1. Introductory Remarks

1.1 Background

Natural rubber is one of the major non-petroleum export commodities for Indonesia. Despite its declining contribution to the total non-oil export value, natural rubber exports still have an important role as a source of foreign exchange earnings. In 1978, export earnings from natural rubber were US$ 718 million while in 1992 the export value reached US$ 1039 million (DGEC 1994; CBSI various issues).

Indonesian rubber is predominantly produced by small-scale farmers with an average holding of 2 hectares of rubber trees. In 1992, 73 per cent of the rubber production came from these smallholdings while the remainder was produced by the estates, both private and government owned. The smallholders have achieved yields between 290 kg and 370 kg per hectare, whereas the estates have achieved yields between 900 kg and 1090 kg per hectare (Mubyarto and Dewanta 1991; DGEC 1994).

Natural rubber is also an important source of income for more than 13 million people who work as rubber producers, processors and traders (CBSI 1993). The Indonesian government has encouraged the development of this commodity in each of the previous five-year development plans. One aspect of the policy was the implementation of the Nucleus Estates Smallholder System (NESS) in 1977. Under this program, the large estates, the nucleus, are expected to act as development agents to the surrounding small-scale farmers. The development includes: (1) transfer of better technology from the nucleus estates to the surrounding farmers; (2) provision of processing facilities by the nucleus estates for the smallholding producers; and (3) provision of marketing facilities and outlets to the small-scale farmers (Baharsyah and Hadiwigeno in Mubyarto 1982; Mubyarto and Dewanta 1991).

The area of rubber planted and the quantity of both rubber production and exports have increased progressively since the government intervention in natural rubber (Mubyarto and Dewanta 1991). In 1978, total production was 884 982 tonnes, while it amounted to 1 371 787 tonnes in 1992, an average increase of 3.93 per cent per year. Natural rubber exports have also expanded from 865 960 tonnes to

consumers of natural rubber, has influenced the domestic price, such as in 1980-82 (Barlow *et al.* 1994; see Figure 1.3).

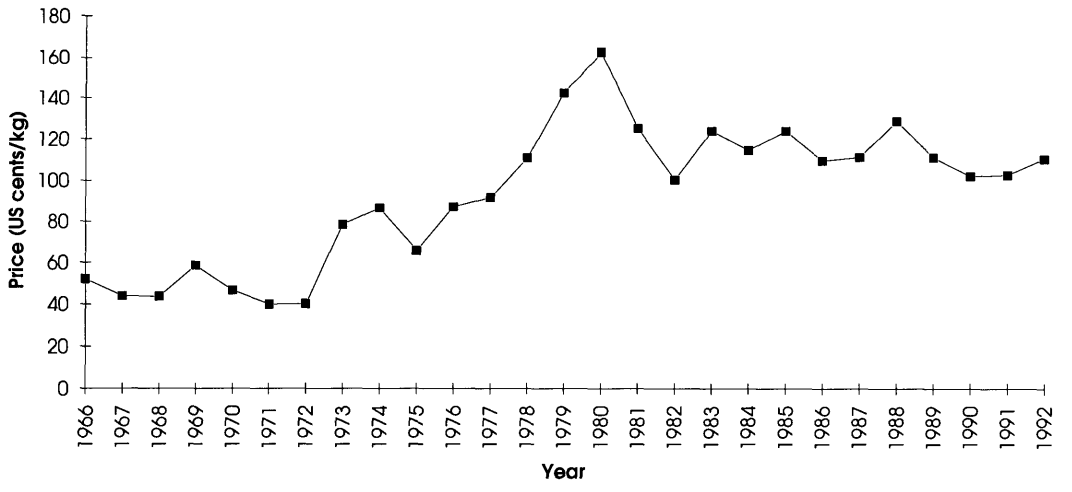
Table 1.1: The instability index of Indonesian natural rubber, 1966-1992

Variable	Index		Increase/ Decrease (%)
	1966-1977	1978-1992	
Production[a]	3.20	4.11	28.44(↑)
Quantity traded[b]	7.31	5.00	31.60(↓)
Quantity exported[c]	7.32	6.35	13.25(↓)
Domestic price[d]	22.12	18.09	18.22(↓)
Export earnings[e]	19.75	22.10	11.90(↑)

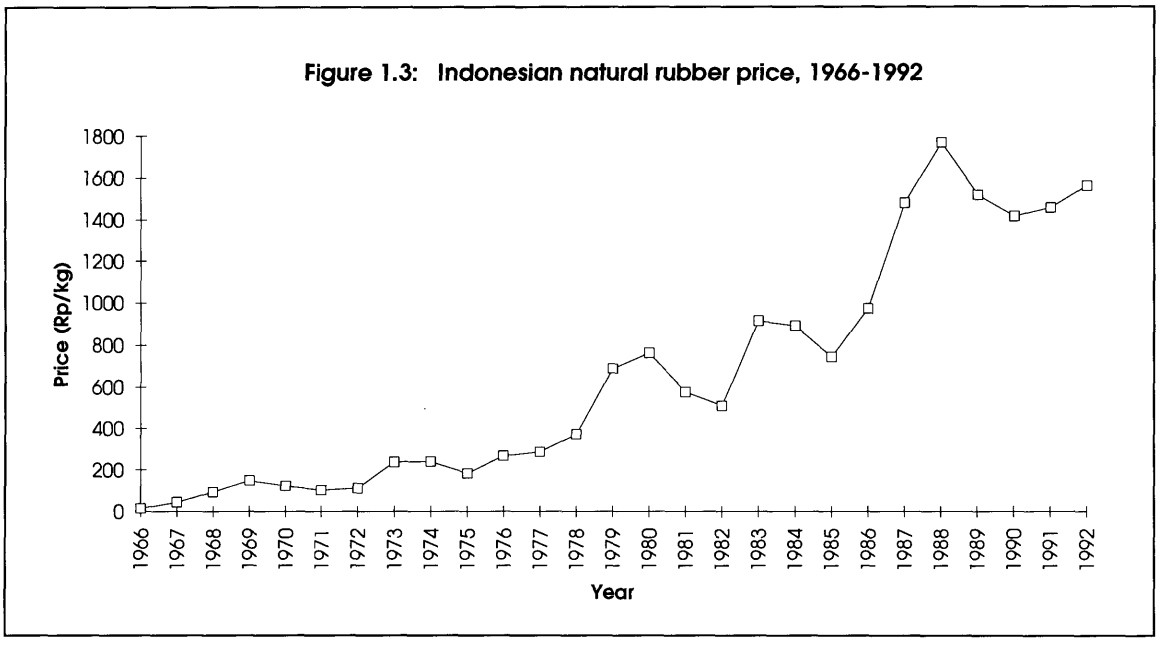
Note: [a] The summation of export demand and domestic consumption.
These index values are calculated by applying the MacBean Index (MBI) which measures deviation from a five-year moving average of observed values (Murray 1978; Athukorala and Huynh 1987). The MBI formulae is presented in Appendix A1.

Source: [a]DGEC 1994
[b]EIU various issues; CBSI various issues
[c]IRSG various issues
[d]CBSI various issues
[e]DGEC 1994

Figure 1.2: World natural rubber price, 1966-1992



Source: CBSI, various issues



Source: CBSI, various issues

According to Grilli *et al.* (1980), natural rubber in the international market is sold under conditions approaching perfect competition. Changes in the balance of supply and demand affect the market price of natural rubber. In addition, natural rubber is quite insensitive to price changes in the short term, but is more responsive to changes in economic activity. Natural rubber supply is also very unresponsive to price movements in the short term.

Athukorala and Huynh (1987) pointed out that the degree of price elasticity of demand and supply of a given commodity determines the instability of its price and revenue. They noted that the more inelastic the demand and supply curves and the more frequent their periodic shift, the higher the degree of instability. These are the conditions in the natural rubber market.

