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**THE ASIAN FINANCIAL CRISIS –
Implications for the Environment**

(Draft Version)

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THE ASIAN FINANCIAL CRISIS – Implications for the Environment¹

Abstract: The recent economic crisis in Asia has resulted in sharp declines in the currencies, stock markets, and other asset prices of many Asian countries and has put pressure on the global economy. The environmental issue is considered long term and government policy remains generally unaffected by the economic crisis. However, in the countries hardest hit by the recent Asian crisis, environmental policies that present a cost to industry are being delayed. In addition, capital spending programs for wastewater, solid waste and air pollution have been cut as these countries rely heavily on imported technology and services for key components of their environmental projects.

This paper reviews literature related to on going debate of Asian economic crisis and examine the (i) interactions between Asian crisis and the environment; (ii) how these interactions are likely to develop over time; and (iii) what consequences they may have on air quality in the developing Asian economies. The Regional Air Pollution and Information Simulation for Asia (RAINS-ASIA)² model has been used to provide some pictures of current and future air pollution situation in Asia.

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² RAINS-ASIA is PC based software designed to see implications on air quality in Asia with different economic scenarios.

I. Introduction

Popular sentiment in much of Asia ascribes the Asian crisis to sudden and destabilizing withdrawal of foreign capital.³ This is the “panic” view, encompassing bank runs, “fickle” investors, and “hot money”.⁴ The argument is that Asia did not exhibit traditional fundamental weaknesses associated with weak or wrong macroeconomic policies that result in currency and financial instability. These countries were reportedly following the “right” policies, hence, the “East Asian Miracle”. Unlike the debt crisis of 1980s, macroeconomic indicators in Asia were strong, public debt and inflation rates were low and investment, savings, and growth rates were high. In some sense, this is also an explanation as to why the crisis was not generally expected. However, regardless of these strong positive macroeconomic indicators, “weak” fundamentals are necessary for such self-fulfilling speculative attacks to occur.

The Asian crisis began with a financial panic that eventually led to marked contractions in GDP and employment in the affected economies. GDP shrinkage in 1998 ranged from nearly 14 per cent in Indonesia to 0.5 per cent in the Philippines. In turn, these have resulted in adverse social consequences. Although there are signs that the worst of the financial crisis is over and the crisis economies are getting on the road to recovery, the social impacts continue to unfold. The social crisis is likely to be deeper and can be expected to persist long after the “crisis economies” return to solid growth. There is danger, therefore, that improving economic conditions may lull observers into thinking that social conditions have recovered when they may in fact be worsening.

Against this background, this paper attempts to explain the causes and consequences of the Asian crisis. The remainder of this paper is organized as follows. Section II provides the summary of the recent development on literature of Asian currency and financial crisis. Section III briefly discusses the social impacts of crisis. Section IV highlights crisis and environment with special emphasis on Thailand and Section V provides economic policies of environmental pollution (in particular the environmental policy matrix). Section VI concludes.

³ For Asian Developing countries, net inflows on the capital account (as a share of host-country GDP roughly doubled between 1984-1988 and 1989-1993) (Khan and Reinhart, 1995).

⁴ Corsetti and Srinivasan (1999) argued that unlike in the case of debates on the EU system between 1992 and 1993 or Mexico at the end of 1994, the Asian experience has reduced the dichotomy between “panic” and “fundamentalist” views.

II. Asian Economic and Financial Crisis

2.1 Overview of Asian Crisis

When the Thai baht was floated on July 2, 1997, it was hardly a surprise for many foreign exchange dealers, treasury officials, central bankers and academic economists. However, few predicted that the exchange rates would depreciate as much as it actually did, and the crisis would spread to other countries in the region, especially to South Korea, in the following several months. From the end of June to the end of December, 1997, the Indonesian rupiah depreciated more than 140 per cent, while the Korean won and the Thai baht depreciated more than 80 per cent, vis-à-vis the US dollar. Malaysian ringgit and Philippine peso depreciated about 50 per cent. The least affected was the Hong Kong dollar and Chinese renminbi, all of which kept the nominal exchange rate to the US dollar. Table 1 provides the chronology of the Asian crisis.

