}^*}^{\varepsilon^*} (\chi y_h - D)f(\varepsilon_h)d\varepsilon_h - C \int_{-\varepsilon_m}^{\varepsilon^*} f(\varepsilon_h)d\varepsilon_h,$$

Using (A2) and (A4) yields

$$\Pi_h = \int_{\varepsilon^*}^{\varepsilon_m} (y_h - D)f(\varepsilon_h)d\varepsilon_h - \chi \int_{-\varepsilon_m}^{\varepsilon^*} y_h f(\varepsilon_h)d\varepsilon_h$$

$$-(1 + r_C)wn_h + \int_{\tilde{\varepsilon}^*}^{\varepsilon^*} (\chi y_h - D)f(\varepsilon_h)d\varepsilon_h - C \int_{-\varepsilon_m}^{\varepsilon^*} f(\varepsilon_h)d\varepsilon_h,$$

which can be rewritten as

$$\Pi_h = \int_{\varepsilon^*}^{\varepsilon_m} y_h f(\varepsilon_h)d\varepsilon_h - D \int_{\tilde{\varepsilon}^*}^{\varepsilon_m} f(\varepsilon_h)d\varepsilon_h \quad (\text{A5})$$

$$-(1 + r_C)wn_h - \chi \int_{-\varepsilon_m}^{\tilde{\varepsilon}^*} y_h f(\varepsilon_h)d\varepsilon_h - C \int_{-\varepsilon_m}^{\varepsilon^*} f(\varepsilon_h)d\varepsilon_h.$$

Finally, the expected market value of the initial debt is given by, for  $\tilde{\varepsilon}^* > -\varepsilon_m$ :

$$V = D \int_{\tilde{\varepsilon}^*}^{\varepsilon_m} f(\varepsilon_h)d\varepsilon_h + \int_{-\varepsilon_m}^{\tilde{\varepsilon}^*} (\chi y_h - C)f(\varepsilon_h)d\varepsilon_h. \quad (\text{A6})$$

From equations (A5) and (A6), it can be readily established that all the results summarized in propositions 1 and 2 given in the text continue to hold.

