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Development and Sustainable Future: The Environmental Dimension of Indonesia's Socio-Economic Progress:[1]

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I. Introduction

Indonesia is at a policy crossroad. The economic achievements of the last generation have been in many ways remarkable, but the policy framework underlying them was not robust enough to sustain the economy into the next generation. This research analyzes Indonesia's sustainable development progress during the last 3 decades or so, and provides a set of long-term scenarios with the policy implications towards 2020. Three components and their interrelations take a center stage in our concept of "sustainable development": *economic, environment* and *social* development.

We first survey the country's socio-economic progress, appraise the environmental repercussions of such a progress, offer an analysis of the recent financial crisis, and provide an overview of the constraints and limitations that the country must now face. Subsequently, we attempt to generate a long-term general equilibrium projection of the socio-economic-environment conditions under a set of reasonable assumptions.

The ultimate goal is to provide a basis for empirical and forecasting scenario analysis in order to support more sustainable development policies for Indonesia. By using the modeling approach, we are able to unravel the workings of some important elements of sustainable development, grapple with the new complexities of achieving sustainable development, and provide development scenarios for the country that can ensure the process will not be accompanied by a destruction of the most fundamental and precious economic asset, the environment.

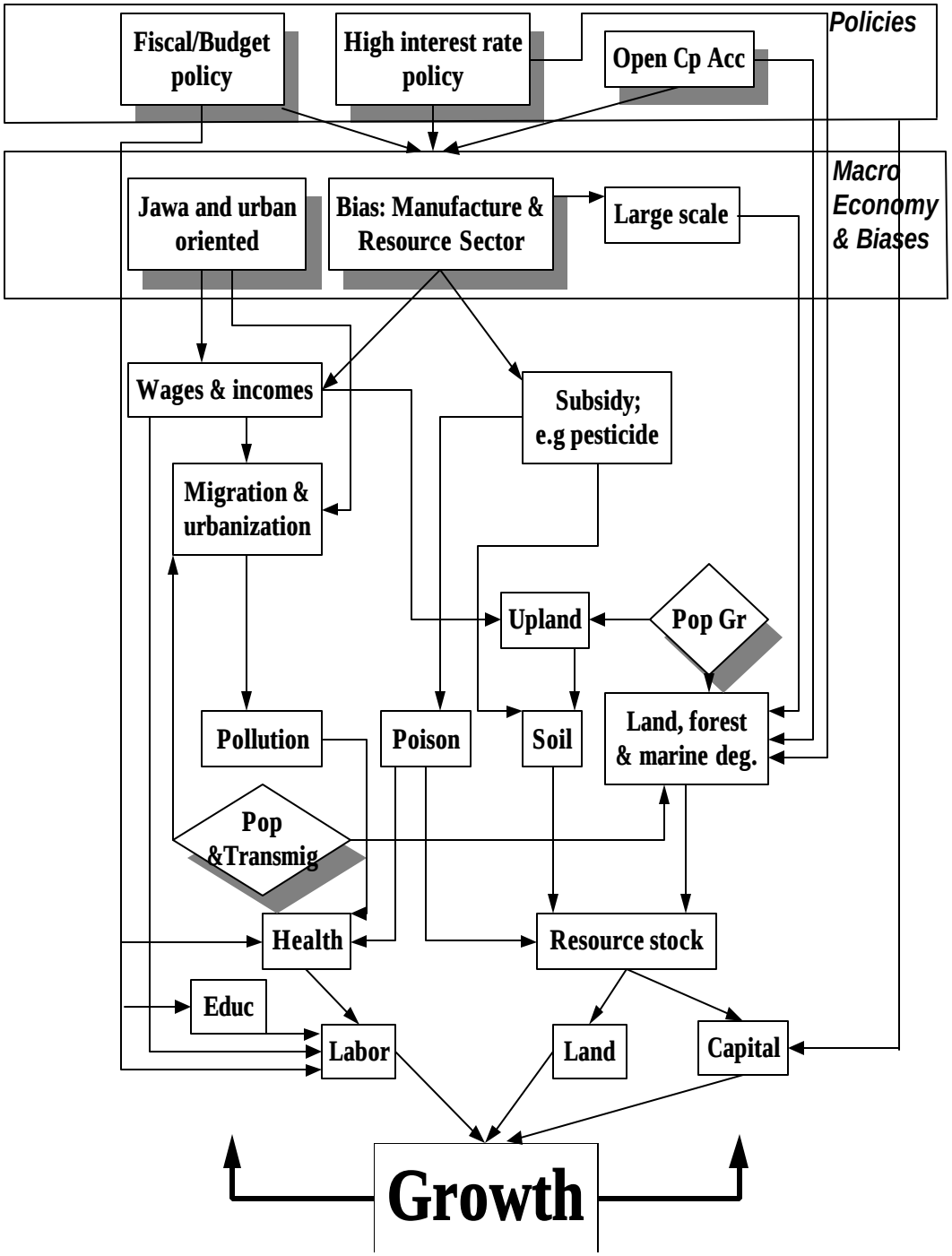
The organization of the manuscript goes along with what is displayed in Figure 1. At the top of the chart, a set of government policies (fiscal, monetary, trade, etc) affects the macroeconomic performance of the country, the progress of which, including the recent economic crisis, is described in Section II. Ingrained in the macroeconomic performance are the structural features believed to be characterizing the country's development patterns. These include the spatial dimension (Java and urban oriented), sectoral dimension (manufacturing and resource-based bias), and scale characteristics (large scale preference). The social and environmental repercussions of these structural features are discussed in Sections III. Since the ultimate goal is to provide future scenarios, a particular model of a general equilibrium type is build and used in this research. To capture the recent episode of financial crisis and its social repercussions, the inclusion of a fairly detailed financial block in the model is discussed in Section IV.

Section V is devoted to the natural resource and energy topic. An analysis of resource depletion, covering forest, oil, gas, coal and water, and the corresponding results of genuine saving, are presented in Section VI.

As various policies and development processes generate pollution and resource depletion, inputs such as labor, land and capital are all affected. Without proper policy responses, this will influence the country's growth in the subsequent stage through a series of

declines in the productivity parameters (the bottom part of Figure 1). It is precisely these productivity factors that will be used as the assumptions for generating scenarios of long-run projection discussed in Section VII.

Chart 1. The Dynamics of Socio-Economic and Environmental Interaction: Indonesian Case



II. Macroeconomic Development

A. From Rehabilitation to Economic Boom

The Indonesian economy has grown at a relatively steady rate of more than 6 percent annually over the last three decades, performance on par with that of the East Asian economies. Interestingly, the highest growth rates occurred in the beginning and the last few years of the "New Order" government.

The policy episode under consideration began with a series of stabilization programs undertaken during the late 1960s (the 'rehabilitation' period), through which the economy rebounded from a chaotic situation to more than 11% annual growth during 1970-1973. The decision of the "New Order" government to let capital flow freely (liberalized capital account) at that time was a surprise, given the early stage of development. The open capital account regime has prevailed since that time even during and after the severe financial crisis of 1997/98.[2]

A new foreign investment law was enacted in 1967, recognizing the link between investment and foreign aid and the importance of both to economic development. Given past experience, historical background, and the political climate at that time, the role of foreign investment was stipulated as a 'supplement' to domestic investment in a two-gap model sense, implying that it should in no way become dominant. Soon after promulgation of the law, the government abolished foreign exchange controls, an important obstacle to attracting foreign investment. However, during the import-substitution period of the 1970s, no strong incentives were offered to foreign investors. On the contrary, investment regulations expanded, and, consequently, flows of foreign investment became stagnant.

During 1969-1973, some pro-market policies advocated by economic technocrats, co-prevailed with dirigiste programs championed by those representing economic nationalism. The latter, who appeared to enjoy support from Suharto, were exemplified by policies such as promoting the state-owned oil company *Pertamina*, whose funding came not only from oil earnings but also from commercial bank loans. Overall, during the period, the economy grew above 6.5 percent annually, exports expanded strongly despite the fixed exchange rate system, and inflation was steadily decreasing (Azis, 1999B).

The year 1973 saw a turn-around. The quadruple increase of oil prices produced an atmosphere in which *Pertamina* actively expanded operations and easily borrowed in international credit markets. Unfortunately, many of these operations were economically

[2] The early success of rehabilitation and stabilization policy had played a major role in the decision of Western creditors to form what is known as 'Inter-Governmental Group for Indonesia' (IGGI). Equally important was the government's decision to embrace market-oriented policies, particularly in microeconomic areas.

unjustified, and the company began to perform various activities unrelated to oil sector, making it similar to a development agency. When the company was finally forced into default in 1975, the central bank had to take over its debt, resulting in a draw down of foreign reserves, which, by September 1975, amounted to only $0.5 billion.

The windfall from the oil boom in 1974 certainly helped to improve Indonesia's the balance-of-payment positions. Both the trade surplus and foreign exchange reserves reached an all-time high. In 1974, the current account was, for the first time, in surplus (US$.6 billion). But the 'boom' also led the country to experience, albeit at a mild degree, a 'Dutch disease' phenomenon, in which prices of tradables relative to nontradables declined. A nominal increase in the domestic demand, due to the boom, caused nontradables prices to rise, inducing real exchange rate to appreciate and exports to become less competitive. As expected, a quick reversal of current account, from surplus to deficit, occurred in the following year (more than US$ 1 billion deficit in 1975).

By 1976 GDP growth had already rebounded, accelerating further in 1977. The deficit on current account was also on a declining trend, reaching almost zero in 1977, and the oil price was on the rise, even higher than the level in 1974. It was from this perspective that many people were caught by surprise when in November 1978 the government decided to devalue the currency and chose to adopt a 'managed floating system.'

With the improved relative price of tradables following devaluation, non-oil exports received a strong boost. For the second time, the country's current account showed a surplus of close to US$1 billion and US$2.8 billion in 1979 and 1980 respectively. Hence, the 'Dutch disease' effect that would have been experienced during the oil-boom period was somewhat ameliorated by the 1978 devaluation.

Following the Iran-Iraq war, Indonesia had the second oil-boom in 1979-1980. As in the first oil-boom, current account improved dramatically to attain surplus of some US$2.8 billion in 1980. Strong GDP growth was recorded during that period, but in 1982 signs of world economic recession became visible. When prices of many commodities in the international markets collapsed, the country's terms-of-trade deteriorated, making the deficit on current account widen enormously, and economic growth turned negative for the first time under the new government. However, the recorded average growth during 1979-1982 remained positive (4.7 percent), while world economic growth declined persistently during the period.

The year 1983 marked the beginning of a new era in Indonesian economic policy. In March of that year, another major devaluation (28 percent) was announced. Unlike the 1978 devaluation, this time the fear of a balance-of-payment crisis was credible. Efforts to boost non-oil exports were clearly stressed, and at the same time the government imposed some import restrictions. A number of public investments were either delayed or postponed, and the government tightened monetary policy. But the most dramatic policy change was in the financial sector. In June of that year a major financial deregulation was announced, aimed at dismantling the old system of direct monetary control, to be

replaced by a more indirect approach based on reserve management through open market operations.

Another blow hit the economy in 1986, when the price of oil plunged to less-than US$ 10 per-barrel. As expected, deficit on current account widened, forcing the government to take another major devaluation (31 percent). A fairly extensive trade deregulation was also announced in May of that year. Since then, a series of reforms in trade and investment were taken. As a result, the growth of non-oil exports was impressive, almost tripling from US$5 billion in 1983 to US$14.4 billion in 1990.[3] The economy grew strongly, expanding more-than 7 percent, and there was no serious inflationary pressure (during the reform period, the average growth rate was recorded more than 6 percent, and inflation remained at one-digit rates).

Meanwhile, the pendulum of foreign investment swung back to the direction of more liberalization. The first "pull" came from the May deregulation package. But the 'push' factor was also prominent. Currency realignment (e.g., yen, Taiwanese dollar, Korean won) and policy changes in a number of ANIEs prompted investments from these countries to pour in, mostly to make use of low cost labor.[4] In parallel with the government's outward-oriented strategy, the majority of these investments were export-oriented.

Subsequent policy measures touched the following areas: tariff reduction, divestment, ownership requirement, and reduction of sectoral restriction. Less attention was given to the legal and tax system. Increased competition, primarily from China, India and neighboring ASEAN countries also became an important factor that prompted these policy changes. International pressures, e.g., the formation of AFTA, the non-binding principles within APEC and the completion of GATT round in early 1990s, also played a significant role.

Entering the 1990s, Indonesia's economy was booming, forcing the government to tighten monetary policy. Throughout the first-half of 1990s, massive capital inflows put pressure on the exchange rate to appreciate, reducing the country's export competitiveness. Increased competition from other countries, including those representing new emerging markets, aggravated the difficulties in sustaining high export growth. As a result, the current account deficit widened during 1995-1996 from 3.6 to 3.9 percent of GDP.

Massive capital inflows also stimulated domestic investment, resulting in robust economic growth in the 1990s. Low international interest rates helped provide "easy money" from abroad. Like in most Latin American countries, the government responded with sterilized intervention. Preventing the currency from appreciating further was

[3] For the first time export composition was dominated by non-oil category, whose share in total exports increased dramatically from 25 percent in 1983 to 56 percent in 1990.

[4] The establishment of 'growth triangle' linking Singapore, Johor and Batam island also contributed to the rise of foreign investment.

considered necessary to maintain competitiveness.[5] Increased deposits and reserves resulted in higher growth of credit, contributing to the booming economy. Table 1 presents the summary of Indonesia's macroeconomic progress during 1970-1996.

Table 1. Indonesia's Key Macroeconomic Indicators

Level	**1970**	**1975**	**1980**	**1985**	**1990**	**1996**
GDP (local currency, bn)	3340.00	12643.00	45446.00	98406.00	210866.00	532631.00
Exchange Rate (lc/US$)	378.00	415.00	626.80	1125.00	1901.00	2383.00
GDP (US$, bn)	8.84	30.47	72.50	87.47	110.92	223.51
Population (mn)	119.47	135.67	147.49	164.63	179.83	195.28
Per-capita GDP (US$)	73.96	224.55	491.59	531.32	616.83	1144.58
Exports (US$bn)*	n.a	n.a	23.35	18.59	25.68	49.81
Imports (US$bn)*	n.a	n.a	16.54	10.26	21.84	42.93
Current Account (US$bn)*	n.a	n.a	-0.57	-1.92	-2.99	-7.66
Current Account/GDP (%)*	n.a	n.a	-0.63	-2.20	-2.69	-3.43
Real GDP (local curr, bn)	57321.00	84413.00	123556.00	155714.00	210866.00	321313.00
Real GDP/per-capita	479.79	622.19	837.72	945.84	1172.59	1645.40
CPI	9.10	22.20	43.90	69.80	100.00	168.70
Annual growth rates (%)		**70-75**	**75-80**	**80-85**	**85-90**	**90-96**
Real GDP growth		8.05	7.92	4.74	6.25	7.27
Real Per-capita GDP Growth		5.34	6.13	2.46	4.39	5.81
Pop growth		2.58	1.68	2.22	1.78	1.38
Inflation (CPI)		19.53	14.61	9.72	7.46	9.11

Source: Azis (1999B)

*) Data in col 1980 are for 1981

[5] The extent of sterilization can be evaluated through the impact of capital flows on bank loans to the private sector. Studies by Glick and Moreno (1994) and Chinn & Dooley (1995) show that such relations are indeed present in Indonesia. Hence, increased deposits and reserves were translated into higher growth of credit.

B. Crisis Episode and Policy Response

Far from being predicted, a major crisis came in 1997. The crisis evolved in stages. In the first stage, the devaluation of the Thai's baht on July 2 created serious anxiety among global investors. Mutual fund managers and corporate treasurers from around the world, not only in Thailand but also in Jakarta, Manila, and Kuala Lumpur immediately began to sell local currencies and more liquid assets (so called hot money), setting off a tumble not only in local currencies but also in the stock markets.

Subsequently, depreciation expectations created nervousness among local corporate sectors. These local companies scrambled to buy greenbacks to meet repayment of their enormous loans; many of which were unhedged, short-term, and used to finance long-term projects or high-risk schemes including many in the real estate sector.

It is unclear, however, which of the above stages contributed most to the currency plunge. What is clear, however, is that early pressures did not come from what some political leaders in the region called "speculators" (i.e., those who attempted to profit from the declining values of a currency). It was only at a later stage that they may have taken advantage by joining the flux, exacerbating the already depressed rupiah, baht, etc., and further bruising regional stock markets.[6]

After two frustrating weeks of discussions, in October 1997 the government reached an agreement with the IMF on a reform package involving some 23 plus 20 billion US dollar. A major step related to the agreement was the decision to liquidate 16 banks, some of which were owned by well-connected businessmen and members of the President's family. After a few days of shake up, including people's rushing to withdraw deposits from these banks, it soon became clear that market confidence had not been restored. Instead, people were panicking. The rupiah continued to dive and the stock market plunged. Only months later did the IMF recognize that its demand to close insolvent banks had backfired and caused a panic, among others due to the fact that there was virtually no deposit insurance system in place. A deterioration of people's confidence over the economy and the banking sector also played an important role. It was not until the economic crisis quickly turned into a political crisis that the fear of a systemic collapse became real. The IMF seems to have failed to take into account the sudden jump in the political risk premium.

Entering 1998, the situation became worse. The way the 1998/99 budget was announced on January 6 did not satisfy the market. The number of laid-off workers continued to

[6] Just one month after the collapse of the baht, Indonesia's ministry of finance implemented a credit squeeze unilaterally, putting massive pressure on the country's banking system. No longer able to borrow reserves from offshore, the central bank, with Suharto's approval, issued overdraft facility by extending credits called *BLBI* to cover negative clearing positions of many banks. Within only a couple of months, the allocated credits already reached over Rp160 trillion, mostly received by politically powerful banks. Worse, a substantial portion of the credits was used either to shift assets abroad or to purchase foreign currency at inflated exchange rates, putting further pressures on the rupiah and making the entire banking condition even worse. Many banks suffered from either a negative spread or a negative earnings condition. The repayment ability of *BLBI*-receiving banks quickly turned sour.

increase, adding to already high open unemployment. The stock market plunged again and the rupiah hit an "insane" level of over Rp11,000 per US dollar. Pandemonium set in when on January 8 and 9 people went on a buying spree to hoard foodstuffs. Meanwhile, perceptions were widespread that Suharto had lost his touch. A popular revolt gained strength and public attacks on the government and Suharto's leadership were on the rise. Fearing deeper political turmoil, the armed forces were put on special alert.

After mounting pressures from government critics, demanding economic, legal and political reforms, essentially asking Suharto to step down, by mid May Indonesian politics began to reach a turning point.[7] Once again, investors and the market faced a lot of uncertainty. One thing was certain, however: Suharto's era was over. It was only the exact time and the modes of transition that remained uncertain.

Then came the historical day, May 21, when Suharto announced his resignation and Vice President B.J. Habibie came to replace him. But social repercussions of the crisis have already been very serious. The combined forces of declining real wages and unemployment raised poverty dramatically, creating fertile ground for social and political instability (Azis, 1998). The hardest hit was the middle-income group, especially those in urban areas. There were also the devastating effects of inflation on transportation services. The price hike for vehicle components, up to 300 percent, forced many public transport operations to close down. More-than 30 percent of public transport ceased to operate, affecting the mobility of millions of medium and low-income workers throughout the country. The inter-regional and inter-island distribution of basic commodities was also disrupted, putting further pressure on the already sharply increased prices of many food products.

The exit of money and capital, especially owned by Indonesian Chinese (ethnic Chinese control a lion's share of assets of Indonesia's top 300 companies), also represented a serious blow to the economy. The exodus of expatriates and foreigners bruised the country's image and made the prospect for economic recovery more remote. Meanwhile, the exchange rate and the stock market continued to head south. On May 18, the former touched 17,000 per US dollar and the latter came closer to low 400.

To sum up, at the early stage, a lack of confidence in Suharto's government failed to offset the damaging effects of the baht contagion. Then the policy package prescribed by the IMF pulled the economy further down.[8] Later, repeated violence, looting, destruction and street battles elevated the economic costs even further. As Suharto's term neared it's

[7] It all started on May 12 when a bloody incidence took place in one of the private universities ('Trisakti') in Jakarta. Four students died when real bullets hit them during student demonstrations. On the next day, larger scale demonstrations spread across the nation. All this occurred while Suharto was in Egypt attending the G-15 summit in Cairo. But it was on May 14 that mob violence took place, in which more-than 500 people were killed, many of them looters burned to death. A chaotic situation clearly happened, the stock market plunged and the rupiah weakened to 11.500 to the dollar.

[8] Prolonged discussions on the possibility of adopting a fixed exchange rate under a currency board system at that time also raised more confusion.

end, the political temperature peaked. Financial markets continued to shun Indonesia, the currency plunged, and the stock market dropped sharply[9]

Meanwhile, the banking sector was among the hardest hit during the crisis. The lack of bank supervision resulted in rising numbers of non-performing loans and subsequently troubled banks. Aside from the state banks, only a few commercial banks controlled most of this oligopolistic market.[10] The combined effect of these conditions was very ominous. The amount of low quality credit was ballooning, raising perceived risk factors significantly. In turn, many banks were rendered insolvent. They could remain in operation only because of the government's various bailout programs. Financial institutions with such low quality are the ones that the government and the IMF wanted to liquidate.

Realizing that pressures on the rupiah also came from a huge local demand for dollars, the IMF was also of the opinion that interest rates must be raised. The use of liquid assets for the purchase of foreign currency ought to be minimized. Otherwise, the central bank must be prepared to defend the currency with its own reserves. As it turned out, high interest rate exacerbated the situation, creating a serious credit crunch (caution is to be made, however, in defining credit crunch, since the base money growth remained high).

Through a dramatic election, the government of Abdulrahman Wahid came to power in 1999 when the economy has begun to recover slowly. While in 1998 GDP fell by more-than 13%, during 1999 the GDP growth started to show a positive number, albeit very small (0.2%). But the positive growth was largely driven by increased consumption, both private and government, while investment continued to drop considerably (over 20%). The largest drop of investment is in the machinery and equipment component (66.2%), consistent with the 40.8% collapse of imports.