The problem of natural rubber market instability became more complicated by the dynamic growth of the synthetic rubber industry. The existence of this type of rubber in the world elastomer market, to a large extent, has affected the demand for natural rubber. In its oligopolistic market, synthetic rubber prices are very stable in the short-run. This price stability has been an additional factor that has helped this rubber to penetrate the world elastomer market (Grilli *et al.* 1980; Tan 1984; Mubyarto and Dewanta 1991).

Widely fluctuating prices can lead to be inefficient use of resources, both in production and processing. This would happen to be the case if producers are induced to expand production when prices are high and then are forced to liquidate assets when prices fall to unprofitable levels (Tomek and Robinson 1990).

Fluctuations of world prices can be crucial for producing countries, particularly to countries heavily dependent on commodity exports for foreign export earnings. Hence, the effect would be passed on the domestic economy. Athukorala and Huynh (1987) indicated that the impact of export instability on the domestic economy can be viewed as two main linkages. The first linkage is that the balance of payment position may be influenced by the existence of export instability. Fluctuations in export earnings will have significant repercussions on the stability of developmental imports. The second effect is that government revenue tends to fluctuate with the level of exports. Moreover, export fluctuations, through their effect on domestic income, will bring about fluctuations in the level of domestic savings. A given degree of income instability generated by export revenue variations could lead to a higher degree of instability in domestic savings.

Considering the facts above, it is important to analyse the sources of Indonesian natural rubber price instability as a part of commodity market variability, especially in conjunction with the relative contribution of supply and demand side forces. Thus, price instability can be decomposed into supply, demand, and interaction components. According to Piggott (1981) the importance of undertaking a decomposition analysis of the causes of price instability is its ability to provide the relative contribution of supply and demand sides to instability. Knowledge of the sources of price instability is required for policies to be developed to counter the effects of instability.

1.3 Research Objectives and Hypotheses

This study aims to identify the sources of Indonesian natural rubber price instability over the period of 1966 to 1992. The specific objectives of this study are

- to determine the relative importance of supply variability and demand variability to the Indonesian natural rubber price fluctuations; and
- to derive policy implications for the Indonesian natural rubber industry to overcome the effects of trade instability.

In order to achieve the research objectives, the following null hypotheses will be adopted to guide this study:

- Supply variability and demand variability are of equal importance in affecting price instability;
- Government policy is no more important than other supply shifters in influencing shifts in the supply of natural rubber; and
- Exchange rate policy is no more important than other demand shifters in causing shifts for natural rubber export demand.

The rationale underlying the first hypothesis is that supply and demand variabilities are considered to be the main factors contributing to price instability. Tomek and Robinson (1990) pointed out that annual production fluctuation is attributable to price variation from year to year. On the other hand, demand may also change as a result of fluctuations in export demand, income, as well as variations in prices of substitutes.

The second hypothesis is included owing to the involvement of government in natural rubber development. Barlow *et al.* (1994) indicated that government-financed expansion of natural rubber planted area has been a vital long-run factor acting to enlarge its supply.

Finally, the third hypothesis is formulated following the considerations of the argument advanced by Islam (1990) that exchange rate movement could be an important variable in expanding foreign markets.

1.4 Outline of the Dissertation

This study is organised into six chapters. In the next chapter, the world natural rubber market is described. Included is an overview of the development of Indonesian natural rubber. In Chapter 3, the causes and impacts of price instability are the main attention. Some previous studies on price instability and efforts to reduce its impact are presented in this chapter. In Chapter 4, research methods and model specification for this study are the main focuses of presentation. Then in Chapter 5, the estimation results and the decomposition of the variance of natural rubber prices, as well as the validity of the hypotheses are discussed. Finally, a summary and policy implications of this study are provided in Chapter 6, along with suggestions for further research.

2. World Natural Rubber Situation

2.1 Introduction

In this chapter, an overview of natural rubber development is presented. The aim is to describe the world natural rubber market, as well as to analyse the nature of an individual producer, Indonesia. A review of the world natural rubber industry is first presented and then the Indonesian natural rubber industry is discussed. Production, exports, demand, and international marketing are the main focuses of discussion in the world natural rubber situation. Also included is a discussion of synthetic rubber which is a competitor to natural rubber. In the discussion of the Indonesian natural rubber industry, government intervention in facilitating production and export expansion is reviewed. Domestic use of natural rubber is presented briefly and finally, price fluctuations of Indonesian natural rubber are outlined in conjunction with world natural rubber price variations. All information presented is aimed to improve understanding of the source of trade instability in natural rubber market.

2.2 World Natural Rubber Industry

Natural rubber production is based upon the extraction of latex from the tree *Hevea brasiliensis* which generally takes a period of 5 - 6 years from planting to the commencement of tapping. This tree originated from the Amazon jungle habitat and was spread to East Asia in the mid 1870s by the initiative of the British Colonial Office (Drabble 1991). The main use of natural rubber is for tyres, and then latex products, footwear, belts, hoses, and wire cables are the other important uses of natural rubber (Grilli *et al.* 1980).

Grilli *et al.* (1980) pointed out that important changes within the world natural rubber economy took place throughout the 1800s until the mid 1900s. Plantations in East Asia led to vast improvements in productivity due to technological innovations in production practices. The rapid growth of the natural rubber industry was also accelerated by the use of motor vehicles in the United States, Western Europe, and Japan.

The rapid expansion of motor vehicles used in Western Europe and Japan, as well as other countries, in the 1950s and 1960s, created a growing demand for elastomer. Unfortunately, natural rubber was unable to fill this growing demand. Barlow *et al.* (1994) noted that demand for elastomer increased an average of more than seven per cent per year between 1960 and 1990, while natural rubber production grew at an average of five per cent per year in the same period. This gap in demand was filled by the synthetic rubber industry. The world synthetic rubber industry continued to grow at a rapid rate, about nine per cent a year between 1960 and the early 1990s.

The major difference between synthetic and natural rubbers is in their modes of production. Synthetic rubber is produced under a capital-intensive investment which requires large amounts of chemical and is processed with great economies of scale. On the other hand, natural rubber is labour-intensive and entails considerable use of land. In addition, natural rubber is mostly grown on small farms where economies of scale in production is not clearly marked (Barlow *et al.* 1994)

Over the past three decades, the world rubber economy has included these two types of elastomer, natural and synthetic rubbers. Their relative importance has changed drastically since the sharp increase in oil prices in 1973. The effect of the oil crisis has led to changes in synthetic rubber production costs, making them much higher than that of natural rubber. This condition has improved the share of natural rubber in the world elastomer market (Grilli *et al.* 1980). Although this share has shown an increasing trend during the period 1979 to 1992, it only accounts for less than 40 per cent of total world elastomer use. Accordingly, synthetic rubber consumption is broadly spread across the world (Barlow *et al.* 1994).

2.2.1 Production

Natural rubber is mainly produced by three Asian countries, Malaysia, Indonesia, and Thailand, constituting about 80 per cent of the total world production. Despite a declining share in the world market, Malaysia is still the largest producer. By the end of 1990 Indonesia was the second largest while Thailand was the third. Changes have occurred since 1991 when Thailand overtook Indonesia's position in the international market. The other two Asian producers, Sri Lanka and India, and two African countries, Liberia and Nigeria, account for another 12 per cent of world output (Grilli *et al.* 1980; UNIDO 1993).

On the other hand, developed countries such as the United States, Western Europe, and Japan, are the major producers of synthetic rubber. Previously the United States dominated production of synthetic rubber, accounting for more than 21 per cent of total world synthetic rubber production in 1990. However, Japan has recently shown a vast increase in synthetic rubber production, amounting to 14.30 per cent of world production in the same year (Grilli *et al.* 1980; Barlow *et al.* 1994).

