UNIVERSITAS INDONESIA

THE IMPACT OF IMPORT TARIFF OF MAIZE ON POULTRY FEED PRODUCTION IN INDONESIA

THESIS

A Thesis submitted in partial fulfillment of the requirements for the degree of Master of Economics in Planning and Public Policy University of Indonesia

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2010

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ABSTRACT

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Due to its energy and protein content, maize becomes one of the important ingredients of poultry feed. Most of maize used in feed industry is still imported. Since domestic production of maize could not satisfy domestic demand, Indonesia is still a net importer of maize up to this day. In order to protect domestic producers from import surge, government imposed 5% tariff on maize. On the other hand, producers of feed, as the main consumers of maize, suggest that the imposition of 5% tariff is too high, and ask the government to remove the import tariff.

The objective of this research is to analyze the impact of import tariff of maize on poultry feed production in Indonesia, especially in Sumatra, Java, and Sulawesi. In order to reach this objective, the study will use the following independent variables: (i) domestic price of maize, (ii) consumption of maize for feed, (iii) domestic price of soybeans, (iv) price of feed in previous year, (v) average production feed in the previous year, and (vi) import tariff level of maize.

With the purpose of analyzing the impact of import tariff of maize on feed production, a panel data analysis is used. Based on a Chow test and a comparison of cross-section and time-series data applicability, Fixed Effect Method (FEM) was decided as the appropriate method for this study.

The result indicates that average feed production and the price of feed in previous year have positive impact on feed production. Meanwhile, domestic price of soybeans, and import tariff level have negative impact of feed production in Java, Sumatra, and Sulawesi.

Furthermore, average feed production in previous year influences feed production this year significantly at the 99% level. Domestic price of soybeans also affects significantly at the 95% level. Other variables such as feed price in previous year and the import tariff level are also significant at the 90% level. Although these variables have significant impact on feed production but the result also shows that feed production is not too responsive to the changes in these variables.

Keywords:

Import tariff of maize, poultry feed production, panel data

ABSTRAK

Nama : Risnawaty
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Judul : Dampak Tarif Impor Jagung terhadap Produksi Pakan Ayam di Indonesia

Jagung menjadi salah satu bahan penting yang terkandung dalam pakan unggas karena nilai kandungan energi dan proteinnya. Sebagian besar jagung yang digunakan dalam industri pakan masih merupakan jagung impor. Dikarenakan produksi yang belum mampu mencukupi kebutuhan jagung dalam negeri, sampai saat ini Indonesia masih merupakan importir utama jagung. Untuk melindungi para petani penghasil jagung dari serbuan barang impor, pemerintah mengenakan pajak impor sebesar 5% bagi jagung impor. Di lain pihak, para pengusaha pakan ternak sebagai konsumen utama jagung, berpendapat bahwa impor tariff sebesar 5% tersebut terlalu tinggi dan meminta kepada pemerintah agar tarif tersebut dihilangkan.

Penelitian ini bertujuan untuk menganalisa dampak tariff impor jagung terhadap produksi pakan ayam di Indonesia, khususnya di Sumatera, Jawa, dan Sulawesi. Agar tujuan penelitian dapat tercapai, penelitian ini menggunakan beberapa variabel bebas: (i) harga jagung di pasar domestik, (ii) Konsumsi jagung untuk pakan, (iii) harga kedelai di pasar domestik, (iv) harga pakan pada tahun sebelumnya, (v) produksi pakan rata-rata di tahun sebelumnya, dan (vi) tingkat tarif impor jagung.

Dalam penelitian ini analisis data panel digunakan untuk menganalisa pengaruh impor tarif jagung terhadap produksi pakan. Dari hasil tes *Chow* dan perbandingan jumlah data *cross-section* dan *time-series*, ditetapkan bahwa metode yang cocok digunakan dalam penelitian ini adalah Metode Efek Tetap (MET).

Hasil estimasi menunjukkan bahwa produksi pakan dan harga pakan pada tahun sebelumnya memiliki dampak positif terhadap produksi pakan. Sementara itu, harga kedelai dan tingkat tarif impor memberikan dampak negatif terhdap produksi pakan di Sumatera, Jawa, dan Sulawesi.

Lebih lanjut, produksi pakan di tahun sebelumnya secara signifikan mempengaruhi produksi pakan di tahun berjalan pada tingkat kepercayaan 99%. Harga kedelai di pasar domestik berdampak secara signifikan pada tingkat kepercayaan 95%. Variabel lain seperti harga pakan pada tahun sebelumnya dan tingkat tarif impor berdampak secara signifikan pada tingat kepercayaan 90%. Namun demikian, hasil penelitian juga menunjukkan bahwa produksi pakan tidak terlalu responsif terhadap perubahan variabel-variabel bebas tersebut.

Kata kunci:

Tarif impor jagung, produksi pakan ayam, panel data.

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CHAPTER 1
INTRODUCTION

Background

After the avian flu outbreak was contained, poultry industry begun to revive. The rapid growth of poultry industry was encouraged by the increase of demand for poultry products. One of the trigger was because people started to believe that they could consume poultry products without worrying about being infected by the deadly virus. Thus, the growth of poultry industry has urged other industries, especially feed industry.

The increase of poultry industry was followed by the increase of feed industry due to the facts that feed is one of the important components in poultry industry. The important role of feed in poultry industry can be noticed from the share of expenditures for feed that reach 70% of total production cost (Market Intelligence Report, 2008). Moreover, the quality of poultry products is determined by the quality of feed. It is hard to deny that good quality of feed will give better quality of poultry's products. Therefore, it is undeniable that feed play an important role in poultry industry.

Thus far, Indonesian feed industry is still dominated by large feed mills. They are Charoen Popkphand, Japfa Comfed, Sierad Produce, Cheil Jedang, and Wonokoyo, which are operating in several provinces in Java, Sumatera, and Sulawesi. Those five large feed mills account for more than 65% of domestic feed production. (Lokollo, Hutabarat, and Swastika, 2006: 25). Moreover, to satisfy domestic demand of feed, there are some small feed mills that are developed by the central government in some provinces, such as West Java, East Java, Bali, and some provinces in Sumatra.

The rapid growth of feed industry followed the boom of poultry industry in 1980s. Not surprisingly, the economic crisis in 1997 which hit poultry industry had caused feed industry in Indonesia decline (Lokollo, Hutabarat, and Swastika, 2006: 37). The data from the Ministry of Agriculture reveals that the total production of feed in Indonesia grew as much as 73% from 4,497 ton to 7,800 ton in 2000 up to 2007. The highest growth of feed

production occurred in 2006 with total production around 7,200 ton that increased 15.64% from 2005 meanwhile it hit the lowest growth in 2004 with total growth of 4.05% that increased from 5,743 ton in 2003 to 5,975 ton in 2004.

The increase of feed production can also be noticed from the increase of maize consumption for feed industry. The Ministry of Agriculture reported that around 50.62% from total consumption of maize in 2006, or 4,100 metric ton from 8,100 metric ton of maize, was used as the raw materials of feed. But in 2007, maize consumption for feed lessened to 49.41% or 4,200 metric ton of total maize consumption that had reached 8,500 metric ton of maize. This data illustrates that even though maize is not the primary food for Indonesians, but maize is important for cattle and poultry industries, especially for the feed.

Maize is one of the essential agricultural, especially grains products in Indonesia. Due to its high carbohydrate and protein level, maize is used as a main food beside rice in certain provinces in Indonesia. Maize is also used as raw materials for food industries, especially snacks, and also as raw materials for livestock feed industries, particularly poultry. Although maize is needed for direct consumption and food industry, but domestic demand for maize is dominated by livestock feed industry. Since 1975, farming industries, particularly poultry, have been growing, which urged the feed industries. Therefore, the necessity of maize had shifted from the fulfillment of human consumption to the fulfillment of raw material for livestock feed industries (Erwidodo *et al.*, 2003: 181).

Maize becomes the main energy resources in feed due to its high level of energy contents which also known as metabolized energy (ME) and its high fiber concentrates. Thus, the role of maize in feed production is irreplaceable by other energy resources commodity such as soybeans. As energy resource, soybeans have a high level of protein but low level of energy. (Tangendjaja and Wina, 2007: 434). Data from the research agency in Ministry of Agriculture stated that maize is used as the main content (more or less about 60%) of feed. It also shows that more than 55% of domestic maize demand comes from feed industries (Kasryno, et. al., 2007: 474).

The necessity of maize in feed industry was also shown by the total volume of imported maize that was used as the raw material of feed. Most of the imported maize was used as the raw material in livestock feed production. In 1990, the consumption of maize for feed reached 1.1 million ton and kept increasing to 3.3 million ton on 1996. Moreover, the rapid growth of feed industries has pushed the demand for imported maize. From 1991 to 2007, the fluctuation of maize consumption for feed followed the fluctuation of maize consumption. Thus, in 2007, as the total consumption increase, the consumption of maize for feed increased as much as 8,250 MT or as much as 1.74% (Maize production and Consumption in Indonesia, n.d.).

The data from the Ministry of Agriculture on ARAM (Angka Ramalan) III shows that on 2007, the volume of maize harvest reached 13.28 million ton of dried maize seeds which indicated an increase from 11.61 million ton on 2006. The increase of maize production was urged by the increase of harvest land (Purwanto, 2007: 457). Different from rice production, the increase of maize production in Indonesia is driven by the rise in demand. Although the volume of domestic maize production on 2007 performed an increase by 3.70%, Indonesia still imports maize from other countries to fulfill domestic demand.

Due to the fact that maize production had not been able to satisfy domestic demand, Indonesia has been importing maize from other countries, mainly from China, Thailand, and USA. Although Indonesia is still a net importer of maize, government believes that domestic production will be sufficient to satisfy the domestic necessity and tries to lessen the import volume of maize. One of the efforts taken by the government was the imposition of import tariff. From 1993 to 1994, tariff import was 10%, but on 1995, the import tariff of maize was removed to 0%. On 2007, the import tariff was reinforced as much as 5%.

Import tariff policy on maize was imposed in order to protect domestic production form import surge. It is still not surprising that the imposition of import tariff would increase domestic price of maize. Moreover, it will push down import demand and pull up domestic production of maize.

On the other hand, if tariff is removed, domestic price of maize will go down and consequently it pushes down domestic production. Whereas, total imported maize will increase as the price goes down.

Since most of maize used in feed industry is still imported, the imposition of tariff becomes a burden for feed producers. This burden arises due to the increase of production cost which is caused by the increase of maize's price as the raw material. Moreover, the decrease of imported maize volume might reduce the stock of maize in Indonesia especially for feed industry. Therefore, although the import tariff rate of maize was already low, but it was still considered as high by the association of Indonesian livestock feed Industries (Gabungan Perusahaan Makanan Ternak Indonesia or GPMT). GPMT argued that the 5% tariff was still too high and decided to ask the government to reduce the import tariff to 0%[1].

From the background above, it can be concluded that maize has an important role on poultry industry, especially as the raw material of feed. Therefore the trade policy on maize will affect livestock feed's production. The aim of this thesis is to analyze the impact of government policy on maize on the farming industry. The government policy on maize is represented by import tariff policy on maize as the raw material of feed, while farming industry is represented by the production of poultry feed in Indonesia, especially in Sumatra, Java, and Sulawesi.

Research Questions

Due to the important role of maize on farming industry, especially for feed, it is necessary to find out to what extent the import tariff of maize affects the poultry feed production in Indonesia. Therefore, there are two questions can be proposed:

a. Will import tariff policy causes the decline of poultry feed production in Indonesia?
b. What are other factors that will affect the poultry feed production in Indonesia?

[1] The request was stated on the letter from GPMT No. 041/BP-GPMT/XII/06 to the Minister of Finance; cc Minister of Trade on December 7th 2006.

Research Objectives

To answer the questions above, this study is conducted in order:

a. To analyze the impact of imports tariff on maize, as the raw material of poultry feed, on poultry feed production in Indonesia.
b. To examine other factors that may affect the poultry feed production in Indonesia.

Research Coverage

The study discusses about the impact of government policy of maize (HS 1005) on Indonesian farming industry. Maize (HS 1005) includes maize seeds and other seeds. However, this study is restricted on examining the impact of import tariff policy related to the feed production in some provinces in Indonesia, especially in Java, Sumatra, and Sulawesi. Those three islands are selected due to the fact that large feed mills are located in those three main islands. Feed products in this study include feed for layer starter, grower, and finisher, broiler grower and finisher. In addition, this study will also investigate other factors that may affect feed production such as domestic price of maize, domestic price of soybean, the price of feed in previous year, feed production in previous year, and also the consumption of maize for feed industry.

The data used in this study is an econometric pooled data, including Indonesian feed production, domestic price of maize and soybeans, and consumption of feed in three main islands in Indonesia (Sumatra, Java, and Sulawesi) from 1991 – 2007. Data are acquired from the Ministry of Agriculture, the Ministry of Trade, BPS, FAO, and WITS, CEIC, and other internet resources.

Research Hypothesis

Theoretically, the price of output will affect the production of the output itself. In this study, the increase of feed price in recent year is supposed to encourage feed's producers increasing their production for the next year. Therefore, it is expected that the price of feed in previous year would contribute positively to the production of feed. Just like the price of feed, the consumption of maize for feed industry is expected to have a positive impact

on feed production. The increase of maize consumption for feed would indicate the increase of the livestock food production. In other words, it can be concluded that the production of feed will positively be affected by the consumption of maize for feed industry.