It is our assumption that the recovery process will be slow, and only after few years the country could reach a "normal" growth path in the neighborhood of 5% annually.[11] Such a rate of growth is used in the baseline scenario for the long-term projection discussed in the last section.

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[9] Habibie's government had no deficit of challenges. Since mid-1997, the country's economy already started to slide, although the worst really began in early 1998. Even without the crisis the country had been stricken by long drought related to the El-Nino phenomenon, the haze problem caused by forest fires, a fall in oil prices, and a series of diseases occurred in some parts of the country. The financial and political crisis only exacerbated the situation.

[10] As in Korea, the structure of the industrial organization in Indonesia--with its high degree of concentration--determines the nature of the financial structure, not vice versa.

[11] Despite its relatively small amount, the return of expatriate capital may prove to be critical for the country's true recovery. Should the government be unable to maintain the political certainty and stability (e.g., in dealing with ethnic conflicts and the rising autonomy demands from many regions), the return flows will cease and a similar trend of foreign investment is expected to occur.

C. Weak Institutions

While credit boom is what Sachs et.al (1996) claimed to be one of the 'fundamentals' that may contribute to a crisis, it is an oversimplification to assert that the culprit in the crisis was credit expansion and capital inflows, especially when, comparatively speaking, the growth of credit and the size of capital flows in Indonesia were not among the highest in the region (surely less than in Thailand and Malaysia). So, what caused the crisis? What went wrong?

Despite the admirable economic performance until the mid-1990s, various institutions in the country remained weak, stagnant, and socially inefficient. The legal system was marred with flaws. In almost all public affairs, effective checks-and-balances were absent. Even the formally installed rules, regulations, and laws were not effective, and in any case were weakly enforced in almost all sectors and at all levels of organization.

Informal institutions and prevailing social norms were equally non-conducive to transparency and stability, sufffering from the same predicament. When a high profile political or business case was at stake, the ultimate decision generally must have come from the president himself or from his inner circle. In this sense, Suharto was practically the only truly decisive institution in the country.

Interestingly, even some foreign investors and external partners in joint-ventures operating in Indonesia tended to comply with the prevailing socially sub-optimal norms, e.g., in looking for domestic partners, they revealed a preference for local partners with strong political connections. For local entrepeneurs, opportunities were limited, hence transaction costs were high, unless they are willing to collaborate with those politically influential groups.[12]

The weak enforcement of formal rules and regulations was very serious in Indonesia because it prevented *'transaction costs'* from declining. In the banking sector, for example, weak supervision by the monetary authority turned out to be fatal. After the 1988 deregulation, many big companies (conglomerates) set up banks or multi-finance institutions primarily to serve their own projects. Despite the standard regulatory measures formally imposed by the monetary authorities (e.g., legal lending and risk limits, capital adequacy ratios, and so forth), weak enforcement discouraged the development of a healthy banking sector. When the Thai baht contagion struck, the weaknesses of the entire financial sector were prominently revealed.

It was this condition that failed to cope with massive flows of capital in the 1990s, especially short-term capital, that have the tendency to oscillate sharply between waves

[12] The Indonesian Army, another important national institution, had been always loyal to Suharto. When the economy was booming, the military gradually transformed itself from a repressive force into a mechanism to share some of the national wealth. When the country was awash in cash, money was the mechanism for national solidarity. Holding most of the wealth were Suharto and his children and cronies. This, once again, points to Suharto being the only effective institution.

of euphoria and panic. This instability was further exacerbated by the country's quasi fixed exchange rate system.

When Suharto's government fell, the stock values of the politically connected companies were the first to drop sharply as investors and foreign partners turned their back on them. Companies owned by the children of, or businessmen deemed to be close to, the former leader have been most affected. Thus, the growth of these companies is unsustainable!

Why the pressures to improve the institutional frameworks were not strong during the time? When the economy and the business sector flourished, there was no apparent need to alter the system. As long as growth was delivering benefits to everyone, the so-called *corruption, cronyism* and *nepotism* (CCN) could be tolerated as annoying but not fatal. Consequently, the demand for improved institutions was not there.

But it became a different story when the crisis struck. At any rate, even with many institutional deficiencies, Indonesia still managed to produce a robust growth story. But when perturbed with a shock, the system disintegrated. As soon as the effort to sustain growth rates demanded too much of established institutions, a serious mismatch was unveiled.

III. Social and Environmental Dimensions

The fairly strong macroeconomic performance during the last thirty years has been accompanied by continued sectoral changes. One of the most pronounced features of the Indonesia's sectoral changes has been the rapid decline in value-added share of the agricultural sector (from 30.2% in 1975 to 15.4% in 1996), and the rise of industry and services sector (from 33.5 and 36.3 to 40 and 44.6%, respectively). The declining share of the agricultural sector, however, was accompanied by the continued growth of the sector's production and value-added (Dillon, 2000). Analysts would be quick to refer such a trend to a typical "normal pattern of development" a-la Chenery & Syrquin (1989).

One would argue that it is not just the speed of the changes that matter, but more importantly is the question of how and through what mechanism such a trajectory is attained. The roles of relative prices, elasticity of food consumption, and technology, provide the standard explanations.

However, specific development strategies and policies during the last three decades also played a prominent role. More particularly, along with the macroeconomic policies described earlier, the government adopted industrial development policies emphasizing import-substitution and subsequently shifted to export-oriented one. While this produced a fairly strong economic performance, it had also resulted in a development pattern that was Java-oriented, fairly pro-urban and large-scale, as well as agriculture-biased pattern.

In this section, we discuss the environmental dimension and repercussions of Indonesia's development patterns, by exploring the nature and intensity of various trade-offs. We first begin with the discussions on the repercussions of urban-biased development pattern.

A. Urbanization, Welfare and Pollution

Poverty, population growth, including urbanization, and environmental degradation interact in a close cyclical pattern.

Indonesia's urban population in 1995 has reached more-than 30%. About one third of them fall under the category of poor. The patterns of the country's urban population growth closely follow those of other emerging economies, in which natural growth and rural-urban migration resulted in a rapid increase of urban population, i.e., from 22.3% in 1980 to 35.9% in 1995.[13]

Roughly 70% (a quarter) of urban population resides in Java (mostly in the Jakarta Metropolitan Area or *Jabotabek*). But urban population in cities other than Jakarta grew faster, resulting in a stable primacy index (the ratio of population in the largest city over total urban population), i.e., around .23. This figure is still considerably lower than that in Thailand. The urban population share is also higher in Java than in the outer islands (40% versus 30%). But in some areas, where regional GDP grew relatively fast, e.g., North Sumatera and East Kalimantan, the proportion can be higher than in Java (between 40 and 50%, see Firman & Prabatmodjo, 2000).

Interestingly enough, the role of small towns as collectors and distributors of goods in Java is undermined by the active presence of traders and suppliers from large cities. This is not the case with small towns in the outer islands. Consequently, population growth in small towns in the latter is higher than that in Java.

The repercussions of the fast growing urban population in Indonesia are no different from those occurring in other countries. The transformation of CBD in core areas from manufacturing-based to services-based activities, and the expanding use of agricultural land for non-agricultural purposes in the fringe areas are clearly observed. From 1980s to 1990s, for example, the non-farm employment in DKI Jakarta expanded by 52%, while that in the fringe area grew more-than 5 times (425%).

The environmental impacts could be overwhelming. In addition to the well-known pressures on resource demand in the urban area itself (for water, soil and clean air), the expansion towards the outskirts region raises serious environmental concerns. For example, the emergence of new townships at the outskirts of Jakarta at an alarming rate encroached some environmentally sensitive areas such as in northern Bandung and southern Jakarta (Puncak corridors). The reclaiming of coastal areas, e.g., Jakarta

[13] It is worth to note, however, that the reclassification of spatial units also played a significant role. About one third of the increase has been due to such a reclassification.

Waterfront City, is also potentially damaging, if conducted without sufficient environmental consideration.

Due to the 1997/98 crisis, the number of urban poor increased much more significantly. This poses further environmental challenges to policy makers. As stated earlier, about one third of 63.4 million urban population in 1995 was categorized as poor. The estimated number of urban poor clearly depends on the definition (of poverty line) being used. Using a more lenient criterion (i.e., poverty line of 38,246 rupiah, or roughly US$16.05 per-person per-month), the number is 7.2 million in 1996. Whichever number we use, however, during the 1997 crisis the number of urban poor increased dramatically.

In July 1999, the CBS came up with a report showing that the percentage (absolute) number of urban poor increased more (less) than that of the rural poor during 1996-1998, i.e., from 7.2 to 17.6 million and from 15.3 to 31.9 million, respectively. Different calculations based on the core SUSENAS indicate that poverty incidence in urban area increased from 7.2 to 22.6 million, whereas the increase in rural area was from 15.3 to 56.8 million. Hence, the urban poverty incidence has either doubled or tripled during the crisis.

There are several ways through which the number of poor increases. The most direct one is through a decline in nominal income or wages, and this is related to the fact that the number of laid-off workers increased during the crisis. According to SAKERNAS data, from August 1997 to August 1998 the number of open unemployment in urban area increased by 21%, i.e., from 2.5 to 3.1 million (or, from 8 to 9.3%).

Some argued that the collapse of many formal sectors in urban area forced most workers either to go back to rural area or to accept informal jobs. It turns out that a majority (about 60%) of the laid-off remained jobless during 1997-1998, even after they attempted to change jobs 1 to 2 times (see Table 2).[14] Furthermore, SAKERNAS data also point to 9.4 and 14.4% increase of urban self-employed and unpaid family workers, respectively, whereas the number of employees dropped from 55 to 52%.

As argued in Azis (2000), urban recession during the crisis eventually affected the rural non-farm sector as well, limiting job opportunities for the urban laid-off workers. Those who are still lucky to remain on the job must face the possibility of working fewer hours. Indeed, urban workers who worked less-than 15 and less-than 35 hours increased by, respectively, 15.5% and 19.5% (Table 3). Obviously, their money incomes are also less. A CBS survey in 1998 revealed that the average monthly income from main jobs of all income brackets, with the exception of those whose income was greater than Rp400,000, dropped. The largest percentage drop, i.e., 22.1%, was for the low-income earners (less-than Rp200,000), followed by the informal sector (20.5%).

[14] Based on CBS Survey on the Crisis Impacts on Cost of Production and Informal Sector, 1998.

Table 2. Percentage of Respondents Ever Experiencing Lay-off and Bankruptcy By Employment Characteristics/ Problems, 1997-1998

Employment Characteristics/ Problems	Ever Laid-Off	Ever Bankrupt
Employed	**40.2**	**62.1**
Formal Sector	21.7	22.4
Informal Sector	18.5	39.7
Unemployed	**59.8**	**37.9**
Changes in Jobs		
1-2 times	59.8	82.8
>2 times	40.2	17.2

Source: *Survey on Crisis Impacts on Cost of Production and Informal Sector, BPS 1998, as quoted in Irawan et.al (1999)*

Table 3. Distribution and Percentage Change of Employment By Region and Working Hours

Region/	**1997**		**1998**		
Working Hours	Number	%	Number	%	Percentage
	(000)	Distribution	(000)	Distribution	Change
Urban					
* 15 Hrs	1673.2	5.70	1 933.1	6.38	15.53
* 35 Hrs	6120.5	20.85	7314.3	24.14	19.50
~: 35 Hrs	23233.3	79.15	22990.2	75.86	-1.05
ALL	29353.8	100.00	30304.5	100.00	3.24
Rural					
* 15 Hrs	6497.6	11.59	7260.2	12.66	11.74
* 35 Hrs	24444.2	43.61	26987.5	47.04	10.40
~: 35 Hrs	31 607.5	56.39	30380.4	52.96	-3.88
ALL	56051.7	100.00	57367.9	100.00	2.35

Source: *Sakernas 1997 & 1998, BPS*

Combined with the sharp increase in inflation (over 90% during 1996-98), the drop in nominal wages could be translated into collapsed real wages. Indeed, across all sectors real wages dropped. The only sector that posted greater real wages in 1998Q2 than in 1994Q1 was wood products. But even in this sector, real wages declined by 23% during the crisis (Table 4). An estimate of per-capita real income shows that the drop of urban

real income was larger than in rural area (30% versus 6.5%), and the sharpest decline in the two areas occurred among the low-income group, i.e., 37.1% and 22.7%, respectively (Irawan et.al,. 1999).

Table 4. Index of Real Wages by Type of Industry (1994Q1=100)

	1996-II	1997-II	1997-II	1997-IV	1998-I	1998-II	% change
Hotel	91.4	86.4	86.8	88.9	84.4	72.5	-16.1
Mining	117.8	104.5	100.6	82.1	79.0	85.2	-18.5
Manufacturing Industry	112.9	125.7	121.5	121.5	96.7	92.2	-26.7
Foods	103.3	117.0	113.2	106.2	88.4	84.6	-27.7
Textile	113.5	124.5	118.2	124.6	97.8	89.6	-28.0
Wood/ Products	120.4	138.7	140.5	136.7	109.2	107.0	-22.9
Paper/ Printing	128.7	153.9	137.7	129.4	109.7	83.2	-45.9
Chemical	118.2	123.4	118.9	116.8	95.8	95.5	-22.7
Cheramic	111.8	118.2	116.2	117.7	88.8	83.7	-29.2
Basic Metals	95.5	104.7	102.3	98.3	79.5	80.3	-23.3
Metal Products	110.6	131.4	128.4	125.6	97.1	98.8	-24.8
Others	102.5	120.4	115.9	108.8	84.3	75.0	-37.7

***Source**: BPS, Bureau For Demographic and Population Statistics, as quoted in Irawan et.al (1999)*

Another element of welfare is related to health status. One of the important health indicators is the morbidity rate MR (feeling of illness), especially the so-called disruptive morbidity, DMR, defined as morbidity that disrupts daily activities. A series of SUSENAS data shows that prior to the crisis, the DMR dropped from 9.6% in 1995 to 9.1% in 1997. But as the crisis hit the country, the rate went up to 10.6%, and continued to increase to 10.8% in 1999. Most of the deterioration occurred in the rural areas. Such a trend coincides with the substantial drop in the budget share of health care sector.

In some regions, i.e., Sulawesi and Kalimantan, however, the DMR went down during 1998-99 (Table 5). An improvement of MR from 1998 to 1999 is also detected in all regions except in "other islands." But one should not be overly optimistic to relate the effectiveness of the social safety net (SSN) programs on health sector with such a performance. Also, the national averages of both MR and DMR in 1999 are still higher than the 1997 levels (in fact, the DMR still continued to rise). During 1997-1999, the average urban MR is always higher than the rural MR, but it varies across region, i.e., in some regions outside Java the opposite holds.

Outcome that is less damaging than originally thought is detected in the education-related sector. The fear of a sharp drop in school enrollment during the crisis appears to be unfounded. In the primary education level, the enrollment rates did not change significantly. This applies to both urban and rural areas. In the junior secondary level, the urban rates are generally higher than the rural rates, and in both areas the enrollment rates are higher in 1999 than in 1998 (see Figure 2).

Table 5: Morbidity by Region, Urban and Rural (percentages)

		MR			DMR		
		1997	**1998**	**1999**	**1997**	**1998**	**1999**
Java Bali	**urban**	25.8	27.2	26.1	8.6	10.3	10.5
	rural	24.3	26.3	25.4	9.5	11.2	11.5
		25.0	26.7	25.8	9.1	10.8	11.1
Sumatra	**urban**	20.8	21.8	21.0	6.1	7.8	8.0
	rural	21.9	21.0	21.0	7.9	8.7	9.1
		21.6	21.2	21.0	7.4	8.4	8.8
Sulawesi	**urban**	23.1	26.6	21.8	8.8	11.2	9.5
	rural	25.3	24.9	23.1	11.4	12.3	10.9
		24.7	25.3	22.7	10.7	12.0	10.5
Kalimantan	**urban**	27.5	29.1	26.6	8.3	10.1	8.8
	rural	22.7	24.2	22.7	8.2	9.6	9.4
		24.2	25.7	23.9	8.2	9.8	9.2
Other islands	**urban**	26.5	25.3	24.9	11.4	12.2	12.5
	rural	29.1	28.5	29.6	14.3	15.5	17.2
		28.6	27.8	28.7	13.7	14.8	16.3
Indonesia	**urban**	24.9	26.3	25.0	8.2	10.0	10.0
	rural	24.1	25.0	24.4	9.6	10.9	11.2
TOTAL		**24.4**	**25.5**	**24.6**	**9.1**	**10.6**	**10.8**
Nr of observations		887266	880040	864580	887266	880040	864580

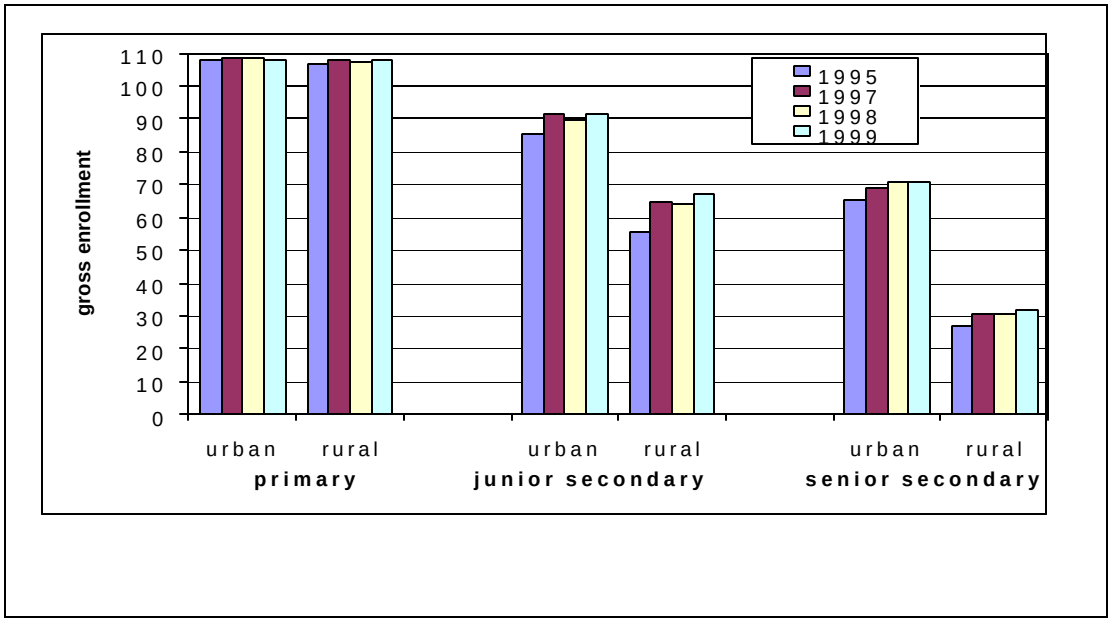
***Source**: Pradhan & Sparrow (2000)*

A similar pattern is observed with respect to senior secondary enrollment rates. It is revealed from the SUSENAS that expenditures per student increased, the largest one of which is in the urban area. The SSN programs implemented during the crisis may have contributed to the above picture, but one needs to be more careful in identifying the real reasons behind the results.

Nonetheless, the fact that urban income decreased and urban poverty increased remains of a concern. The urban-rural migration did not seem sufficient to offset forces that may reduce the country's urban population.

The early expectation that the crisis would reverse the increasing trend of urbanization may not come immediately, and it is unsure whether the urban-rural migration is permanent or transitory. Table 6 shows that although it is not detected in 1997-1998, the number of households and populations in the urban (rural) areas decreased (increased) during 1998-1999, suggesting that eventually there was a reversal in the urbanization trend during the crisis.

Figure 2. Gross Enrollment: Urban/Rural and Level



***Source**: Pradhan & Sparrow (2000A)*

With a persistent urbanization trend, air pollution in some urban areas has increased significantly along with booming economic growth. The ambient level in large cities already reached an alarming point. As shown in Table 7, in Jakarta the annual average SPM concentration in 1995 was already three times higher than the number in Kuala Lumpur. Even compared to Bangkok, Jakarta's SPM level was still higher (271 versus 223). What is even more of a concern is the fact that Jakarta's SPM concentration did not show any meaningful improvement during the last two decades. It increased considerably since 1985, while SPM levels in Kuala Lumpur, Calcutta, Delhi, and Xian declined (see Table 7).

Such a trend occurred despite the fact that the government had launched a *Blue Sky Program* (BSP) designed specifically to control air pollutants from mobile and stationary sources.

Table 6. Largest Global Influence (Multipliers) of Manufacturing On Household Incomes

Year	Food Proc	Textile & Clothing	Wood and Products	Paper & Transport	Chemical & Fert
1995	Rural High 0.127	Urban Low 0.117	Urban High 0.111	Urban Low 0.098	Urban High 0.124
	Urban High 0.124	Urban High 0.091	Rural Low 0.11	Urban High 0.091	Urban Low 0.099
1998	Urban Low 0.147	Urban High 0.054	Urban Low 0.12	Urban High 0.035	Urban High 0.162
	Rural High 0.147	Urban Low 0.048	Rural High 0.087	Urban Low 0.022	Urban Low 0.118
1999	Urban Low 0.096	Urban Low 0.09	Urban Low 0.14	Urban High 0.079	Urban High 0.143
	Rural High 0.081	Urban High 0.064	Rural Low 0.107	Urban Low 0.077	Urban Low 0.095

Source: Author's calculation based on SPA of SAM 1995, 1998 and 1999

Interestingly, the financial crisis in 1997 changed the above trend. The SPM concentration dropped significantly, but at the same time the NO_x concentration increased sharply. The drop in SPM levels is consistent with the severe recession in many industries (GDP growth slowed down to reach 4.6% in 1997 and plunged to minus 14% in 1998), but the dramatic increase of NO_x concentration deserves further explanation.

Since motor vehicles are the main source of NO_x emission, it is likely that their use was not seriously affected by the crisis. More importantly, however, lax of pollution control and the rising costs of vehicle maintenance caused the city's air quality to deteriorate. The SPM concentration in other urban areas is also high. In Bandung, Surabaya and Medan, the level is always higher than the national average.

One of the most direct repercussions of high pollution is on health status. It is estimated by Ostro (1994) that the prevailing ambient level of air pollutants in Jakarta could cause 1,200 cases of premature mortality, 32 million cases of respiratory symptoms, and 464 thousand cases of asthma attacks. The World Bank (1994) estimated that the cost to make the ambient level of air pollutants in Jakarta meets the national standard would reach roughly US$220 million.