The spread of modern production practices, as well as continuous research into high-yielding clones, have resulted in rising output of natural rubber. This includes the tapping system and the utilisation of chemical yield stimulation of rubber trees. As a result, world natural rubber production increased at an average rate of 5.28 per cent per year between 1960 and 1992 (Grilli *et al.* 1980; FAO 1990; Barlow *et al.* 1994).

Closer observation indicates that there were not big changes in production during the oil crisis in 1973-74 or during the sharp rise of the crude oil price in 1978-79. This high increase in crude oil prices affected the production cost of synthetic rubber far more than that of natural rubber. World natural rubber production remained steady in those years, reflecting insensitive response to price changes of synthetic rubber. Grilli *et al.* (1980) indicated that natural rubber supply has a low price elasticity in the short term, and this in turn results in wide price fluctuation whenever the flow of supply is reduced temporarily.

2.2.2 Exports

Natural rubber is a typical raw commodity, with about 70 to 80 per cent of the total world production exported. Export trends have paralleled natural rubber production trends. By the end of 1992, total world exports reached 78.96 per cent of the total world production (FAO 1994). Developed countries are the largest importers of natural rubber, including the United States, Western Europe, and Japan. Centrally planned economies are also major importers. Developing countries including China, however, consume only a small proportion of the world natural rubber exports (Grilli *et al.* 1980; FAO various issues).

World natural rubber exports grew at an average of 3.45 per cent a year between 1966 and 1992. Total world exports reached 4 335 000 tonnes in 1992 and at the same time natural rubber accounted for 38 per cent of the total elastomer use.

Among the major producing countries, Thailand has drastically increased its export share in the world natural rubber market. In 1966, it accounted for only nine per cent but it reached 32.70 per cent in 1992, overtaking Indonesia's share in the total world exports which only amounted to 26.90 per cent (FAO various issues).

Natural rubber exports did not change much during the energy crisis and sharp rise of crude oil prices. World natural rubber exports increased slightly, 13.15 per cent, from 1972 to 1973 and less than one per cent from 1977 to 1978 (FAO various issues). The unresponsiveness of natural rubber to the price changes could be explained by the inelastic export supply of this commodity. Some previous studies indicated that the price elasticity of natural rubber exports from major producing countries is almost perfectly inelastic. For instance, export elasticity of natural rubber from Indonesia is 0.061, from Thailand is 0.244, and from Malaysia is 0.027 (Teken 1971; Muslim 1990).

2.2.3 Demand

The world demand for rubber, either natural or synthetic, relies on the utilisation of various types of elastomeric materials in a large number of manufactured products. Therefore, rubber demand is a derived demand. This demand is determined by the level of rubber manufactured, which is subject to economic conditions including industrial development (Grilli *et al.* 1980; Barlow *et al.* 1994).

Owing to the perfect competition evident in the natural rubber market, changes in the balance of supply and demand, as well as uncertainties in major importing countries, affect the market price of natural rubber (Teken 1971; Grilli *et al.* 1980). As can be seen from Figure 1.2, world natural rubber prices vary from year to year. This price reached a peak in 1980, amounting to US$ 1.63/kg, then it levelled off to around US$ 1.20/kg. MacBean (1966) noted that price instability of an exported commodity leads to fluctuations in the export proceeds of the commodity concerned.

In contrast, the price of synthetic rubber is more stable than that of natural rubber, owing to the oligopolistic structure of its market. This price stability has been an advantage for synthetic rubber to affect demand for elastomer in the world market (Teken 1971; Grilli *et al.* 1980). Although synthetic rubber accounts for about 62 per cent of the total elastomer use in 1992, its future use is likely to be much less than in the 1950s and 1960s. Apart from the rising real cost of energy, prices and availability

of chemical feed stocks may pressure the synthetic rubber industry (Grilli *et al.* 1980; EIU 1994).

Demand for natural rubber heavily depends on the development of automotive industries. It also relies on the choice of types of rubber, natural or synthetic. Grilli *et al.* (1980) pointed out that willingness of rubber users to substitute one type of rubber for another will rely on changes in relative market prices. In addition, the largest users of rubber that also have a production ability of synthetic rubber tend to use their own supply. Other users, however, that do not have production capacities are often tied to specific domestic synthetic rubber supply for the sake of saving foreign exchange.

The Economist Intelligence Unit, EIU, (1994) recorded that the total world elastomer use is approaching 15 million tonnes and is expected to increase in the future. Owing to the gradual improvement of natural rubber proportion in the total elastomer use, it is hoped that demand for natural rubber will increase as well. Moreover, with the advancement of vehicle industries in developing countries, as well as an increase in Japanese demand for natural rubber, it is expected that demand for natural rubber is stemming from these countries.

Grilli *et al.* (1980) indicated that the natural rubber industry is in a favourable position to take advantage of the present good market. Natural rubber producers, however, have to meet certain conditions such as keeping the pace of natural rubber supply with the expected growth of synthetic rubber demand through production technologies as well as marketing system improvement. The competitive standing of natural rubber to synthetic rubber can also be improved through the improvement of the grade of natural rubber.

2.2.4 International marketing and price formation

The early natural rubber trading arrangements between producing areas and manufacturing consumers entailed big primary markets in Kuala Lumpur and Singapore and terminal markets in Europe, North America, and Japan. In this structure, natural rubber from varying origins and qualities were processed into different types and grades, and finally consigned to consumers through dealers and brokers. This type of trading was followed mostly by major producers such as Malaysia, Thailand, and Indonesia (Grilli *et al.* 1980; Barlow *et al.* 1994).

Changes in technology and consumer preference, however, have encouraged direct trading between producers and especially tyre-making consumers. Natural rubber direct trading entails long term contracts of up to 18 months. This type of trading has drastically altered much of the previous marketing structure. The rapid growth of rubber-based manufacturers in South-East Asia has also changed the trading pattern, owing to lower transport costs between producers and consumers. Meanwhile, terminal markets for natural rubber still operate but their functions are greatly reduced from their previous dominant roles (Barlow *et al.* 1994).

Barlow *et al.* (1994) also noted that direct trading has higher benefits for producers and consumers. This is because of the gains from better consistency and tailoring to specific needs, and from reduced uncertainties related to long marketing channels and price fluctuations.

Although direct arrangements have been established to reduce price fluctuations, natural rubber prices are characteristically variable because of its low price elasticity of supply. The low price elasticity of demand has also caused natural rubber prices to vary widely in the short-run due to the changes in economic activity in consuming countries (Barlow *et al.* 1994). In addition, government intervention in expanding planted areas together with technological advance through cost-reducing innovations have led to increasing supply. Accordingly, that situation has depressed natural rubber prices (Grilli *et al.* 1980; see Figure 1.2).

To reduce price variations, since 1976 an international agreement has been proposed under the International Natural Rubber Agreement (INRA) through the implementation of buffer stock schemes. The operation of INRA has been funded by participating countries, where the producers and consumers agreed to share equally the responsibilities and benefits under this agreement (Barlow *et al.* 1994).

The main impact that can be assessed under the international agreement is the reduction of wide price fluctuations in the short-run, accordingly lowering income fluctuations of producing countries. The macroeconomic effect of buffer stock stabilisation, however, is judged very small as natural rubber was no longer a major source of foreign exchange earnings for most producing countries (Barlow *et al.* 1994).

Assessing the success of the buffer stock stabilisation scheme relies not only on its past performance but also expectations about future trends. The implementation

of this scheme seems appropriate to attain stable market prices. However, since the reduction in price and income variabilities have been small and the costs of achieving them substantial, a solely economic judgement is hard to gauge (Grilli *et al.* 1980; Barlow *et al* 1994).