On the other hand, the price of maize and the price of soybean are expected to have a negative impact on feed production. It was suggested by Kariyasa, Sinaga, and Adnyana (2004) and Swastika *et al.* (2005) that the production of feed was strongly related with the price of its input (maize). Although soybean is not the main ingredient of feed, but it has important role in feed production, that is as the source of protein. Therefore, it is expected that the price of soybeans would give a negative effect on feed production.

Other factor that may contribute to the feed production is the feed production in the previous year. If the production level in previous year was high, then the production level in current year is likely to increase. Therefore it is predicted that the feed production in previous year has a positive impact on the feed production in present year.

On contrary, the imposition of import tariff on maize will give a negative effect on feed production. As already mentioned that maize is the main ingredients of poultry feed, therefore the fluctuation of maize price will involuntarily influences the level of poultry feed production. In other words, it is expected that the import tariff policy, would have a negative impact on the production of feed.

The Necessities of the Research

This study is important because it may become one of the information resources about the impact of import tariff of maize on the production of poultry feed for academic society. This study is also expected would be able to give relevant information to the government in implementing import duty on a commodity that has a big influence for other sector. Furthermore, from this study, government may get the information about factors that greatly contribute poultry feed production, thus those factors can be managed in order to increase the production of poultry feed.

CHAPTER 2

PROFILE OF MAIZE

2.1. History and Characteristics of Maize

Maize is classified as one of potential commodities in Indonesia due to its important role in poultry industry, particularly feed industry. It is undeniable that the rapid expansion of poultry industry in Indonesia has been able to encourage maize production to grow rapidly. Further information about maize will be described as follows.

Iriyani et al. (2007) stated that maize (Zea mays) came from Southern Mexico, and then brought to Latin America, Caribbean, and North America where it was cultured by the Indian. In 1492, Columbus brought maize to Spain from Cuba and he was followed by other South European explorers who introduced maize to their fellow in Western European. In the end of 1500, maize had been planted in all parts of Europe, especially Italy and southern area of France, where it was widely consumed and became commercial plant for about 100 years.

Merchants from Portugal, Arab and Zanzibar brought maize to South Asia on early 1500 and developed it in western cost of India, North West of Pakistan, and Himalayan mountain. Not long after that, in the mid 1500, maize was introduced in South East Asia and widely planted in Indonesia, Philippine, and Thailand. In the mid 1700, maize was commonly planted in China. It was served as the main food in Northern provinces and spread to Korea and Japan.

Dowswell *et al*. (1996) argued that maize is the most productive cereal plant in the world due to its ability to survive in any condition of soils. Maize can grow well in tropical or subtropical region with high or low rain intensity. However, in order to have its maximum growth, maize needs certain kind of environment. Optimal growth can be attained if maize is planted in fertile soils with good drainage and good soil's humidity (Iriany, Yasin, and Takdir, 2007: 1). The life cycle of maize will be ended within 80 to 150 days. The harvest period of maize depends on the temperature of the environment and the level of the plantation ground. Different environment would not only determine the quality of maize but also the type of maize.

Iriany, Yasin and Takdir (2007) suggested that maize can be classified according to the shape of the grains and the life period of maize. According to the shape of the grains, maize is divided in to seven kinds of maize:

1. Dent or field maize (Zea mays identata) which most of the crops used as food, animal feed, and as the main content in industrial products. It contains hard and soft starch and become indented when it reach its maturity period.
2. Flint maize (Zea mays indurata), mostly grown in South America and has the same usage as dent. It has hard, horny, rounded or short and flat kernels.
3. Waxy maize is variety of maize which grains has a waxy appearance once it's cut. It is grown in order to make special starches for thickening foods.
4. Sweet maize (green maize) which grown in many horticultural varieties because it suitable for table use. It usually eaten fresh, canned or frozen and has high level of sugar in the milk stage. Sweet maize differentiated into two distinct species, Zea sacharata or Zea rugosa, and Zea mays rugosa.
5. Popcorn maize (Zea mays everta) that has small ears and small pointed kernels.
6. Indian maize (Zea mays) which originally grown by the Indians with red, purple, brown, or multi colored kernels.
7. Flour maize (Zea mays amylacea) that also known as soft or squaw maize. It's usually used as the ingredients of tortillas, chips, and baked goods, and beer.

Based on the life period, maize which planted in Indonesia is classified in to three groups:

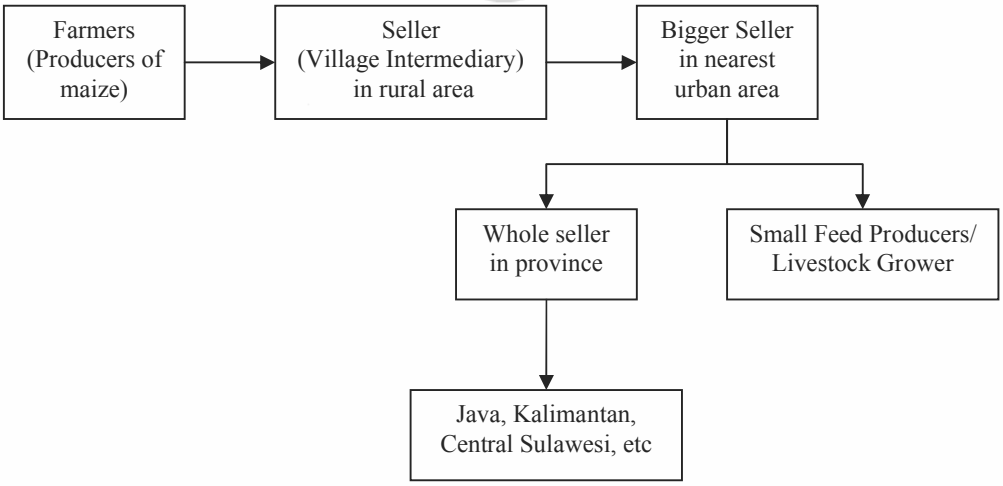
1. Short life period maize (genjah) which lives for 75-90 days. For example Genjah Warangan, Genjah Ketas, Abimanyu, and Arjuna.
2. Medium life period maize (tengahan), lives 90 to 120 days, like various kind of hybrid maize (Hibrida C 1, Hibrida CP 1 dan CPI 2, Hibrida IPB4, and Hibrida Pioneer 2), Malin, Metro, and Pandu.
3. Long life period maize lives for more than 120 days. Maize with long life period for example are Kania Putih (White Kania), Bastar, Kuning, Bima, and Harapan.

2.2. Indonesia's Commerce Control System of Maize

In order to ensure the security of maize distribution process and trade, the government of Indonesia contrives a commerce control system of maize. This system organizes the distribution of maize from surplus provinces or maize's central production areas to the provinces with high demand of maize. Three important stockholders who influence the maize's commerce control system are producers (farmers), the merchants (suppliers), and consumers. However, Indonesia's maize production today is already market oriented, especially to fulfill the demand of food industries and animal feed industries.

Due to the different need of maize, the commerce control system of maize in each maize central production area in Indonesia is different. Sarasutha, Margaretha, and Suryati (2007) mentioned that the commerce control system of maize in South Sulawesi, which represents the commerce control system in Sulawesi, is begun from the traders in rural area or village intermediaries who bought maize directly from farmers. Then, they sell the maize to the other seller in nearest urban area. Sellers in urban area usually sell their maize either directly to the small feed producers and livestock grower from other urban area, or sell it to the whole seller in province or bigger city. From the whole seller in the province, maize is brought to Java, Kalimantan, Central Sulawesi, or other province which has high demand of maize. The commerce control system of maize in South Sulawesi was described in the figure 2.1 below.

Figure. 2.1. Commerce Control System of Maize in South Sulawesi

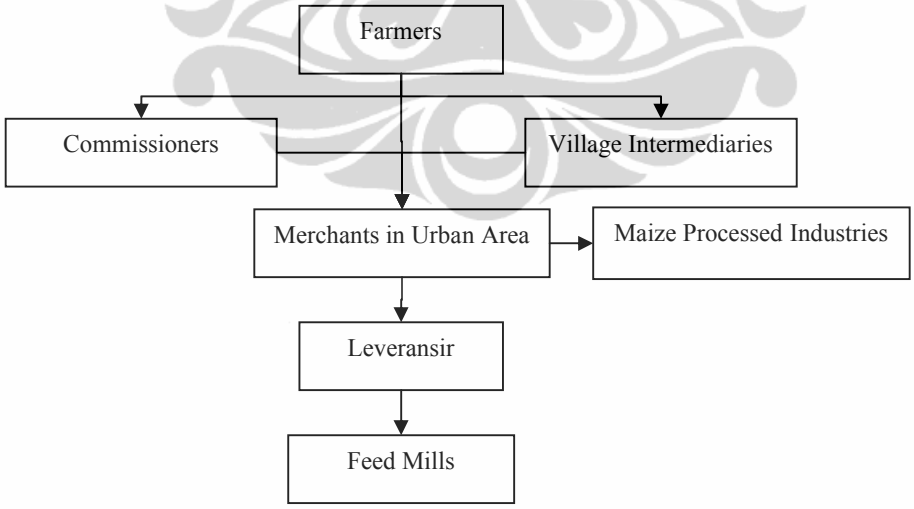


Source: Sarasutha, Margaretha, and Suryati (2007)

The commerce control system in Gorontalo, is a little bit different from the commerce control system in South Sulawesi. The trade system in Gorontalo is more organized. It is conducted base on the partnership program between farmers and village intermediaries. The farmers are given soft loan and other production facilities which will be calculated on harvest time with reasonable market prize. Maize form village intermediaries will be sold to bigger private seller or states own companies who will export the maize to Singapore, Philippine, and Malaysia, or sell it in other island in Indonesia.

Meanwhile, the commerce control system in Sumatra is represented by the commerce control system in North Sumatra. Saleh, Sumadi, and Jamal (2005) stated that in North Sumatra, maize crops are sold to village intermediaries, commissioners, or directly sold to the merchants in urban area. In this stage, maize is processed (peeled and dried) and sold to feed mills through leveransir and to other maize processed industries. Based on this commerce control system, maize from farmers only has to go through short path (three or four stages) before it is brought to consumers. The commerce control system in North Sumatra is presented in figure 2.2.

Figure. 2.2. Commerce Control System of Maize in North Sumatra

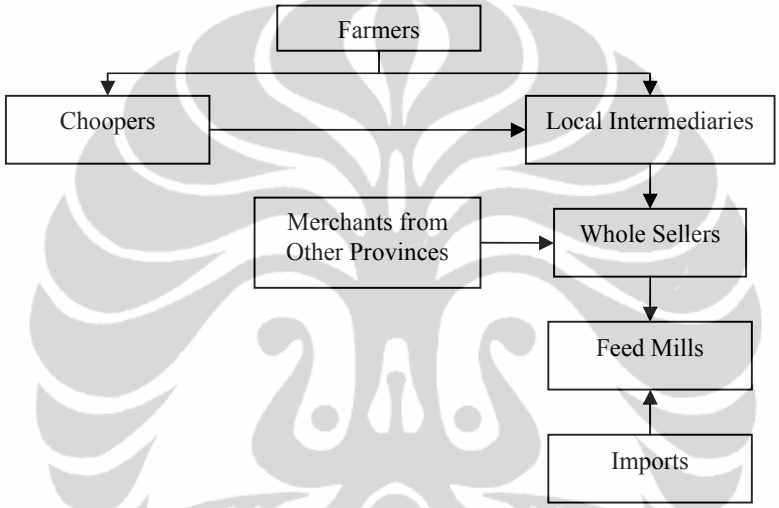


Source: Saleh, Sumadi, and Jamal (2005)

The commerce control system in Java is represented by the commerce control system in East Java. In East Java, farmers usually sell their products (maize) to village intermediaries or choppers. From here, maize will be brought to

the whole sellers who will sell the maize to feed mills. During dry season, when local maize production is low, maize are also purchased from the nearest rural area or from other provinces. Beside from whole sellers, some of maize used by feed mills is imported. Since the economic crisis in 1997, maize from farmers is directly bought by some small poultries who produce their own feed (Saleh, Sumadi, and Jamal, 2005). Complete picture of commerce control system in East Java is presented in figure. 2.3.

Figure 2.3. Commerce Control System in East Java



Source: Saleh, Sumadi, and Jamal (2005)

2.3. Trade Policy on Maize

Rachman (2003) argued that domestic price of maize was strongly determined by the fluctuation of exchange rates, word market of maize, price stability, and the implementation of trade policy. There are three major policies on maize which had been imposed in Indonesia.

The first policy was base price policy. The aim of this policy is to protect farmers from the fallen of maize price, especially during harvest time. Started on 1977/78, this policy was considered as an important policy since there were a rapid increase of maize production, thus, maize was believed as one of exported potential agricultural commodities. Moreover, maize was also had a role as main food in certain areas and as main ingredient of feed. Latter on, the price of maize on farmers level was higher than the stated basic price, therefore this policy was

stopped on 1990, since it was considered as ineffective. Since then, the commerce system of maize was settled on the hand of market mechanism.

The second policy on maize was domestic price stabilization program. To reach the goal of the program, the government gave mandate to BULOG (Board which responsible for logistic matters in Indonesia) to ensure the availability of stock of maize, either from domestic production or imports. The stock of maize was distributed to all markets in Indonesia and exported.