Table 7. Annual Average SPM Concentration (? g/m^3) At Industrial Areas in Jakarta and Other Large Cities

		1976	1985	1990	1995
U.S.	Chicago	161	104	74	n.a.
	New York	74	74	67	n.a.
	Houston	107	59	n.a.	n.a.
China	Beijing	n.a.	n.a.	430	377
	Guangzhou	n.a.	160	142	n.a.
	Shanghai	n.a.	n.a.	269	246
	Shenyang	n.a.	554	447	n.a.
	Xian	n.a.	528	444	306
Hong Kong		114	95	n.a.	n.a.
India	Bombay	166	227	n.a.	240
	Calcuta	369	405	n.a.	375
	Delhi	432	488	n.a.	415
Indonesia	Jakarta	210	204	273	271
Japan	Osaka	n.a.	48	56	43
	Tokyo	n.a.	56	56	49
Malaysia	Kuala Lumpur	153	139	121	85
Thailand	Bangkok	281	204	198	223

Source: *Reksosudarmo (2000)*

Yet, the above estimates are primarily based on a partial equilibrium approach. As an alternative, we measure the impacts by adopting a general equilibrium model. As it turns out, the general equilibrium impacts of increasing air pollution are even more far reaching. Under two alternative scenarios, i.e., Vehicle Emission Standard (VES) and Phasing Out Two-Strokes Engine (POTSE), the air pollutants would have been effectively controlled, and that can be achieved without sacrificing economic growth (a no trade-off scenario).

But the health impact, measured by health costs associated with air pollutant-related illness, would have been even lower had the government implemented another policy option, i.e., Unleaded Gasoline policy (UG). Even though GDP growth could be adversely affected, technically the use of unleaded gas, hence UG policy, is necessary to ensure that the catalytic converters installed under VES will operate effectively.

When the three policy options are imposed simultaneously, the outcomes are favorable. The emissions will be reduced, and GDP growth will not be seriously affected (the overall results of general-equilibrium simulation are displayed in Table 8).

Hence, it is clear that the monetary value of the benefits from adopting the policy mix would be higher than the value estimated with partial analysis, primarily because the latter neglects the general equilibrium multiplier effects of the policy shock (another example of general equilibrium analysis applied to pollution tax problem in Indonesia can be found in Azis, 1997).

Table 8. Impacts of Various Air Pollution Abatement Policies on GDP, Household Incomes, and Health Costs of Air Pollutant-Related Illnesses (% Difference from Baseline)

	Unleaded Gasoline	Ban Two-Stroke	Emission Standard	Tax	Combined Policy	Municipal Waste
GDP	-0.010%	0.001%	0.067%	-1.300%	-1.178%	-0.013%
Annual Growth Rate	-0.022%	0.002%	0.153%	-2.976%	-2.692%	-0.030%
Ag. Employee	-0.028%	0.001%	0.047%	-1.345%	-1.272%	-0.005%
Small Farmer	-0.038%	0.001%	0.064%	-1.722%	-1.624%	-0.009%
Medium Farmer	-0.039%	0.001%	0.063%	-1.717%	-1.622%	-0.009%
Large Farmer	-0.037%	0.001%	0.060%	-1.650%	-1.558%	-0.008%
Rural Low	-0.025%	0.001%	0.070%	-1.779%	-1.661%	-0.013%
Rural Non-labor	-0.013%	0.001%	0.057%	-1.944%	-1.850%	-0.011%
Rural High	-0.028%	0.001%	0.073%	-1.800%	-1.677%	-0.014%
Urban Low	-0.018%	0.001%	0.069%	-1.804%	-1.685%	-0.014%
Urban Non-labor	-0.023%	0.001%	0.073%	-2.142%	-2.022%	-0.014%
Urban High	-0.019%	0.000%	0.072%	-1.880%	-1.755%	-0.016%
Air Pollutant-Health	-6.898%	-1.511%	-7.176%	-3.225%	-16.050%	-4.930%

Base Condition: no air pollution abatement policy is imposed
Unleaded Gasoline: unleaded gasoline policy is imposed
Ban Two-Stroke: government phases out two-stroke engines
Emission Standard: a vehicle emission standard is imposed
Tax: government places taxes on gasoline and HSDO
Combined Policy: government imposes the unleaded gasoline, phasing out two-stroke engines, emission standard, and tax policies at the same time
Municipal Waste: the government builds incinerators and improves municipal waste management
Source: *Reksosudarmo (2000A)*

B. Agricultural Development and Land Use

In line with the government's preoccupation for food security during 1970s and 1980s (defined narrowly as "rice self-sufficiency"), various efforts had been made to meet such a goal. One such effort was to promote the use of fertilizer and pesticides through massive subsidies, especially a fertilizer subsidy (in 1987 this subsidy peaked at more-than Rp700 billion). This intensification program contributed to a steady growth of food

crop production from 1980s to 1990s, i.e., at an annual rate of 3.7% (for total food crop) and 4.7% (for rice), and successfully transformed the country from world's largest importer of rice to being self-sufficient in 1983/84.

But some damaging effects were also observed. There was a rising incidence of pesticide poisoning and chronic pesticide-related illnesses. More brown plant hoppers and green leafhoppers resistant to pesticides were also detected. The former caused rising health costs and adversely affected labor productivity, the latter damaged more-than 450,000 hectares of rice fields, creating a yield loss of 364,500 tons of milled rice in 1976/77.

The turn around came in late 1980s. Through an Integrated Food-Crop Pest Management (IPM) program, introduced in 1989, the subsidy was abolished and the government also banned 57 broad-spectrum insecticides. It is estimated that with IPM program, IPM farmers would raise their income by 59%, the reduction of pesticide use could save some Rp212 billion, and the crop yield would also increase. More importantly, the environmental impacts, among others in terms of not poisoning the habitat, can be very significant.

The general equilibrium effects of such a policy are more pronounced. By generating some simulations of a general equilibrium model over a ten-year period, it is found that the economy-wide repercussions of basic IPM policy would generate higher GDP growth, more equal income distribution, and a considerable reduction in health costs. From the simulations of some counter-factual scenarios, it is revealed that there are alternative policies that could generate even better results. Specifically, the so-called strategic IPM program, that raises the government spending for adding the number of farmers to be trained, i.e., from 200 thousand each year during the first 5 years to 400 thousand in the remaining 5 years, could have produced even faster GDP growth and higher household income with fairly stable income distribution.

Clearly, this demonstrates that with careful policy selection, the objective of achieving growth with equity does not have to be in conflict with the environmental goals (see Tables 9 and 10 for the overall results of simulation).

Deforestation is another activity that has a strong environmental dimension. From a case study involving sample data from two regions, i.e., Lampung and Jambi, covering a broader range of economy-cum-environmental issues, it is revealed that the process in achieving a simultaneous reduction in deforestation and poverty is fairly complex (Tomich et.al, 1998). Conceptually, both could be achieved if the productivity of labor and land for smallholder farmers could be raised through intensification. However, increased productivity--hence returns to investment—can also attract more migrants and large scale land developers, causing deforestation to accelerate. Central to the analysis is the distinction between (high) private returns and (low) social returns to forest conversion.

Table 9. Impacts of Various IPM Program Scenarios on GDP, Household Income, and Health Costs of Pesticide-related Illnesses

	Basic IPM Program t10	IPM+Tax Program t10	Ambitious IPM t10	Strategic IPM T10
GDP	0.056%	0.021%	0.111%	0.145%
Annual Growth	0.131%	0.050%	0.260%	0.331%
Ag. Employee	0.046%	0.024%	0.090%	0.094%
Small Farmer	0.009%	-0.024%	0.017%	0.066%
Medium Farmer	0.007%	-0.025%	0.014%	0.061%
Large Farmer	0.014%	-0.016%	0.028%	0.067%
Rural Low	0.087%	0.048%	0.172%	0.183%
Rural Non-labor	0.046%	0.006%	0.092%	0.130%
Rural High	0.075%	0.036%	0.149%	0.171%
Urban Low	0.109%	0.069%	0.216%	0.216%
Urban Non-labor	0.055%	0.010%	0.110%	0.153%
Urban High	0.112%	0.071%	0.223%	0.225%
Pesticide-Health	-4.606%	-4.814%	-9.206%	-6.093%

Note:

Basic IPM = government spends 11.25 billion rupiah to train farmers in IPM
IPM+Tax = in addition to training farmers, government imposes a tax on pesticides
Ambitious IPM = government double (compared with the Basic IPM Program) its IPM budget from the first year
Strategic IPM = government double (compared with the Basic IPM Program) its IPM budget after the first five years

***Source**: Reksosudarmo (2000A)*

Table 10. Summary of Impact of Various Scenarios on Annual GDP Growth Rate and Health Costs of Pesticide-related Illnesses

	Basic IPM Program	IPM+Tax Program	Ambitious IPM	Strategic IPM
Annual Growth	**	*	***	****
Pesticide-Health	*	**	****	***

Note: More stars mean higher GDP growth rate or lower health costs associated with pesticide-related illnesses.

***Source:** Reksosudarmo (2000A)*

In analyzing the trade-offs involved in the process, the study identified six distinct interest groups, each with different concerns and objectives: (1) international community is concerned with global climate change, extinction of species and loss of distinctive ecosystem; (2) small scale farmers depend primarily on forest-converted land. They comprise of local people, spontaneous migrants and transmigrants; (3) public and private estates operate forest concessions and plantations of 100 to 300 thousand hectares or more. They must compete with small holders for a limited area of land, and therefore they can put pressures for forest conversion; (4) medium size farmers (absentee), who hold 10-25 ha or more and effectively function as an intermediary between smallholders and estates; (5) policy makers, who may be influenced by private interests due to their low salaries; and (6) hunter gatherers who do not really cause deforestation.

Those six actors show up in the columns of the so-called ASB (Alternatives to Slash-and-Burn) matrix, and the different types of land use are listed in the rows, ranging from natural forest and community-based forest management to upland rice/bush fallow rotation and continuous cassava. Tomich et.al (1998) used the matrix to assess options to balance environmental benefits with sustainable agricultural development (See Table 11).

Some interesting findings are worth pointing out here. From the smallholders' point of view, returns are highest for community-based forest management. It is also the only system that has no multi-year cash flow constraints. But its superiority applies only when the community could regulate access to their forest. If open access is not provided, returns to labor from extraction of forest products may be lower. On the other hand, the study also found that returns to land are lower since there is not enough land for everyone. Nonetheless, community-based forest management still has a high overall rating in terms of agronomic sustainability. Hence, if institutional arrangements could make such a system work effectively, deforestation and poverty could be reduced at the same time.

A case of trade-off emerges under the land use scenario for large-scale oil palm monoculture. The returns of land are relatively high and, compared to other countries (Malaysia), labor wages are lower. This makes such activity among the most profitable alternatives, especially in Sumatera. But labor returns to smallholders are even lower. Government policies of not providing licenses to palm oil mills that does not have their own plantation discourage independent smallholders. While the policy is meant to prevent nucleus estate/smallholder participants from selling their products outside the project (to avoid repayment of loans), at the same time it retards development of the market for independent smallholder oil palm producers. Hence, it is unfavorable from the objective of poverty reduction.

Table 8 ASB Matrix for the Forest Margins of Sumatra

Land use		Global environment		Agronomic sustainability		National policymakers' concerns		Adoptability by smallholders			
Description	Scale of operation / evaluation	Carbon sequestration	Biodiversity	Plot-level production sustainability		Potential profitability	Employment	Production incentives	Household food security	Institutional & policy issues	
		Time averaged (Mg/ha)	Plant species/ standard plot	Overall rating	Main sustainability issues (1)	Returns to land (Rp 000 / ha) at social prices	Time averaged labor input (days/ha/yr)	Returns to Labor (Rp / day) at private prices	Food enctitlement viz	Market imperfections (2)	Other institutional problems (3)
Natural forest	25 ha fragment / 1 ha	254	120	1		0	0	0	n.a.		
Community-based forest management	35,000 ha common forest / 1 ha	176	100	1		9.4 to 18	0.2 to 0.4	11,000 to 12,000	own prodn & exchange	o	N, R, P, C
Commercial logging	35,000 ha concession / 1 ha	150	90	0.5	C	(32) to 2,102	31	(17,349) to 2,008	wages	O, K	N, R, E, P, B, C
Rubber agroforest	1-5 ha plots / 1 ha	116	90	0.5	C	73	111	4,000	exchange		P, b, c
Rubber agroforest w/ clonal planting material	1-5 ha plots / 1 ha	103	60	0.5	C,K,W,P	234 to 3,622	150	3,900 to 6,900	exchange	I, k	N, P, b, c
Rubber monoculture	1-5 ha plots / 1 ha	97	25	0.5	C,W,P	(993)	133	3,683	exchange	I, k	N, P, b, c
Oil palm monoculture	35,000 ha estate / 1 ha	91	25	0.5	C,Fert	1,480	108	5,797	wages	I, o, K	N, R, e, P, B, c
Upland rice / bush fallow rotation	1-2 ha plots / 1 ha	74	45	0.5	Fert,P	(180) to 53	15 to 25	2,700 to 3,300	own production		n, P, c
Continuous cassava degrading to *Imperata*	1-2 ha plots within settlement project / 1 ha	39	15	0	C,Fert,W	(315) to 603	98 to 104	3,895 to 4,515	own prod'n & exchange	o, K	n, E, p, c

Notes:
(1) Plot-level production sustainability: C = soil compaction; K = potassium balance; Fert = cost P = pest or disease problem
(2) Market imperfections: I = input market problem; O = output market problem; L = labor market problem; K = capital market problem
(3) Other institutional problems: N = non-market information problem; R = regulatory problem; E = local environmental problem; B = equity biases (gender or distributional); C = social cooperation required
For market imperfections and other institutional problems: upper case letters indicate more serious problems.

Source: Tomich et.al (1999)

Actually, employment opportunities for large-scale palm oil are high, mostly for harvesting labor, i.e., roughly 10 months a year. Therefore, it is in line with the objective of employment creation (one of the policy makers' interests). A similar pattern also applies to rubber plantation. The profitability of rubber plantation is comparable to that of palm oil plantation. However, all the large-scale systems, notwithstanding, often displace the more labor-intensive smallholders with little compensation. This suggests the presence of a trade off between growth and poverty.

But perhaps the more important trade-off is with the objective of biodiversity conservation (one of the concerns of international community). There is an important trade-off with biodiversity conservation for large-scale plantation monocultures such as palm oil. More discouraging, even the smallholder-based activities may still prove to have a serious trade-off of this nature.

The case is rather different with rubber agro-forestry. The benefits of raising productivity and profitability of smallholders in this sector, especially through adaptation of existing high-yielding clones, could probably be combined with biodiversity conservation, since the mix of planted species may be augmented by natural regeneration of forest species (Tomich et.al, 1998, quoting Michon and de Foresta; van Noordwijk et.al 1995). However, natural forest remains superior for biodiversity conservation. More on forest conditions are discussed in the next section.

While the study does not incorporate other types of environmental impacts, e.g., on water and air quality of, say, processing of rubber, oil palm and cassava, it does point to the complexity of achieving sustainable development in practical terms. The interests and concerns of different parties could clearly generate trade-offs between socio-economic and environmental goals. While forest conversions or other derived land uses could potentially raise returns (socio-economic objective), they could also be inferior to natural forest (global environmental concerns).

Hence, a careful policy selection is always needed to reconcile possible conflicts between economic and environmental objectives in the agricultural sector. Depending on the case, detecting the nature and intensity of trade-offs in some situations is easier than in others.

IV. More on Crisis-Related Social Dimension: A Modeling Approach

As noted at the beginning, we strongly believe that if one wishes to make a long-term projection for Indonesia, the 1997 financial crisis episode and its repercussions ought to be included in the assumptions. To include and capture this crisis episode, one needs to construct and use a specific model with detailed financial block. The current section is devoted to this topic.

After describing the model framework and the equations, we discuss the working mechanism of the model, followed by the presentation of the results of model simulations, from which the impacts of the crisis on a number of variables, including social variables such as income distribution and unemployment, are to be derived.

A. Model Specifications and Assumptions

The proposed model consists of the following components: financial/monetary block, capital flow block, real sector block, price block, trade block, labor market block, and investment-saving block. The financial block plays a pivotal role in the modeling facility since it is designed specifically to capture the financial crisis episode. There are 6 institutions each having its own balance sheet: central bank, commercial banks, foreign sector, government sector, households, and production sector.

A.1 Financial Sector

At the first stage, capital inflows are specified as a function of interest rate differentials and country risks (labeled ***RISK***), the latter being measured in terms of debt exposure ***FOREXDEB***. This is primarily determined by the service-debt ratio:

$$PFCAPIN = \gamma_0 + degree.\gamma_\gamma.(RLOAN - RFLOAN - RISK) \quad (1)$$

$$RISK = \gamma_0 + \gamma_1.\ FOREXDEB\ /\ \gamma_p E_p.pwe_p\ ) \quad (2)$$

where ***PFCAPIN*** and ***FOREXDEB*** are the gross capital flows and the size of foreign debts, respectively, ***degree*** indicates the intensity of capital openness, the size of which is calibrated from the SAM, and ***pwe*** is the world price of exports.

Theoretically, the interest rate performs as an equilibrating factor in securing the saving-investment balance. However, during the crisis the interest rate is treated as a policy variable, hence exogenously determined. On the other hand, the rupiah/dollar rate was allowed to float in August 1997. In this sense, the exchange rate will play an important role in the saving-investment balance.

The phenomenon of capital outflows, particularly done by foreign investors, is widespread during the early part of the crisis. This is shown through a shrinking equity asset ***EQROW*** in the foreign sector's balance sheet that will eventually contribute to the rising outflows, ***PFCAPOUT***:

$$PFCAPOUT = \gamma_o . (PEQ.EQROW/EXR)^{\gamma 1} \qquad (3)$$

Next are the exchange rate determination and the role of non-economic factors. Since a testable *uncovered interest parity* (UIP) model requires a rational expectation (ratex) assumption, the corresponding risk premia lumped together with expectational errors would have a rather loose economic interpretation. The usual assumption that is orthogonal to the interest rate differential (hence the slope parameter should be close to unity) is nothing more than a statistical assumption. No wonder a clear consensus is hardly reached by most empirical tests using UIP model (see for example, Froot, 1990, MacDonald & Taylor, 1992, and Meredith & Chin, 1998).[15] Due to this fact, several interpretations can be suggested.

Since political variables played a prominent part in the whole crisis episode (Azis, 1998 and Azis, 2000), the interest-parity condition in the model is tailored through equation 4, in which the risk premia are replaced by a variable reflecting the country's political condition; the more unstable the political condition, the lower the value of ***POL***:

$$RLOAN = RFLOAN + (EXPEXR/EXR\ -1) + POL \qquad (4)$$

One of the most dynamic components in the financial block during the crisis is the portfolio allocation made by agents. More importantly, in order to translate a financial shock to welfare indicators one needs to specify agents' behavior of in determining their wealth, based upon which the stream of incomes (earnings) to different agents could be determined.

Following James Tobin (1970), Brunner & Meltzer (1972) and Bernanke & Blinder (1988), we choose to abandon the perfect substitutability assumption in the portfolio allocation. More specifically, households' wealth is allocated between liquid assets (narrow money) and other assets. Other assets are further allocated between time deposit

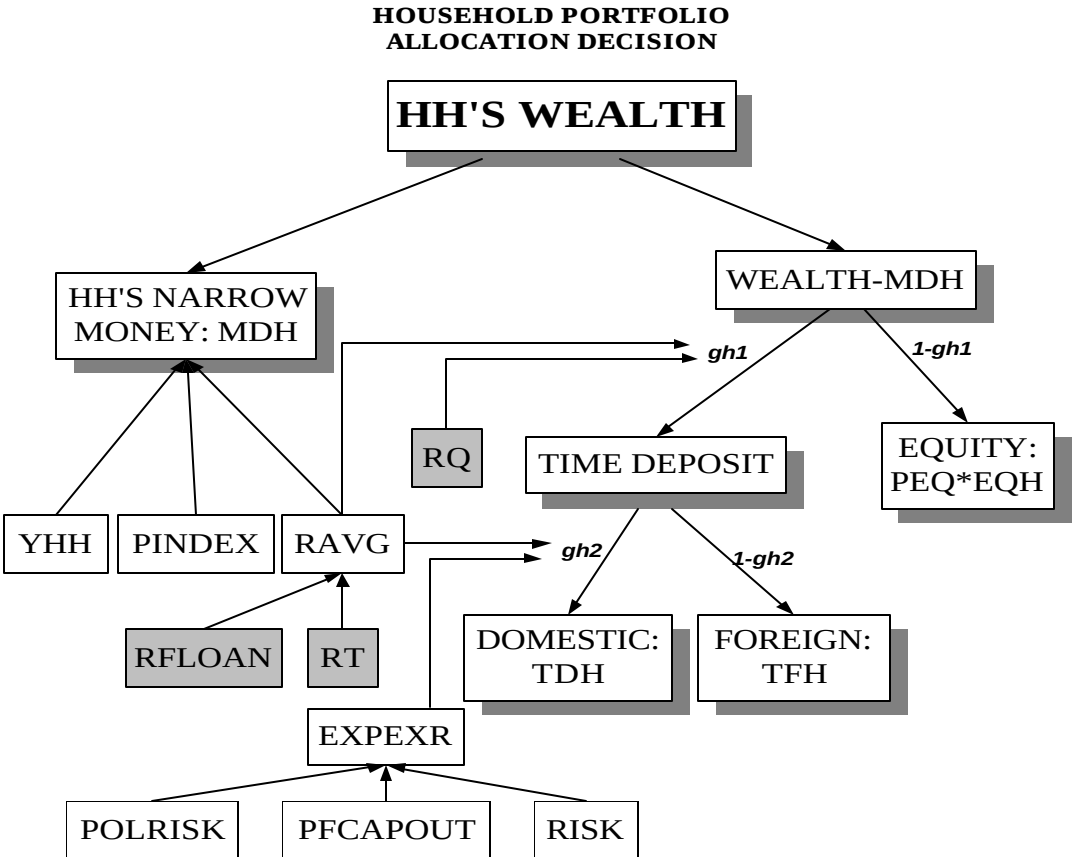
[15] Most studies imply, however, that it is not rue that exchange rate movements are best characterized as a random walk, as suggested by Meese & Rogoff (1983).

and equity holdings. Hence, there are four assets in the model: narrow money, domestic time deposit, foreign time deposit, and equity.