2.3 Indonesian Natural Rubber Industry

Development of the Indonesian natural rubber industry was based upon the involvement of colonial governments in the late nineteenth and the early twentieth century. Natural rubber was well-regarded by the colonial government as a creator of favourable commercial opportunities, especially for the benefited estates. This was due to boom years for natural rubber prices in the London market from 1909 to 1912. In addition, the tobacco crisis of the 1880s provided the impetus for renewed economic expansion through investment in natural rubber plantations (Barlow and Drabble in Both *et al.* 1990; Mubyarto and Dewanta 1991).

The planted area of natural rubber increased rapidly following the boom prices. In 1910, the planted area was 110 000 hectares and in the next five years the area cultivated had more than doubled to 264 000 hectares. By 1925, the planted area had risen to 460 000 hectares, an average increase of 10.27 per cent between 1910 and 1925. This rapid expansion was not only due to the estates activities but also because of the actions of smallholdings. A basically simple technology with high expected proceeds influenced smallholders to cultivate natural rubber. Moreover, natural rubber seeds were easily obtainable from the estates (Barlow and Drabble, in Both *et al.* 1990). Unselected rubber seedling materials used by the smallholders, however, has resulted in a far lower quality product than that of the estates (Mubyarto and Dewanta 1991).

In comparing the value of exports, natural rubber has had considerable changes. Export value in 1913 comprised only four per cent of the total exports including petroleum, while in 1925 it accounted for 32 per cent. This value surpassed the petroleum export value and other major export commodities such as sugar, tea, and tobacco (Both *et al.* 1990).

Although natural rubber prices declined following the 1909-1912 boom, planting area continued to rise. The estates expected to extend their revenue through area expansion in order to reduce the average capital cost per hectare and to pay

attractive dividends. At the same time, smallholders viewed natural rubber as a year-round source of income compared to other annual crops. By the end of 1940, 54 per cent of the 1 357 000 hectares planted area was occupied by smallholdings that have average holdings for about 2 hectares (Barlow 1978; Barlow and Drabble in Both *et al.* 1990).

2.3.1 Planted area and production

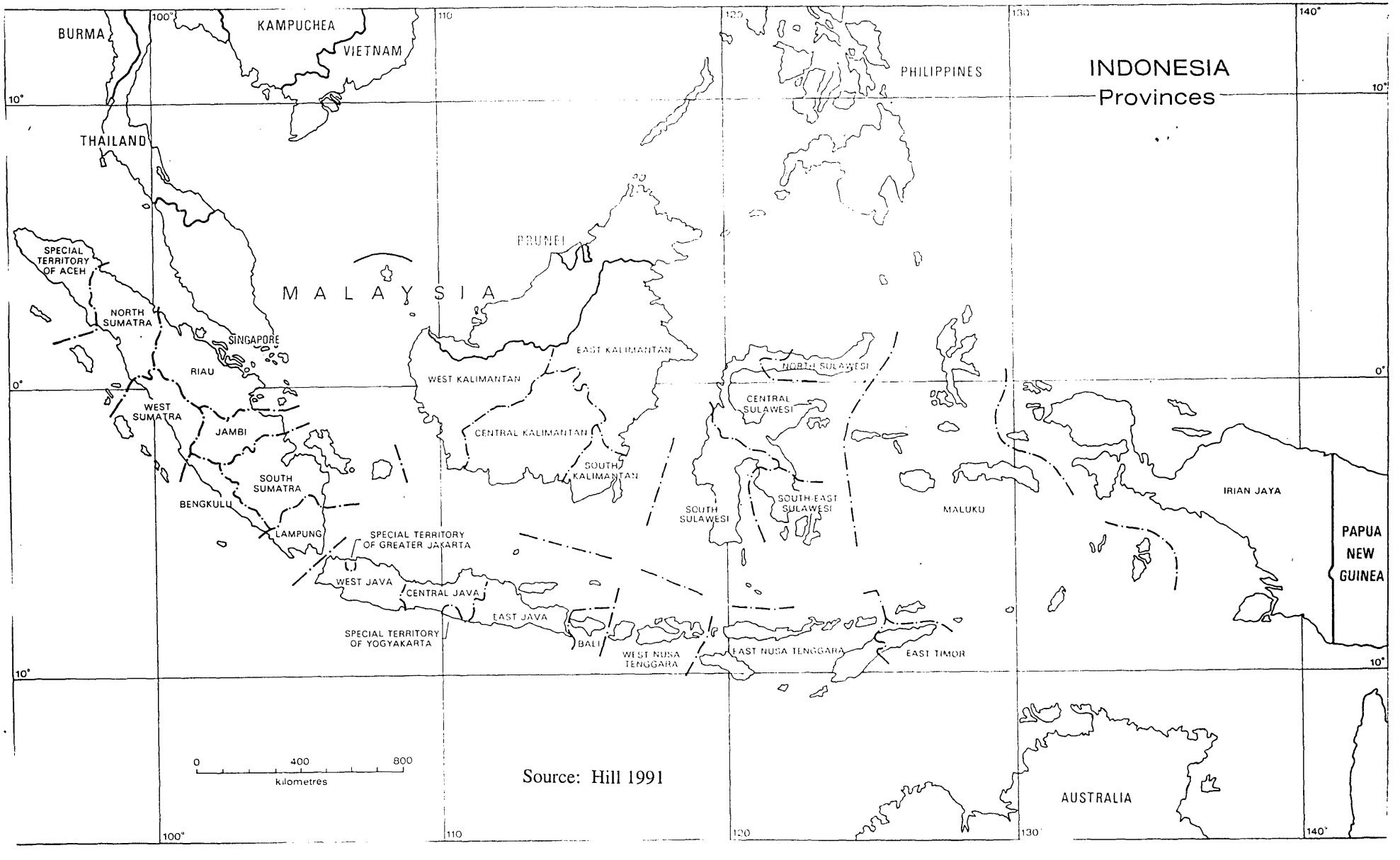
As a source of foreign earnings, development of natural rubber became a major concern of the Indonesian government after its independence in 1945. Government support has been mainly for the smallholders due to the high potential of these producers to contribute to Indonesian natural rubber exports. These smallholders are mainly concentrated in North Sumatra, South Sumatra, and West Kalimantan while the estates, both private and government owned, are found in East Java, West Java, and Central Kalimantan. The geographical regions of Indonesia are illustrated in Figure 2.1.

The government of Indonesia has launched natural rubber development programs since 1969, when the first five-year development plan commenced. Smallholding rubber development was initiated through the Nucleus Estate Smallholder System (NESS) in 1977. Within this program, the estates are expected to improve the condition of the smallholdings by conducting several activities. This includes expansion of planted area and a replanting program to replace old and low producing rubber trees with new high-yielding clonal material. At the same time, marketing procedures of the smallholding rubber to be exported is to be improved (Mubyarto 1982; Mubyarto and Dewanta 1991).

A loan of US$ 1.3 billion from the World Bank, Asian Development Bank, and Commonwealth Development Corporation was awarded to Indonesia to support the NESS program. With this loan, three export commodities were expanded, including natural rubber, palm oil, and coconut. Area development for the estates also resulted from this loan (Mubyarto and Dewanta 1991).