The third policy on maize was the imposition of import tariff. The objective of the policy was to protect farmers from import surge of maize. During 1974-1979 government imposed 5% tariff on imported maize, which increased to 10% during 1980-1993. The increase of tariff level was generated by the low level of domestic maize production. As the level of domestic production increased, on 1994, the imported tariff was reduced from 10% to 5%. On 1995, government decreased the tariff level to 0%.

This step was taken in order to improve business efficiency, strengthen economic elasticity, and increase the competitiveness of poultry feed industry. The decrease of maize import tariff was followed by other major ingredients of feed. The major ingredients such as, soybean meal, fishmeal, groundnut meal and bone meal had zero import duty (Tangendjaja, n.d). Since then, the 0% tariff was imposed until 2007 when it was raised to 5%.

Beside all reasons that were mentioned above, there is also a possibility that the imposition of import tariff was caused by the fluctuation of domestic maize production and consumption. The fluctuation of maize production and consumption was shown in table 2.1. The table showed that during 1991 to 1993, the domestic average production growth was lower than the domestic consumption growth. Even though in 1992, domestic production increased more rapidly than the consumption, but in the next year the production level showed greater decrease than the consumption level. In 1994, the domestic production started to increase and from 1995 to 2006 it successfully exceeded the consumption level. In 2007, the domestic production still showed an increase. On the other hand, the consumption level also showed a great increased. Therefore, in

order to protect domestic producers of maize from import surge, government increase the import tariff level to 5%.

Table 2.1. Domestic Maize Consumption, Production and Import Tariff Level

Year	Production (1000 ton)	Consumption (1000 ton)	Tariff level (%)
1991	6,164.83	489,937	10
1992	79,131.84	506,644	10
1993	6,355.21	504,744	10
1994	6,752.15	536,215	5
1995	8,142.86	529,652	0
1996	9,200.81	557,034	0
1997	8,671.65	571,139	0
1998	10,110.56	578,583	0
1999	9,204.04	597,732	0
2000	9,676.90	605,908	0
2001	9,347.19	618,873	0
2002	9,654.11	623,465	0
2003	10,886.44	644,963	0
2004	11,225.24	683,659	0
2005	12,523.89	699,153	0
2006	11,609.46	720,389	0
2007	13,287.53	767,157	5

Source: Various sources (processed)

2.4. Maize Production and Consumption in Indonesia

Kasryno (2007) stated that the increase of maize production started in 1984 after the production of rice in Indonesia had reached the goal of self fulfillment (swasembada) program. Since that year, the agricultural program in Indonesia was more diversified, and one of the potential commodities was maize. In 1981 the production of maize was centralized in certain provinces such as East Java which share in the total production of maize was as much as 43%, followed by Central Java with total share 22%, South Sulawesi 11%, East Nusa Tenggara 6%, Lampung 2%, and North Sumatra with total share as much as 1%.

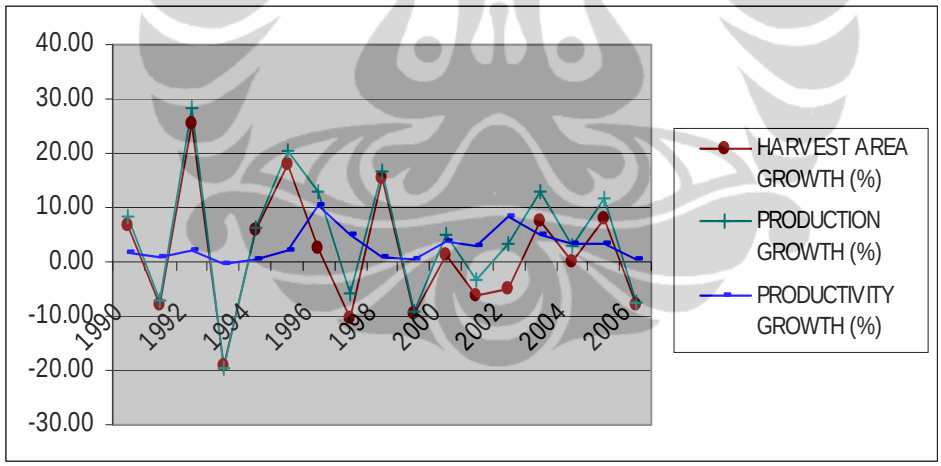
Latter on, this situation changed. In 2005, Lampung held the third position of biggest production share with total share as much as 11%, followed by North Sumatra and South Sulawesi with the same total share as much as 6%. East Java

still had the biggest share, 35%, of total production, while East Nusa Tenggara with its total share as much as 5% hold the smallest production share of maize. This change was urged by the development of livestock feed industry which concentrated in West and East Java, Lampung, and also North Sumatra.

In period of 1990 – 2000, the total of maize production experienced an increase from 6,647,937 ton to 9,676,400 ton. This harvest growth had followed the growth of harvest area which performed an increase from 3,093,239 Ha in 1990 to 3,500,318 Ha in 2000. Although maize production was seemed stagnant during 2000 to 2002, but it showed a rapid increase from 2003 to 2007, even though there was a decline of maize production and productivity in 2006.

The decline of maize production and productivity in 2006 was due to the decline of harvest area of maize. But, in 2007, maize production, productivity, and harvest area showed a significant increase. The growth of maize production, productivity, and harvest area can be seen in the figure 2.4.

Figure 2.4. The Growth of Maize Production, Productivity, and Harvest Area



Source: Ministry of Agriculture (processed)

The increase of maize productivity is supported by the development of research and technology on maize plantation which is more concentrated on the advancement of maize production as raw materials of feed industry. Tangendjaja (n.d.) stated that corn production could be increased by increasing the corn area and switching to hybrid corn.

The same opinion was also stated by Kasryno et al. (2007). He argued that the growth of maize productivity was urged by the intensive promotion of hybrid

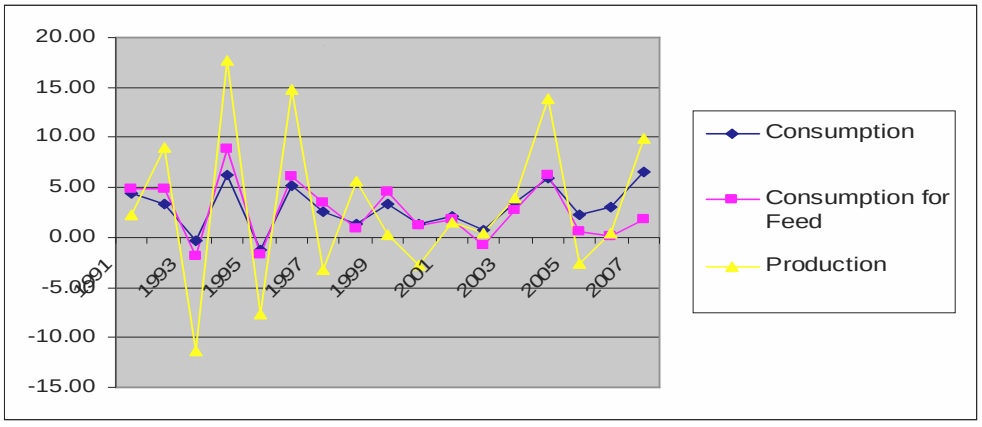
maize and guidance and partnership program from maize seed producers which was also the producers of feed, such as Charoen Pokphand and Pioneer. All these programs managed to increase the price of maize in the producer's level.

Although in 2007 maize production grew as much as 14.45%, but the harvest area's growth was only 8.50%. It seems that the harvest area in certain maize central production provinces is hard to be developed any further due to the rapid population growth. To provide larger area for maize plantation, some provinces changed the plantation area from dried soil to irrigated fields. A study by Mink *et al*. (1987) revealed that in Indonesia, as much as 79% of maize plantation was cultured on dry soil, another 11 % on irrigated fields, and the other 10% is planted on rain-watered fields.

On the other hand, other study by Kasryno (2002) showed that there were some changes in the maize plantation area. Maize plantations on irrigated fields and rain-watered fields increased from 10% to 15% and 20% to 30%. Since those changes, around 57% of maize yields in Indonesia were planted in rainy seasons on dry soil. Other 43% planted in dry seasons on irrigated and rain-watered fields (Zubachtirodin, Pabbage, and Suband, 2007).

Maize consumption growth in Indonesia has the same pattern with the production growth. As shown in figure 2.5, the consumption of maize sharply increased in 2004 as much as 6.0%, but sharply fell in 2005. Latter on, it rose again and reached 767,157 MT of total maize consumption in 2007. Most of this consumption was used as the raw material for feed industry.

Figure 2.5. The Growth of Maize Production, Consumption, and Consumption for Feed



Source: worldfood.apionet.or.jp

Following the pattern of total consumption growth, consumption of maize for feed also increased sharply in 2004 as much as 6.29% from previous year, but dropped to 0.58% in 2005. In 2007, as the total consumption increased, the consumption of maize for feed went up as much as 8,250 MT or as much as 1.74%.

2.5. Problems of Maize Supply in Indonesia

Actually, the quality of domestic maize is better than the imported maize. Compared with imported maize from China, domestic maize has higher level of *beta-carotene* which important for producing better yolks and chicken meat. Therefore, feed producers prefer to choose domestic maize rather than the imported one. Unfortunately, domestic maize is available during the harvest time only and imported maize is still needed, due to some problems that faced by maize producers.

Tangendjaja (n.d) stated that the main problems of maize supply in Indonesia were not only on plantation systems, but also on the after harvest treatments. These problems include procurement for dryer. After maize is harvested, it needs to be dried. The drying process becomes a problem during the rainy seasons, when the intensity of rain is high. Therefore, dryer with high capacity is needed. Unfortunately, the price of the dryer is higher than any other machineries used in maize processing, thus, it is unaffordable for farmers.

Other problem that has to be faced is storage problem which demanded for better storage facility, such as procurement for silo (Jagung dan Industri Pakan Ternak, n.d). Within harvest time, the domestic production of maize can exceed the domestic consumption. But, all these crops should be store in a place with certain humidity level. Therefore silo is needed in order to maintain the quality of crops, thus they can be used while waiting for the next harvest time.

2.6. Indonesia's Export and Import of Maize

In fact, Indonesia's production of maize is big enough to fulfill the demand of poultry industries. The Ministry of Agriculture reported that maize production reaches its peak production on January to March with total production as much as 6.7 million ton on 2007. But, on May to August the production only could reach 3.7 million ton, while the demand of farming industries was around 5

million per year. Due to the lack of technology on drying and storing process, the over production on January to March can not be used for the next crop season. As a consequence, on May to August, while the total production is low, Indonesia has to import maize in order to fulfill the demand of maize.

The volume of maize export and import fluctuated depend on domestic production and maize price in international market. Other factor that might influence the export and import volume was the economic crisis in 1998. During the economic crisis, the total export volume of maize increased 3,197% from 18,957 ton in 1997 to 624,942 ton in 1998. This sharp increase was caused by the depreciation of Rupiah over US Dollar. Consequently, although the international price of maize declined during the time, but it was more profitable for maize producers to export their crops rather than sell it in domestic market.

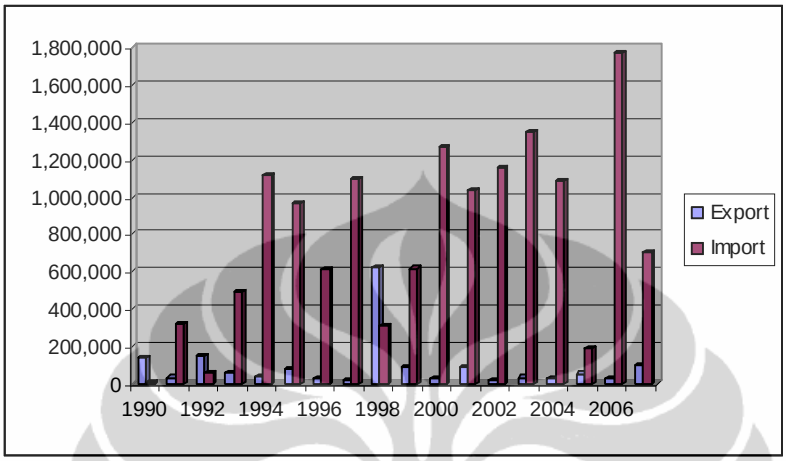
On the other hand, the depreciation of Rupiah to US Dollar had pulled up the price of imported maize, thus the total import volume was decreased 71% from the previous year. Nevertheless, the economic crisis has a contradictive effect on maize export performance. Due to the economic crisis, the export volume of maize increased significantly. The rapid increase of export volume during that time was also urged by the increase of harvest area, and high harvest yields (Jagung dan Pakan Ternak, n.d).

In 2006, Indonesia imported maize as much as 1,775.32 MT which showed an increase from 185.60 MT in 2005. The increase of imported maize volume was urged by the decreasing of domestic production due to the decreasing harvest area on that time. Hence, domestic production was not been able to satisfy domestic demand of maize, especially demand from feed industry. However, in 2007 the amount of imported maize decreased sharply as much as 60% to 701.95 MT in 2007. In the mean time, the export volume of maize had reached its highest volume as high as 107.00 MT, or increase 262% from the previous year.