Table 1: Chronology of the Asian Crisis

June 1997	<ul style="list-style-type: none">Thailand orders 16 finance companies which has high levels of bad debt to merge with healthier ones.
July 1997	<ul style="list-style-type: none">Thailand is forced to abandon its fixed exchange rate for the baht against the US dollar. The baht plunges more than 20% immediately and continues to slide. At the end of the month, Thailand finally asks for help from the IMF.The Philippines peso falls nearly 10% against the dollar, followed by the Malaysian ringgit and the Indonesian rupiah. Regional stock markets plunge.South Korea's Kia Group, the country's eighth largest 'chaebol' conglomerate, is put under the control of a government-organized alliance of banks. Kia is the fourth of South Korea's top 30 chaebols to collapse, or nearly collapse, in 1997.
August 1997	<ul style="list-style-type: none">Indonesia abandons its fixed exchange rate for the rupiah against the dollar. The IMF approves a \$17 billion rescue package for Thailand.South Korea announces emergency measures, including soft loans to banks, to try to prevent bad debts overwhelming the banking system.Regional stock markets plunge again. Hong Kong is affected for the first time and its stock market falls 17% in five days.
October 1997	<ul style="list-style-type: none">Indonesia asks for help from IMF and an \$23 billion rescue package is assembled. Hong Kong's stock market crashes 40% during the month.
November 1997	<ul style="list-style-type: none">South Korea asks for help from IMF, indicating it needs \$20 billion.Malaysian government announces National Economic Action Council, chaired by the Prime Minister, to rescue the economy from crisis.

	<ul style="list-style-type: none"> • Thailand's government resigns. • Japan's fourth largest securities house, Yamaichi, collapses with debts estimated at Y3,200 billion (equivalent of \$25 billion).
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Source: URL: <http://www.megastories.com/seasia>.

The Asian crisis affected most of the economies that had previously been considered as the most successful in interacting with international markets (designated as “Asian miracle”). The Asian currency crises have been a surprise in its depth and contagion. The crisis is different from most of the earlier structural adjustment crises that have affected developing countries around the world. Unlike the Latin American crisis of the 1980s, it does not reflect either commodity price shocks or large changes in world interest rates. Nor does it reflect the fiscal imbalances and inflationary shocks that have been central to many other previous crises. Companies in these worst hit Asian countries borrowed much of its US dollars because interest rates were much lower than on their own currencies. The exchange rates of local currencies were pegged against the dollar, so they had no fears about having to earn money in local currency to pay back loans in dollars. This was fine while the economy was booming. But from the middle of 1995, the US dollar started to rise against most of the world's other currencies. Asian currencies pegged against the dollar rose with it – so Asia's exports became more expensive and less competitive on world markets. From May 1997, international banks and money traders came to the view that Asian currencies would have abandon the dollar peg and devalue in order to revive exports. Asian governments tried to resist, knowing that devaluation would cripple firms that had borrowed huge sums in dollars from foreign market. When the traders sold the local currency and bought dollars, the Asian central banks bought the local currency and sold dollars. But even central banks ran out of dollars. First, Thailand, then Malaysia, and Indonesia gave up the fight and allowed their currencies to devalue. Stock markets plunged because it was clear many companies would have problems repaying dollar loans. As the crisis spread, weaknesses in the Asian economies which had seemed unimportant during the boom suddenly looked serious. Much of the vast amounts of borrowed money had been spent on speculative property developments, prestige projects and unneeded factories. The problem was bad in Thailand, where a succession of weak governments had allowed money to flood into building unwanted skyscrapers rather than investing in productive sectors such as roads, telecommunications and education. But it was worst in South Korea, where the entire economic system was based on the government encouraging banks to make cheap loans to big conglomerates for continual expansion – regardless of world demand. Four of the South Korea's “chaebol” conglomerates collapsed in 1997.

2.2 Causes of the Crisis

An extensive literature has now emerged on the causes of the Asian crisis. While extremely informative, much of these literature focuses on relationships between endogenous variables, such as domestic

interest rates, exchange rates, and current account imbalances rather than on exogenous shocks that set off or exacerbated the crisis. The three main type of primary shocks considered that could plausibly be regarded as exogenous to the crisis countries, are: terms of trade shocks; appreciation of the US dollar under a currency peg; and downward revisions in the anticipated profitability of investment (McKibbin and Martin, 1999). A key question in examining a crisis of this nature is whether the crisis was purely the result of a financial shock such as a bank run or disorderly workout (Radelet and Sachs, 1998), or from a change in economic fundamentals. While the causes of purely financial panic are typically difficult to observe, at least some changes in economic fundamentals can be observed and used to identify potential causes. Brief review of the literature on the causes of the crisis under five major headings are provided below.