The specific allocation is determined by household's preferences/tastes. In the model, the preferences for time deposit and equity are reflected through parameter ***gh1***, which is influenced by the expected returns to those assets. The choice of holding domestic or foreign time deposits is also determined by preferences via parameter ***gh2***, which is influenced by returns to time deposits ***RAVG***, and the expected depreciation ***EXPEXR*** (see Figure 3). In this way, the portfolio selection is also affected by the country's political conditions in addition to the standard economic risks.

The selection of foreign or domestic time deposits by the non-household (production) sector is determined by—or, as a fraction of--the size of foreign loans and bank loans, respectively. The production sector's demand deposit, on the other hand, is influenced by the value of total output. Once the portfolio allocation is known, money demand is derived (narrow money and time deposit), and so is the amount of loanable funds (bank loans), after taking into account the commercial bank's borrowing and the reserve requirement.

Figure 3



The money supply is modeled through a money multiplier and high powered money (reserve money), the size of which is determined by the difference between the central bank's loans plus reserves (NDA plus NFA) and the central bank's wealth plus non-interest bearing government deposits and the central bank's certificate (*Sertifikat Bank Indonesia* or *SBI*). The money multiplier fluctuates rather sharply during the crisis episode, because household behavior changes considerably. Therefore, money multipliers are allowed to change freely, influenced among others by government's policy such as reserve requirements (see Harberger, 2000 for the discussions of flexible multipliers during a crisis).

The saving-investment closure departs drastically from a neo-classical specification. The private domestic investment in sector p, $DOMPINV_p$, and capital inflows $FCAP$, that set the size of foreign investment $FORINVNET$, are determined through independent functions as in equation 7:

$$FORINVNET = FCAP - ?\ ?_{inl}\ BORROW_{inl} \quad (5)$$

$$FCAP = PFCAPIN - PFCAPOUT + BORROW_{govt} \quad (6)$$

$$DOMPINV_p = ?_p . VA_p^{?1p} . (1+RLOAN)^{??p} . (EXR/PINDEX)^{?3} \quad (7)$$

where $BORROW_{inl}$ is total foreign borrowing by inl institutions (government, private companies including banks and SOEs), VA_p is the value added of sector p, $RLOAN$ and EXR are interest rate and nominal exchange rate, respectively, and $PINDEX$ is the price index.

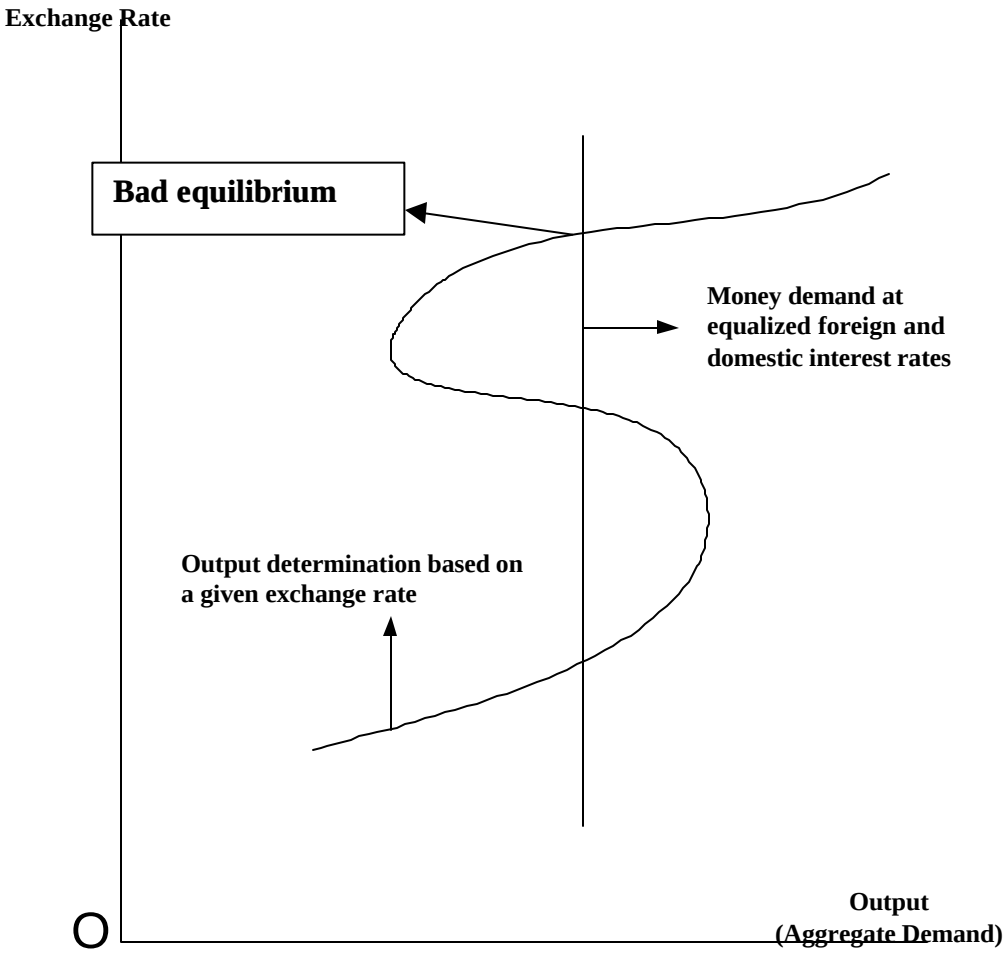
The specification of domestic investment reflects the financing behavior (i.e., bank-dependent) and the emerging constraints on the corporate balance sheet following the exchange rate collapse (Bernanke & Gertler, 1989, and Krugman, 1999). Hence, the interest rate and the production capacity, combined with (depreciating) exchange rate, would affect the size of domestic investment.

When the real exchange rate (RER) is favorable, few firms would be balance sheet constrained. In such a case, the direct effect of RER on aggregate demand would be minor. On the other hand, as the exchange rate collapses, firms with foreign-currency debt and hence deteriorating balance sheet, would be unable to invest at all. This will cause further recession. In the interim, exports may rise, but the effects of bankrupt corporate sector and the absence of new investment may be large enough to outweigh the direct effect on export competitiveness, in such that the collapse EXR would be contractionary.

This clearly implies that exchange rate movements will also affect the aggregate demand. As suggested by Aghion et.al (1999), under such circumstances, the normally upward-sloping curve of output determination given the EXR may have a backward-bending

segment as shown in Figure 4. This creates multiple stable equilibria, i.e., allowing a bad equilibrium with collapsed ***EXR*** and bankrupt corporate sector.

Figure 4. Backward Bending Curve For Multiple Equilibria Case



A.2 Output and Factor Markets

The real sector resembles a class of common CGE models, in which the production structure is specified as a set of nested CES function. At the first stage, the production function of value-added is determined, with primary inputs in the RHS. Like in most emerging markets, Indonesia's structure of production and trade is such that many intermediate inputs are still imported. Therefore, the composite intermediate inputs are necessarily modeled as a CES function of domestic and imported inputs. In the second

stage, domestic output is specified as a CES function of value-added and composite intermediate inputs.

The demand side is modeled in the subsequent stage, in which sectoral exports are assumed to be different from domestically sold output (domestic sales). By using a constant elasticity of transformation (CET) assumption, domestic output is formed through exports and domestic sales. This suggests that substituting exports with domestic goods is not costless; lower elasticity implies greater cost (more obstacles). Furthermore, the domestic market price will be different from export price (determined by the world price and the exchange rate). Thus, in the revenue maximization program, the producers' behavior is captured through equations that express the ratio of exports to domestic sales as a function of the relative prices.

Finally, total supply is modeled by making use of the Armington function (Armington, 1969), in which composite demand is a CES function of imports and domestic sales. Importers minimize the cost of acquiring composite goods such that the ratio of imports and domestic sales is determined by their price ratio. The supply of imports is assumed infinitely elastic with fixed world prices (small country assumption). Along with the exchange rate, import tax and trade & transport margin, the world price will determine the domestic price of imports.

The labor market is specified by making use of an independent function for wages, in which changes in the price of value-added, labor productivity, and the general price level, are the RHS variables in the equation. The wage factor income is set to be proportional to wages. Since in reality wage rates differ across sectors, despite intersectoral mobility of labor some stickiness and market distortions are allowed in the model; they are captured by a sector-specific parameter (***wfdist***). With such a specification, the sectoral labor demand, classified according to types of labor, could be subsequently derived.

In a crisis model, even when it is used for a short-term analysis, labor supply cannot be treated exogenously. More specifically, labor supply must be influenced by spatial migration. It is expected during the crisis that the movements of labor would be from urban to rural, especially when the urban sector is hardest hit. Consequently, the rural-urban composition of labor supply would alter, causing the spatial unemployment and income distribution to change. The migration model follows the Todaro (1970) specification, in which labor movements are determined by the relative employment probability and the earning differential.

B. Model Mechanism

Beginning with a deteriorating confidence induced by the Thai baht collapse in June 1997, capital began to leave the country. With sizeable corporate sector debts, private domestic investment could not be made, since the corporate balance sheet had severely deteriorated. This was exacerbated by the inability of the banking sector to lend, due to the fast growing non-performing loans and attenuation of investment activity. Consequently, the economy plunged into recession. This caused a further loss of

confidence. Hence, the cycle continued, and the circular causality in Figure 5 is intensified.

Figure 5
CIRCULAR CAUSALITY, MULTIPLE EQUILIBRIA, AND POLICY CHOICES

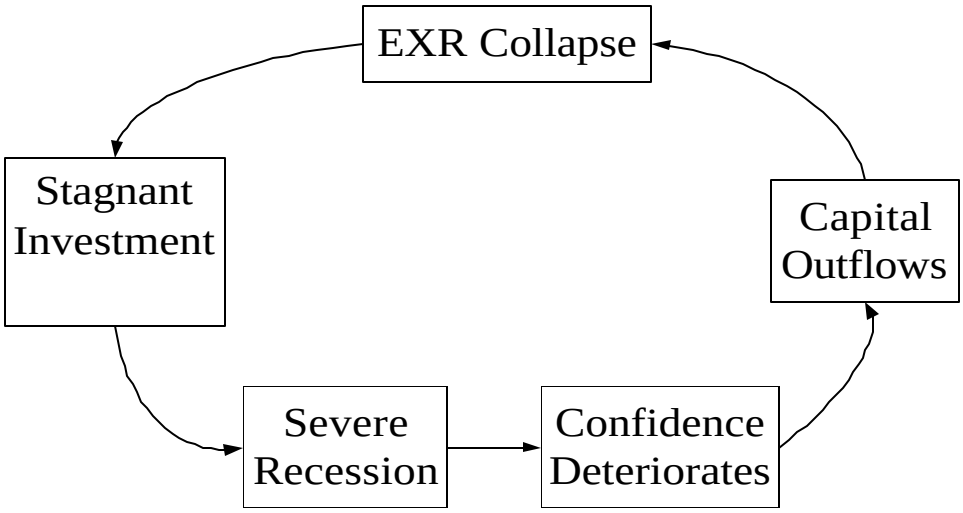


Figure 6 displays the detailed mechanism of the CGE model related to the above circular causality (the shaded areas contains the relevant variables in the illustration). With the collapse of confidence, capital began to leave the country; decreasing foreign equity ***EQROW***, leading to rising capital outflows (***PFCAPOUT***). The most direct impact is on the shift in devaluation expectation reflected through the change in ***EXPEXR***. With additional pressures from ***RISK*** factor, the actual (nominal) exchange rate ***EXR*** collapses.

Four subsequent repercussions are to be expected: (1) standard push on net-exports, ***E-M***, via more competitive export prices, ***PE***; (2) increased values of foreign saving that will affect household incomes ***YHH***, (3) increased domestic value of foreign investment (***FORINV***), and (4) declining domestic investment, ***DOMPINV*** via both, increased interest rate (***RLOAN***) and direct impact of deteriorated firm balance sheets due to rising values of foreign liabilities. As a result, total supply (***Q***) drops and so does the aggregate demand.

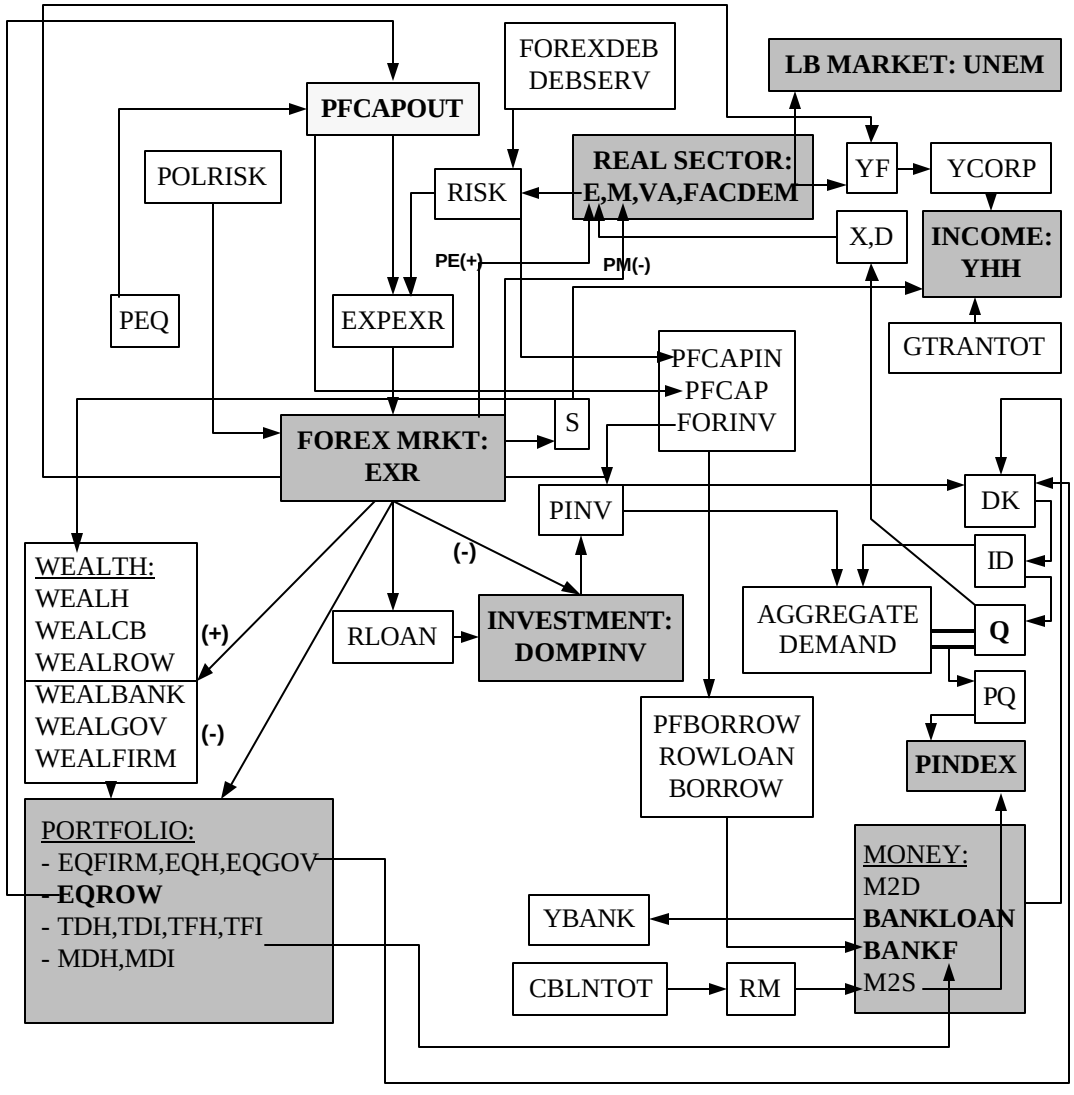
The resulting inflation (***PINDEX***) is determined by the interaction between aggregate demand and total supply. In the Indonesian case, however, we need to add several cost-push sources of inflation, one through a drop in food production due to unfavorable weather condition (El-Nino phenomenon), another through interruptions in the distribution system of some basic commodities such as rice, especially after May 1998, when a major riot led many Chinese businesses to flee the country. This has disrupted the effective supply of several commodities, and is captured in the model by adjusting

selected parameters in the production function. Finally, import prices also soar due to exchange rate depreciation.

Theoretically, pressures on prices can be countered by tight money policy (***MS2***). But the brakes were not effective, since the central bank began extending special loans known as *BLBI* to several commercial banks (increased ***CBLNTOT*** in Figure 6). This was done in response to the fear of a collapse in the financial system following a major rush related to the closure of 16 banks in November 1997. As a result, prices increased significantly throughout 1998.

Figure 6

IMPACTS OF CAPITAL OUTFLOWS ON FINANCIAL AND REAL SECTORS



There are 5 components of household incomes (***YHH***): (1) in the first bracket on the RHS of equation 8 is the factor income; (2) the second bracket consists of transfers from rest-of-the world, inter-household transfers and government transfers; (3) in the third bracket is household income from the after-tax corporate dividend; (4) in the fourth is the interest income from time deposit (***OTDH*** is the time deposit at the initial period); and (5) the last bracket captures the interest income from foreign currency-denominated time deposit. The disposable income (***YCONS***) is given by equation 9.

$$YHH_{ihh} = [\ ?_{f}\ factoin_{ihh,f}.YF_{f}\ ] + [\ EXR*ROWTRAN_{ihh} + ?_{ihh}\ transih_{ihh,ihhh}.YHH_{ihhh}.(1\text{-}thh_{ihhh}) + gtran_{ihh}.GTRANTOT\ ] + [\ compdist_{ihh}\ .(1\text{-}ctax).YCORP\ ] + [\ rt.\ OTDH_{ihh}\ ] + [\ rfloan\ .\ EXR\ .\ OTFH_{ihh}\ ] \quad (8)$$

$$YCONS_{ihh} = YHH_{ihh.}\ .(1 - th_{ihh}).(1\text{-}\ mps_{ihh} - ?_{ihh}\ transih_{ihh,ihhh}) \quad (9)$$

Notice that if the interest rate ***rt*** is raised, which is often the case in an IMF-inspired policy response to a crisis, the ***YHH*** of household categories ***ihh*** who hold saving will also increase.

The household time deposit ***TDH*** will be affected by the size of household wealth (***WEALH*** in equation 10), the latter being determined by household saving, ***HHSAV***, defined as the ***mps*** proportion (marginal propensity to consume) of ***YHH*** after tax (equations 11 and 12). Hence, with a certain time lag, ***YHH*** and ***HHSAV*** are actually interdependent:

$$TDH_{ihh} = gh_{2ihh}.gh_{1ihh}.(WEALH_{ihh} - MDH_{ihh} - EXR.HHFR_{ihh}) \quad (10)$$

$$HHSAV\ = ?_{ihh}\ mps_{ihh}.YHH_{ihh}.(1 - th_{ihh}) \quad (11)$$

$$WEALH_{ihh} = mps_{ihh}.YHH_{ihh}.(1 - th_{ihh}) + OWEALH_{ihh} + (EXR - EXR0).OTFH_{ihh} + (PEQ - PEQ0).OEQH \quad (12)$$

Finally, the sequential dynamics of the model are expressed through the following motion equations for the aggregate capital stock ***K***:

$$K_{t,p} = K_{t\text{-}1,p}(1 - ?_{p}) + ?\ DK_{t,p} \quad (13)$$

where *? ??*is depreciation rate, and *?* is the absorption rate.

C. Sequential Simulations

As the early pressure on exchange rate came following the Thai baht depreciation in July 1998, the government responded by widening the exchange rate band to 12%. At the same time, driven by the jitteriness among foreign investors, some capital began to leave the country. This outflow, reflected in the model through ***EQROW*** and ***FCAPOUT***, continued in the following month (August 14), despite the fact that the interest rate (on CB certificate SBI) was raised. Unable to defend the exchange rate further, in the subsequent stage the government floated the rupiah that month. In the model simulation, these two events (in July and August) are captured sequentially.

The third and fourth stages of simulation are basically a continuation of the previous two, except that at these stage the central bank tried to intervene in the forex market by releasing some of its foreign reserves, and the SBI rate was reduced. But the outflow ***EQROW*** continued, prompting the government to finally invite the IMF to rescue. With no deep understanding of what caused the crisis, the IMF demanded its standard prescription, i.e., raising interest rate and closing some banks, despite the fact that the country had virtually no deposit insurance system. The resulting outcome was obvious: a bank run.

When the interest rate continued to increase but capital outflows and the rupiah depreciation persisted (partly because of the IMF's neglect at the time on dealing with mounting corporate foreign debts), things got worse. The country's financial sector went haywire, and the entire economy fell into a deep recession. The stock market plunged and the rupiah hit an "insane" level of over 11,000 per US dollar. Pandemonium set in when on January 8 and 9, 1998 people went on a buying spree to hoard foodstuff.[16]

In the model specification, the collapse of the exchange rate caused the corporate balance sheet to deteriorate with large negative net-worth (related to unpaid foreign debt). Consequently, no investment could be made, prolonging the recession (see again equation 7). As shown in Figure 6, a deep recession damaged investors' confidence further, causing capital to continue leaving the country (increased ***EQROW***). Furthermore, for the first time the political factors (***POL*** in equation 4) began to play a significant role in the system, as the Suharto's government no longer received a vote of confidence. These shocks are applied in simulations 5 and 6.

Under the Habibie government, various uncertainties could not be removed, causing market confidence to remain lacking. This is detected by, and captured through, the continued outflows of capital and increased political risks. Such a trend is applied in simulations 7 and 8.

By selecting the relevant exogenous variables and adjusting the size of the changes based on the above stages, we conduct a set of sequential simulations (from stage 1 to stage 8). Figure 7 displays the collapse of value-added in various sectors.