In 2007, export growth of maize experienced its highest growth as much as 262%, with the total export increase 73.67 MT from 2006. The sharp increase of exported maize which was followed by the decreased of imported maize was caused by the increased of maize price in international market. Moreover, the imposition of 5% import tariff had made the price of imported maize became

more expensive, thus feed producers were forced to lessen their import and substitute the imported maize with local maize. The total volume of export and import maize is presented in figure 2.6.

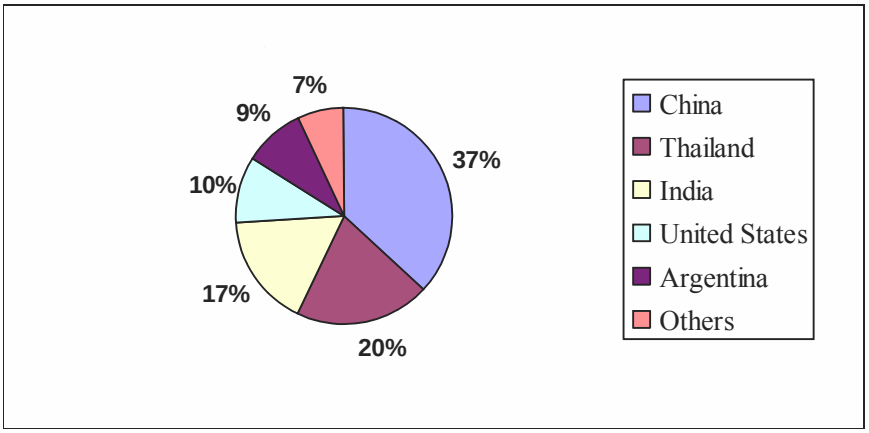
Figure 2.6. Maize Import and Export Volume (Ton)



Source: Ministry of Trade

The main exporting country of maize in 2007 was China which held 37% of total import volume in Indonesia. Before 2000, The United States held the biggest shares of maize import, but it changed since the demand of maize as energy resources in that country increased. This situation had made China become the number one importing country of maize. China was followed by Thailand with total share 20% from total import in 2007, the United States 17%, India 10%, and Argentina 9%. Other 7% came from other exporting countries. The shares of five biggest exporting countries to Indonesia is presented in figure 2.7 below.

Figure 2.7. Total Import Share from Five Biggest Maize Exporting Countries to Indonesia

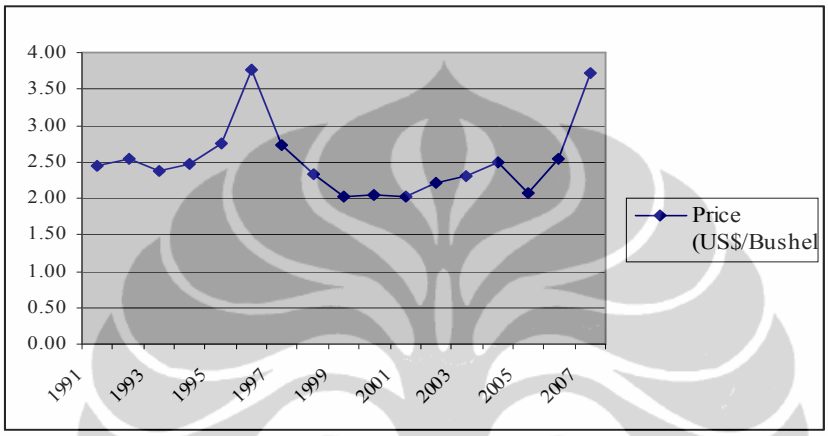


Source: Ministry of Trade (Processed)

2.7. The Price of Maize

As the production of maize increased, the price of maize also showed an increase due to the increase of demand from industrial sector. The rapid increase of the price is not only happened domestically, but also internationally. The changes of maize price in international market were illustrated in the figure 2.8.

Figure 2.8. International Price of Maize



Source: Ministry of Trade (Processed)

The figure showed that in 1996, price of maize in international market reached its highest level as high as US$ 3.76/bushel from US$ 2.76/bushel in 1995. Meanwhile, the highest growth occurred in 2007 when the price of maize had significantly increased from US$ 2.54/bushel to US$ 3.73/bushel or around 46.51%. This increase was the highest growth of maize international price which urged by the increase of maize demand as the raw material of bio ethanol in certain development countries, while international production of maize was seemed stagnant.

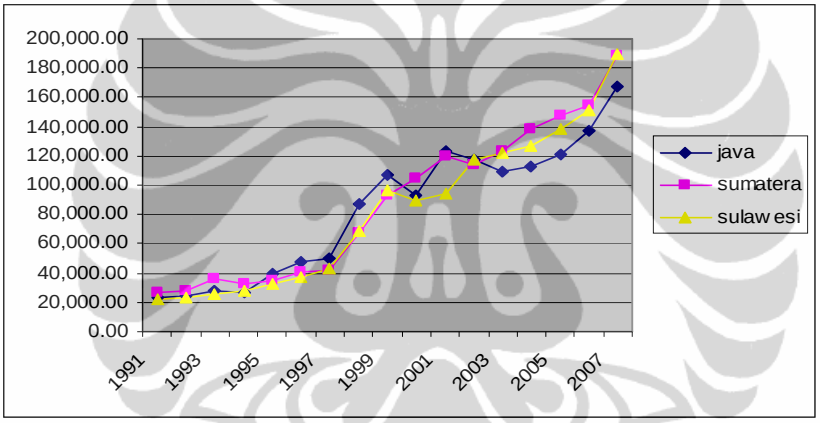
As a contrast, the lowest growth level of the international price was experienced during economic crisis in 1997. On that time, the international price of maize was pushed down as much as 27.34% to US$ 2.73/bushel. The economic crisis was still affecting the international price until in 1999. Within that time, the price of maize in international market fell 12.33% to US$ 2.03/bushel from US$ 2.32/bushel in 1998.

In the meantime, the fluctuation of maize price in domestic market was greatly determined by the level of domestic maize production. During harvest time, maize production was higher than the demand. Consequently, there will be

an excess supply of maize which will push down the domestic price. Since the domestic price is lower than the international price, maize producers were likely to sell their products abroad with higher price. On the contrary, when the level of maize production was lower than the domestic demand, there was an excess demand which urged wholesaler to import maize from other countries.

Other factor that might influence the price of maize in domestic market is the fluctuation of exchange rates level (Swastika *et al.*, 2005). As the Rupiah depreciated, the price in international market is more interesting, so the farmers are likely to export their products. But, when Rupiah appreciated, it will be more beneficial for farmers if they sell their products in domestic market.

Figure 2.9. Domestic Price of Maize



Source: Ministry of Trade (Processed)

As can be seen in figure 2.9, a sharp increase of maize price in Java, Sumatra, and also Sulawesi occurred during the economic crisis on 1998. Although the international price of maize decreased throughout that time, but since the value of Rupiah was depreciated, the imported maize's price pulled up. In 1998, the price of maize in Java increased from around 74.10%. While in Sumatra and Sulawesi the increased hit 60.35% and 57.93%. In Java and Sulawesi the increase continued until 2000 when the price began to fall 13.37% and 8.02% from a year before. As the value of Rupiah started to be less variable, the price of maize in domestic market became more stable.

Meanwhile, Sumatra still experienced the increase of maize price until 2002 when avian flu cases began to spread in Indonesia. Through the year, maize price in Sumatra decreased 5.22% than 2001 when maize price reached Rp

120,064.11/100 kg. Avian flu case did not only affect the price of maize in Sumatra but also in Java. Due to the rapid growth of that pandemic, the price of maize in Java was pushed down as much as 4.87% from Rp 123,053.73/100 kg to Rp 117.066.75/100 kg.

The price of maize in domestic market performed an increase in 2001 when it increased as much as 17.36% from Rp 1,507/kg in 2000 to Rp 1,769/kg. The rapid increase occurred in 2006 from Rp 2,151/kg in 2005 to Rp 2,623/kg in 2006, or as much as 21.96% (Kasryno, *et al.*, 2007). The important factor which encourages the rise of maize price in domestic market is the demand of maize for feed industry. Although the demand of maize as the main food crops decreases, but the increase of maize demand for feed is faster. Therefore, the price of maize still performed an increase.

Maize price in domestic market was also determined by the presence of import tariff. Usually, import tariff is imposed in order to reduce the amount of imported good and protect national industries. On the other hand, import tariff will cause significant raise of imported good's price. Due to the rapid increase of the demand of maize from feed industries, from 1995 to 2006 the import tariff was decreased to 0%. But in 2007, the import tariff was elevated to 5% in order to urge the domestic maize production. As 5% tariff was imposed on 2007, domestic price of maize in Sumatra, Java, and Sulawesi was pulled up about 21.97%, 21.29%, and 24.74%.

CHAPTER 3

PROFILE OF FEED INDUSTRY

3.1. Feed as One of Derivative Products of Maize

Generally, animal feed is divided into two, feed for ruminants such as cows, sheep, buffalo, and goat, and non ruminants like swine, and poultries (chicken, bird, duck, and goose). As the most important factor in poultry industry, feed, which account for 70% of total cost, has to be made with the right composition and form. Therefore the feed producers ought to know the right production technique, including the tools, machineries and raw materials.

Thus far, maize is used for direct consumption, as well as the main raw material in food industry and feed production. In order to satisfy the necessities of maize for feed industry, 3.5 million ton of maize are needed per year (*www.alabio.cjb.net*). Generally, feed for poultry or non ruminant contains high level of maize, because it should contain low rough fiber, but high energy and protein level.

Tangendjaja (n.d.) argued that the main ingredient of feed for poultry was maize, especially yellow maize. Furthermore, he also stated that the quality of maize was determined by the moisture level, which should be around 16-17%, the proportion of broken or damaged kernels, and contamination of hazardous materials such as mycotoxin. The second major ingredient of feed is soybean meal that is known as the best protein source for poultry. Compare to other plant protein source for poultry, soybean meal is more preferable due to its higher digestibility. All soybean meals are imported, especially from Argentina, Brazil, China, and USA. The other important ingredient of feed is rice barn that accounts for 10% of ingredient for broiler's feed and 10-30% for layer's feed.

Beside those major ingredients, feed also contains some minor ingredients and feed additives. Minor ingredients comprise dicalcium phosphate which is brought from Belgium, China, and USA, calcium that is produced domestically from limestones or oyster shells, and salt. Meanwhile, feed additives consist of vitamins, trace elements, cossidiostat, growth promotants, cloline chloride, antioxidants, and preservatives or nutritional supplements or enzyme. All these

substances are still imported. Each feed producers has different formula and composition of feed that their produced. The formula and the composition of feed depend on the price, the availability of the ingredients, and services offered by the supplier (Tangendjaja, n.d).

3.2. Feed Producers in Indonesia

Most of the major feed producers are operating in Java, to be exactly 35 producers, with total feed production in 2007 reached 4,395.51 MT. Sumatra is in the second row with total production 3,179.44 MT comes from 23 big producers. Meanwhile, Sulawesi with only 2 big producers can achieve total production as much as 125.08 MT. Every feed producer has its own production capacity which is usually above the actual production. The high feed production in Java is supported by the fact that most of feed mills are located in Java. Furthermore, it also cannot be denied that total maize production in Java is higher than those two other islands, since it is easier for feed producers to acquire the raw materials.

Tangendjaja (n.d.) stated that based on the production capacity, feed mills were divided into three groups; large, medium, and small scale feed mills. Feed mill is categorized as large if their production capacity exceeds one million tons per year. If the production capacity is ranging from one hundred thousand to one million tons annum, feed mill is categorized as medium. Otherwise, if production capacity is less than one hundred thousand tons annum, feed mill is classified as small. Usually, large feed mills are integrated with poultry industries. They have their own commercial poultry operation and poultry processing plant, and even have their own trading companies.

Some of feed milling plants are concentrated in three major areas; Jakarta, Surabaya, and Medan. Jakarta becomes the major area since it is close to the port that is used in importing the raw materials. Moreover, it has large number of consumers of poultry products. Nowadays, many new feed mills are established in Serang (to the west of Jakarta) since a new port for handling corn has been built in this area (Cigading). Surabaya and Medan become the major feed industry areas because they have supporting port facilities, large number of consumers of poultry products, and strategic location that is close to the local raw material supply, particularly corn and rice bran (Tangendjaja, n.d.).

Feed production in Indonesia is dominated by some major feed mills which spread in eight provinces. Recently, there are 8 mills in North Sumatra, 4 mills in Lampung, 10 mills in Banten, and 4 mills in Jakarta. Both West Java and South Sulawesi have 2 mills, while East Java, with 15 major feed mills and 52 home industries which produce feed, becomes the centre of feed industry in Indonesia. Most of those major mills are foreign investment companies which also has their own farm and poultry products' producing industries. Those major mills in Indonesia are Charoen Pokphand, Japfa Comfed, Sierad Produce, CJ Feed, Gold Coin, and Sentra Profeed *(*Market Intelligence Report, 2008*)*.

Charoen Popkhand Indonesia (CPI) is the biggest foreign investment feed mills in Indonesia. It has three major factories in Mojokerto, Jakarta, and Medan, with total production capacity as much as 2.6 million ton of feed per year. The second largest feed mill is Japfa Comfeed (JC) which total production capacity is 1.73 million ton. As the oldest foreign investment feed mills in Indonesia, JC has its own integrated poultry and poultry's product processing factories. Cheil Jedang (CJ) Feed Indonesia owns two feed mills, PT. CJ Superfeed and Pt. CJ Feed Jombang. With total production capacity of 750,000 ton annum, CJ Feed Indonesia becomes the third largest feed mill. Moreover, it has its own silo which allows it to keep the maize for longer period. Hence, CJ Feed Indonesia will always have the raw materials in their storage.