Current Account Deficit: Economists argue that the current account (CA) deficit, as a percentage of GDP, gives fair idea of a country's balance of payments (BoP). As we know, the CA deficit is nothing but the difference between national savings and national investment and is thus a manifestation of excess demand. This is important for two reasons. First, it has implications for growth. Second, depending on what is happening to the capital account, it affects exchange rates and hence the competitiveness of an economy. With a higher CA deficit, an economy that operates with a fixed exchange rate runs into trouble as foreign fund managers start attacking the "overvalued" domestic currency.

Under Summer-IMF hypothesis, large and persistent CA deficits tend to undermine the BoP position if any of the following happens: a) Foreign loans are used for financing projects where the productivity of investment is low relative to the costs of borrowing; b) there is low export diversification, which constrains the flow of foreign exchange earnings (Capiro and Klingebiel, 1996); and c) foreign capital inflows finance domestic consumption rather than investments. However, whether a high CA deficit necessarily trigger a crisis depends on how the CA deficit is financed, that is, the composition of capital account inflows used to finance the deficit. In principle, a high CA deficit can trigger expectations about depreciation and lead to speculative attacks against a currency. But if CA deficits are not used to finance domestic consumption, there need not necessarily be any difficulties about serving future debts. If one leaves out Malaysia and Thailand, in the other three countries (Korea, Indonesia and Philippines), CA deficit/GDP ratios were not all that high.⁵ There is no evidence in country like Thailand that in general, returns on domestic capital formation were too low to repay foreign creditors. Additional productive capacity was indeed converted into extra earnings in terms of foreign currency. All these reasons weaken the CA hypothesis as being the principal or even one of the main factors causing the crisis.

⁵ In Korea, it was below 3 per cent till 1996, when it went up to 4.8 per cent. In Indonesia, its was less than 3.5 per cent throughout. In the Philippines, it varied between 4.5 and 5.5 per cent (ADB, 1997).

Short-term Debt: CA, however, can be linked not to total external debt, but short-term debt. Such debt accumulation became possible because of liberalization of the CA. Although, cross-country variation exists, there was, in general, increase in short-term debt owed by private financial institutions and non-financial corporations. In Thailand and Korea, the borrowing was more by banks and non-banking financial institutions that performed the task of intermediation. In Indonesia, there was a lot of direct borrowing by non-financial institutions. Data on short-term debt to foreign exchange reserves ratio was more than 100 per cent in mid-1997 (World Bank, 1999) creating mismatches between currency and maturity of liabilities and assets. In principle, a liquidity problem and a high ratio of M2 money to reserves coupled with fixed exchange rates, can potentially lead to a run on reserves by residents because the residents are not longer sure of the future store of value function of their currency holdings and realize that government reserves may not be sufficient for supporting the currency in circulation. This represents a loss of confidence in the government and its capacity to handle the economic situation.

Fragility of the Financial Sector: High short-term external debt and high leveraging was only one example of broader issue of financial sector fragility. Between 1990 and 1996, the ratio of bank lending to GDP grew by more than 50 percent in Thailand and Philippines, 27 per cent in Malaysia, and around 15 per cent in Hong Kong, Indonesia, Korea and Singapore (Corsetti et al. 1999). While private credit to GDP ratio increases as per capita income increases, the increases in East Asia were far higher than indicated by increases in per capita income alone (World Bank, 1999). However, in the process of handling the problem of asymmetric information and separating good borrowers from bad ones, banks ration their credit with the implicit assumption that investors borrowing at "bank optimal" rates of interest are safe and are less likely to invest in dud projects (Stiglitz and Weiss, 1981). But this risk-averse behavior of banks broke down in East Asia due to the presence of implicit deposit guarantees and stable exchange rates. This made credit risk extremely under-priced and led to problems of moral hazard, since there was little bank supervision and no penalty for managers.

Another feature contributing to the fragility of the banking sector in these economies was weak monitoring and supervising capabilities and practices of the central banks, and absence of enforcement of prudential norms. Financial sector liberalization comprising interest rate deregulation and opening of the CA magnified these weaknesses as banks were exposed to large capital inflows and more sophisticated practices of foreign banks and financial agents. A financial sector crisis was precipitated when the fragile financial sector with its weaknesses was exposed to an external shock in the form of export slowdown, decline in unit export prices, and steep hike in interest rates.