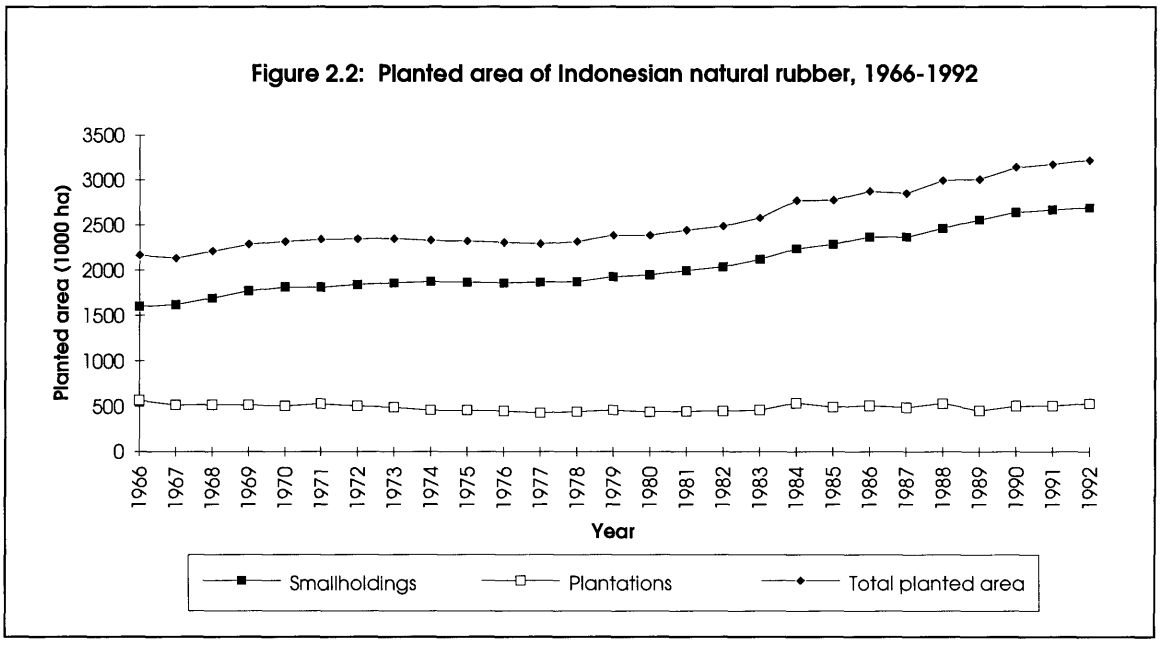
As a result of the NESS and other integrated schemes, an average increase of 2.95 per cent of planted area occurred in the smallholders between 1977 and 1992. In the same period, the estates have expanded by about 1.63 per cent. By the end of

Figure 2.1 Geographical regions of Indonesia



Source: Hill 1991

1992, the rubber planted area totalled 3 220 462 hectares. The trend of rubber planted area from smallholdings and estates is shown in Figure 2.2.

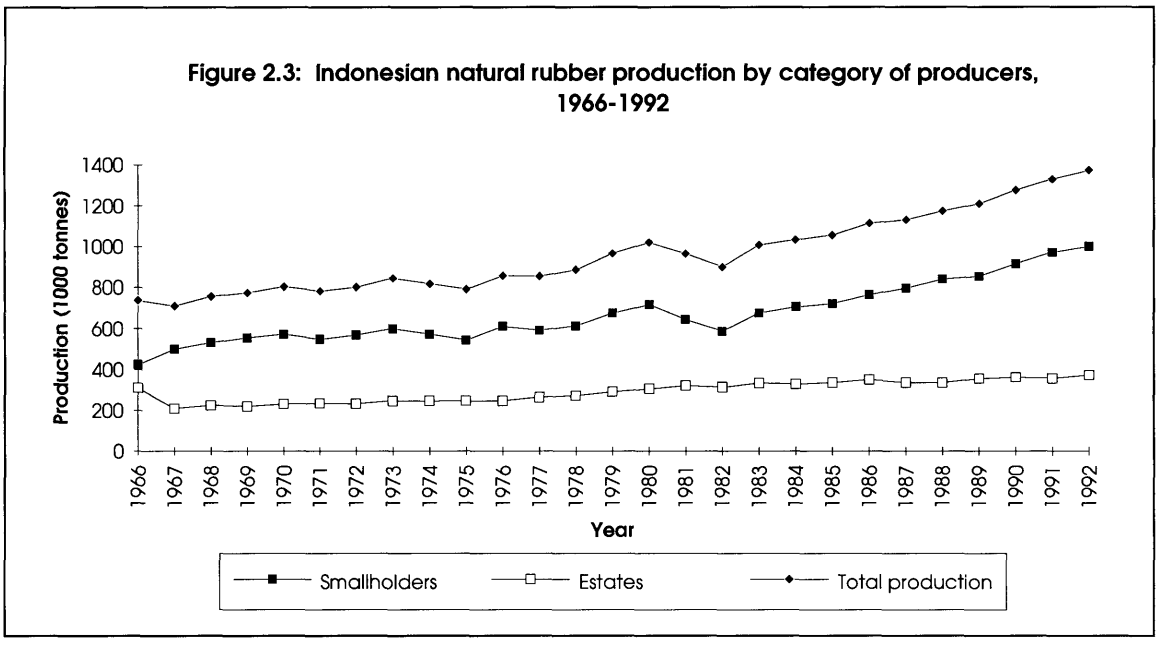


Source: DGEC 1994

In line with planted area expansion, Indonesian natural rubber production has increased gradually. Total production was 736 000 tonnes in 1966 and by the end of 1992 it approached 1 371 787 tonnes. There was a 3.32 per cent annual rise in production during the same period. The trend of this production in selected years is shown in Figure 2.3, as well as in Table 2.1. As can be seen from that table, smallholders are still a major contributor to Indonesian natural rubber production.

Compared to the estates, smallholdings have far lower yields. The smallholding yield, however, has improved from 290 kg per hectare in 1966 to 370 kg per hectare in 1992. The estates on the other hand, have achieved yields between 950 kg and 1090 kg per hectare (Mubyarto and Dewanta 1991; DGEC 1994).

Despite increased production, the share of Indonesian natural rubber in the world market has remained steady. Indonesian natural rubber accounted for 24.31 per cent of total world production in 1978 while it was 24.17 per cent in 1992 (FAO 1981 and 1994). This implies that other competing countries have higher growth of output than of Indonesia (particularly Thailand).



Source: DGEC 1994

Table 2.1: Indonesian natural rubber production in selected years (tonnes)

Year	Producers		Total
	Estates	Smallholdings	
1969	219 607 (28.39)	553 826 (71.61)	773 433
1974	245 432 (30.06)	571 050 (69.94)	816 482
1979	290 817 (30.17)	673 122 (69.83)	963 939
1984	328 385 (31.80)	704213 (68.20)	1 032 598
1989	355 837 (29.43)	853 200 (70.57)	1 209037
1992	377 956 (27.55)	993 831 (72.45)	1 371 787

Note: a) Production from estates includes private and government owned estates.
b) Figures in parentheses are the percentage of total production

Source: DGEC 1994.

2.3.2 Exports

Most Indonesian natural rubber is exported. It accounts for more than 90 per cent of the total production. The volume of natural rubber exports fluctuated around an increasing trend from 1966 to 1992. Natural rubber exports from Indonesia amounted to 1 267 605 tonnes in 1992, while it was 680 410 tonnes in 1966.

The United States is the largest importer of Indonesian natural rubber, accounting for 40 per cent of total exports. Other major importers are Singapore (32.8 per cent), Western Europe (7.5 per cent), the former USSR (5 per cent), and Japan (3.3 per cent) (Mubyarto and Dewanta 1991).

Revenue from natural rubber exports fluctuates in accordance with world natural rubber price fluctuations. Indonesian natural rubber exports enjoyed high revenues in 1974 and 1980. This was due to sharp increases in crude oil prices in those years (Grilli *et al.* 1980). Revenue reached the peak in 1980 due to the high world price. It totalled US$ 1.165 million from 976 131 tonnes of natural rubber exported. As a comparison, 1 267 605 tonnes of Indonesian natural rubber entered the world market in 1992 but only received US$ 1.038 million (DGEC 1994).