Clearly, construction, real estate and banking & financial sectors are among the hardest hit during the crisis. Within industries, the largest drop occurred in the food processing and paper-manufacturing sector. The least affected is textile manufacturing. All categories of manufacturing industries, represented by solid lines, suffer from a significant downfall (note that the x-axis represents the 8 stages of events described

[16] The author observed the IMF's lack of touch with these chronological events, when in a private conversation with the IMF economists in Jakarta in March 2000 he was told that there was no food hoarding and rioting in January 1998 that caused prices of some basic goods, including rice, to soar. The fact is, there was hoarding and occasional riots, and the inflation rate rose by 13% from December 1997 to January 1998. The IMF remained convinced that the resulting inflation was an aggregate-demand phenomenon, hence to be solved by aggregate demand management, i.e., raise the interest rate further.

earlier). This is consistent with the recently released national account data that show all industries decline, and that the largest drop of value-added in nominal terms is in the food processing and paper industries.[17]

Figure 7. SECTORAL VALUE-ADDED: RESULTS OF MODEL SIMULATION

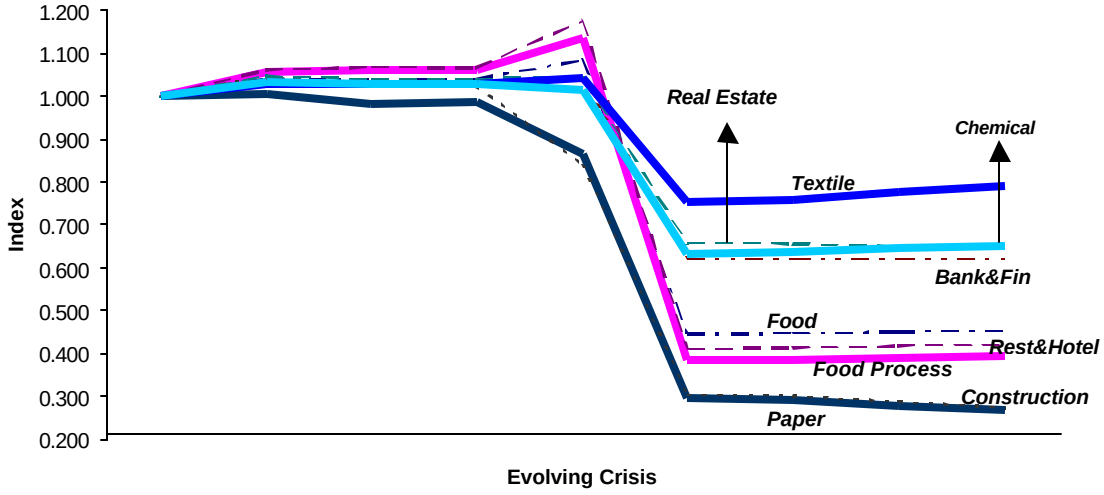
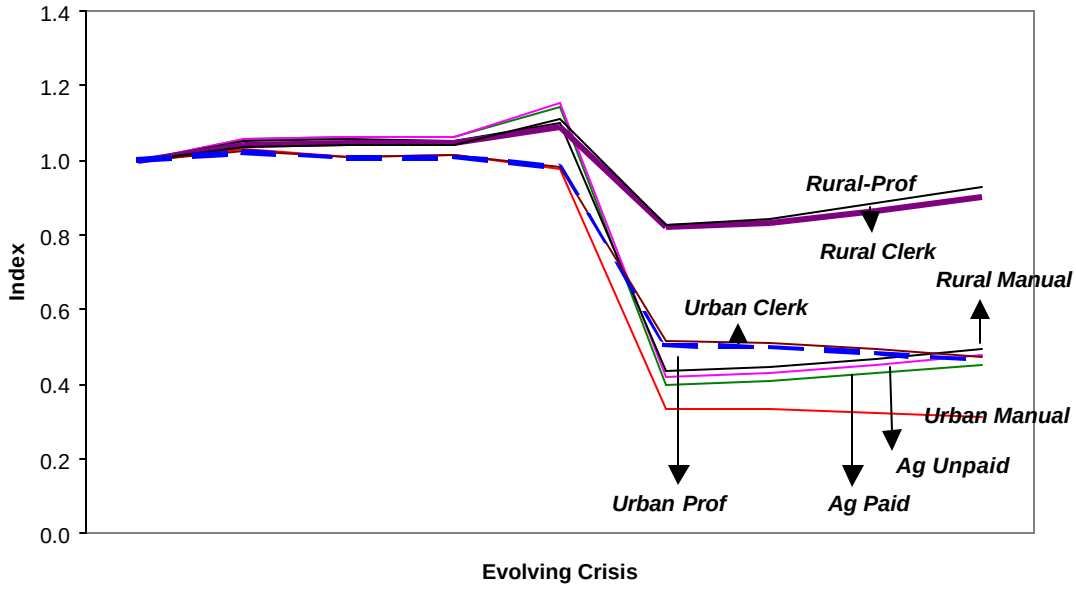


Figure 8. LABOR'S REAL INCOME (WAGES): RESULTS OF MODEL SIMULATION



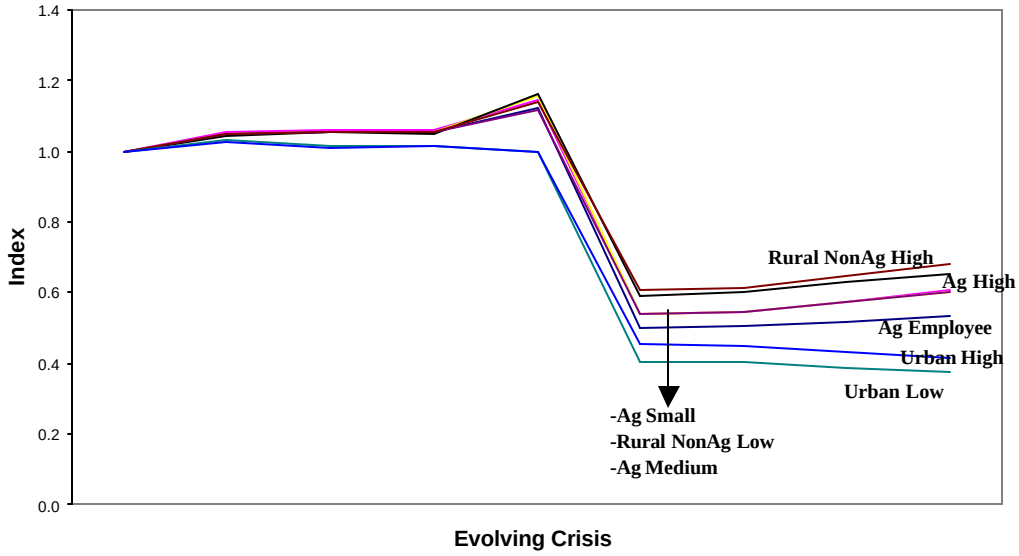
[17] To be comparable with the SAM data used in the model, one needs to do the comparison by using nominal--not constant--prices. A different conclusion can be obtained when constant prices are used, e.g., the value-added of the two industries increase, not decrease. Also, in making the comparison, one needs to take into account the fact that there are some discrepancies in the classification and coverage of manufacturing sector between those in the national account and in the SAM.

The most immediate impact of the economic downfall is on the real income of labors. Figure 8 indicates that the steepest fall of real wages occurred in urban workers of all categories, i.e., manual, professional, and clerical types. At the end of the simulation period, real wages of the latest two are close to those of agricultural paid and unpaid workers. The difference is, while real wages of agricultural workers show a slightly upward trend from simulations 6 to 8, real wages of all urban workers decline persistently.

The trend of household real income is even more important to observe, since in reality not all incomes are derived from wage earnings. Furthermore, various forms of transfer have been received by low income groups during the crisis, either through government's social-safety net and anti-poverty programs, or prompted by a mutual-help process, which is an important traditional institution existing among rural communities (*gotong royong*).

As displayed in Figure 9, judging from the household income once again the urban areas are the hardest hit. Both urban low and urban high categories suffered the largest drops in real incomes. Similar to wages, household incomes are moving persistently downward, while for other categories there is an increasing trend. Obviously, rising inflation related to a sharp increase in food prices during 1998 contributes significantly to such a decline.

Figure 9. CRISIS IMPACT ON HOUSEHOLD REAL INCOME: RESULTS OF MODEL SIMULATION



The unemployment result of the simulation clearly indicates that it increases considerably with the annual rate of roughly 10%. This estimate is close to what the CBS data indicate. According to SAKERNAS, based on the official definition of "employment" (i.e., those who worked at least 1 hour per-week), the open unemployment increased from 4.3 to 5.1 million from 1996 to 1998. Of the 5.1 million unemployed, 3.1 million are in urban (representing 9.3% urban unemployment rate), and 2.0 million are in rural (3.3%).

Using a different definition of unemployment, the Ministry of Labor predicted that unemployment has continued to increase each year, reaching 36 million in 2000.

At this stage of the modeling, the unemployment rate is broken down neither by sector nor by labor category. Yet, such a break down is important to make. For example, while the downturn in construction sector is likely to hurt male workers more than female workers, within the manufacturing sector different activities will have varying effects on female and male workers differently. In the machinery sector, for instance, most affected are male workers, while downsizing in textile and electronic industries may disproportionately affect female workers.

The combined force of declining real wages (and incomes) and increasing unemployment could potentially raise poverty dramatically. The process is activated through a downfall in consumption levels. If real consumption dropped as much as the rate of price increases, the impact on poverty would be most devastating. Rather fortunately, there was a process of consumption smoothing. Many households have either changed their food menu (e.g., eating rice once a day, using other less desirable foods the rest of the time), switched to lower price food (e.g., from imported to domestic produce), or used their accumulated savings to purchase food (dis-saving). Also, as the price of rice and CPI dropped from their 1998 levels, the poverty line in 1999 went down, causing the head-count poverty index to decline. However, within the poor group the conditions may have been more severe, as measured by the FGT index of poverty.

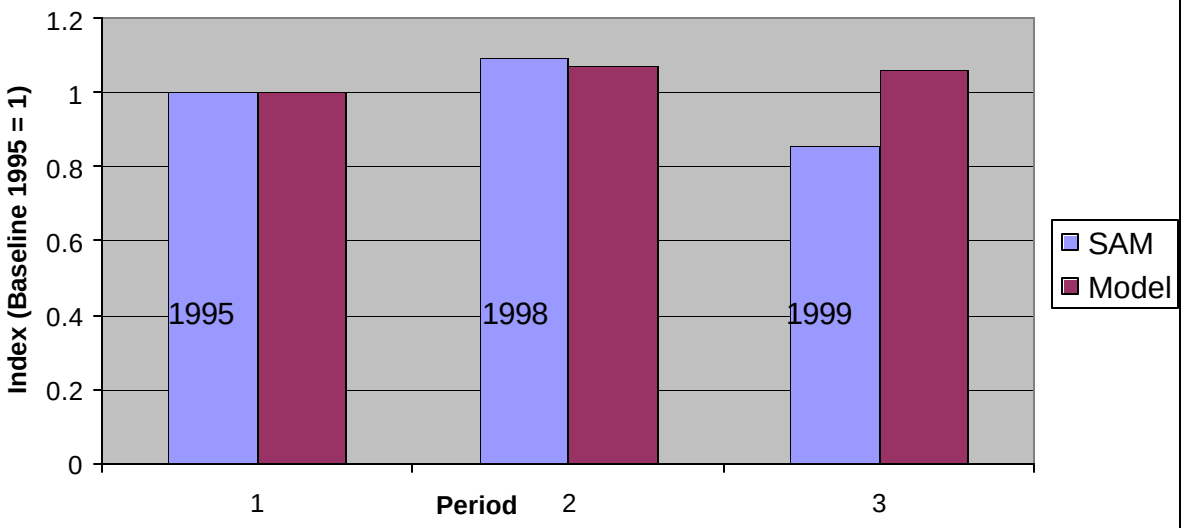
There is widespread evidence that a smoothing process also takes place in non-food consumption. However, the impact on poverty, more particularly on diets, is less serious compared to the case when the smoothing is in food consumption (especially among the poor). However, the economic crisis was not the only culprit. During 1997/98, Indonesia also suffered from crop failures due to the fickle global weather (El-Nino) phenomenon. Subsistence farming areas were the worst affected. Hence, the economic and political crises only aggravated the situation.

Since income can be derived from the model, one could estimate the relative income distribution resulting from the sequential shocks. Figure 10 shows the trend of estimated GINI index. It is clear from the chart that the relative income distribution tends to fluctuate, i.e., from improving at the early stage, worsening in the middle stage, and slightly improving towards the end of the simulation period. Using the income data from SAM 1995, 1996 and 1998, the Gini index also shows a fluctuation, with the following trend: 0.31 (1995), 0.34 (1998) and 0.29 (1999).

Two reasons can be posed as to why there was a period of improved distribution followed by a worsening one. First of all, as the model suggests, a depreciating exchange rate contributes to rising exports (see again Figure 6). This has occurred in the early stage largely among the export-oriented primary sector. However, as prices of basic necessities and inputs--including imported inputs--began to rise, farmers' relative position tends to

worsen.[18] Secondly, at the early stage, the hardest hit group has been the urban households, including the high-income group. But as specified in equations 8, when the interest rate is persistently high, the middle and higher income groups who hold savings in the bank will eventually benefit from their increased interest incomes.[19]

Figure 10. Gini Index: SAM Data and Model Simulation



V. Natural Resources and Energy

We have so far discussed the socio-economic dimensions of the Indonesia's development, including the repercussions of the recent crisis. We also have elaborated some of the environmental impacts of the socio-economic progress that the country has experienced. There are, however, another set of crucial environmental dimension we have left out, that is, the role and implications of the natural resource and energy use. For a large resource rich country like Indonesia, these issues are of utmost importance. The categories of resources to be discussed in this section are: forest, water, marine and energy.

[18] Data on farmer's terms-of-trade also indicate an improvement in certain major areas during mid-1997 to mid-1998, then it deteriorates during mid-1998 to mid-1999 (CBS, *Buletin Ringkas*).

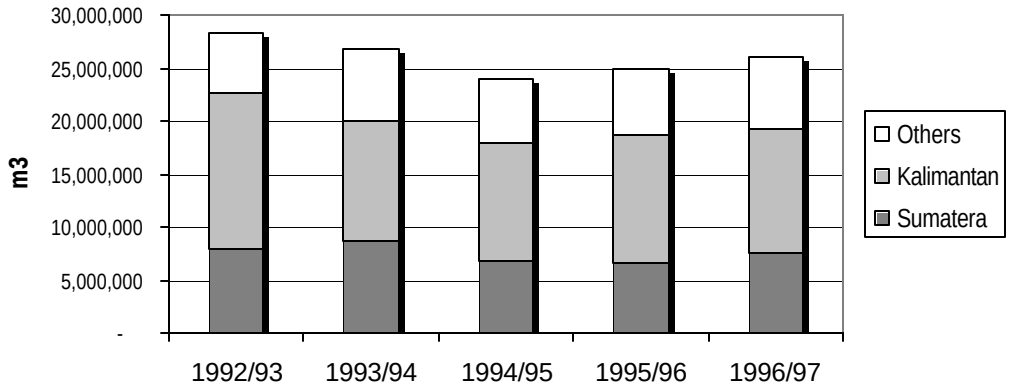
[19] Note also that the precise condition of relative income distribution at a certain point in time is highly sensitive to the date of data collection. Results of a survey done during the pre-harvest period tend to differ from data collected during or after the harvest season. The model simulation, on the other hand, does not take into account such seasonal adjustments. This explains why the income distribution index generated by the model is rather different from what the SAM data suggest, although the two produce the same direction of change.

A. Forests Resources

Being 60% of total area covered by forest, Indonesia has one of the largest tropical forest areas in the world, second only to Brazil. It is estimated that the country's total forest area in 1995 is 109.791 million ha, down from the 124.476 million in 1980. Of these, 94% is natural forest, comprising of designated areas of parks, reserves and protected areas, and a large share designated as production forests. The average per capita forest area is 0.6 ha, with striking regional differences, i.e., from a high 17.5 ha in Irian Jaya to a low 0.3 ha in Nusa Tenggara, and almost 0 ha in Java.

In roundwood production, Kalimantan and Sumatera are consistently the largest producers (80%, see Figure 11). In terms of forest resources, however, Kalimantan is known to have better stocking than Sumatera.

Figure 11. Log Production By Region 1992/93 - 1996/97 (cubic meter)



Source: Ministry of Forestry, "Forestry Statistics," 1999.

In addition to its contribution to GDP and environmental services (i.e., for habitat atmosphere, soil, and water conservation), forest also provides additional revenues through tourism, i.e., fees and tourist expenditures. Table 12 shows the estimate of forestry sector's total contribution in the economy.

The annual rate of deforestation in Indonesia is estimated around 1 percent of total forest area during the 1980-1995. This is equivalent to 1 to 1.2 million ha annual loss, or roughly 8% of world forest loss.[20] While individual contribution to deforestation is difficult to estimate, the following are the important explanatory factors: smallholder conversion of forest land for agricultural use by spontaneous migrants and traditional shifting cultivators, commercial forest harvesting operations, and conversion to agricultural land, especially for estate crops.

[20] Japan Environmental Council, "The State of the Environment in Asia: 1999/2000", p. 84.

Table 12. Economic Contribution of the Forestry Sector

Category	Quantity (000 m3 rwe)	Value added (Rp 000/m3)	Total value added		Destination US$ million	
			Rp million	US$ million	Domestic	Export
Sawn wood						
Large mills	13,900	170	2,780,000	1,166	580	586
Small mills	10,600	70	742,000	311	371	
Teak	300	270	81,000	37	37	
Pine	900	170	153,000	70	70	
Other	600	170	102,000	46	46	
Sub total sawn wood	23,600		3,858,000	1,630	1,044	586
Plywood	18,300	200	3,660,000	1,534	154	1,380
Pulp	14,760	20	2,867,000	1,303	1,303	
		30	12,750	6	6	
Total industry	59,360		10,397,750	4,473	2,507	1,966
Fuelwood	109,400	15	1,641,000	745	745	
Charcoal	4,480	72	332,600	151	51	100
Total energy	113,880		1,973,600	896	796	100
Grand total	173,240		12,370,750	5,369	3,303	2,066

Source: IFMTP (1999).

Deforestation by traditional shifting cultivators is more limited and will only create problems in the case of increasing population pressures, which could cause expansion into primary forests or serious soil degradation.[21] It is the other factors that have caused more serious damages. The so-called "Indonesian Selective Cutting System" (*Tebang Pilih Tanaman Indonesia*), which is a silvicultural management approach based on the assumption that in the course of initial logging a residual stand will be left and grow into harvestable timber in 35 years, has not been effective. Low rent capture in the forestry sector is a serious problem, resulting in production far in excess of the estimated sustainable yield (around 31 million cubic meters per year). Widespread illegal logging is another problem. The expansion of palm oil estates is also believed to add significant pressures on forests, although theoretically it does not have to intrude into primary forest areas.

The trend of roundwood exports followed closely the production pattern from 1970 up to 1980. The precipitous drop in roundwood exports between 1980 and 1985 is the result of

[21] Lack of registration of most traditional (*adat*) rights has made it difficult for existing forest dwellers to prevent the takeover of forestland by new migrants. On the other hand, lack of secure tenure rights to existing spontaneous migrants prevents them from becoming settled farmers and discourages the practice of clearing additional forests.

government regulation banning log exports (Figure 12). The ban was later revoked and replaced by a 200% export tax in 1991. Roundwood export tax is expected to decline further to 20% (part of the IMF economic recovery program following the crisis).

Exports of sawn wood were once discouraged by the imposition of a 200% export tax in 1989, causing them to drop sharply ever since. On the other hand, exports of plywood had been rising since 1980 before beginning to taper off in 1993. The rise of the latter was encouraged in part by regulatory environment and the abundance of cheap veneer logs supply as the results of government's unwillingness to raise stumpage fees to a level reflecting the real value of standing timber (IFMTP, 1999).

The use of fire in forest conversion, combined with the dry weather partially caused by *El Nino*, led to massive damage in 1997. More than 300,000 hectares of forest was burnt, and thick smoke spread over large areas of South East Asia. The smoke, combined with urban air pollution caused immense health, social and economic damages. The agricultural and forestry officials did not have political will to enforce the laws, and the Ministry of Environment had no sufficient budget to deal with the matter.

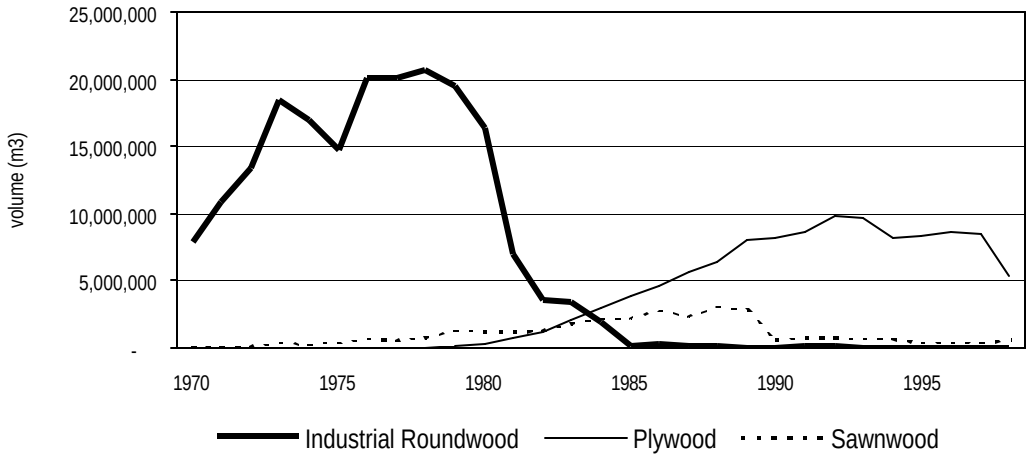
Following the recent financial crisis, it became apparent that distortions and policy failures in the forestry sector continue to take place, to some extent even became worse (World Bank, 1999). Most policies fail to adequately recognize the scarcity of forest resources, and consequently provide inappropriate incentives to resource users. At the onset the crisis, for example, huge forest fee is suddenly imposed, reflecting government's desperate effort to raise revenues, and at the same time also showing a symptom of ineffectiveness in forest management.