The fourth largest mill is Sierad Produce Tbk. This domestic investment feed mill is a holding company which includes PT. Anwar Sierad Tbk, PT. Sierad Produce Tbk, PT. Sierad Feedmill, and PT. Sierad Grains. With five factories that are located in Tangerang, Bogor, Sukabumi, Lampung, and Sidoarjo, and total production capacity of 540,000 ton per year, Sierad Produce becomes one of the biggest feed producers in South East Asia. Meanwhile, Malindo Feedmill, with total production capacity as much as 438,000 ton annum, is the fifth largest feed mill in Indonesia. In order to increase its production capacity, Malindo Feedmill planed to build new feed mill in Banten with total production capacity 360 ton per year.

To facilitate the increase of national feed production, government, on 2007, had developed new mini feed mills in 14 locations that include 5 locations

in West Java, 2 locations in Central Java, 1 location in East Java, 2 locations in Bali, and 4 locations in Sumatra. The raw material for these mini-feed mills comes from local farmers which hadn't been absorbed by national feed industry. With overall total production capacity as much as 3-5 ton per day, hopefully, those new mini feed mills will be able to support local farmers in satisfying their necessities of feed.

3.3. Government's Regulation on Poultry and Feed Industry

As the feed industry is closely related to the poultry industry, any changes in government policy in poultry industry will affect the feed industry. The Presidential Decree No. 23/1991 about the restriction on investment in the feed industry stated that feed industry was still opened for new investments by both domestic and foreign investors (Tangendjaja, n.d).

The decree affirmed that the local feed mills are not required to export their products. They can sell their products locally if they followed the quality and safety regulation. It also mentions that feed mills are not required to sell their products to co-operatives. They are permitted to appoint a number of distributors or retailer agents within an area as long as those distributors or agents had a trading license from the Minister of Industries and Trade. However, feed mills remained responsible for feed quality, and distributors or agents were prohibited to replace the original packing of feed. Additionally, animal feed are not sold in the same area as chicken or eggs, and distributors or agents complied with and committed themselves to the regulation of animal feed control.

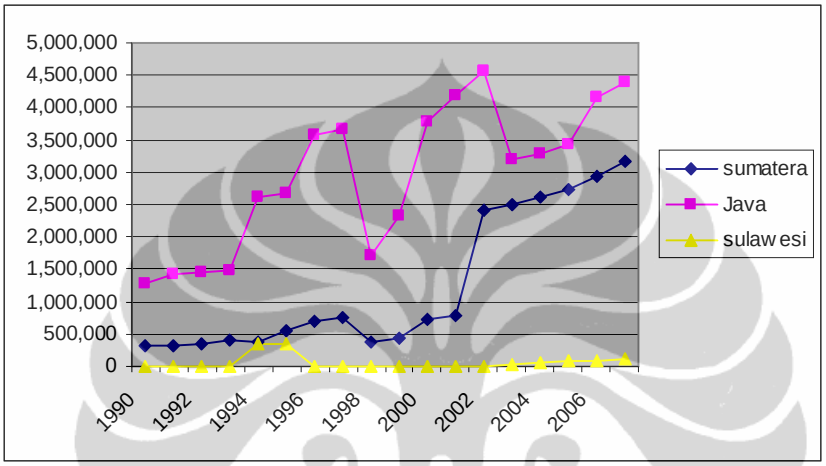
3.4. Feed Production and Consumption

Generally, feed production in Indonesia is determined by market and non-market forces. Market forces such as the domestic or international price of maize and soybean as the raw materials of feed. Non-market forces include seasonal factors like El Nino, disturbance in the distributional system especially during rainy seasons, shortage of maize supply due to the long extreme dry periods, and pets or plant diseases outbreak (Swastika *et. al*. 2005: 58).

In 2007 there are 60 large feed mills in Indonesia with total production as much as 7,800.03 MT. Since 2000 to 2007, this total production kept increasing. Although, the highest total production occurred in 2007, but the biggest growth of

feed production was experienced in 2006 when the production increased 15.64% or as much as 973,748 MT from a year before. Feed production in Indonesia is still dominated by big feed mills which spread in Sumatra, Java, and Sulawesi. The total production of feed in Sumatra, Java, and Sulwesi was demonstrated in figure 3.1 below.

Figure 3.1. Total Feed Production in Sumatra, Java, and Sulawesi



Source: Ministry of Agriculture (Processed)

Figure 3.1 shows that feed production in Java is more fluctuated than Sumatra and Sulawesi. The highest production growth in Java was experienced in 1994 which increase 74.49% or as much as 1,114,662 ton from 1993. Sulawesi which has the most stable production level, had also reached its highest production growth in 1994 with total increase 335,581 ton from 1993. In 1994, Indonesia was hit by El Nino which caused longer period of dry seasons. This condition had caused most of farmers failed to harvest their crops, especially rice or paddy. Thus, many farmers changed their crops from paddy to maize which requires less water than paddy. Furthermore, this condition has increased the production of feed which raw material was maize.

Meanwhile, the highest production growth in Sumatra happened in 2002 with total increase 1,606,384 ton or around 202.75% from previous year. In 2002, when El Nino strike Indonesia for the second time after 1994, the total production of feed in Java had experienced it highest level with total production as much as 4, 574, 415 tons. It showed that El Nino had caused the decrease of paddy's crop but it increased maize crops which further increase the production of feed.

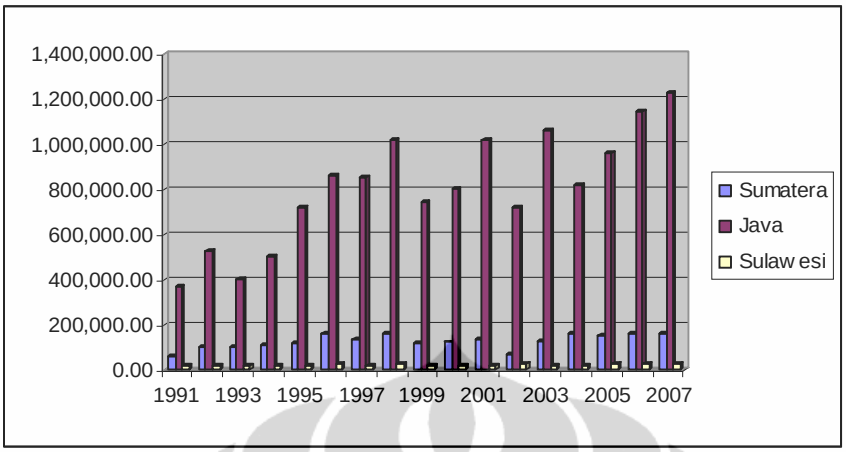
Economic crisis in 1998 had pushed down the feed production in Java and Sumatra to their lowest production growth. Java with -53.57% growths had less total production as much as 1,956,322 tons than in 1997, while total production in Sumatra down of 51.86% or 398,932 tons. The sharp decrease that was experienced by Java and Sumatra was also experienced by Sulawesi, which production decreased as much as 37.62% or 3,920 tons during 1998. Therefore, it can be concluded that economical crisis in 1998 has generally caused the decline of total production of feed in Indonesia, especially in Java and Sumatra.

One year after the financial crisis, feed producers begun to increase their productions. It can be noticed from the increase of feed production in Sumatra and Java which increased 17.18% and 36.70% on 1999. But, in the same year, Sulawesi was still disturbed by the effect of financial crisis. During that period, its total production decreased as much as 36.57%. Moreover, in 2003, feed production in Java decreased as much as 1,376,307 tons or around 30.09%, meanwhile, feed production in Sumatra and Sulawesi kept increasing until 2007.

The sharp decline of feed production on 2003 in Java was triggered by avian flu case that hit Indonesia in early 2003. As the Avian flu began to spread all over Indonesia, demand for poultry products decreased sharply which was followed by the decrease of demand and production of feed. After avian flu case had successfully been resolved, feed production began to grow. Thus, feed production in Sumatra reached its peak in 2007 with total production 3,179,444 tons or increase as much as 8.44% from 2006.

Just like feed production, feed consumption is also likely to be fluctuated. The effect of 1997-1998 economical crisis on feed consumption was showed a year after the crisis, not during the crisis. On 1999, consumption of feed in Sumatra, Java, and Sulawesi decreased around 26.45%, 26.66%, and 22.48%. Figure 3.2 demonstrated that those three islands had different growth level of feed consumption.

Figure 3.2. Feed Consumption in Sumatra, Java, and Sulawesi



Source: BPS (processed)

Figure 3.2 shows that in Sumatra, the highest growth of feed consumption occurred in 2003. At that time, feed consumption grew 78.77%. In the previous year it suffered a great decrease as much as 49.47% because of the avian flu issue that began to spread in Asia. Avian flu issue also had affected feed consumption level in Java. In 2002, the feed consumption level in Java decreased as much as 29.92% from the consumption level on the previous year. But, a year after, it experienced its highest increase as much as 78.77%. Although in 2003 Java reached its highest growth level, but it only pursued the highest level of feed consumption on 2007 when it reached total feed consumption as high as 1,229,727.03 ton.

Sulawesi had undergone its lowest growth of feed consumption in 2003. During the year, consumption level down as much as 29.04% or around 7,132.57 tons. Meanwhile, the highest growth level of feed production occurred in 2005 with total increase 9,269.80 ton or about 46.55% from 2004. In 2005, Sulawesi also experienced the highest level of feed consumption.

3.5. The Price of Feed in Indonesia

Indonesia's feed market is likely moving towards an oligopoly market structure which dominated by large feed mills (Swastika et al, 2005). In this market structure, firms are interdependent, which means that a firm's production strategy or policy depends on other firm's strategy or policy. In order to keep the competition among firms, they usually create barriers to entry the market, whether

artificial barriers like controlling the inflow of raw materials or the distribution of feed or natural barrier like creating customers loyalty on their products. In oligopoly market structure, firms have significant control on price and also engage actively in non-price competition, such as using economic of scope production strategy. Therefore, besides feed, those firms also have their own small or big-scale poultry.

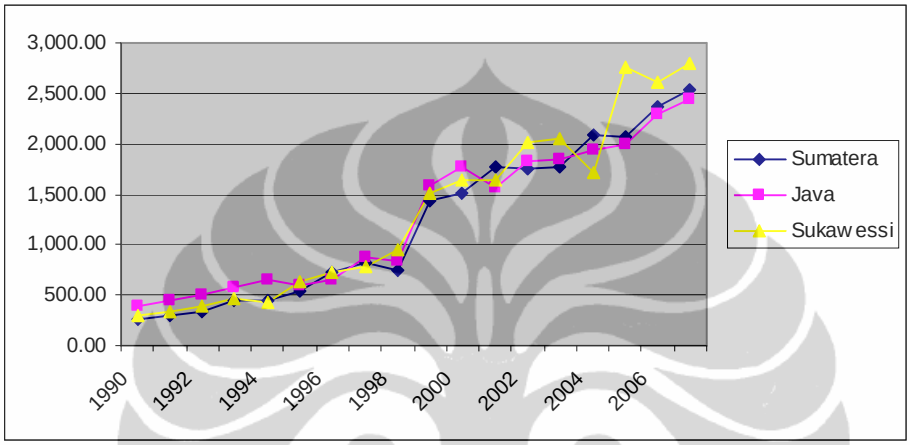
Moreover, Rusastra in Swastika *et al*. (2005) suggested that the fluctuation of feed price in Indonesia was strongly determined by distortion in the raw material price, such as production of maize and soybean meal, and the price of soybean meal which determine the price of feed. Since most of raw materials for feed are imported, any trade policy imposed by the exporting country would affect the domestic feed production and feed market. In addition, Swastika *et al.* (2005) also proposed other factors that might influence feed price, included the fluctuation of exchange rates level, seasonal factors, health issues, and various government policies.

The economic crisis has resulted a severe set back to the poultry industry and the feed mill industry. Several feed mills were closed down while the survivors had to reduce their production. In 1997, during the economic crisis, the feed mill association (GPMT) increased the selling price of feed several times in order to take account of the fluctuation in the exchange rate. The fluctuation of exchange rate had caused an increase in the prices of imported products such as soybean meal, meat bone meal, rape seed meal, synthetic amino acids (lysine, methionine), vitamins, minerals and drugs. However, the final price of feed was not three times higher and did not follow the fluctuation of the exchange rate due to relatively low prices of corn and rice bran (Tangendjaja, n.d).

The price of feed in Indonesia did not fluctuate as high as the production of feed. As shown in figure 3.3, the price differences among Sumatra, Java, and Sulawesi is not too big. The highest increase of price in Sumatra happened in 1999. In Sumatra, during economic crisis in 1998, the price of feed fell as much as 10.59%. A year after the crisis, price of feed increased 93.74% from Rp 740.95 per kg to Rp 1,435.48 per kg. Meanwhile, just like in Sumatra, in Java, the highest growth of feed price occurred in 1999 when the price of feed arose 89.61% from a

year before. Sulawesi also reached its highest growth of feed price in the same year as Java and Sumatra. Within the same period, feed price increased from Rp 957.48 per kg to Rp 1514.11 per kg or around 58.13% from the previous year. Therefore, it can be concluded that the economic crisis in 1998 had caused the feed price in domestic market declined, although Sulawesi didn't suffer the same.