Exogenous Factors: Since much of the East Asian success story depended on export-led growth, any slowdown in international trade would affect these economies more than relatively insulated ones. During 1996, there was a general slowdown in world trade, affecting export growth from this region. Asian

economies suffered as their main trading partners, Japan and Latin America, were badly affected by this recession. At the same time, appreciation (overvalued) of yen causes rising import costs from Japan. While an overvalued yen helped price-sensitive exports to Japan, there were adverse effects for import-intensive exports to other regions. There was also deterioration in the terms of trade due to oversupply. This excess supply condition tended to become more critical as a result of US firms regaining some of tier lost market shares and improving their competitiveness over the 1990s, including continued domestic demand contraction in Japan. One of the features of the Asian crisis has therefore been that economies in which the share of exports to total industrial sector value added has been higher have suffered relatively more than those that are relatively more self-contained.

Efficiency-type Arguments: When on accounts for the role of efficiency in explaining growth in East Asia, Krugman's (1994) findings were that the contribution was negligible (also see Roubini, 1998). The higher short run employment elasticities in the case of East Asia reflect the higher labor-absorbing tendency in manufacturing activities of these economies. This implies that they opted for labor-intensive modes of production, with higher production made possible by siphoning labor from "agricultural" to "manufacturing" and "service" sectors. Technological growth for the region was low as compared with the international standards.

The above brief survey of literature has revealed that the discussion of the causes of the crisis has focused almost exclusively on the macro aspects with some attention being given to governance type issues in the financial sector. There has been hardly any attempt to answer the questions: Were there any structural factors that contributed to the crisis and its timing? Further, the answer to why the crisis has been so much more protracted and the recovery so elusive, compared with the Mexican or other crisis, has been given in terms of the financial sector fragility or the breakdown of export credit mechanisms.

On the positive side, since the first quarter of 1999, however, developing Asia has experienced a substantial pickup in economic activity. In the first quarter, developing Asia grew at 4.8 per cent compared to 1.0 per cent in the fourth quarter of 1998. The recovery in the crisis-affected economies has been driven by increased industrial sector activity and better agriculture sector performance in some economies. The growth impetus has come from both an increase in domestic absorption, supported by reflationary policies, and a global recovery in demand for semiconductors and related computer and electronic products. In addition, inventory rebuilding in Asia, particularly in electronics, combined with a surge in intra-regional trade, has contributed to the faster than expected recovery. Table 2 summarizes the outlook of the recent developing Asia's economy. From the table it can be observed that though there are downside risks in developing Asia, these seem to be lower than they were twelve months ago. But they have not disappeared.

A strong commitment to and speedy implementation of structural reforms is necessary. Progress in restructuring the banking and corporate sectors and making business transactions more transparent and accountable will ensure efficiency in resource allocation. Policy initiatives are also required for raising productivity levels and restoring the international competitiveness of the region.

Table 2: The Economic Indicators of Developing Asia

<i>Economy</i>	Growth Rate of GDP (percent per annum)			Change in Consumer Price (percent per annum)			Growth Rate of Merchandise Export (percent per annum)			Growth Rate of Merchandise Import (percent per annum)		
	1996	1998	2000*	1996	1998	2000*	1996	1998	2000*	1996	1998	2000*
Newly Industrialized Economies:												
Hong Kong, China	4.5	-5.1	1.5	6.3	2.8	0.0	4.0	-7.5	2.0	3.0	-11.6	
South Korea	7.1	-5.8	6.0	4.9	7.5	3.0	4.3	-4.9	2.3	12.3	-36.1	
Singapore	6.9	1.5	6.0	1.4	-1.5	1.0	6.4	-5.6	6.3	5.4	-9.0	
Taipei, China	5.7	4.8	6.3	3.1	1.7	1.0	3.8	-9.4	10.5	-0.1	-5.6	
PR of China	9.6	7.8	6.0	8.3	-0.8	2.0	17.9	0.5	3.0	19.5	-1.5	
Southeast Asia:												
Indonesia	7.8	-13.2	4.0	7.9	64.7	10.0	9.0	-14.0	9.0	10.4	-28.2	
Malaysia	8.6	-7.5	3.9	3.5	5.3	3.6	7.3	-7.8	5.0	1.7	-26.8	
Philippines	5.8	-0.5	4.5	9.1	9.7	7.0	17.7	16.9	15.5	20.8	-18.8	
Thailand	5.5	-9.4	5.0	5.9	8.1	4.0	-1.9	-6.8	5.5	0.6	-33.8	
Vietnam	9.3	4.4	4.5	4.5	9.2	6.5	41.0	1.0	7.0	38.9	-2.1	
South Asia:												
Bangladesh	5.4	5.2	5.0	6.6	7.0	8.0	11.8	16.8	8.0	19.1	5.1	
India	7.8	6.0	7.0	9.4	7.0	5.0	5.6	-3.9	4.5	12.1	-7.1	
Pakistan	5.2	4.3	4.5	10.8	8.2	6.0	7.1	3.7	8.0	16.7	-14.9	
Sri Lanka	3.8	5.3	6.2	15.9	9.4	8.0	7.6	6.7	7.0	2.4	7.1	
Developing Asia	7.4	2.3	5.5	7.2	5.6	3.1	-	-	-	-	-	