During the economic downturn, there was a sharp cutback in major regional export markets for hardwood and plywood. In 1998, Indonesia's wood-related exports dropped by 25% from US $ 8.3 billion to US $ 6.24 billion. Logging companies faced a serious financial problem, and many had to lay off workers. But external factors are expected to reverse the trend, at least during the next few years.[22]

On the other hand, the crisis provides an opportunity to reform the forestry sector. The list of proposed policies include raising the royalties, liberalize trade in roundwood, imposition of antitrust policies, and make policy and regulatory action to control illegal logging more effective. In the short run, such efforts are expected to reduce pressures on forests, but if the international demand for timber and agricultural products indeed continue to rise, this could add more pressures on forests. Hence, in such circumstances, without compensatory policy oversight deforestation may increase substantially

[22] Recently, China decided to reduce logging to 60%, causing mill owners to prefer importing plywood. At the same time, Malaysia restricted its export of plywood. This leaves China's plywood market open for Indonesian exporters.

Figure 12. Roundwood, Plywood, and Sawn wood Exports, 1970 - 1998 (cubic meter)



Source: FAOSTAT database

The recent trend of rising demand for greater regional autonomy adds further uncertainties with respect to the overall forest management in the country. In the longer run, assuming that there will be a freer trade regime, logging production could result in a rate of deforestation similar to that during the pre-crisis period. Hence, pessimistic and optimistic scenarios are both possible. It is for this reason, in the forecasting work (Section VII), we simulate a set of scenarios with different rates of deforestation.

Based on the medium and long-term assumptions, that is, that production will return to below the pre-crisis level, which is in excess of sustainable level of 31 million m3 annually, a projection is made, the results of which is shown in Table 13. Clearly, under such a scenario, the production level in 2020 will exceed the sustainable level by as much as 47%.

Table 13. Roundwood Production and Excess Felling Projection 2000 – 2020 (thousand m^3)

	2000	2005	2010	2015	2020
Production	39,845	41,516	43,010	44,362	45,596
Sustainable production	31,000	31,000	31,000	31,000	31,000
Excess felling	8,845	10,516	12,010	13,362	14,596

Source: Projected from FAOSTAT database.

B. Water Resources

Constraints on groundwater availability, irrigation systems to support wetland agriculture, and water supply systems in urban areas, have become more serious,

especially in the densely populated Java, where 60% of the population, 70% of irrigated agriculture, and 75% of industries are located. At issue is the competing use of surface water between agriculture, industry and municipal, particularly during the dry season.

As shown in Table 14A, Indonesia's freshwater resources are about the same amount as those in China and in the U.S, but in terms of per capita, the country has more than what other large countries have (China, India and the U.S.). In fact, on the basis of freshwater withdrawals, Indonesia is ranked very low among large countries (e.g., 96 m3 per capita in 1998, compared with 461 m3 per capita in China and 612 m3 per capita in India). Most (76%) freshwater withdrawal in Indonesia is for agricultural use (irrigation), followed by domestic use (13%), and industrial use (11%).

About 87% of urban and 57% of rural populations in 1995 had access to safe water. The coverage of urban population with safe water in Indonesia compares favorably with that in other middle-income countries, but the coverage for rural population is less favorable (Table 14B).

Most surface water is allocated for agriculture use (90%) with the rest goes to meet industrial and municipal demand. Another important source for industrial and municipal use comes from groundwater (72% of factories in Jakarta use groundwater).

In addition to inefficient use, existing patterns of reliance on groundwater cannot be sustained. This is particularly true for Jakarta and the northern coastal cities of Java where groundwater abstraction is greater than its replenishment rate. It is not uncommon to have saltwater intrusion and land subsidence in these areas, causing increased groundwater pollution.

Table 14A. Water Resources and Sectoral Water Withdrawals: International Comparison

Country	Water resources				Sectoral water withdrawals		
	Total freshwater resources (cu km)	Freshwater resources (cu m/capita)	Annual freshwater withdrawals (billion cubic meters)	Withdrawals (cu m/capita)	Percent domestic	Percent industrial	Percent agricultural
Indonesia	2,530.0	12,251.0	16.6	96.0	13.0	11.0	76.0
China	2,800.0	2,304.0	460.0	461.0	6.0	7.0	87.0
India	1,850.0	1,957.0	380.0	612.0	3.0	4.0	93.0
US	2,459.0	9,270.0	467.3	1,839.0	13.0	45.0	42.0
Japan	547.0	4,350.0	90.8	735.0	17.0	33.0	50.0
World	41,022.0	6,918.0	7,342.0	645.0	8.0	23.0	69.0

Source: World Resources Institute (1998)

Table 14B. Access to Safe Water

Country	Acces to safe water (% of population)			
	urban		rural	
	1982	1995	1982	1995
Indonesia	60.0	87.0	32.0	57.0
Low income countries	69.0	80.9	39.0	64.9
Middle income countries	-	88.7	-	76.7
High income countries	-	99.4	95.0	95.2

Source: World Development Indicators (1998)

Government policies related to water resources include rehabilitation of existing irrigation work; expansion of service areas, construction of new irrigation systems, upgrading of semi-technical irrigation system to technical level, introduction of special maintenance to upgrade the physical infrastructure, and implementing more efficient O&M. But the main emphasis of water resource policies until the mid-1990s was to support the agricultural sector in order to expand paddy cultivation (more than half of the irrigation system are located in Java).[23]

C. Marine Resources

Being an archipelago with more-than 17,000 islands, marine resource is another important source of wealth for Indonesia. Based on the International Marine Law Convention in 1982, the country's marine area increased from roughly 100,000 km^2 to approximately 3,100,000 km^2.[24] This area consists of approximately 2,800,000 km^2 of archipelago waters and 300,000 km^2 of territorial waters. The country also has a coastal line of 61,000 km (81,000 km) long according to World Data Center (national official data). With such statistics, Indonesia is considered the biggest archipelago in the world.

Fully of 78% of the Indonesian territory is shallow sea located on the Sunda and Sahul Shelves, separated by the deep Timor, Banda, and Flores Seas (Tomascik et.al., 1997). In the depth of less than 200m, lives sea biota, which is extremely precious for supporting many lives in the sea.

The low salinity content at the upper layer of Indonesian Sea enables more solar energy to be absorbed, which also means accelerated photosynthesis. This photosynthesis supports the lives of the plankton, and it made the Indonesian Sea rich of fish (Reksosudarmo et.al., 1999). It is estimated that at least 6.18 million tons of fish can be

[23] Total harvested wetland paddy area is recorded 10.2 million ha in 1996, and the average yield for irrigated paddy in Java is about 5.4 ton/ha (Java contributed 60% of Indonesia's rice production). Another major crop under irrigation control is *palawija*.

24 The United Nations Law Convention in 1982 also recognized Indonesia's claim on all sea between Indonesian islands and the sea around the waters of the sea between up to 12 miles outside, which stated in the Djuanda Declaration, December 13, 1959.

caught in the Indonesian waters every year. Without including other bio-organisms such as coral reefs, mangroves and seagrasses, the fish sector alone is able to generate more-than US$2.3 billion foreign exchange (Aristiarini, 1999). The Indonesian sea territory has also a large potential for marine environmental services such as marine transportation and marine ecotourism.

The total fishery yields in Indonesia actually increased persistently, reaching 4.8 million tons in 1998 (CBS, 1999), but local populations do not reap most of the gains. There are only 35 modern fishing ships throughout the country. Some estimates suggest that the ideal number should be around 600 ships (by comparison, Japan, which has much smaller marine areas, has 700 modern fishing ships). It is not surprising that the country's poor ability to exploit marine resources has been "substituted" by foreign fishermen with their sophisticated ships (their catch reached US$4 billion a year, or twice as much as Indonesian legal fishery export yields).[25]

Mangrove is another important resource. Although the total area of mangroves is only 3.16% of the country's forest, Indonesia is considered to have the largest mangroves area in the world. By 1996, it is about 3.45 million hectares, or 18-24 percent of world's mangroves area. Out of that figure, approximately 1.5 million ha (35%) is in Irian Jaya, and the rest spreads out across East Kalimantan, South Sumatra, Riau, and Maluku. The very large area of Indonesian mangroves is also rich with many kinds of biodiversity.

The damage of mangrove ecosystems could have serious impacts on the population of fish and numerous marine biota that usually use mangroves to stay, take shelter, eat, and breed. Those conditions also occur on coral reefs and coastal ecosystems. Furthermore, without mangroves, the beach will not be protected from the tides, causing serious erosion. A microclimate change, expanding malaria disease, and seawater infiltration to mainland could also result from disappearing mangroves. Hence, the destruction of mangroves could be disastrous.

Unfortunately, Indonesia has already been experiencing such a trend. As development progresses, a considerable amount of the country's mangrove areas have been lost. From Table 15, it can be seen that up until 1990 Indonesia has lost approximately 60% of its mangrove areas.

Since 1982 alone, almost half of the country's mangrove forest has disappeared, causing land abrasion by the sea and threatening the life of biota.[26]

Coral reefs and sea grasses are another marine resources the country is rich in. Sadly, coral reef destruction has been also on the rise, costing the country considerably.[27] The

25 Having 5.8 km2 area and a coastal line of 81,000 km, it is estimated that Indonesia could actually have benefited from 6.2 million tons of fish catch every year.

26 A research conducted by the Puslitbang Oseanologi LIPI in 9 coastal cities in Indonesia (1996), including Jakarta and Surabaya, reveals that the sea surface increased on average by 0.5mm per year (or 90mm in every 15 years).

estimated lost of Indonesian fishery sector from coral reef degradation and over-fishing is approximately US$410,000 per km^2, assuming a 10% discount rate over 25 years (Cesar, 1997). *Ceteris-paribus*, this suggests that Indonesia has already lost approximately 40% of its reef fishery resources, or $30 billion loss to the economy (see also Endinger et.al., 1999).

Table 15. Estimates of Mangrove Area (ha)

Province	Remaining Mangroves 1986-1990	Former area	Percentage Lost (%)
Aceh	<20.000	60,000	67
North Sumatra	30,750	95,000	68
West Sumatra	1,800	11,000	85
Riau	184,400	259,500	29
Jambi	4,050	18,500	78
South Sumatra	231,025	354,500	35
Bengkulu	<2.000	2,000	<1
Lampung	11,000	56,500	81
West Java	<5.000	55,500	92
Central Java	13,577	46,500	71
East Java	500	57,500	99
Bali	<500	1,000	50
NTB	4,500	9,500	53
NTT	20,700	29,000	29
East Timor	100	100	0
West Kalimantan	40,000	213,000	81
Central Kalimantan	20,000	84,000	76
South Kalimantan	66,650	115,000	42
East Kalimantan	266,800	680,000	61
North Sulawesi	4,833	30,500	84
Central Sulawesi	17,000	43,000	60
South Sulawesi	34,000	110,000	69
S. East Sulawesi	29,000	89,000	67
Maluku	100,000	197,500	49
Irian Jaya	1,382,000	>1.500.00	10
Total	**2,490,185**	**4,129,100**	**60**

Source: Giesen, 1993.

[27] Research results from "Indonesian Center of Research and Development of Oceanography" (*Puslitbang Oseanografi*) in 1995 showed that only 6.2% of corals are still in a very good condition, 23.72% in good condition, 28.30% in medium damage, and 41.78% in terrible damage. Even in the conservation area, the quality and quantity of coral reef has been decreasing. With total marine area of around 5.8 km^2, Indonesia has only 38 locations of conservation area in 25 provinces (total 4,711,782.81 ha). Ideally, for the large marine area like Indonesia, at least 10 million hectares are needed for marine conservation area (Aristiarini, 1999).

Marine resources also include materials used in biotechnology. Indonesia is known to have many biomarine resources that can be developed, such as bioactive compound extracts (natural products) like squalane, omega-3, phycocoloids, biopolymers, etc. The microalgae (phytoplankton), macroalgae, microorganisms, and invertebrates can be developed for food and pharmaceutical industries, cosmetic industry, and other biotechnology-based industry. Yet, value-added generated by this sector has so far been very limited (e.g., exports of marine products are worth only US$2 billion). Although not comparable, it is worth noting that incomes generated from the biotechnology industry in the US is recorded at US$14 billion (1994 data).

Related to marine resource exploitation are the following issues: (1) pressures on marine biodiversity, (2) improper marine potential management, and (3) unexplored marine resources. Pressures on marine ecosystems include coastal population density and continued population growth, which are accompanied by increased consumer demand for marine products, increased waste disposal, rapid alteration of coastal habitats, uncontrolled industrial pollution, inadequate institutional structures for managing marine resources, lack of property rights and management regimes within international waters, and lack of understanding/awareness about marine ecosystem processes and the effects of human actions on marine biodiversity (WRI, 1996).

Indeed, during the last 3 decades, rules and regulations concerning marine resources had proliferated but had been weakly implemented. There are numerous government offices and agencies handling these resources, each with different interests but without clearltly delineated responsibilities. As expected, poor coordination is an endemic policy problem.[28]

D. Energy

In 1998, Indonesia is the fifth largest energy consuming country in East Asia after China, Japan, India and South Korea (see Table 16). Energy consumption has tripled since 1980. In 1997/1998, the transportation sector accounted for 40% of total energy consumption (petroleum), and industrial sector is in the second position with 37% share (see Table 17).

Indonesia's primary energy consumption is dominated by oil. In 1997/1998, the transportation sector constituted 54% of total petroleum consumption (rising from 35% in 1980/1981). Meanwhile, the share of the household sector has declined to 21% (from 38%), and that of industrial sector remains constant at around 20-24%.

Natural gas consumption tripled during 1980-1997, but the share in total energy consumption has been relatively constant at around 8%-12%. The largest natural gas

[28] The Environment Law No.23/1997, which is meant to protect the mangrove ecosystem, for example, has not been enforced effectively.

consumer is the industrial sector, with the following ranking: power stations, fertilizer plants and steel industry (World Energy Council, 1999).

Table 16. Primary Energy Consumption (in quadrillion btu)

	1980	1985	1990	1995	1998
China	17.29	22.20	27.01	35.18	33.93
Japan	15.25	15.69	18.28	20.95	21.28
India	4.16	5.90	7.78	11.11	12.51
South Korea	1.68	2.25	3.66	6.44	6.93
Indonesia	1.11	1.65	2.19	3.29	3.62
Thailand	0.51	0.71	1.25	2.24	2.34
Malaysia	0.42	0.70	0.98	1.46	1.74
Philippines	0.58	0.54	0.73	0.96	1.08
United States	78.44	76.75	84.12	91.00	94.79
Australia	2.76	3.13	3.67	4.13	4.30

Source: EIA: International Energy Database (1999)

Table 17. Energy Consumption by Sectors in 1997/1998

Consumption by Sectors in 1997/1998							
	Industrial		Household		Transportation		total
Oil	67731.8	23.66%	62782.9	21.93%	155756.1	54.41%	286270.8
	47.85%		70.24%		100%		74%
Natural gas	36340.1	99.39%	62.8	0.17%	158.6	0.43%	36561.5
	25.67%		0.07%		0%		9%
Coal	16749.69	100%	0	0%	0	0%	16749.69
	11.83%		0%		0%		4%
LPG	2008.1	27.87%	5188.8	72.01%	8.8	0.12%	7205.7
	1.42%		6%		0%		2%
Electricity	18725.46	46.72%	21351.57	53.28%	0	0%	40077.03
	13.23%		23.89%		0%		10%
total	141555.15	36.59%	89386.07	23.11%	155923.50	40.30%	386864.72
	100%		100%		100%		100%

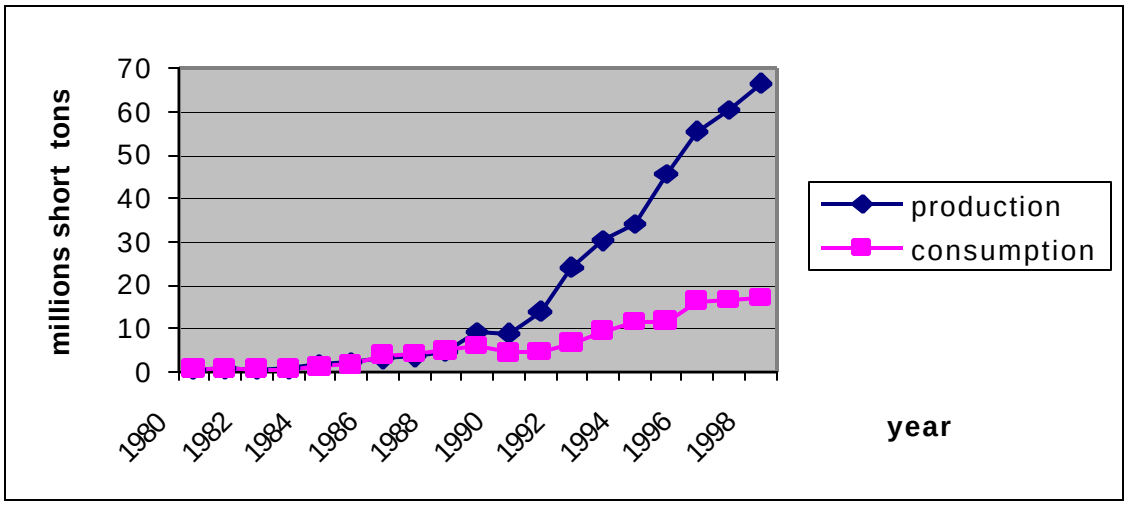
Source: Ministry of Mines and Energy, 1999.

Coal consumption, largely by the industrial and transport sectors, is a mere 4% of total energy consumption. Since 1987/1988, only the industrial sector has recorded coal energy consumption. As displayed in Figure 13, in the 1990s, most Indonesian coal production is exported (by 1997, they constitute 8% of world's coal exports).

Along with the fast economic growth, demand for energy has been on the rise. Electricity consumption rose five times since 1980, from 12.6 billion KWh to 68 billion KWh (mostly thermal electricity).[29] However, the energy intensity (energy use per unit of GDP) has declined by roughly 1% during 1984-1996. This is rather unique, since in most developing countries the figure usually increases along with industrialization (see Lo and Xing, 1999).

[29] Hydropower electricity consumption is mere 0.09% of total electricity consumption, and the share of renewable fuel for electricity generation (geothermal, solar, biomass, wind and tidal wave) is only 0.04%.

Figure 13. Coal Consumption and Production

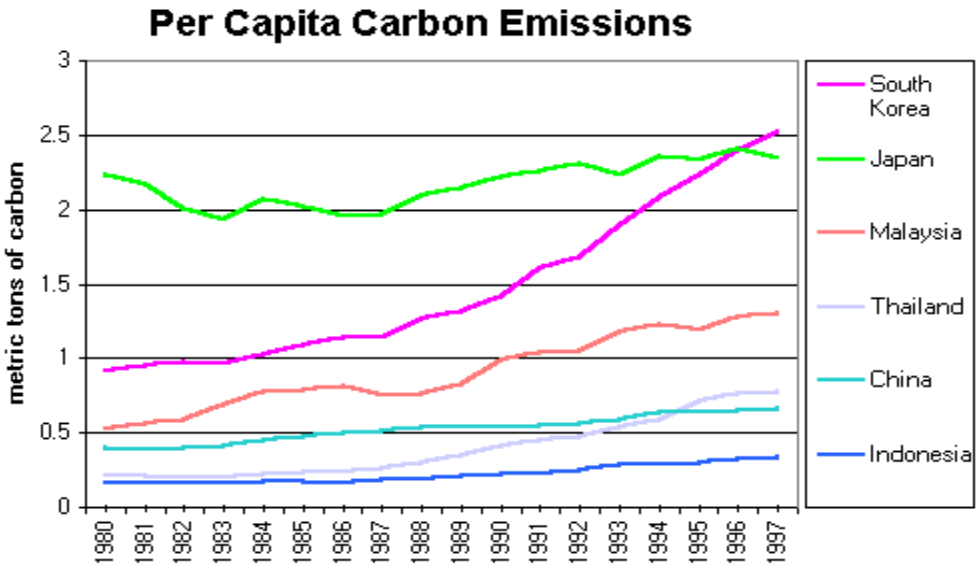


Source: EIA: International Energy Database, 1999.

The 7% annual growth of energy consumption during the past 20 years has caused some environmental problems, especially air pollution from heavy usage of fossil fuels. Combustion of fossil fuels produces gas emissions, such as CO_2, NO_2, SO_2, and CH_4. These gas emissions could be hazardous to human health, and potentially can create greenhouse effects.

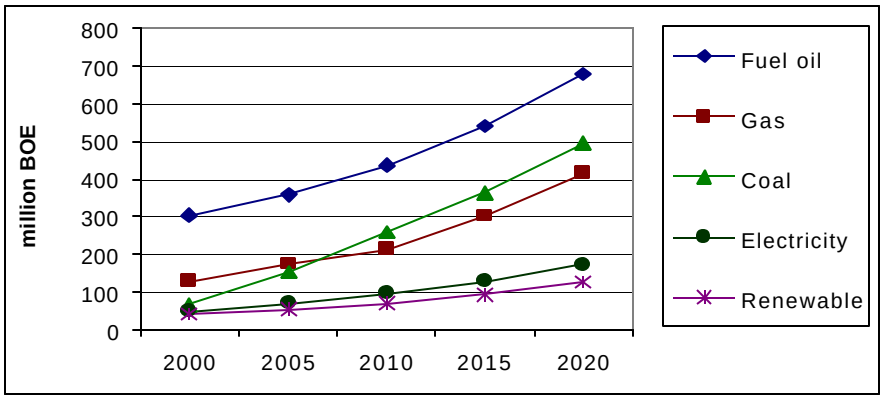
Indeed, fossil fuels supply about 93-95% of total primary energy consumption in Indonesia, although the per capita carbon emissions are relatively low compared to other Asian countries (Figure 14). Note that the industrial sector is the biggest producer of carbon emissions.