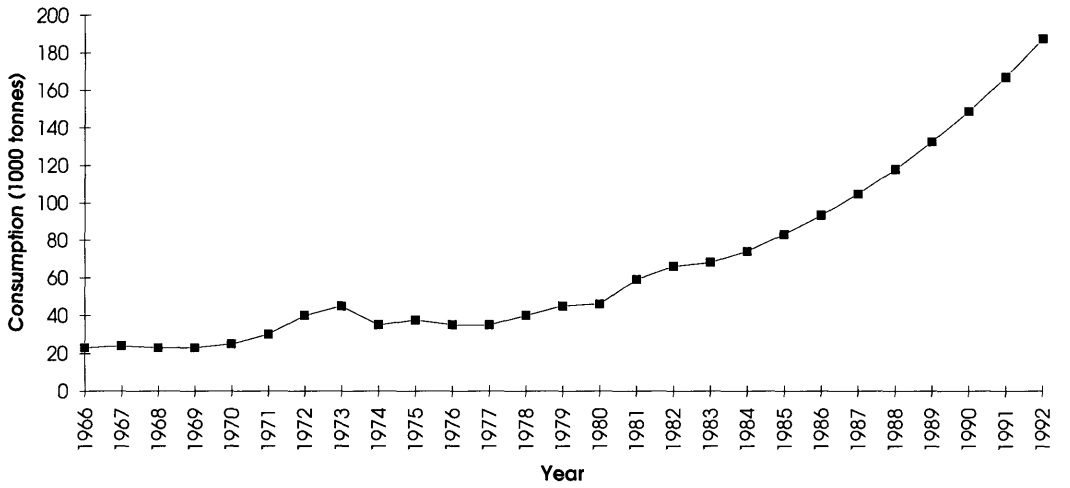
Indonesian natural rubber accounted for 26.10 per cent of the total world natural rubber exports in 1978 and it remained steady at 26.90 per cent in 1992 (DGEC 1994; FAO 1994). These figures imply that Indonesian natural rubber exports could not keep pace with the increased shares of other competing countries, such as Thailand.

According to Mubyarto and Dewanta (1991), low quality of natural rubber exports from smallholders is attributable to the export volume fluctuations, as well as revenue. By looking at the natural rubber grades, 51.70 per cent of Indonesian natural rubber is in the form of crumb rubber, known as Standard Indonesia Rubber (SIR), and only 23.60 per cent in the more desirable form of Ribbed Smoked Sheet (RSS). Barlow (1978) noted that this crumb rubber is a common grade in the world natural rubber market, however, it has lower price than that of RSS. Mubyarto and Dewanta (1991) noted that efforts have been made by the Indonesian government, in this case the Ministry of Agriculture, to improve the quality of Indonesian natural rubber exports, especially from smallholdings.

2.3.3 Domestic use

The magnitude of domestic natural rubber consumption remains low. The progressive increase in production has not been followed by the same growth of domestic demand for natural rubber. A significant increase of domestic consumption can be seen since the 1980s when the tyre industry and other rubber-based factories commenced expansion within the country (UNIDO 1993; see Figure 2.4).

Figure 2.4: Domestic natural rubber consumption, 1966-1992



Source: [1]EIU various issues

[2]CBSI various issues

Demand for natural rubber in Indonesia is mostly dependent on the development of the tyre industry. Nowadays, there are seven major tyre manufacturers in Indonesia which produce tyres for two-wheel and four-wheel vehicles. Their annual production capacities in 1991 cover 8.5 million unit tyres for four-wheel vehicles and six million unit tyres for two-wheel motorcycles. Their production, however, fluctuates due to unstable vehicle production. Vehicles are still viewed as luxurious goods and the ability to purchase vehicles is limited to higher income earners (UNIDO 1993).

The non-transport sector, on the other hand, promises increased demand for natural rubber, basically to play an import-substituting role. This demand is especially strong for the sport-shoe industry. Domestic demand for rubber-shoe production tends to match the increase of population, as well as demand from European countries. Mubyarto and Dewanta (1991) showed that the demand for rubber shoes increased by 8.2 per cent between 1984 and 1988, which amounted to 45.7 million pair of shoes in 1988. Owing to this widening demand, it is expected that domestic use for natural rubber will be growing from this non-transport sector.

2.3.4 Domestic price

Indonesian natural rubber price fluctuates considerably following the variations in the world price. The trend of Indonesian natural rubber prices between 1966 and 1992 has been shown in Figure 1.3. As can be seen from that figure, Indonesian natural rubber price peaked in 1980 at Rp 790.79/kg (approximately US$ 1.19/kg) while the world price achieved US$ 1.63/kg. Economic difficulties occurred in most developed countries after 1980 to 1982 influenced the Indonesian domestic price, shown by a sharp drop of the natural rubber price in Figure 1.3. The Indonesian price increased again when the world price of natural rubber rose in 1988 following the increase in demand within that year. At that time, the Indonesian price achieved Rp 1766.33/kg (about US$ 1.10/kg) whereas the world price was US$ 1.29/kg.

According to Mubyarto and Dewanta (1991), the low quality of Indonesian natural rubber exports also explains price fluctuations. As previously mentioned a large proportion of Indonesian natural rubber exports comes from the smallholdings. Poor management of product from the smallholdings results in low quality and in turn the price is reduced. In addition to that, domestic price formation, to some extent, is influenced by long marketing channels from the producers to the marketing centres. The role of NESS scheme seems inappropriate to guarantee lower price fluctuation as the estates also compete with the private middlemen in purchasing product from the smallhoders.

2.4 Summary

Several main points have been discussed in this chapter. Production and exports from major producing countries have shown an increasing trend. The rapid

growth of synthetic rubber production was described to give an idea of the other input in the automotive industry that could compete with natural rubber. Prospects of world elastomer demand was also presented in order to give an illustration of natural rubber prospects. Attention was given to the Indonesian natural rubber industry, especially government intervention in encouraging export expansion, as well as in rubber-based products in the country. Price fluctuations of Indonesian natural rubber was discussed in accordance with fluctuations of world natural rubber price and export volume fluctuations. Understanding the linkages amongst those factors is necessary to be able to analyse the nature of price variability of Indonesian natural rubber.

3. Commodity Market Instability

3.1 Introduction

Primary commodity markets have been analysed from a wide range of alternative economic perspectives and these approaches have resulted in an array of alternative policy prescriptions. In addition, the focus of attention on commodity problems has predominantly been on short-term instability in commodity prices, on the commodity export earnings of developing countries, and on the effects of such instability on economic growth of particular countries (Maizels 1994; Morgan and Sapsford 1994). Therefore, the instability of agricultural prices have been the subject of much theoretical and empirical investigation.

In this chapter, the literature on the causes and impacts of price fluctuations in relation to the relative importance of supply and demand in determining earnings fluctuation is highlighted. A review of natural rubber market instability has been undertaken in Chapter 2. Some empirical evidence on natural rubber market instability, however, is presented along with a discussion of causes and impacts of price variations. Some studies in relation to the sources of price variability are presented in this chapter as well. Efforts to moderate the effect of price instability, and hence earnings, are also discussed in conjunction with their usefulness and weaknesses.

3.2 An Overview of Commodity Price Instability

3.2.1 Causes of price fluctuations

It is commonly accepted that the prices of primary products fluctuate much more sharply and more frequently than do the prices of most manufactured goods. The major explanation from most studies lies in the short-run inelasticity of both supply and demand with respect to the price changes (MacBean 1966; Campbell and Fisher 1982; Tomek and Robinson 1990). Tomek and Robinson (1990) added that temporal price variability for agricultural commodities can be caused by the biological

nature of production process which makes output partly dependent on uncertain events and the prevalence of lagged response relationships in agriculture.