*. Estimated. -. Not Available.

Source: ADB (1999)

III. Social Implications of the Crisis

The Asian crisis began with a financial panic that eventually led to marked contractions in GDP and employment in the affected economies. GDP shrinkage in 1998 ranged from nearly 14 per cent in Indonesia to 0.5 per cent in the Philippines. In turn, these have resulted in adverse social consequences. Although there are signs that the worst of the financial crisis is over and the crisis economies are getting on the road to recovery, the social impacts continue to unfold. The social crisis is likely to be deeper and can be expected to persist long after the “crisis economies” return to solid growth. There is danger, therefore, that improving economic conditions may lull observers into thinking that social conditions have recovered when they may in fact be worsening. Table 3 provides the summary of a study that assesses the social impact of the crisis. However, as environment is the main focus of this paper, it will be given a special emphasis below.

Table 3: The Social Impacts of the Asian Crisis

Prices and assets	Increase on the prices of imported goods and services. Impact of inflation was harsher on the poor. Reduction on the real value of household sectors.
Employment and Income	Increase in unemployment (especially manufacturing and construction sectors). Decrease in real earnings. Fall in rental income and profits and other forms of business income.
Inequality and Poverty	Increase in income inequality and poverty. Change in intra-country regional distribution of income.
Education	Education budget cuts. Reduction in school enrolments.
Health and Family Planning	Decline in public health budgets and facilities in real terms. Increase in use of contraceptives.
Social Capital	Flourish in community-based initiatives. Increase in crime rates.
Especially Disadvantaged Groups	Poor have suffered more because of their low income and education with fewer options for coping with the crisis. Harm to overseas migrants

	working in other Asian countries. Urban population have been more adversely affected.
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Source: Knowles, J.C. et al. (1999)

Even before the crisis, an estimated full cost valuation of all pollution in large Asian cities is 5-10 per cent of GDP, while the cost of cleanup is estimated to be only about 2-3 per cent of GDP (World Bank, 1992; and Brandon, 1994). Yet as Table 4 indicates, no government is spending at the levels needed, and individual enterprises do not on their own have the incentives to internalize costs and thus reduce resource use and waste production. Actual spending has decreasing significantly in several countries over the past two years, primarily due to the crisis.⁶ It is clear that whether considering finance, personnel, or political will, government cannot manage the environment alone.

Table 4: Government Spending on Environmental Infrastructure and Services

Sub-Region/Country	% Share of GDP Spent by Government on the Environment (1997)
<i>East Asia</i>	
Japan	1.8
China	Less than 0.5
Taiwan	1.0
South Korea	1.3
<i>South-East Asia</i>	
Indonesia	Less than 0.5
Malaysia	0.9
Singapore	1.2
Philippines	0.5
Thailand	0.8
Vietnam	0.1

Source: AET (1999)

Government budgets for the environmental protection have been declined further in Thailand, Korea, and Malaysia since the onset of the crisis, and probably also in the other crisis countries. People's intense quest for additional income during the crisis has placed strains on forest, fishing, and water

⁶ For example, Thailand's government's expenditure on environmental programs decreased by 27 per cent for 1999 as compared with 1997 (Kittiprapas, 1999).