Figure 14



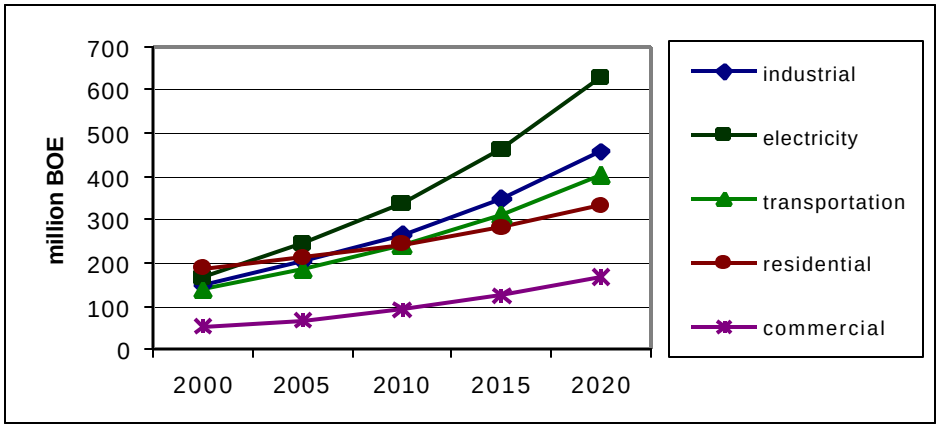
A study by CES-UI predicts that fuel oil will still be the most important energy for Indonesia in the next two decade. Fuel oil consumption is expected to increase from approximately 303 million BOE in 2000 to approximately 680 million BOE in 2020. Meanwhile, it is also predicted that between 2005 and 2010 coal will become the second most important energy, replacing the position of gas (see Figure 15A).

Figure 15A. Forecast of Energy Consumption



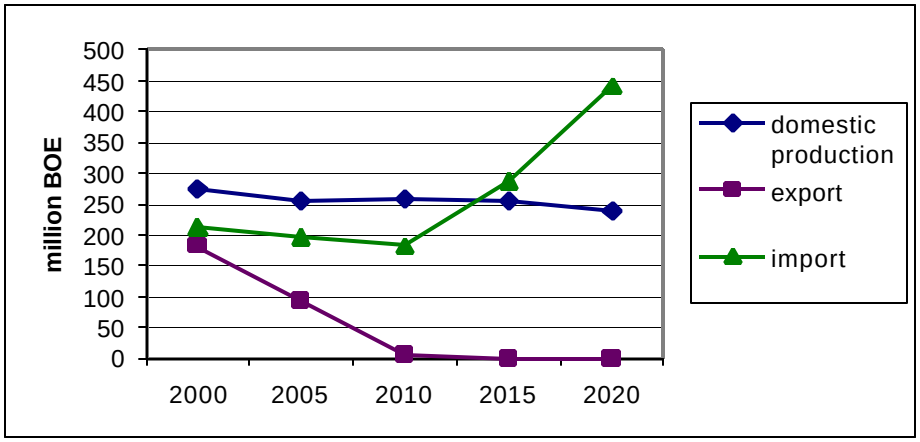
Source: CES-UI, 2000

Figure 15B. Forecast of Energy Consumption by Sectors



Source: CES-UI, 2000

Figure 15C. Crude Oil Production, Import, and Export

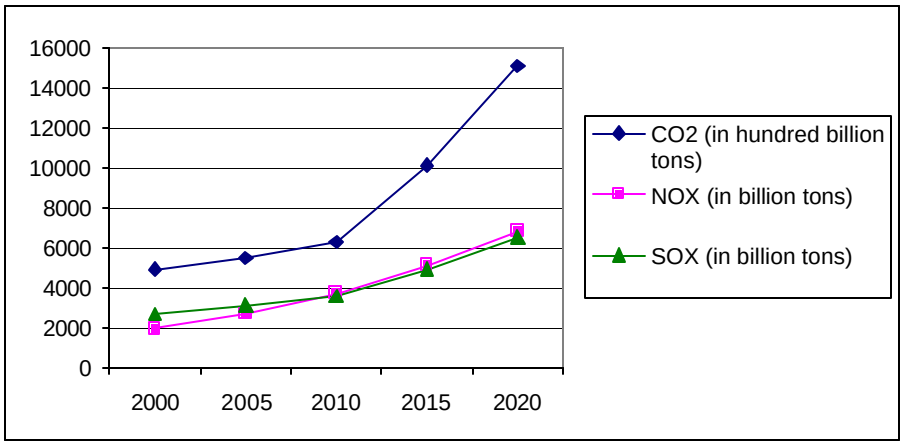


Source: CES-UI, 2000

By sector, the industrial activity is estimated to remain the largest energy consumer. Its consumption will increase from 146.753 to approximately 456.427 million of BOE (Figure 15B). What is also important to note is, until the year 2020 Indonesia is predicted to be still a net exporting coal country (Figure 15C).

The estimated of CO_2, NO_x and SO_x emission is shown in Figure 16. It is clear that all three pollutants, especially CO_2, are expected to increase significantly after 2010.

Figure 16. Forecast of CO_2, NO_x and SO_x Emissions



Source: CES-UI, 2000

VI. Resource Accounting and Genuine Saving

In order to identify and select strategies consistent with the sustainable development concept, we adopt an approach that allows us to generate alternative long-term growth trajectories. One of the important conditions to be imposed in generating such trajectories is the extent of resource depletion, that is, the available stock or supply of natural capital (e.g., land as an input into agricultural and animal husbandry, sub-soil assets as a source of minerals and fossil fuels, and forest as a source of timber). These environmental resources, along with produced assets (physical capital) and human resources (labor), are inputs to production (see again the flow-chart in Figure 1). Hence, the intensity of past and current production determines the stock and supply of these resources available for future use.

The concept of weak (strong) sustainability maintains that the aggregate (individual) resources should not decline overtime. The concept also implies a close connection between economic progress and environmental conditions. Hence, relevant measures and indicators of the two ought to be integrated.

Prominent among indicators linking the economy and the environment are measures of "green" net national product (green NNP), and genuine saving. Central in those measures is the concept of rental value, defined as the difference between the market price and cost of production/extraction. The problem is with the determination of "market price" of environmental resources ("environmental functions"). Theoretically, supply curves for these resources are possible to construct, but not the demand curves, because the information on preferences for environmental functions are very limited or difficult to reveal. Therefore, estimating the (shadow) price of these resources is problematic.

An alternative way is to set environmental standards as the demand curves, based upon which one could then measure the monetary costs of meeting those standards. The reduction of national income by these costs gives a first approximation of activity level that is considered sustainable (Hueting & Tinbergen, 1992).

Notwithstanding the difficulty to assign prices on environmental resources, Repetto (1986) attempted to measure the depletion of Indonesia's three environmental resources: oil, forest, and soil (see also Azis, 1994). Rents for oil and forest are determined by the international resource commodity price less all factors costs incurred in extraction. With Hotelling's paths of extraction, this implies that domestic and international markets for the resource are assumed perfect. For soil erosion, the one-year costs of erosion are capitalized to obtain the total PV of the future stream of productivity losses associated with erosion (soil depreciation). As erosion increases, the loss of potential future farm income also increases.

The approach we use in this research is basically to estimate the required cost of maintaining the quality and quantity of the environment at a certain level (standard). We apply the calculation to the following environmental resources: air, water residuals, destruction of ecosystem due to excess felling of cultivated forest, and depletion of resources from oil, gas, coal, bauxite, and tin sector. After measuring the physical units, the imputed environmental costs are divided into three categories: (1) degradation of natural resources caused by residuals, (2) destruction of ecosystem, and (3) depletion of resources.[30]

Imputed environmental costs of air pollution are broken down into fixed sources (industrial sector), and mobile sources (transportation sector). After measuring the volume of discharges of certain polluting substances, we multiply the volume by the unit cost of removing the substance to come up with the imputed environmental costs.

For fixed sources, the emission substances that we take into account are: NO_2, SO_2, CO, Volatile Organic Compound (VOC), Particulate (PT), Fine Particulate (PM10), and Toxic Air.[31] Constrained by the difficulties in estimating the unit cost of removing residual discharges from mobile sources, we use total gasoline consumption (premix) as the basis for estimating the imputed environmental costs of air pollution from mobile sources. Unit cost of lead phase-out of US$ 0.03/liter gasoline is used as the unit cost of removing air

[30] The method of maintenance cost is used in computing the imputed environmental costs. We measure qualitative and quantitative changes in the environment by estimating the required cost of maintaining its quality and quantity at a certain level.

[31] Air pollution load from industrial sources at 2-digit ISIC level (ISIC code 31 – 39) is estimated using the following procedure. *First*, for each ISIC category we aggregated its production value for 1990 and 1995 using the respective I/O Tables. *Second*, air pollution load for each ISIC classification and for each emission type is calculated by multiplying the production value by its respective emission factor based on World Banks' Industrial Pollution Projection System. *Third*, imputed environmental costs are obtained by multiplying the air pollution load for each ISIC classification and type of pollutants by its respective abatement costs coefficient based on World Bank study.

pollutants from gasoline.[32] For water pollution, we measure waste pollution load, i.e., Biological Oxygen Demand (BOD), Total Suspended Solid (TSS) and Toxic Water from industrial sources, by using the same procedure and data source as outlined earlier for air pollutants.

In the case of natural resources, the measure of costs of extraction of the most important sub-soil resources, i.e., oil, gas, coal, bauxite, and tin, is based on user-cost method (the difference between the actual and the constant eternal revenue).

For the destruction in ecosystem, we concentrate on two main sources: excess felling, and other destruction of cultivated forests due to economic activities (illegal cultivation, illegal pasture, illegal cutting and logging damage). Cultivated forest destruction due to forest fires is not included in the imputed cost calculation. If most forest fires are caused by land clearing activities and only then exacerbated by wind or dry season, then log values destructed by fires are considered as part of the forest destructed values. The costs of the ecosystem destruction in cultivated forests are calculated as the difference between natural growth with felling, forest damages and conversion.

With the above approach, we could generate the imputed environmental costs. Subtracting the Net Domestic Product (NDP) with such imputed costs will give what is called ENDP (Environmentally adjusted NDP), a measure based on a concept similar to that of the green NNP described earlier.

Tables 18 and 19 display the results for Indonesia. It appears that the booming economy during 1990-1995 produced some damage to the environment, i.e., between 5.6 and 5.2 percent of total GDP. As expected, most damages (around two-thirds) were due to natural resource depletion resource depletion including sub-soil depletion and excess felling of forest, followed by degradation of natural resources caused by residuals.

The trend of imputed environmental costs by sources during 1990 to 1995 shows that there is a decreasing share of oil depletion. By 1995, it reaches 28 percent. This is mostly as a consequence of the declining share of oil sector in total GDP, in line with the government policy to diversify the economy by reducing the dependence on oil (see again the discussions in Section II). The trend in the imputed environmental costs by sources, however, indicates an increasing share of costs of air and water pollution and excess felling of forests due to excessive commercial exploitation of forests. Hence, this reflects that the reduced dependence on one natural resource (oil) is subsequently followed by increased dependence on another natural resource (forest).

As stated above, the concept of weak (strong) sustainability maintains that the aggregate (individual) resources should not decline over time. To secure continued growth in the capital stock, saving must be sustainable as a source of investment financing. The question is, what saving are we concerned about?

[32] World Bank, "Removal of Lead from Gasoline: Technical Considerations" in Pollution Prevention and Abatement Handbook, July 1999.

From the perspective of sustainable development, it is the *genuine saving* that we ought to examine, since its calculation includes the reduction due to resource depletion, in contrast to conventional saving measures. One of the important policy issues regarding genuine saving pertains to the determination of royalties that capture resource rents. Ideally, one should find an optimum balance between royalties that will ensure incentives for resource sustainability and adequate returns for resource exploiting firms.

Table 18
Imputed Environmental Costs by Sources: 1990 & 1995 (Rp million)

	1990		1995	
Degradation of natural resources caused by residuals	**3,074,137**	**26.0%**	**8,422,325**	**35.7%**
Air pollution	2,464,478	20.9%	6,825,420	29.0%
Fixed sources	2,145,108	18.2%	6,189,076	26.3%
Mobile sources	319,370	2.7%	636,343	2.7%
Water pollution sources	609,659	5.2%	1,596,906	6.8%
Destruction of ecosystem (cultivated forests)	**1,157,562**	**9.8%**	**6,623,532**	**28.1%**
Depletion of resources	**7,586,753**	**64.2%**	**8,515,494**	**36.1%**
Oil	6,013,365	50.9%	6,639,879	28.2%
Gas	1,563,831	13.2%	1,862,200	7.9%
Coals	0	0.0%	92	0.0%
Bauxite	6,208	0.1%	0	0.0%
Tin	3,350	0.0%	13,321	0.1%
Total imputed environmental costs	**11,818,452**	**100.0%**	**23,561,351**	**100.0%**

Source: Alisjahbana and Yusuf (2000A)

Table 19
GDP, NDP, Imputed Environmental Costs and Eco-Domestic Product 1990 and 1995 (Rp million)

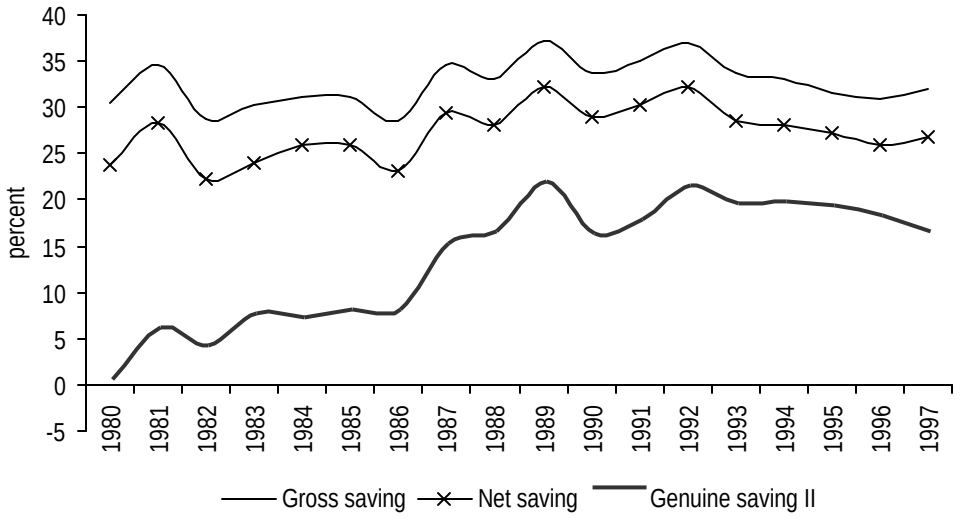
	1990		1995	
Gross Domestic Product	210,866,000	100.0%	454,514,000	100.0%
Depreciation of fixed assets	9,783,900	4.6%	19,189,600	4.2%
Net Domestic Product	201,082,100	95.4%	435,324,400	95.8%
Imputed environmental costs	11,818,452	5.6%	23,561,351	5.2%
Degradation of natural resources caused by residuals	3,074,137	1.5%	8,422,325	1.9%
Destruction of ecosystem	1,157,562	0.5%	6,623,532	1.5%
Depletion of resources	7,586,753	3.6%	8,515,494	1.9%
Eco-Domestic Product	189,263,648	89.8%	411,763,049	90.6%

Source: Alisjahbana and Yusuf (2000A)

For resource-rich Indonesia, the performance of exports of natural resource based products should also be examined from the perspective that growth may entail excessive liquidation of natural resource base. If the dollar values of exports equal the monetary values of depleting the resources being used for the export products, from the sustainable development perspective the country's wealth does not increase. Still worse, *ceteris-paribus*, an increasing trend of exports would be unsustainable.

We can observe from Figure 17A that there was an improvement in the genuine saving up to 1995. From 5 percent of GDP in 1980, the genuine saving reached more-than 20 percent in 1995. The declining resource rents, shown in Figure 17B, contributed to such an increase. However, from 1995 to 1997 the genuine saving dropped considerably. The fact that both net and the gross savings increased during that period should cause some concerns.

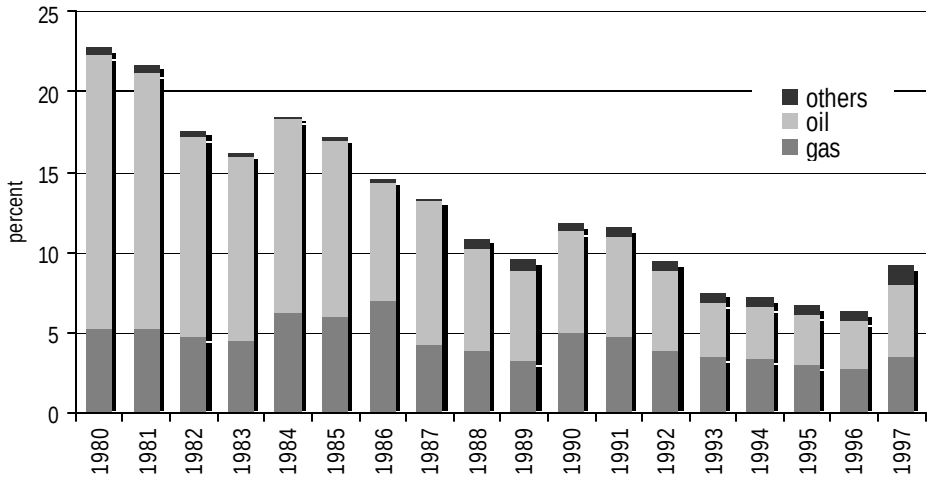
Figure 17A
Indonesian Genuine Saving 1980 - 1997
(percent of GNP)



Source: Alisjahbana and Yusuf (2000B)

Obviously, the fluctuation of environmental costs, including the resource depletion, depends on the type of selected development strategy. From the above description, a shift from import substitution to export oriented strategy in Indonesia throughout 1980s and 1990s produced a fairly favorable trend from the resource depletion perspective. Placing more emphasis on less resource-intensive exports and raising the productivity of resource-oriented export industries would be the logical policy direction for the future.

Figure 17.B
Resources rents 1980 - 1997
(percent of GNP)



One needs to be aware that the above measure covers only a small number of environmental resources. Furthermore, two other things cause some concerns: (1) the absolute increase of environmental costs from 1990 to 1995 remains high. In real terms, it reaches roughly 35%.

Some environmental resources are more output enhancing than others, yet the country's endowment differs in abundance of different resources. Unless resource distributional issues are already accounted for in such a high absolute increase of environmental costs, there is always the risk of making output growth unsustainable; (2) Investment is ultimately the key variable. High genuine saving does not necessarily imply good quality development, since the quality of investment depends upon other incentives.

Notwithstanding these limitations, to the extent that it implies a critical role of (resource) productivity, using the concept of ENDP and genuine saving provides an important avenue for our subsequent task of generating scenarios of long-term economic projection. It is absolutely critical to account for environmental costs and resource depletion if we wish to simulate realistic long-term growth trajectories under different sets of assumptions about the country's natural resource-related production capacity.

VII. Long Run Projection

Looking ahead, given the difficult time and uncertainties Indonesia is currently facing, we feel that it is absolutely necessary to specify what would be the general policy setting in the next 20 years or so. In our study, we select the following trends for our baseline

assumptions: (1) greater regional (sub-national) autonomy will be in place; (2) international free trade regime is to be continued and even strengthened; (3) egalitarian policies with greater democracy and participation, and (4) pro agriculture and small-scale industry type of strategy will receive a greater emphasis.[33] These, along with the natural resource potential of the country, are used as the baseline assumptions. In addition to these, we also run alternative scenarios with respect to policies that are more (less) environmentally sound, implying greater (smaller) productivity growth in a number of strategic sectors.

Before presenting the projection scenarios, we will first outline what we believe to be the most reasonable long-run trend of population.

A. Population Size and Distribution

Based on the 1990 Census data (adjusted to mid-year), and using certain assumptions on fertility, mortality, population in Indonesia is estimated to reach close to 260 million in 2020. More precisely, the following is the forecast (in thousands): 178385 (1990), 192803 (1995), 207326 (2000), 221692 (2005), 235289 (2010), 247359 (2015), and 257675 (2020). This is the baseline assumption without considering net international migration (Gardiner, 2000).[34]

Such a projection implies substantial declines in the rate of population growth over the period, but still a substantial increase in the total population, by around 80 million from 1990 and 50 million from 2000. The most important and basic questions are: where will they be, what will they be doing, and how will these increments affect pressures on resources and the environment?

Obviously, pressures will be there, particularly as it is fairly safe to predict that most of the increment will accrue to urban areas, except during the transitional period of crisis discussed earlier.

With no net interregional migration (e.g. growth differences are based solely on regional differences in natural increase - fertility and mortality) the projection produces a population in Inner Indonesia of around 149 million in 2000 (up from 110 million in 1990) and 108 million in Outer Indonesia (up from 69 million in 1990). This is likely a maximum for Inner Indonesia (and a minimum for Outer Indonesia) since net migration has, and continues to favor the Outer Islands. Adding in trend migration assumptions, the

[33] On regional autonomy, the Law No. 25 (stipulating that district, rather than province, is the ultimate target of autonomy) and Law No. 22/1999 (about taxes and central-regional financial relations) seem to represent a turning point in the Indonesia's regional development system. The spirit of the two laws is to provide greater autonomy and discretion (e.g., on the use of revenues) to the regions, although the implementation may have to be gradual. Despite all the difficulties in enforcing them, the two laws reflect the upcoming political and social environment, i.e., greater transparency in a more democratic system. Whether or not the eventual outcome would be close to federalism, it is clear that a highly centralized system like the one adopted during the last 30 years is a thing of a past.

[34] Actually, during the 1990s there has been a significant net outflow, possibly as much as 1 million given known and suspected increases in the numbers of legal and illegal overseas migrants.

population in Inner Indonesia will reach close to 242 million and in Outer Indonesia close to 116 million in 2020.[35]

It would be extremely difficult to justify past migration trends and that the future, particularly after 2000, would see reduced net out-migration from Inner Indonesia in order to balance labor supply and demand. On this basis, the "trend" migration assumptions above are likely to represent a minimum for Inner Indonesia and a maximum for Outer Indonesia. Thus, in line with our overall growth scenario, we may be looking at a population of around 145 million in the already densely populated heartland of Indonesia in 2020, with the remainder (112-113 million) elsewhere.