A low supply elasticity means that any changes in demand for a particular commodity, resulting from a change in consumers' incomes or a rise in industrial activity, will induce a disproportionately large fluctuation in price. Similarly, a low price elasticity of demand means that any change in supply caused by exceptional weather conditions or pests will cause a large change in price (MacBean 1966; Campbell and Fisher 1982).

On the supply side, the lack of short-term response can be attributed to the lengthy period required to bring about changes in production. This is particularly so for commodities with fairly long production periods, such as perennial crops. On the demand side, many commodities depend on a derived demand which means that their costs form only a small part of the costs of final product. A substantial change in the price of the raw material will hardly be reflected in the price of the finished product (MacBean 1966).

The prices of agricultural products are not only prone to greater fluctuations than the majority of other prices, but these fluctuations are also more frequent. In the case of Australian wool prices, Campbell and Fisher (1982) noted that wool price fluctuations occur not only from year-to-year or from week-to-week, but also from day-to-day. They further argued that agricultural price series based on monthly and yearly averages tend to understate the real amount of instability faced by producers when they enter the market.

A study by Shamsudin (1992) on forecasting Malaysian natural rubber prices, using a multivariate autoregressive-moving average (MARMA) model including monthly dummy variables, found that Malaysian natural rubber prices are still volatile and will continue to fluctuate. A recent study on the behaviour of the world rubber economy, focusing on the four major natural rubber producers over the period 1980 to 1992, has been undertaken by Bogahawatte and Samaruppuli (1995). They came to the conclusion that the short-run supply elasticity of natural rubber varied from 0.14 (Sri Lanka) to 0.29 (Thailand). These results suggest that supply cannot be adjusted by large quantities in response to price fluctuations. However, producers can adjust their output, to some extent, by manipulating the tapping system in response to price changes in the market. On the demand side, the authors found that price elasticities for the market share varied from 0.13 (North America) to 0.39 (less-developed

countries) and from 1.26 to 3.45, for the short-run and long-run elasticities respectively. The magnitude of the estimated short-run supply and demand elasticities were both inelastic which imply that the future prices for natural rubber will continue to fluctuate.

MacBean (1966) indicated that the low price elasticities together with uncontrolled variability in demand and supply, and their relationship, leads to an entirely credible explanation for sharp instability in prices, and in turn proceeds from primary products. Instability has also been attributed to a cobweb-like phenomenon for tree crops on the supply side (Johnson 1975). Hence, the time lag between investment and production can lead to alternating periods of high and low levels of production. In addition, Morgan and Sapsford (1994) indicated that the instability of price arises from the interaction between producers and consumers. Since these two groups have different policy agendas and needs, the influence of demand and supply shocks has meant that commodity prices are subject to variation.

Campbell and Fisher (1982) pointed out that instability in agricultural prices, especially in the international market, more often stems from changes in demand than of supply. The significant factors on the demand side are: (1) changes in the tempo of industrial activity and hence the level of income growth; (2) political instability; (3) variations in the stocks; and (4) tariff and quota imposition in other government policies.

Empirical evidence shows that there has been a reduction in price instability for a large number of commodities, although some commodities remain at a high level of instability. Murray (1978) analysed the price instability for overall export commodities for 75 less developed countries and found that the export price instability index for those countries declined from 5.40 during the period 1952 to 1961, to 4.30 in the period 1962 to 1971. Morgan and Sapsford (1994) observed that exported agricultural raw materials in developing countries had a price instability index of 9.0 for the period 1980 to 1991, compared to 16.6 in the period 1962 to 1980. However, these analysts found that a number of commodities retained high price instability indices, such as sugar and several vegetable oils.

In contrast to the evidence above, Myers and Runge (1985) found that the United States corn market has become more unstable since the early 1970s. Using a simple measure of instability, the coefficient of variation measured as deviation from the mean, they found that the corn market experienced a marked increase in price

instability. During the period 1971/72 through 1982/83, the farm price instability index was 23.6 while it was 7.2 in the period 1962/63 to 1970/71.

Thus there is no clear consensus on the extent of price instability of the commodities reviewed.

3.2.2 Impacts of price instability

Various studies have shown that price fluctuations of a particular commodity has led to revenue variation to producers and uncertainty to other related parties such as traders, processors, and consumers. Producers are handicapped in making future plans when prices are highly unpredictable. Price uncertainty also tends to lead to unwillingness on the part of producers to make investments (internal capital rationing) or to lenders refusing to make loans (external capital rationing) due to the risks involved (Tomek and Robinson 1990). MacBean (1966) and Athukorala and Huynh (1987) noted that for foreign-trade-oriented countries, fluctuation in export prices means unstable earnings to the exporters as well as to the producers. This revenue fluctuation, in turn, can be transmitted into the domestic economy.

Price instability may also create employment problems. This particularly occurs for some export industries. However, if the proportion of the total population involved in the wage-earning employment is generally small, employment levels does not seem to be seriously affected (MacBean 1966).

Tan (1984) summarised two types of problems that can be seen as the impacts of price instability. First, at the micro-level, price instability affects employment and producers' earnings and hence investment in the commodity concerned. Second, at the macro-level, for exporting countries, export price instability will influence export earnings. As export proceeds from primary commodities often form the main sources of foreign exchange funds for imports of investment goods, then export earnings fluctuations could cause financial constraints.

Another repercussion of price instability is its effects on long-run production. MacBean (1966) pointed out that if small-scale production is important, especially in export industries, price uncertainty may induce the internal allocation of resources away from the optimum. Producers may decide against specialising in the crop and change to another crop which promise higher returns, so avoiding the risk of severe

instability. In the case of natural rubber, Tan (1984) observed that in the more land-abundant rubber producing countries, smallholders tend to shift from rubber to cash and subsistence intercrops cultivation from which substantial values can be derived.

A number of analysts have attempted to link export price instability and the process of economic growth in many developing economies, including MacBean (1966), Lim (1974), Athukorala and Huynh (1987), and Maizels (1994). A high degree of export instability may be expected to affect the domestic economy in several ways. First, government revenue tends to fluctuate with the level of exports. As export taxes account for a significant proportion of government revenue in most developing economies, variations in export earnings will exert a significant effect on broader tax bases such as imports, domestic sales, and income (Mansfield 1980 in Athukorala and Huynh 1987). Second, it is recognised that the export sector can contribute a significant proportion of the total value added of the economy. Hence, instability stemming from the export sector can be expected to have direct repercussions on the overall stability on the domestic economy (Athukorala and Huynh 1987). Third, export instability is likely to raise the risks for entrepreneurs because of the difficulty of estimating the expected returns on investment (MacBean 1966).

Morrison's study of Ghana (Morrison 1979 in Athukorala and Huynh 1987) was concerned with the fiscal repercussions of export instability over the period 1961 to 1975. This result strongly supported the view that export instability affected government revenue fluctuation. As a comparison, Lim (1974) observed the effect of fluctuations in the export price of natural rubber in West Malaysia and found the presence of a fairly high degree of economic instability resulting from export earnings fluctuation. However, the transmission of instability from the export sector to the rest of the economy was smaller than is commonly believed, shown by the foreign-trade multiplier being less than one. In addition, Lim indicated that there was no correlation between annual percentage changes in real GDP and percentage deviations of export earnings from the trend over the period 1947 to 1968. This result proved little concerning the effects of instability on economic growth.

The empirical works reveal that there is no consensus as to the impact of price instability. According to Athukorala and Huynh (1987), the nature and the degree of effect of price instability for a given economy is determined by the interaction of various factors. This includes both the economic structure and the nature of domestic economy policy.

3.2.3 Previous studies on commodity market instability

Studies on commodity market instability have emerged as concerns for many economists. Agricultural economists have also given much attention to the consequences of the unstable prices and revenues received by producers. Further attention has been drawn to the causes of price and revenue instability.