resources in most of the crisis countries. The recent collapse and uncertain recovery of major Asian economies has accentuated the need for new approaches towards environmental management. Although, many casual observers have noted reduction in air pollution in capital cities owing to fewer vehicles on the road, the only country study reporting official levels (in Seoul) suggests that there has been not departure from the previous trends (Moon et al., 1999). Likewise, contrary to some expectations, the downturn in industrial production due to contracted markets has not led to diminishing levels of industrial pollution, but, as revealed in the case of Indonesia, has instead seen a rise of about 15 per cent (Asfah 1998). The reasons are the most troubling: the lower regulatory capacities of financially strapped, downsized governments have allowed producers to dump untreated wastes and pollute the air with less fear of being caught or subject to sanctions. These trends are taking place in a context of dramatically increased levels of poverty and unemployment, greatly reduced spending on environmental infrastructure, and a general diversion of attention away from environment management. In assessing the impacts of the economic reversals, Asfah (1998) concludes "effective policies will require increased reliance on community and market incentives and voluntary programs to control pollution".

The current economic crisis, however, is only a transient event. The critical question for the environment is whether growth will resume in the context of fundamental reforms. The environmental problems associated with the crisis can not be as easily and directly managed as economic problems; solutions involve building regulatory, institutional, technical and managerial capacity over time. The short term policy responses should include a) ensuring that food markets work, b) sustaining purchasing power of poor households, c) targeting geographical areas, d) promoting public employment and local infrastructure, and e) providing direct food support, especially where markets are breaking down. In medium term, governments should aim to protect social capital, improve local financial intermediation, reform labor market policies, and establish environmental law and regulations. It will be interesting to carry out the further research on change in the quality of the environment will take place in next few years in Asia.

3.1 Social Implications of Thai Crisis: A Case study

The drastic depreciation of the baht, together with rigid IMF conditions, generated extreme economic difficulties. Higher costs of inputs from abroad led to production cutbacks and higher inflation. Tight liquidity and heavy foreign debt burden aggravated the situation, so numerous companies opted to downsize their operations reducing employment as well as pay scales, particularly manufacturing sectors. The manufacturing sector's GDP was dropped to 15 per cent by the end of 1998 and manufacturing

production index has been declining since January 1997 (Kittiprapas, 1998). Declining purchasing power together with the economic downturn gave rise to more bad debts and a growing number of bankruptcies, which have adverse impact upon national credibility. Foreign capital continued to shun Thailand and new leaders hesitated due to the spread of the crisis to other Southeast Asian countries.

The drop in government revenue adversely affected government expenditure in a number of crucial areas such as human resource development, technology development and other social services. Table 5 provides the percentage cut by programs over 1997-1999 in Thailand.

Table 5: Percentage Change of Government Expenditure for 1997-99

Programs	% Difference from 1997	% Difference from 1998
Agriculture	-25.6	-2.5
Communications & Transport	-16.1	-17.4
Energy & Environment	-27.2	-6.8
Education	-3.7	0.8
Public Health	-11.4	-5.9
Social Services	-35.0	-9.8
Total*	-15.7	-0.6

* Total also includes Industry and Mining, Commerce and Tourism, Defense, Internal Security, General Administration, and Debt Serving.

Source: Budget Bureau (1999).

Although the government budget cuts in 1998 have been made under the IMF advise that priority programs such as education, public health and social services should be protected, the percentage cut for these programs are significant, particularly social services – which received the highest percentage cut in fiscal year 1998. The limited supply of social service programs would inevitably affect the welfare of poor. Agriculture, energy and the environment are also considerably affected as too have suffered high percentage cuts. Figure 1 shows the impacts of economic crisis to various socio-economic groups at various levels.