145 million people on Java/Bali is staggering, particularly since it is almost certain that all of the increment (35 million) plus some of the rural (1990) base population will be reflected in urban growth. The rural population in Java/Bali in 2020 will be considerably smaller than it is today. In short, how to deal with an urbanized population almost certainly more than double its 1990 base (39 million) will be one of the most important questions in taking about environmental degradation and sustainable development in this part of Indonesia. Obviously, with such a trend it will require considerable political will and investment in infrastructure and pollution control that, unfortunately, is not indicated in current postures of government, business or the society.[36]

From a point of view of population pressure, the projected growth in Outer Indonesia is less worrisome. However, the overall increment - perhaps on the order of 43-45 million persons - will have to place somewhere. Much (probably most) of this growth as in Inner Indonesia will probably accrue to urban areas, so that pressure on the urban environment is also an issue here. Pressure in rural areas will depend in large part on policies reflecting land use and how various forms of land use can accommodate available labor. It is, however, our view that population limits have already been or are soon to be reached in much of Outer Indonesia if we want to both define a sustainable economic condition for rural (agricultural) households, and meet development and environmental objectives regarding land use for major export (timber and estate) crops and in meeting needs for maintaining at least some
biodiversity.

It is also predicted that urbanization will continue at a fairly rapid pace of the foreseeable future, with estimated urban population of slightly over 80 million in 2000 and close to 140 million in 2020. This would mean that the share of urban population in Indonesia would increase from 32 percent in 1990 to somewhere close to 55 percent in 2020, passing the halfway point (50 percent urban) somewhere around 2015. It would also mean that rural population in 2020 nationally would be less, in absolute terms (by

[35] Migration will depend on regional economic prospects (e.g. changes in labor demand), but it will also depend on demographic change reflected in regional differences in growth in labor supply, particularly the working age population. This, due to past differences in the timing and pace of fertility decline, will be slower in Inner than in Outer Indonesia.

[36] Big cities are not inherently bad from a social or economic perspective. They can, however, easily be made bad if appropriate investments are not made.

perhaps 5+ million) than it was in 1990. As noted earlier, Inner Indonesia would account for all of any rural population decline. There may be potential for some rural growth in Outer Indonesia over the period, although, along the lines of the scenario presented here, even this would be quite small.

B. Future Scenarios and Strategies

To help Indonesian policy makers better anticipate the long-term consequences of alternative policies, this research undertook detailed scenario analysis with a prototype empirical simulation model. The modeling methodology is described in an accompanying document (see Azis & Roland-Holst, 2000). In this section, we only summarize the main conclusions of our initial research into sustainable development strategies for the country over the next two decades. The types of policies we focus on in this research have three salient characteristics in common:

- We examine policies that will arise from the regionalization (autonomy) of administrative authority that is now under way in Indonesia and expected to continue.
- We assume that Indonesia's domestic economic growth will continue to be leveraged with greater participation in the international economy, and that international market forces will exert an ever more pervasive and transparent influence on domestic resource allocation.
- We give special attention to the detailed incidence of development policies, to issues of income distribution and equity, and to policies that are intended to promote fuller participation of the entire population in the market economy. We are particularly interested in policies that broaden the basis of development, promoting smaller enterprises and opportunities for low-income households.

In doing so, we evaluate a wide variety of policy scenarios in terms of their effects on economic aggregates, the detailed structure of the economy, and the livelihoods of Indonesians generally.

Our results indicate that the scope of policy intervention is considerable, but that long-term outcomes of short-term growth priorities can vary widely. Moreover, the *indirect, general equilibrium effects* of policies are often more important in the long run than direct instruments and targets. For this reason, policy makers relying on intuition and rules of thumb alone are unlikely to fully anticipate the consequences of their actions. The main findings fall into four categories.

B1. Resource Depletion

Resource depletion and degradation are already serious policy challenges for Indonesia, but it does not seem that their long-term consequences are being fully anticipated. If productivity in the agricultural and primary sectors declines even at moderate rates over

the next twenty years, aggregate GDP growth will be retarded by as much as 30% (Exp 3.5 in Figure 18).[37]

By far, the most important area for resource sustainability and renewal is the Food sector, where annual productivity growth of 3% can double food output and contribute more than 10% to annual GDP growth within 20 years (Exp 3.2).

The overall results in Table 20 summarize the macroeconomic adjustments to resource depletion. Generally speaking, private final demand falls with real GDP, the government expenditure being held artificially high by assumption. Trade is heavily impacted in all the depletion scenarios, directly reducing export capacity and thereby import purchasing power.

Figure 18. Real GDP Trends with Respect to Business as Usual (percent) Under Different Scenarios of Resource Depletion

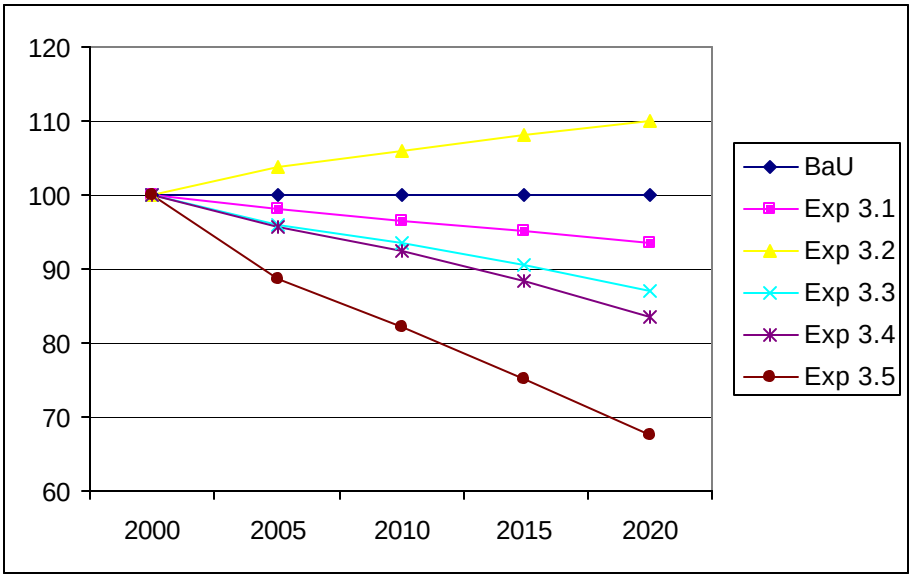


Table 20. Real Macroeconomic Aggregates (percent change by 2020 with respect to Business as Usual, i.e. 5%/yr GDP growth) Under Resource Depletion Scenarios

	GDP	*Consumption*	*Investment*	*Gov Exp*	*Exports*	*Imports*
Exp 3.1	-6.46	-12.05	-2.68	2.42	-5.60	-2.37
Exp 3.2	10.12	15.34	3.89	-1.11	5.60	3.35
Exp 3.3	-13.02	-19.83	-6.08	3.90	-20.34	-8.03
Exp 3.4	-16.42	-14.23	-27.94	-8.39	-23.11	-19.37
Exp 3.5	-32.33	-39.08	-33.79	-3.38	-43.26	-27.72

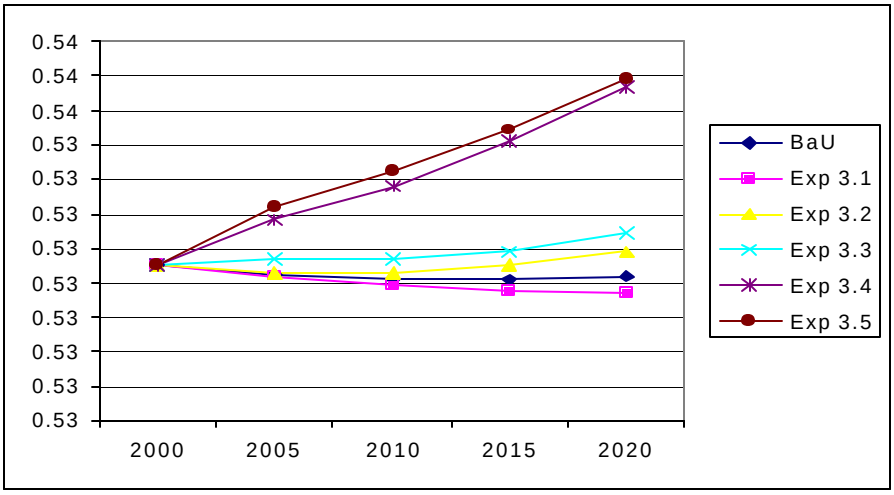
[37] For the definition of each experiment and the detailed model specification, see Azis & Roland-Holst (2000).

What is the distributional impact of resource depletion scenarios? This is a critical question since we know that income distribution can be a critical factor in sustainable development for at least two reasons. First, a viable consumer society is essential for Indonesia to make the transition to a modern, diversified economy, and this is possible only with the emergence of a prominent middle class that provides both diversified consumption and sustained savings resources. Second, chronic inequality undermines the stability of policy institutions and therefore the sustainability of policy itself.

In this regard, our results indicate that indirect measures, targeted to general economic growth and facilitation of market forces, are more effective in the long run than targeted incomes policies. Such policies include investments in infrastructure and education, particularly at the regional level. These may be less politically expedient than transfer payments or fiscal favoritism, but they are the only way to achieve sustainable reductions in inequality.

An interesting scenario relates the issue of resource depletion and welfare (income) distribution. It is revealed from the simulation that resource depletion in the Mining sector (Exp 3.4 in Figure 22) is most aggravating from the income inequality perspective.[38]

Figure 22. GINI Coefficients for Resource Depletion Scenarios



[38] GINIs are measured in absolute units, not as a percent of the baseline value. This is not because of direct income effects, since this sector is relatively capital intensive, but because of the importance of energy prices in household purchasing power.

B2. Foreign Investment

Foreign direct investment can play an essential role in the Indonesian growth, not only in the short run, but also as an integral part of sustainable development strategy. Our results indicate that the targeting of this investment is quite important to its long-term impact, however.

The most significant gains for the overall economy, per dollar of invested foreign exchange, will arise from investments in infrastructure and tertiary activities that confer externalities on the wider economy (Exp 4.6, Figure 19). This should be contrasted, in particular, with historical patterns of foreign investment in enclave, resource-intensive activities. Moreover, investment that confers growth externalities, such as technology transfer and diffusion, is essential to offset the macro costs of rising foreign obligations, both in terms of debt load and real exchange rate appreciation.

Figure 19. Real GDP Trends under Different Foreign Investment Regimes

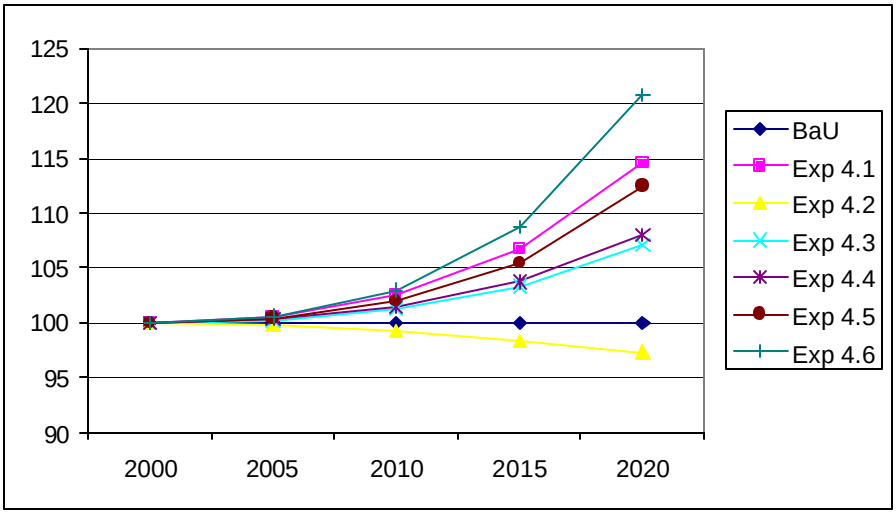


Table 21 summarizes the induced macroeconomic adjustments. The main features here are: real GDP growth induced by increased foreign investment, revenue-driven government expenditure increases, and mixed trade results. The latter are driven by real exchange rate adjustments, which operate from the foreign capital inflows and increased export capacity (appreciation) and greater import dependence (depreciation), particularly for investment goods. Mainly, we see export neutrality and a surge in imports resulting from real exchange rate appreciation.

Table 21. Real Macroeconomic Aggregates (percent change by 2020 with respect to Business as Usual) Under FDI Scenarios

	GDP	*Consumption*	*Investment*	*Gov Exp*	*Exports*	*Imports*
Exp 4.1	14.51	14.22	67.55	10.67	-0.09	41.14
Exp 4.2	-2.68	-2.43	-8.37	-1.36	-1.18	-5.37
Exp 4.3	7.06	6.71	31.30	5.05	0.35	19.55
Exp 4.4	7.98	7.86	36.94	6.27	-1.39	21.18
Exp 4.5	12.43	12.73	64.29	11.07	-4.47	35.51
Exp 4.6	20.68	20.57	104.15	15.36	0.98	66.99

Because foreign capital inflows represent macroeconomic saving, their effect on real GDP is in some sense proportional to the total inflow. This can be seen in the targeted sector scenarios (Exps 4.3-4.6), where the size of the targeted groups initial investment determines the ultimate stock of foreign investment in these scenarios. Because they are growing faster than in scenario 4.1 and given the size of the Tertiary sector, investments in scenario 4.6 actually overtake those in scenario 4.1, as can be seen in Figure 19.

B3. Government Expenditure

In the first simulation of government expenditure (Exp 5.1) we assume that the government shifts its total current account expenditure from its own direct services (Public Administration) to Social Services, in increments of 1 percent per year. By 2020, fully 20 percent of current expenditures are of this form. As in all the fiscal experiments in this section, we assume this expenditure shifting is neutral in the aggregate, i.e. total government expenditures are growing at the same rate as in the Business as Usual scenario. The next experiment (Exp 5.2) moves to government capital spending. Here we assume that the target sectors for expansion under a regional agenda are Trade, Social Services, and Transport. In particular, we assume the government re-allocates its capital spending so that, each year, Transport and Social Service investment grow at twice the rate of GDP, while the smaller share of investment in the Trade sector grows at four times the rate of GDP growth.[39]

The third scenario (Exp 5.3) assumes that the necessary investments have already been made to achieve equal market access in these sectors, i.e. that margins are equalized for domestic and imported goods in the Food and Textile sectors by lower the former. The last public budget scenario (Exp 5.4) examines one potential remedy for this imbalance in social support. We assume the government equalizes income-adjusted transfers for all

[39] These scenarios give an indication of the direct effects of public spending, but in a sustainable development context, indirect effects are often more important. For example, investments in transport infrastructure will ultimately only yield temporary Keynesian stimulus unless they translate into lower trade and transport margins for private sector commerce. This kind of indirect effect is essential to animating market forces, particularly in rural areas where farmers and traders face significant access barriers. Such forces can be initiated by the right public expenditure policies but ultimately they can perpetuate themselves.

low-income households at the level already enjoyed by Agriculture Employees. The beneficiaries in this case are Agricultural Employees, Agricultural Smallholders, Non-agricultural Low Income, and Urban Low Income households. To maintain budget neutrality, transfers to other households are reduced proportionally.

Table 22. Real Macroeconomic Aggregates (percent change by 2020 with respect to Business as Usual) Under Different Scenarios of Government Spending

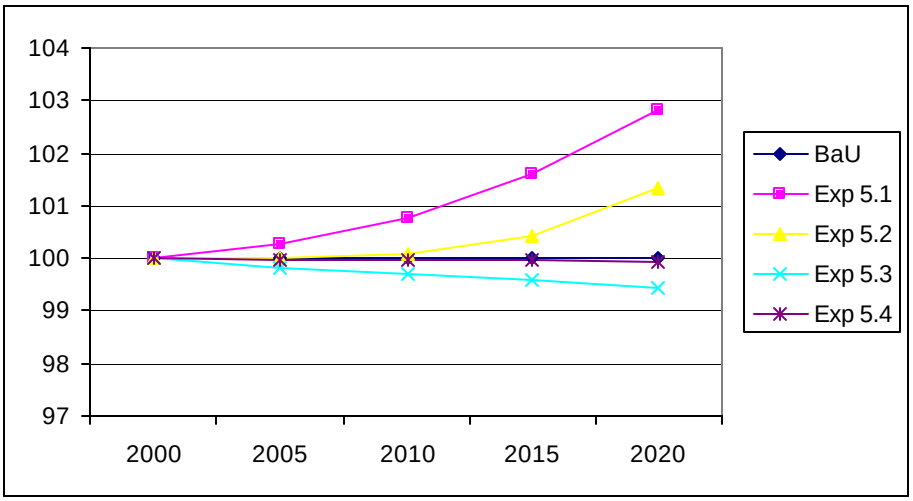
	GDP	*Consumption*	*Investment*	*Gov Exp*	*Exports*	*Imports*
Exp 5.1	2.81	1.25	4.48	-17.61	6.76	1.61
Exp 5.2	1.34	1.38	6.77	1.13	-0.41	4.14
Exp 5.3	-0.57	0.12	-0.67	-0.11	0.63	0.10
Exp 5.4	-0.06	0.02	-0.08	0.01	-0.13	-0.01

In terms of the macroeconomic aggregates, these different policy scenarios are of limited impact (see Table 22). Generally, they represent compositional shifts in existing public commitments, and for this reason their aggregate stimulatory effects are limited. Trade effects are also very negligible over a twenty-year time horizon. While the political expedience of expenditure shifting might be clear to policy makers, it is difficult to argue for it on the grounds of economic efficiency or long-term productivity effects.

Real GDP results for these four scenarios are given in Figure 20. Generally speaking, a reconstitution of government current expenditure is the most stimulatory, shifting demand to more a more low income labor intensive sector that has stronger income and intermediate linkages to the rest of the economy. Next comes shifting capital expenditures to sectors with stronger regional orientation. This has effects similar to the first scenario, but domestic stimulus is more subdued because of the capital good component of investment demand.

Hence, from the above analysis it is clear that government spending is best targeted to maximize indirect economic benefits and externalities for the private sector, emphasizing infrastructure and policies that facilitate commerce. These can be seen as macro commercial policies that benefit the private sector with relative impartiality, and should be contrasted with micro commercial policy, with detailed remedies for specific interests. Particularly important are policies with a regional emphasis that facilitate more decentralized commercial opportunities for the lower income rural population. The latter do not appear to play a major role in sustained economic expansion and should not consume too many public resources.

Figure 20. Real GDP Under Different Government Expenditure Scenarios



It is also apparent from our analysis that government transfer payments are at best a social insurance mechanism for alleviating temporary hardship. These fiscal instruments can do little to change the fundamentals of income distribution in the economy and to make such a change more, a result better achieved by commercial and education/training oriented policies.

B4. Demographic Trends

Many countries have experienced large migrations from rural to urban life, but those that have industrialized successfully during this time have also enjoyed steadily rising labor productivity. In the interest of a sustainable future, Indonesia should work to stabilize its rural population while greater investment in education and training are made to realize the vast potential of this labor force.

Table 23. Real Macroeconomic Aggregates (percent change by 2020 with respect to Business as Usual) Under Demographic Scenarios

	GDP	*Consumption*	*Investment*	*Gov Exp*	*Exports*	*Imports*
Exp 6.1	5.33	-0.67	6.57	0.69	10.40	8.27
Exp 6.2	9.52	6.36	8.52	-0.30	13.99	10.09
Exp 6.3	-14.71	-12.81	-10.31	13.19	-15.86	-10.02
Exp 6.4	59.26	41.61	44.88	-12.49	78.49	51.74

Figure 21. Real GDP Trends Under Different Demographic Scenarios

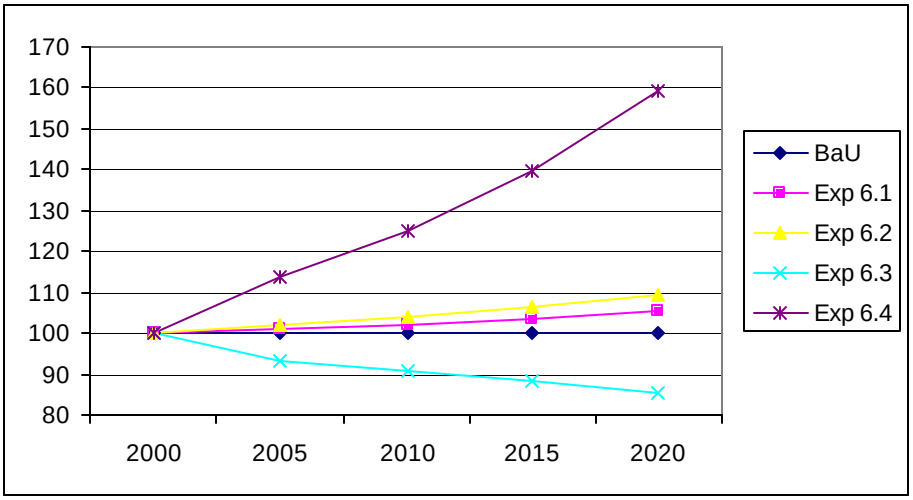


Table 23 summarizes the macroeconomic impacts of four demographic scenarios (see Azis & Roland-Holst, 2000 for the definition of each scenario). It is clear from the table that the most dramatic scenario is Exp 6.4. This scenario is intended to capture the benefits of a more effective education/training policy for sustainable development. While the government has a long commitment to education, it is not unfair to say that the educational potential of the Indonesian population is still far from being fulfilled. This of course translates into forgone opportunity for everyone in the economy, and the sustainable living standard of the population as a whole will ultimately depend on higher productivity of its average citizen.

For illustrative purposes, in Exp 6.4 we examine the implications of a more human-capital oriented approach to growth policy by increasing labor productivity by 3 percent annually in all urban occupational categories. As depicted in Table 23, such a scenario yields almost 60% higher real GDP by 2020. The domestic and foreign demand will also increase significantly.

Other scenarios are positive or negative as intuition would dictate, but clearly the issue of human resources and sustainable development is an essential one for Indonesia (see Exp 6.4 in Figure 21).

From the above set of simulations, a general policy conclusion can be derived as follows. Policies with the greatest benefit in terms of sustainability are those with the most widely dispersed economic benefits. The current tendency of greater regional *autonomy* could be favorable for the long-run development, primarily because it could raise participation and, in turn, reduce dependency of many productive activities on government programs. Furthermore, policies that not only reduce resource exploitation, but also invest in resources and increase their *productivity (technology)*, are essential to sustaining the Indonesian economic transition from a low income primary exporter to a mature and

diversified economy (industry & services). The resulting social conditions (e.g., *income disparity)* of such policies would be also favorable.

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