Previous studies relating to commodity market instability have used a procedure for decomposing the variance of gross revenue into components attributable to price variability, quantity variability, and interactions between these. Burt and Finley (1968) long ago demonstrated a decomposition procedure of gross revenue variability of the US agricultural commodities on local markets. The procedure provides that revenue variability can be traced back into direct effects of price and quantity and interactions of these variables. Piggott (1978), however, criticised the Burt and Finley procedure, pointing out that any pattern of price-quantity variability could be the result of a number of different patterns of supply and demand shifts.

Murray (1978) decomposed the price-quantity relationship in the context of export revenue instability in developing countries and then analysed that relationship into the relative importance of supply and demand variability. The results obtained suggest that export earnings instability in the countries concerned are mainly due to volume rather than price fluctuation. Hence, the earnings variation is mainly caused by supply rather than demand.

Piggott (1978) analysed the sources of instability in quarterly beef revenues in the Australian beef industry into demand and supply variability and interaction between these schedules. The result suggests that the demand side has the dominant effect over the supply side in affecting saleyard revenue fluctuations. Wong (1986) developed an alternative model in which export earnings instability is generated by domestic supply, domestic demand, and foreign demand fluctuations. The author's finding shows that export earnings variation is mainly originated from foreign sources.

Research on the sources of price instability of different commodities has been done by a number of analysts. This includes the US corn market by Myers and Runge (1985), Watkins (1986), and Lestari (1994). Watkins observed the causes of Australian wool price instability, while Lestari analysed the price instability of

sweetened milk in Indonesia. All analysts were concerned with the demand and supply variability, as well as the interaction of both schedules in determining price instability of the commodities concerned. In addition, all these studies used the method proposed by Piggott (1981), where the sources of price instability of a given commodity were traced back into components attributable to supply variability, demand variability, and interactions between these.

Myers and Runge' study (1985) came to the conclusion that both supply and demand shifts were important sources of corn price instability during the period 1962/63 to 1971/72. The result for the period 1972/73 to 1982/83 shows a different figure, in that the demand effect is greater relative to the supply effect. In the case of Watkins' analysis, the author identified that the demand factor was the predominant source of Australian wool price fluctuation over the 60 quarters from 1965 to 1983. On the other hand, the contribution of supply shifts and the interaction component was found to be relatively small in affecting price variations. While the two previous studies found that demand forces were the most important factors in inducing price fluctuation, Lestari's finding was more concerned with the supply effect in causing milk price instability in Indonesia.

3.3 Efforts to Reduce Commodity Market Instability

The presence of price and earnings fluctuations in agricultural commodity markets has attracted efforts to mitigate the undesirable effects of those fluctuations. It can be in the form of government intervention, in the form of international commodity agreements for exported products, and in the form of trading arrangements between producers and consumers.

A government price-support program is one of the alternative means of stabilising commodity prices. According to Tomek and Robinson (1990), political considerations often obviously play a dominant role in the decision to support the price of a particular commodity. This include price supports in different ways in US agricultural commodities. Price supports for most cereals, cotton, tobacco, sugar, and milk have been preserved by the US government since 1930s. These commodities account for about half the cash receipts of producers in the US.

Government intervention in pricing features not only in developed countries such as in the US and many European countries, but also in the less developed

countries. Bale and Lutz (1981) pointed out that government intervention in the form of agricultural pricing policies in developed and developing countries are significantly different. Prices for agricultural commodities in developed countries generally have positive rates of protection, whereas in developing countries commodities are often taxed through price intervention measures.

Tomek and Robinson (1990) indicated that although the objective of government intervention in pricing is to reduce the amplitude of price fluctuations, in practice price stabilisation measures often turn out to be indistinguishable from price-support policies. This is because of pressure from producers to acquire stocks when prices are low and resistance to disposing of accumulated stocks when prices are rising.

In conjunction with the impacts caused by price variability, various international stabilisation measures have been attempted with the aim of moderating price fluctuations. The Nairobi Resolution of UNCTAD in 1976 marked a new departure in commodity market policy for exporting countries. This resolution covered many commodities including coffee, cocoa, sugar, and wheat (Morgan *et al.* 1994). For natural rubber, a buffer stock scheme has been proposed under the International Natural Rubber Agreement (INRA) since 1976 (Barlow *et al.* 1994). All these international agreements emphasised avoiding excessive price and export earnings fluctuations of the commodities concerned.

Perceptions of the benefits of stabilisation through international commodity agreements, especially in buffer stocks, are now largely negative. This is together with a policy shift in developed countries away from intervention and market-wide support schemes (Morgan *et al.* 1994). Moreover, Morgan and Sapsford (1994) pointed out that international commodity agreements have not performed in a successful manner, in the sense that neither producing nor consuming countries have been satisfied with the benefits delivered by such schemes. In the case of natural rubber, Bogahawatte and Samaruppuli (1995) indicated that buffer stock policies for this commodity have not performed up to expectations and more often are biased towards the rubber consuming countries. Morgan and Sapsford (1994), therefore, noted that recent works have contrasted the use of international agreements with futures markets as governments seeks ways to provide effective price and income stability at lower costs.

The first futures market was established for grain in the US in the mid 1860s. Markets for futures contracts nowadays are an important pricing institution for many of the major agricultural commodities in the US including corn, wheat, cattle, and hogs (Tomek and Robinson 1990). A futures market was also commenced in Australia in 1960 for wool and for beef trading started in 1975 (Campbell and Fisher 1982).

A futures market is a paper market which trades highly standardised contracts relating to a clearly defined commodity for delivery at particular price and time (Morgan and Sapsford 1994). Futures markets perform two main roles. First, they serve as a major price-discovery mechanism and provide an opportunity for producers and users to shift the risk of adverse price movements. Second, commodity futures markets offer an opportunity to speculate and thereby to obtain benefits from price changes (Tomek and Robinson 1990). Another advantage of futures markets is its ability to disseminate information if the resultant price changes are an accurate reflection of the information reaching the market (Morgan *et al.* 1994). The difficulty of futures markets, however, is that it presumes a sufficiently large set of contingency markets occur for each commodity, while in practice only few commodities possess a comprehensive set of such markets (Gilbert 1985).

Arshad and Mohamed (1991) examined the pricing accuracy of futures market of Malaysian crude palm oil. The finding suggests that this futures market is able to establish forward prices efficiently, especially as the expiry date approaches. Research has also been done by Morgan *et al.* (1994) on four widely traded commodities (wheat, coffee, cocoa, and sugar). They examined the cointegration between spot and future prices for those commodities and the results suggest that futures markets can facilitate decision making by agents with respect to production, sales, purchase, and storage.

The effectiveness of a futures market as a means of managing the risk associated with price instability, however, will be dependent on its ability to provide a forum for price discovery between spot and futures prices. Since most literature stated that futures trading could provide a better way to moderate price fluctuations, not on the welfare case, thereby an understanding of the basis relationship between cash and futures prices is essential for countries concerned with future trading.

3.4 Summary

Most literature presented in this chapter pointed out that the main cause of price instability, hence proceeds variability, stem from the interaction of inelastic supply and demand for most agricultural commodities. Moreover, many analysts have attempted to decompose the source of market instability in different ways. Some analysts focused on the price-quantity relationship, while others were more concerned with the supply-demand interaction. In approaching these commodity problems, a number of economists have used an array of methods, however, most of them concerned variance and covariance approaches. No one analyst, however, has examined the sources of natural rubber price instability for major producing countries.

A wide variety of proposals have also been designed to mitigate the effects of price instability in certain commodities. Yet, there is no consensus about the general solutions. The alternative approaches of price stabilising agreements, therefore, should be viewed for each different case, owing to the quite different implications for the variability and uncertainty of a given commodity.