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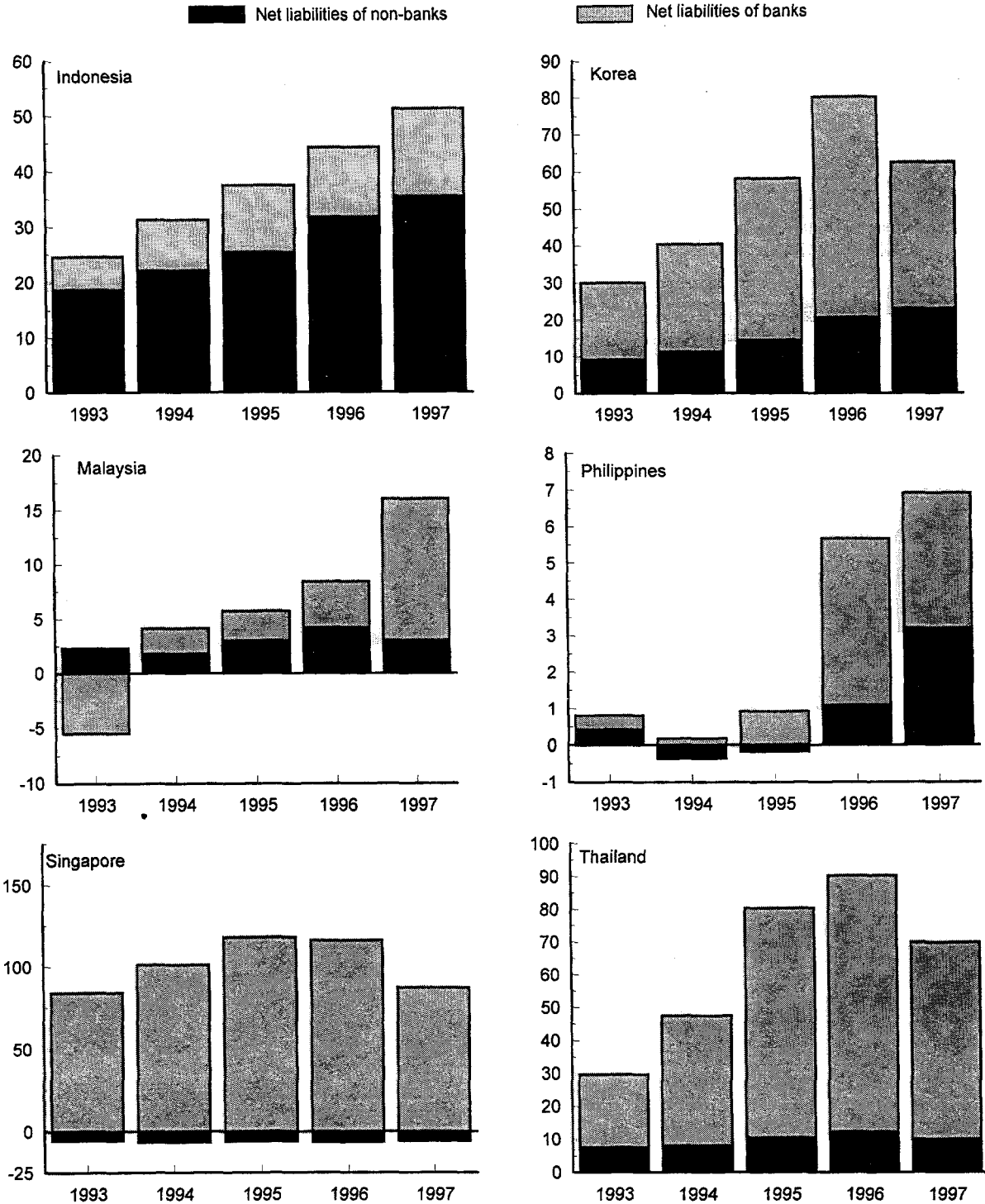
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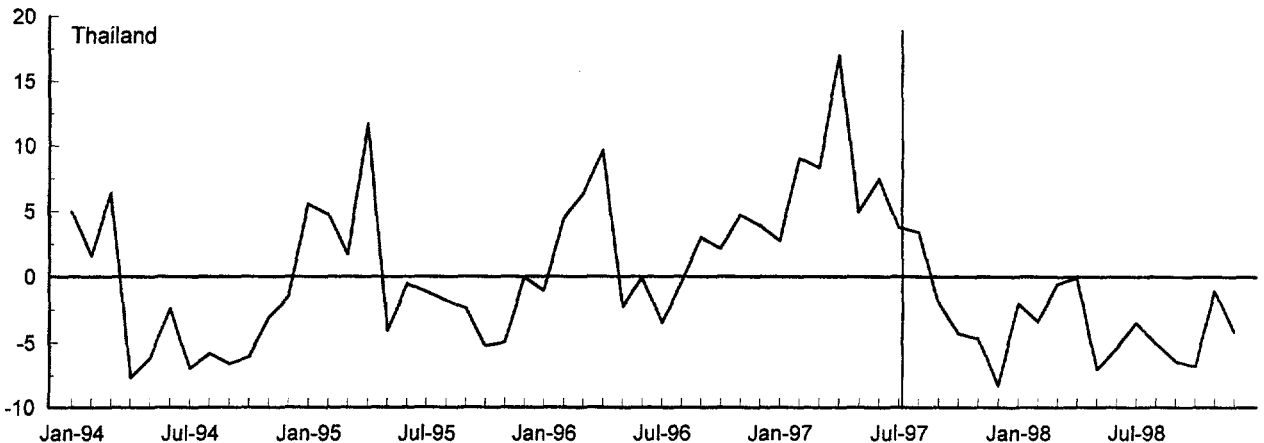
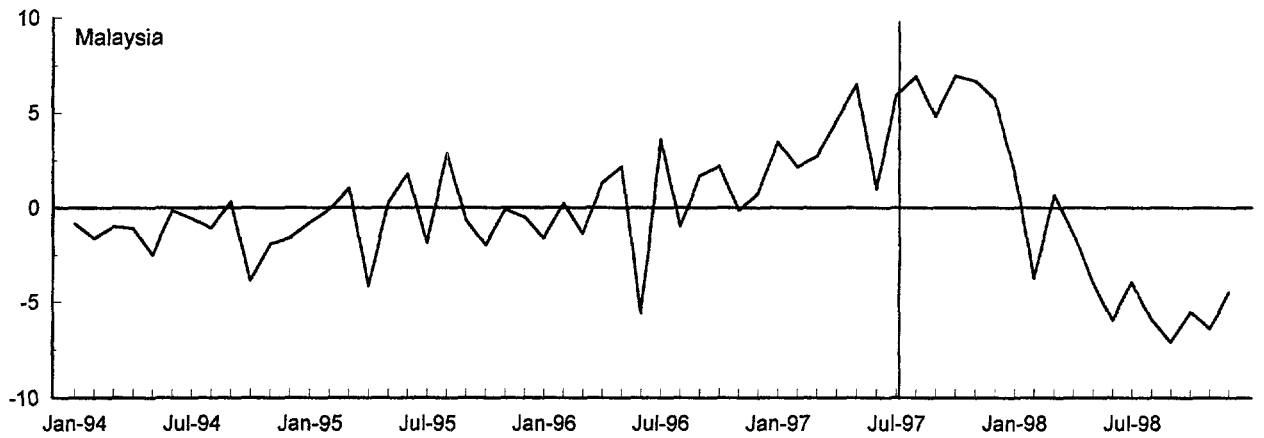
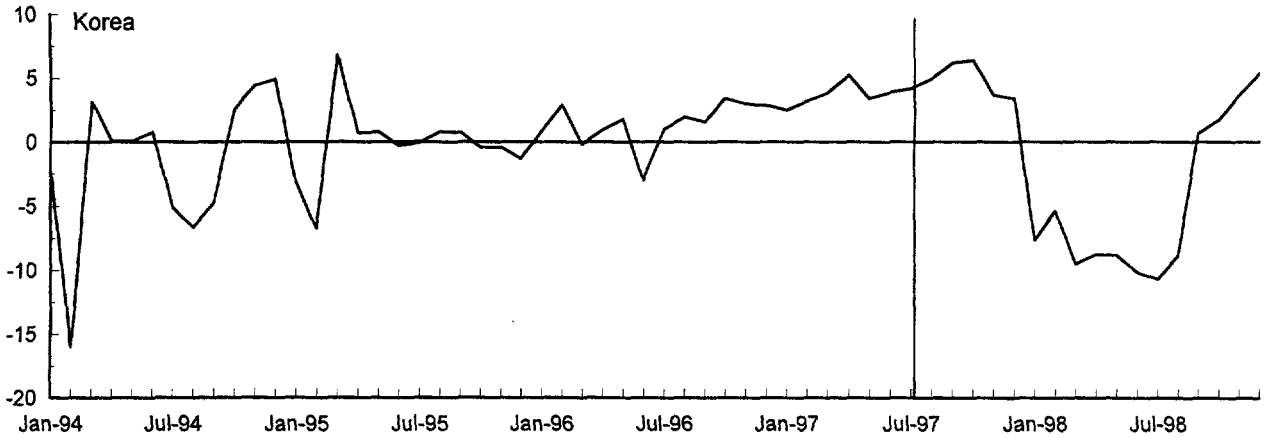


**Figure 2**  
**Asia: Net Foreign Liabilities, 1993-97**  
(in billions of dollars)



Source: Corsetti et al. (1998).

Figure 3  
East Asia: Cyclical Component of Output, 1994-98 <sup>1/</sup>



Source: International Monetary Fund.

<sup>1/</sup> Difference between actual index of industrial output minus trend value (estimated with the Hodrick-Prescott filter), divided by actual output. The vertical bar in each panel corresponds to the initial devaluation of the Thai baht (July 2, 1997).

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