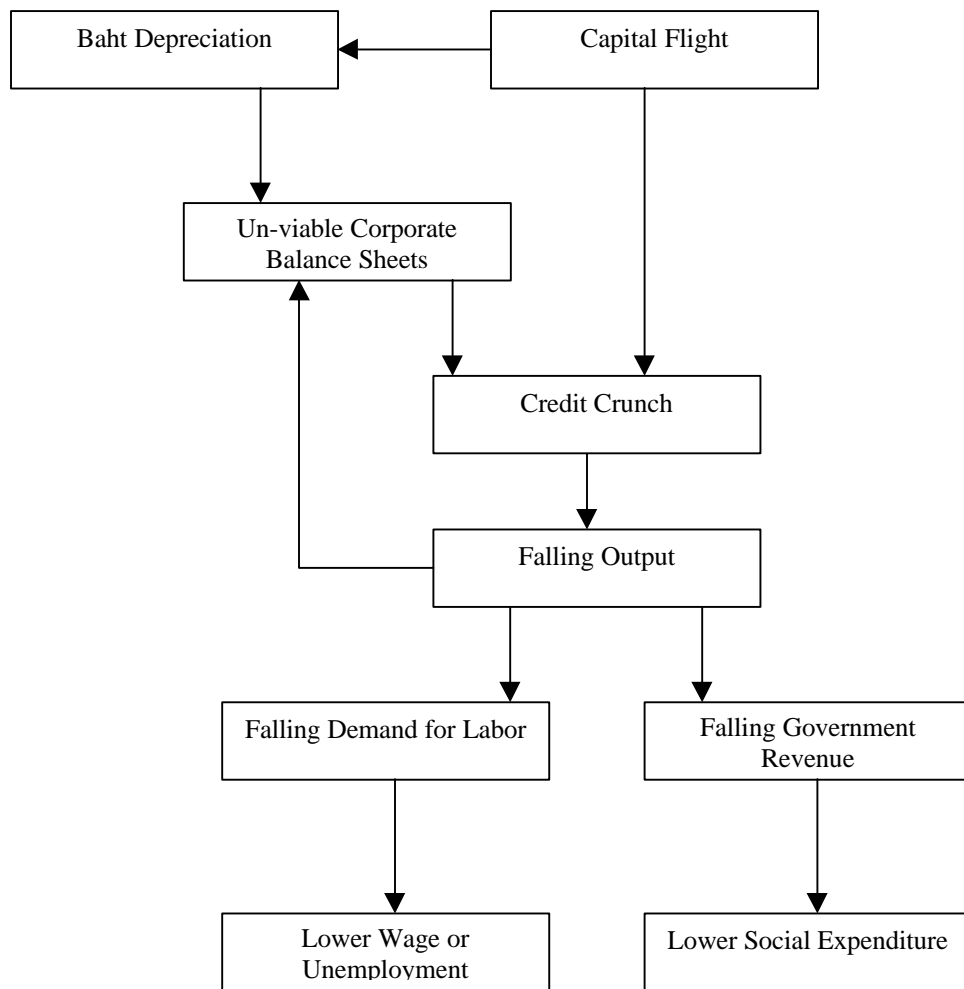


Fig. 1: Pathways from Economic Crisis to Social Impacts

IV Crisis and Environment: A Preliminary Research

In this paper, a preliminary attempt has been made for the likely future transboundary air pollution (in particular, emissions of sulfur dioxide) situation in Asia after the crisis with different selective alternative scenarios using the PC-based RAINS-ASIA model⁷. Table 6 presents the total emissions of sulfur dioxide (SO₂) if no further control due to insufficient fund to finance control technologies is assumed in all of the four sectors (namely, Transport, Industry, Household and Commercial sectors). It is estimated that the total emission of SO₂ will increase by five folds in year 2020 if governments in these countries did not spent on environmental protection. If we take the example of specific crisis hit country Thailand, sulfur deposition is worse without any government expenditure on mitigation options as compared with the government expenditure as planned before the crisis. Figures 2 and 3 present the situation of sulfur deposition with and without government expenditure on control options to mitigate the SO₂ emissions.

However, it can be argued that these higher emission levels in many of the crisis hit Asian countries need not reflect the actual situation shown earlier partly due to the low economic growth which is positively related with the damage to environment. However, most of these countries are rich on its primary energy resources (main cause of transboundary air pollution) and these resources are used inefficiently. In 1990, emission intensity of SO₂ in most Asian countries were higher than those of industrialized countries partly due to low efficiency in energy use (Shrestha et al., 1996). Thus, from regional environmental perspective, the growth of primary energy in these countries is likely to assume an increasingly important role to fuel the deteriorate economy. It is interesting to see whether these countries will spend sufficient capital resource to protect the environment in next few years.