Figure 3.3. Feed Price in Sumatra, Java, and Sulawesi



Source: BPS (Processed)

The strike of El Nino had a small impact on the price of feed in Indonesia. As already mentioned in the previous subchapter, El Nino disaster in 1994 and 2002 had disturbed paddy crops, thus farmers were likely to convert their farms to maize which requires less water than paddy. Therefore maize production increased which furthermore increased the availability of raw material for feed industry. Since the feed production level is determined by the availability of the raw material, the increase of maize production had increased feed production, especially in Java and Sulawesi. During the El Nino strike in 1994, the price of feed in Java increased 15.26% due to the increase of soybean price and the increase of feed demand in Java. On the other hand, the feed price in Sumatra and Sulawesi experienced a small decrease 0.54% and 6.45% from a year before.

CHAPTER 4
PREVIOUS RESEARCH ON TARIFF AND PRODUCTION

4.1. Tariff as a Trade Barrier in International Trade

Generally, international trade will bring advantages for all parties or nations. However, some countries frequently impose some restrictions or regulations while trading with other countries. These restrictions or regulations are also called trade barriers. There are two kinds of trade barriers; non tariff and tariff barriers.

The first kind of trade barriers is non tariff barriers. Non tariff barriers are trade barriers other than tariff, such as import quotas and other forms of new protectionism. Other form of non tariff barriers is recognized as new protectionism which includes export subsidies, voluntary export restraints, technical, administrative, and other regulations.

Beside non tariff barriers, in international trade, there are also tariff barriers. Salvatore (2007: 248) argued that tariff was a duty which charged on traded good when it crossed national boundaries. There are two kinds of tariff in international trade, export tariff and import tariff. Export tariff is a duty levied on exported goods, while import tariff levied on imported goods. Hence, the import tariff is used more often than export tariff. Although nowadays the imposition of tariff barriers are lessened and replaced by non tariff barriers, but it is still used by developing countries to protect their domestic industries and provide revenue for the government.

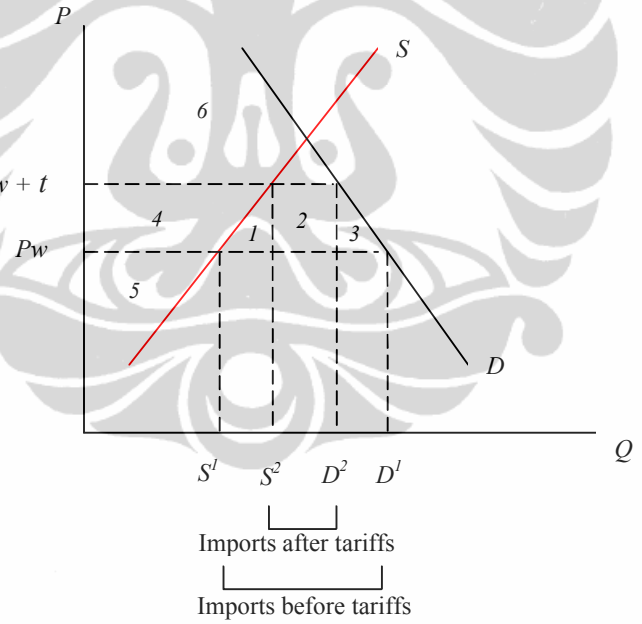
There are three types of tariff; ad valorem, specific, and compound tariff. Ad valorem tariff is defined as a duty on imported goods which is measured base on the fixed percentage of the value of imported goods. For example, duty for imported maize is 25 percent of imported maize. Meanwhile, specific tariff is levied in a fix sum for each unit of imported goods. For example, import duty for imported vehicle is $25 per unit. The third type, compound tariff is a combination of both ad valorem and specific tariff. Therefore, the compound tariff of 25 percent ad valorem tariff and $25 specific tariff on imported vehicle would give as much as $50 dollars for each $100 imported vehicle to the custom officials.

4.1.1. Tariff Effects

The imposition of tariff will give different effects for small and large[2] countries. In international market of maize, Indonesia is considered as a small country. Therefore, this study only discussed the effects of tariff in small country. The effects of tariff can be analyzed by using partial and general equilibrium analysis.

Partial equilibrium analysis of tariff effects tries to explain about the effects of tariff for consumers, producers, and the government of a country. On the other hand, general equilibrium analysis tries to analyze tariff effects in a more general point of view. It gives an analysis of tariff effects on production, consumption, trade, and country's welfare (Salvatore, 2007: 261). The partial equilibrium analysis of import tariff is shown in figure 4.1.

Figure 4.1. The Effects of Tariff for Small Countries



Source: Krugman and Obstfeld, 2006: 181

Figure 4.1 shows that as the import tariff is imposed, it leads to the increase of price in domestic market from P_W to $P_W + t$. Due to the increase of the price of imported goods in domestic market; domestic producers tend to increase their production which increases the quantity of supply in domestic market (from

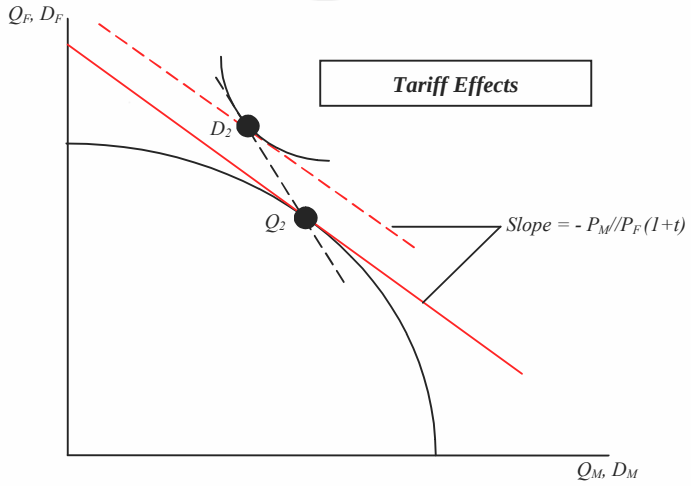
[2] Small countries are countries which have power to influence the international price, while large countries are countries which have the power to determine the international price.

S_1 to S_2) that is known as the production effects. On the other hand, the demanded quantity declines from D_1 to D_2 (known as consumption effects). Therefore, the imposition of import tariff causes the total import volume decrease from S_1 - D_1 to S_2 - D_2 (known as trade effects).

The consumer surplus will decrease to area *6* only while producer surplus become larger, from area *5* into area *5 + 4*. Additionally, tariff imposition brings profit for the government in the form of tariff revenue (revenue effects). On the other hand, tariff may cause some loss in the form of protection cost or deadweight loss as large as area. The deadweight loss occurs due to the shifting of some domestic resources from exportable goods' production which more efficient to the importable goods' production which less efficient (Salvatore, 2007: 253).

Different from partial equilibrium, general equilibrium analysis is more complicated, since cross-market effects are taken into account (Krugman and Obstfeld, 2006: 199). As already mention earlier, tariff imposition tends to elevate the price of imported commodities in a full amount of tariff for consumers and producers. Since the government collects tariff revenue, the price of imported goods is remain constant for the country as a whole. Furthermore, to analyze the effects of tariff by using general equilibrium analysis, this study assumes that the tariff revenues collected by the government are used to subsidize public consumption and the elimination of general income tax. General equilibrium analysis of tariff is illustrated in figure 4.2.

Figure 4.2 General Equilibrium Effects of Tariff in Small Countries



Source: Krugman and Obstfeld (2006: 199-200)

Figure 4.2 shows that when ad valorem tariff at rate *t* is imposed, the price that has to be faced by producers and consumers is as much as $P_F(1+t)$, hence the relative price become $-P_M/P_F(1+t^3)$. Due to the increasing price, the production in country *A* tends to decrease the volume of manufactures production and increase the volume of food production (point Q_2). Under the assumption that the tariff revenue will be returned to the consumers, the budget constraints of consumers exceeds the relative price line which passes through Q_2. Demand for both manufactures and foods become D_2 where manufactures are consumed more than food.

From the explanation above, it can be concluded that the imposition of tariff will decrease welfare. It can be noticed from the level of production that is no longer in the maximum point that maximizes income. Moreover, consumers move their consumption to an indifferent curve which tangents with the true budget constrain. The decline of welfare can be seen from the position consumers' indifferent curve which situated below the indifferent curve before the imposition of tariff. Trade, both export and import, is also lessening since tariff was imposed (Krugman and Obstfeld, 2006: 201).

4.1.2. The Rate of Effective Protection

Other factor that should be considered before imposing tariff is the rate of effective protection. The rate of effective protection indicates the size of protection which is actually provided for domestic production of import-competing goods. Different from nominal tariff rate which is calculated on the value of final goods, effective protection rate is calculated on the domestic value added or processing. Meanwhile, domestic value added is equal to the price of final goods minus the cost of imported inputs which used in the production of final goods. As a tax on the domestic producers, tariff on imported inputs leads to an increase of production cost and a decrease of effective protection rate given from the nominal tariff of final goods. Hence, it discourages the production of imported goods in the country. (Salvatore, 2007: 257-259).

[3] It is assumed that country A export manufactures and import food. P_M is the price of manufactures while P_F is the price of food.

The assumption that underlies the concept of effective protection is that tariff will not affect the international price of commodities and imported inputs, and the usage proportion of input in production is fixed. Therefore, when tariff is imposed, the price of imported inputs increase, therefore, producers tend to substitute the imported inputs with domestic inputs which price is cheaper.

4.1.3. Other Theorems of Tariff

Feenstra (2004: 223-233) affirmed some theorem of tariff effect on large countries. The first theorem was postulated by Brander (1984) and Spencer (1984). They argued that a small specific tariff would improve the terms of trade and welfare of importing country if marginal revenue is steeper than demand. Meanwhile, a small ad valorem tariff would improve the terms of trade and welfare of home country if the elasticity of demand increase while consumption of imported goods decrease. Both assumptions would be satisfied when a country imports from foreign monopolist who has constant marginal cost.

Other theorem was postulated by Helpman and Kugman (1989). They stated that under Cournot duopoly assumption, a positive tariff would likely to be a very optimal policy. With the imposition of tariff, foreign firm would like to reduce their exports. By imposing a small tariff, the welfare of importing country would increase if the pass-through of tariff to domestic price (*dp/dt*) is less than the import share (*m/d(p)*).

Bertrand duopoly theorem assumed that the domestic and imported good were imperfect substitutes. Under this assumption, when the elasticity of demand was increasing in price, the optimal tariff would be positive and a terms of trade would be gained by the importing country. As a contrast, if the elasticity of demand was decreasing in price, an import subsidy was more preferable thatn import tariff. Otherwise, if the elasticity of demand seemed constant, the optimal tariff would be zero.

4.2. Production Theories

Pindyck and Rubinfeld (2005) defined production as a process where inputs are turn into outputs. Inputs[4] are anything used by firms in production process, including raw materials, machineries, and labors, while outputs are products or services produced from production process using inputs and production technology[5]. Different methods may used by firms to produce outputs in different amount by using the same amount of inputs. These methods may be considered as efficient if there are no other ways to produce outputs in larger amount by using the same amount of inputs (Bernheim and Whinston, 2008: 211).

One thing that should be considered in analyzing production is the period of time of the production process, weather it's in short run or long run periods (Pyndick and Rubenfeld, 2005: 190). Short run period is a period of time in which the quantities of production factors are can not be changed. In other words, one or more production factors are considered as fixed in short run. On the other hand, in long run, one or more production factors can be changed or considered as varied.

In the short run, as the number of machineries fix, the addition of labor will bring greater output. After a certain level, the additional labor becomes useless and even counterproductive. At this point labors begin to crowd each other, hence, lessen their productivity. Therefore, it is not surprising that the additional of inputs will cause the decline of its marginal product. This phenomenon is known as the Law of Diminishing Marginal Returns[6].

In the long run, certain amount of outputs is produced by using combination of inputs. The combination of all inputs used in production process is illustrated by an isoquant[7]. An isoquant has a role as the boundary among inputs combination which may produce higher or lower than the given level of outputs, where the farther an isoquant lie from the origin, the higher the level of the isoquant. Likewise, an isoquant gives only one combination of two inputs, that's

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[4] Inputs are also known as factors of production.

[5] Production technology includes all possible methods used by firms in order to produce outputs (Bernheim and Whinston, 2008).

[6] The Law of Diminishing Marginal Returns argues that the marginal product of an input are generally tend to decrease as the use of it increase, while other inputs are considered as fixed (Bernheim and Whinston, 2008).

[7] Isoquant is a curve shows all of possible combination that might be used to efficiently produce a given level of outputs (Bernheim and Whinston, 2008: 228).

why isoquants are thin and downward sloping[8], and it do not cross other isoquant in the same isoquant map[9].

In order to achieve the maximum amount of outputs, a firm should try to find the best combination among two inputs (labor and capital). Holding one input fixed, the addition of other input will lead to lower incremental outputs. For example, if the number of capital is constant, the additional of labor will generate less and less additional outputs. The isoquant becomes flatter due to the addition of labor in place of capital. This phenomenon is called the diminishing marginal return to labor. Furthermore, if the number of labor stays constant, the addition of capital will lead to the decreasing marginal product of capital, and the isoquant becomes steeper because of the addition of capital in place of labor (Pindyck and Rubenfeld, 2005: 201).

Using two variant inputs, firms have the capacity not only to combine the two inputs, but also to substitute one input with another. It may substitute certain amount of capital with certain amount of labors. The amount by which the quantity of one input can be reduced by using one extra unit of other inputs to produce the same amount of outputs is called marginal rate of technical substitution (*MRTS*).

Bernheim and Whinston (2008: 235) suggested that as a firm modified the amount of inputs it used to produce a certain amount of output; technology might be used to make a different level of MRTS changes. Both inputs might be perfectly substituted each other or they should be used in fixed proportion. Two inputs are *perfect substitutes* if firm has the ability to exchange one inputs for another at a fixed rate. On the other hand, if all inputs should be used in fixed proportion, it's seems impossible to substitute one input with another, that's why it's called *fixed-proportion production function*[10]. The other production function is the *Cobb-Douglass production function*. This production function assumed that

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[8] If an isoquant is upward sloping, there will be two combination of inputs which give the same amount of outputs.

[9] An isoquant map is a graph which illustrates combination of isoquants to describe production function (Pindyck and Rubinfeld, 2005: 201).

[10] Fixed-Proportion Production Function is a production function which isoquant is L-shaped, has only one combination of inputs used to produced the same amount of outputas (Pyndick and Rubinfeld, 2005: 203).

each firm has its own production function which combined the amount of inputs it used to produce the same amount of outputs.

4.2.1. Return to Scale

When a firm increases the amounts of all inputs by the same proportions, there will be three possibilities on the amount of outputs it might produce. It may receive increasing, constant, or even decreasing return to scale[11]. A constant return to scale might belong to a firm when it produces outputs the same as the proportional changes of inputs used in production function. It means that the productivity of the production function used is not affected by the firm's operation.

Meanwhile, a firm has an increase return to scale when a proportional increase of inputs produce outputs more than the proportional changes of inputs. It might happen due to the larger operation that allows managers and worker in a firm to specialize their tasks, thus, they would have the ability to use more sophisticated, large-scale equipments. The specialization of labors or managers may cause the increase of the average product of labor which leads to increasing return to scale. Other factor that might increase the return to scale is the physical laws which follow the increasing of inputs.

On the other hand, if the outputs produced were less than the proportional changes of inputs means that a firm has a decreasing return to scale. Although factors that might bring decreasing return to scale is harder to understand, but usually it happens to a firm with a large scale operation which might have difficulties in organizing and running its operation. This situation also probably relates to the problem of task coordinating and maintaining the communication line between workers and management. Otherwise, there are some fixed inputs that haven't being considered. (Bernheim and Whinston, 2008: 241).

4.2.2. Production Cost

One of the important factors in production process that should be considered is production cost. Cost may have different meaning for economists and financial accountants. Cost for economists, which is also called economic

[11] Return to scale is a rate at which the increase of inputs followed by the increase of outputs proportionately.

cost, is the cost for utilizing all resources that a firm has in production process. In economic costs, opportunity cost[12], which often hidden, is included. Unlike opportunity cost, sunk cost[13] is visible, but it has to be ignored once it had been incurred, therefore it should not influence firm's future decision. All of this cost are includes in the total production cost. The total costs[14] that should be incurred by firms include variable cost and fixed cost ($TC = C = FC + VC$). A firm's total cost is summarized in its cost function[15].

Variable cost (VC) is a cost that varies as the variation of output level; includes expenses for wages, salaries, and raw materials used to produce certain level of output. As the level of output increase, the variable cost also increase. As a contrast, fixed cost is a cost which not varies according to the changes of output level. Fixed cost (FC) is avoidable because it might not be incurred when firm stops producing outputs (Bernheim and Whinston, 2008: 251). Fixed cost can be eliminated only by shutting down the firm. This cost includes cost for maintaining plants and paying insurance. Otherwise, if the cost is unavoidable, should be incurred even when firm stop producing, it's called sunk cost.

Besides total cost, there are also marginal cost and average total cost. (Pindyck and Rubinfeld, 2005) defined marginal cost or incremental cost as the increase of cost as one extra unit produced. Thus, marginal cost (MC) is equal to the increase of total cost or variable cost which caused by producing one extra unit of output. In other words, marginal cost informs cost that has to be incurred to expand one unit of output. Average total cost (ATC) calculated by dividing the total cost by the level of output.

In the short run, the change in variable cost is calculated by timing the cost of extra labor times (w) with the amount of extra labor (ΔL) needed. Meanwhile, in the long run, the production cost is variable cost that includes user cost of

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[12] Opportunity cost is cost which associated with opportunities that forgone caused by not using all resources to their best alternative use (Pindyck and Rubinfeld, 2005: 214).

[13] Sunk Cost is an expenditure which can not be recovered one it had been made (Pindyck and Rubinfeld, 2005: 215).

[14] Total cost the total economic expenditures incur in order to produced output in the most economical way (Bernheim and Whinston, 2008: 250)..

[15] Cost function gives description about the total cost that incurred by firm in order to produce each possible level of output.

capital[16]. In the long run the amount of labor and capital used in production process depends on the price of each production factors, the price of labor (*w*) and the price of capital (*r*)

Due to the lower production cost, a firm may experience economies of scale. A firm enjoys economies of scale if its average cost falls while the amount of outputs increases. In other words, economies of scale happen when less than a doubling cost is needed in order to produce a doubling of output. On the other hand, if the average cost of a firm increase as the output increase, a firm experience diseconomies of scale.

Meanwhile, if a firm can produce two or more products using lower cost than two separates firms, it means that the firm enjoys economies of scope. In economies of scope the amount of two-jointed products from a single firm is larger than the amount of each product produced by two different firms. But, if the amount of two-jointed products is less than the amount of each product produced by different firm, it means that the firm experience diseconomies of scale. It means that the cost of producing two products in a single firm is higher than producing them in separated firms.

4.3. Previous Empirical Studies on Import Tariff and Feed Production

4.3.1. Erwidodo, Hermanto, amd Pudjihastuti (2003)

This study tried to answer some question on the impact of import tariff of maize, such as the necessity of import tariff, the appropriate level of import tariff, and factors that need to be considered to determine the level of import tariff. The analysis of optimum tariff estimation was conducted in macro and farm level. Using partial welfare analysis, in macro level the analysis was conducted to comprehend the impact import tariff on the price of maize in domestic market, the production, demand, and import of maize, also the impact on producer and consumer surplus, and government revenue from import tariff. Meanwhile, in the farm level, this study tried to understand the impact of tariff on the price of maize in farm level and the profit level of maize crops.

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[16] User cost of capital is the annual cost of owning and using capital assets which is equal to economic depreciation plus forgone interest (Pindyck and Rubinfeld, 2005: 225).

A simulation was conducted using some scenarios which include the imposition of 0.5 and 10% of import tariff. Parameters used in this study were the elasticity of maize demand which set on -1.0525, elasticity of maize production 0.1250, elasticity of tariff transmission 0.75, and the elasticity of maize price from retailer to farmers which was 0.8254. All theses parameters were set based on guestimation number weighted by empirical experiences of other food crops like rice and soybeans.

The result form the study showed that when the international price (CIF) of maize was US$ 122/ton and the exchange rate was Rp 9,000/US$, the imposition of 0% tariff will give profit as much as 32% for maize farmers in Indonesia which was higher than the normal profit level that was only 20%. In the given situation, there were no convincing reasons for the government to impose tariff on imported maize. Although maize producers gain higher profit, but this was only temporary, because the negative effect of tariff on consumers was even greater. The increase of profit would urge the expansion of maize production which finally would push down the level of profit.

With the same given situation, the imposition of 5% tariff (*ceteris paribus*) would cause the increase of maize price around 3.75% in the wholesaler level, while in the farmer level it would only increase 3.10%. The total demand of maize went down 3.95% as production went up 0.39%. Consumer surplus pushed down as much as Rp 427.8 billion per year, producer surplus pulled up Rp 309.5 billion per year, and government gain revenue Rp 49.7 billion per year form tariff. But Indonesia had to bear higher net social welfare loss, Rp 68 billion per year.

It was recognized that the changes of the exchange rates would cause the changes of the profit from maize crops. When rupiah appreciates (*ceteris paribus*), the profit of maize crops decreased to 28%. But, the profit might increase to 31% if 5% tariff were imposed (*ceteris paribus*), and 31-37% if 10% tariff were imposed (*ceteris paribus*). The same situation would be experienced if the price of maize in international market was falling down continuously. When both or one of this two condition happen, it is necessary for the government to impose tariff.

4.3.2. Kariyasa, Sinaga, and Adnyana (2004)

This study was focused on analyzing the balance between the domestic production and demand of maize, feed, and chicken meet in Indonesia for the next ten years, as well as their level response to the influencing factors, by using time series data from 1980 to 2001 in four provinces North Sumatera, Central Java, East Java, and South Sulawesi, and two stage least square (2SLS) method. The equation models used in this study includes the estimation of maize harvest yields, maize production and productivity, demand of maize for feed industry, direct consumption, food industry, and other purposes, domestic demand of maize, feed production, demand of feed, also production and demand of chicken meet.

In the short term, harvest yields in Central Java, East Java, and South Sulawesi, which determined by the price of maize, price of soybean and the price of peanut in each province, was less responsive to the changes of the determinant factors. Meanwhile, in the long term, it seems that only harvest yields in North Sumatera which quite responsive to the changes of the determinant factors. Maize productivity for all provinces was very responsive to the changes of maize and the price ratio of fertilizers but less responsive to the changes of interest rates and production technology. During the period 2002-2010, it was predicted that maize production would increase 5.41% per year.

Demand of maize for feed industry in the short run was less responsive to the price of maize, price of feed, and the price of soybean, but in the long term, demand of maize for feed in all provinces was less responsive to the price of feed. From the elasticity of maize's demand for direct consumption can be seen that even though maize was direct substitution of rice, but maize was still an inferior commodity. Both in the short and long term, demand of maize for direct consumption was strongly determined by the changes of income per capita. Meanwhile demand of maize for food industries in all provinces was only responsive to the changes of income per capita in the short run, but it also responsive to the changes of input (maize and cooking oil) and output's price. In 2002-2010, it was expected that import of maize would have a sharp increase as much 43.11% annum, due to the big gap between maize production and demand.

The estimation of feed's demand shows that both in the short and long term, demand of feed was pretty responsive to the changes of chicken meet's price in domestic market, as its output, but less responsive to the changes of feed's price. On the contrary, feed production was responsive only to the changes of its input price and the demand of its input (price of maize and imported feed component, and the demand of maize for feed), but it less responsive to its own price. The increase of feed production was predicted as much as 1.25% per year in 2002-2010, while demand of feed was predicted would increase faster, 5.40% per year. Production of feed was estimated by using model as follows:

$$PRP_t = \beta_0 + \beta_1 HPN + f_2 HJD + \beta_3 DJP_t + \beta_4 HKPM_t + \beta_5 TSB_t + \beta_6 RP_{t-1} + \beta_7 D_t + u_6 \ldots\ldots (4.1)$$

where,

PRP_t = Indonesia's feed production in year t (000 ton).

HPN = Real price of feed (Rp/kg).

HJD = Real price of maize (Rp/kg).

DJP = Demand of maize for feed industry (000 ton).

$HKPM_t$ = The price of imported feed components (US$/kg).

TSB_t = Interest rates level in year t (%).

PRP_{t-1} = Indonesia's feed production in one year lag (000 ton).

D_t = Dummy variable of crisis in 1997 and 1998 (D_t = 1 during crisis, D_t = 0 before crisis).

U = Error term.

Chicken meet production, weather in long or short term was very responsive to the changes of the price of chicken meet, but less responsive to the changes of feed price and the interest rates. The increase of chicken meet production was predicted quite low, 0.133% per year during 2002-2010. In the meantime, the increase of demand for chicken meet was greater, 0.165% per year. Demand of chicken meet was relatively responsive to the price of eggs, but not too responsive to the changes of meet and fish's price in long and short term.

4.3.3. Swastika et al. (2005)

The objectives of this study were to analyze historical dynamics and future trends of supply and demand for feed and feed crops in Indonesia, to evaluate

potentials, weaknesses, opportunities and constraints for expanding feed crops in Indonesia, and to formulate policy options to promote the sustainable development of feed crop farming in Indonesia. In order to address its objectives, this study used two stages least square (2 SLS) method to analyze the supply and demand of maize and feed in Indonesia.

The result shows that domestic supply of maize was determined by area of maize plantation and yield of maize. Moreover, maize plantation area was significantly determined by the price of soybean, peanuts, and maize in previous year, and also dummy of economic crisis. In addition, yield of maize was determined by the price of maize and fertilizer in one year lag, wages rates, production technology, and the dummy of economic crisis. The result also indicated that although maize yield was less responsive to the changes of maize price, the increase of maize price and the advancement of production technology were likely to increase the yield of maize. Meanwhile, the increase of fertilizer price might decrease maize yield.

Feed production in Indonesia was estimated using estimation method as followed:

$$FPR_t = k_o + k_1 PF_t + k_2 PM_t + k_3 DF_1 + k_4 DPIFC_t + k_5 IR_t + k_6 FPR_{t-1} + k_7 D_t + U_t \ldots\ldots\ldots (4.2)$$

where:

FPR_t = Feed production in year t ('000 tons).