V. Environmental Policy Matrix

The new post Rio emphasis on reconciling environment and development, incorporating poverty and equity issues, and managing the global commons has built the momentum for environmental policy innovations. Taking stock of the various policy instruments being used for sustainable development requires some organizing principles which are set out in the "policy matrix" as suggested the World Bank (See Table 7). The matrix distinguishes between policy approaches that are aimed at natural resource management as compared with pollution prevention and mitigation, and it organizes the approaches themselves into four broad categories depending on the principal emphasis of each policy instrument:

Table 7: Environmental Policy Matrix

Approaches/policy Instruments		Resource Management				Pollution Control			
		Sectors*				Sectors**			
		I	II	--	N	I	II	--	N
Using Markets	Subsidy Reduction								
	Environmental Taxes on emissions, inputs and products								
	User fees for natural resources and services								
	Performance bonds/deposit reform								
	Targeted subsidies								
Creating Markets	Property rights/Decentralization								
	Tradable permits/rights								
	International offset systems								
Regulating	Standards								
	Bans								
	Quotas								
Engaging the Public	Information disclosure								
	Public participants								

*. Sectors in Resource Management include: water resources, fisheries, land management, forests, sustainable agriculture, mineral resources etc.

**. Sectors in Pollution Control include: air pollution, water pollution, solid wastes, hazardous waste/toxic chemicals etc.

Using Markets: Among the most powerful policies for improved environmental management are those that use the market and price signals to make the appropriate allocation of resources. Environmental resources are typically under priced in two important ways: many subsidies actually reduce the cost of overexploiting or polluting the environment, and market prices generally reflect only private costs, ignoring the damages inflicted on others by pollution emissions. Using markets therefore involves moving towards free market prices on the one hand and moving beyond free market prices on the other. As long as

⁷ RAINS-ASIA is a PC based software designed to see implications on air quality in Asia with different economic scenarios (IIASA , The World Bank and ADB, 1995).

markets are reasonably free and competitive, harnessing market forces can be a powerful way to reduce the cost to the economy of achieving environmental goals.

Creating Markets: Market creation is an important way to reduce one of the most persistent and pervasive dangers to sustainable development, the lack of markets for environmental resources and services. Defining property rights, privatizing and decentralizing, establishing tradable permits and rights, and creating international offsets are all examples of the innovations underway in market creation, as highlighted in the policy matrix.

Using Environmental Regulations: Regulations are the most common approach to environmental problems. But they should be used judiciously because of the large direct and indirect costs they impose. Standards, bans, permits and quotas are often favored by policymakers because they promise certainty of outcome - without costly monitoring and enforcement, however, this promise may not be realized.

Engaging the Public: The final set of environmental policy instruments are those that are a result of public involvement in improved environmental management. It has been commonly observed that governments rarely lead in the fight for an improved environment; more often political leaders respond to public demands for action to address environmental issues. Consequently, information disclosure, community pressure, and public participation are crucial in creating the political will to take effective action.

VI. CONCLUSIONS

While rapid economic development in the late '80s and early '90 had created dynamism and wealth, Asia has at the same time become dirtier, less ecologically diverse, and more environmentally vulnerable. The prevailing government mentality of "grow now and clean up later" and lack of institutional capacity to implement its environmental policy in the region were two main reasons for Asia's environmental problems which impose large costs on the economy and on the society.

The impact of recent 1997-98 Asian crisis on environment is ambiguous. On the one hand, it is argued that the Asian crisis will have lower negative effect on the environment primarily due to the low economic growth and low level of energy use. If the conventional view of the relationship between development and emissions is assumed, then, without policy intervention, there is an underlying strictly increasing relation between pollution and GDP. However, this conventional view can be argued because there are a number of proven technologies that can control emissions.

On the other hand, these crisis-hit countries (with the exception of Japan) will tend to use their huge primary energy resources to fuel their recessed economy in years to come without the consideration of energy efficiency improvement and investment constraint to protect their environment. Additional

financial investment and associated pricing implications will be the problems confronted by the policy makers in most of these countries.

It is too early to predict and analyze the implications of future environment situation in Asia from the recent crisis. It is interesting to see how the policy makers of these countries value the government expenditure on environmental protection in next few years. From the perspective of both environmentalists and economists, these countries should not focus building their contracted economy without considering possible environmental damage in future. The policy makers should keep in mind that it is possible to decouple economic growth from damage to environment by investing in more efficient supply frameworks, improving energy efficiency amongst end-users, and substituting renewable energy technologies. The key to future development lies in providing the services which people need by using the most efficient technologies, and consuming the lowest possible level of material resources. These may be promoted using the most appropriate policy framework.

We intend to examine the mitigation potential of various energy efficiency and emission control options as well as the associated costs based on the available information on government expenditure on environment using the RAINS-ASIA model in a subsequent paper.

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