PF_t = Price of feed in year t (Rp/kg).

PM_t = Price of maize in year t (Rp/kg).

DF_t = Demand for maize as feed in year t ('000 tons).

$DPIFC_t$ = Domestic price of imported feed component in year t (Rp/kg).

IR_t = The interest rate level in year t (%).

FPR_{t-1} = Lagged variable of FPR_t ('000 tons).

D_t = Dummy variable of economic crisis.

U_t = Error term in year t.

The estimation result demonstrated that feed production was positively affected by the price of feed, demand of maize as feed, the feed production in one year lag. On the other hand, the price of maize, the price of imported feed

ingredients, the level of interest rates, and dummy crisis are negatively affected the feed production. Moreover, feed production is quite responsive to the changes of maize demand as feed but not too responsive to the changes of interest rates level in short or long term.

From the result we can also notice that domestic price of maize and soybeans, demand of maize for feed in one year lag, and dummy crisis were determined significantly the demand of maize for feed industry. Meanwhile, demand for feed was only significantly determined by the population of chickens. Domestic maize production was projected to increase 2.36% annually, while the growth of demand for maize was much higher (5.39% annum). In the meantime, feed production and consumption had the same projection as maize. Feed production was projected to increase 1.25% annum while feed consumption increased 5.40% annum.

CHAPTER 5
RESEARCH METHODOLOGY, RESULT, AND ANALYSIS

5.1. Research Methodology

5.1.1. The Econometric Model

The objective of the study is to analyze the impact of import tariff on the poultry feed production in Indonesia, particularly in Sumatra, Java, and Sulawesi where most of large feed producers are located. In order to test the research hypothesis, panel data analysis will be used to analyze the econometric model.

The econometric model proposed in this study is constructed based on previous studies (Kariyasa, Sinaga, and Adnyana, 2004, and Swastika et al. 2005) on feed production in Indonesia. The studies found that production of feed in the short or long term was determined by the changes of input prices (i.e. the price of maize including import tariff), and the demand for input (the consumption of maize for feed). Other variables that may influence the production of feed in Indonesia are the domestic price of soybean, production of feed in the previous year, the level of tariff imposed, and the price of feed itself in the previous year.

All the variables above are factors that have important role in the production of poultry feed in Indonesia, particularly Sumatra, Java, and Sulawesi. The equation proposed is as follows.

$$ln(AFP)_{it} = \beta_0 + \beta_1 ln(PM)_{it} + \beta_2 ln(CMF)_{it} + \beta_3 (Tariff)_t + \beta_4 ln(AFPPY)_{it} + \beta_5 ln(PSB)_{it} + \beta_6 ln(PFPY)_{it} + \varepsilon_{it} \quad \ldots\ldots\ldots (5.1)$$

Where:

AFP	=	Average feed production (tons).
PM	=	Domestic price of maize (Rp/kg).
CMF	=	Consumption of maize for feed industry (tons).
Tariff	=	Tariff level of imported maize (%).
AFPPY	=	Average feed production in previous year (tons).
PSB	=	Domestic price of soybean (Rp/kg).
PFPY	=	Price of feed in previous year (Rp/kg).

The subscript i (= 1, 2, 3) represents three main islands (Sumatra, Java, and Sulawesi) as the centre of feed production in Indonesia. Meanwhile t (=1,….T) represents time period (from 1991 to 2007).

5.1.2. Variables Used in The Equation

AFP denotes the average feed production in Sumatra, Java, and Sulawesi from 1991 to 2007. It is calculated by averaging the total feed production in some provinces in each island. The data, measured in ton, was obtained from the Ministry of Agriculture. Other variable, PM, indicates the price of maize in domestic market. It was obtained from CEIC and represented in rupiah per kilogram (Rp/kg).

As the main content in poultry feed, a higher level of maize's price will lead to a decrease in feed production. Kariyasa *et al*. (2008) and Swastika *et al*. (2005) claimed that production of feed was strongly related with the production of its input, i.e. maize. Due to the important rule of maize in feed production, it is expected that price of maize in domestic market would give a negative effect to feed production.

The consumption of maize for feed industry is measured in ton and denoted by CMF. The data obtained from website http://worldfood.apionet.or.jp. Previous study by Kariyasa, Sinaga, and Adnyana (2004) suggested that feed production is positively related to the consumption of maize for feed. Therefore, it is expected that the increase of consumption of maize for feed implies an increase of feed production.

The next variable is import tariff which is denoted as TARIFF and measures in percentage (%). When import tariff is imposed, it will automatically increase the price of imported maize. Due to the high level of price for raw material, it is suspected that the feed producers have to increase their production cost. Or with the same production budget line, they have to reduce their production volume. Based on that argument, it is expected that import tariff coefficient will show a negative sign. Tariff data was gained from World Integrated Trade System (WITS).

AFPPY represents the average feed production in previous year. The data was obtained from the Ministry of Agriculture and measures in ton. Generally,

feed producers tend to increase their production level every year in order to increase their profit. If the production level in the previous year was high, then the production level in resent year is expected to show an increase. Therefore, it is expected that the average feed production in previous year will have a positive impact on the average feed production in present year.

As in the price of maize, domestic price of soybean, which is denoted by PSB, was retrieved from CEIC database and measured in rupiah per kilogram (Rp/kg). Soybean is an important ingredient of feed beside maize due to its protein and nutrition. So, it can be expected that just like the price of maize, the price of soybeans will have a negative relation to the production of feed. An increase of soybean price will lead to a fall of feed production.

PFPY or the price of feed in previous year was obtained from the Central Bureau of Statistic (BPS) and was measured in rupiah per kilogram (Rp/kg). It is expected that the price of feed in previous year would have a positive impact to the production of feed. The high level of price of feed in previous year may encourage producers to use their production capacity abundantly in present year and increase the production volume of feed.

5.1.3. The Estimation Method

In order to estimate the impact of import tariff on feed production, a panel data regression will be used. This estimation method is used because the author believes that a better description of feed production in Indonesia especially in Sumatra, Java, and Sulawesi, and other advantages will retrieve by using panel data regression[17]. Three main island; Sumatra, Java, and Sulawesi are chosen due to the fact that most of major feed mills are located in those three islands.

There are three approaches which can be used to estimate panel model parameter; Ordinary Pooled Least Square (PLS), Fixed Effect Method (FEM), and

[17] Baltagi (Gujarati, 2003: 637-638) stated that there are some advantages of using panel data. The first reason is because panel data is an appropriate model to study the dynamics change due to its ability to control individual heterogeneity, and ability to detect and measure the effects that can not be observed in pure cross-section or time series data. More over, this method also has the ability to minimize bias that may occur when individual data are aggregated into broad aggregates. Therefore it would give more variability and informative data with less collinearity among variables which in turn will create higher efficiency and degree of freedom. More over, panel data is better suited to study more complicated behavioral model.

Random Effect Method (REM). By disregarding the space and time dimension, PLS becomes the simplest approach on estimating pooled data.

The FEM approach assumed that the intercept across individual may vary but the slope or coefficients of the regressors do not vary across individuals or over time. Meanwhile, REM suggests that different characteristic of individual and time should be accommodated in error term of the model.

5.1.4. Procedures on Estimating Panel Data Model

There are some procedures that should be followed in estimating panel data. These include choosing the most appropriate estimating model, testing for the possibility of heteroskedasticity and multicollinearity. All this tests will be conducted using statistical tools Eviews 5.1.

5.1.4.1.Choosing the Appropriate Estimation Approach

In order to get the best estimation, the first step that should be taken is choosing the appropriate approach that will be used. Choosing the appropriate estimation model could be based on the aim of the analysis or certain kind of data which only can be analyzed using certain kind of estimation method (Nachrowi and Usman, 2006: 318).

Furthermore, Judge in Gujarati (2003: 650-651) had stated some criterion on choosing between FEM and REM approaches:

a. If the number of time series data (T) is larger than the number of cross-sectional units (N), then, FEM is more preferable.
b. Contrast with previous notation, if N is larger than T REM is more appropriate.
c. When the individual error component ε_i and one or more regressors are correlated, The REM estimators are biased while FEM are unbiased.
d. If N is larger than T and the assumptions underlying REM hold, REM estimators would be more efficient than FEM estimators.

Beside those criterions, in order to choose between REM or FEM, Hausman test is also can be used. Hypothesis which underlie Hausman test are:

Ho = Random effects model

H1 = Fixed effects model

The reason to reject the null hypothesis is based on the statistical value of *Chi Square*. If the test shows a significant result (probability is larger than α) it means that FEM approach would give better estimation, hence it is more preferable. But, in this study Hausman test would not be conducted. In order to choose appropriate approach between REM and FEM, criterions from Judge et al. is more preferable for this study.

5.1.4.2.Preliminary Tests

Furthermore, some preliminary tests should be conducted. Those include Chow test, multicollinearity test, and heteroscedasticity test. Chow test is conducted in order to find out whether individual effect is consisted in the model or not. Hypothesis in Chow test are as follow:

H_0 = There is no individual effect; PLS approach is preferable.

H_1 = There is individual effect; FEM approach is preferable.

If there is no individual effect, then the intercepts and the coefficients are constant across individual, therefore pooled least square approach could be used on estimating the model. On the other hand, if there is an individual effect, then the intercept and the coefficients are not constant or vary across individual. It means that fixed effect method (FEM) is more preferable.

Other two tests that should be conducted are the Lagrange Multiplier test and multicollinearity test. The Lagrange Multiplier (LM) test is conducted in order to know the presence of heteroscedasticity which can be noticed by comparing the cross-section chi-square probabilities and the significance level.

If the statistical value of LM (LM statistic) is larger than the value of chi-squares table, it means that there is a hateroskedasticity problem; therefore the null hypothesis is rejected. On the other hand, if the value of chi-squares table is larger than LM statistic, it shows that there is no hateroskedasticity problem, and the null hypothesis can not be rejected.

Meanwhile, multicollinearity test is conducted to find out weather there is any linear relation among independent variables or not. Multicollinearity is categorized as perfect if the regression coefficients of independent variables and their standard errors are infinite. Otherwise, if the

regression coefficients possess large standard errors even though it was determinate, the multicollinearity is less than perfect

5.2. Result and Analysis

5.2.1. The Result of Preliminary Tests

5.2.1.1.The Result of Chow Test

Before Chow test is conducted, the econometric model should be estimated using PLS (no weights) and FEM (no weights)[18]. No weights estimation was used because the true variant residual equation of each variable (σ_i^2) was unknown. Using the result from both PLS and FEM, F-*statistic* is calculated. Moreover, the value of F-*statistic* is compared with the critical value of F-*table* ($\alpha=0.05$, $N_1=2$, $N_2= 41$). The result of the Chow test (F-*statistic*) is as much as 5.099, while the critical value of F-*table* was 3.230. The result of Chow test is presented in table 5.1[19].

Table 5.1. The Result of Chow Test

SSR_1	:	26.929
SSR_2	:	21.565
F-*statistic* (Chow test)	:	5. 099
F-*table* ($\alpha = 0.05, 2, 41$)	:	3.230
Result	:	F-*statistic* is bigger than F-*table*, H_0 is rejected.
Conclusion	:	The model contents individual effects, therefore, FEM or REM is preferable.

As the result of Chow test is bigger than the critical value of F-table, the null hypothesis should be rejected. It means that there is an individual effect in the model; therefore, it should be estimated by using fixed effect methods (FEM) or random effect methods (REM). Since the number of cross section data is smaller than the number of time series data, estimation using REM could not be conducted, thus, the Hausman test could not be conducted either. Therefore, FEM is considered as the appropriate methods in estimating the model.

[18] The result of model estimation using PLS (no weights) and FEM (no weights) are attached in Appendix 1 and 2.

[19] All numerical writings in this study follow English numerical writing's system. For example 1,234.56 is read one thousand two hundred and thirty four point fifty six.

5.2.1.2.The Result of Multicollinearity Test

The existence of multicollinearity in the model can be noticed from the existence of covariance correlation among independent variables. This covariance correlation was calculated by using the coefficient covariance matrix. After the covariance correlation calculated, the next step was finding the coefficient covariance value among regressor whether it was higher from 0.8 or not.

The coefficient covariance value which is higher than 0.8 shows that there is a strong correlation among variables. Hence, it indicates the presence of multicollinearity among regressors (Nachrowi and Usman, 2006: 247). As a contrast, the coefficient covariance value which is lower than 0.8 indicates that multicollinearity is not present. Table 5.2 presents the coefficient covariance matrix.

Table 5.2. Coefficient Covariance Matrix

	LOG(PM)	LOG(CMF)	TARIFF	LOG(AFPPY)	LOG(PSB)	LOG(PFPY)
LOG(PM)	0.437666	0.041522	-0.010176	-0.001548	-0.095270	-0.351814
LOG(CMF)	0.041522	0.066192	0.005596	-0.000250	-0.155495	0.085163
TARIFF	-0.010176	0.005596	0.119238	0.000678	-0.034692	0.051686
LOG(AFPPY)	-0.001548	-0.000250	0.000678	0.002490	-0.004814	0.005086
LOG(PSB)	-0.095270	-0.155495	-0.034692	-0.004814	0.440597	-0.311741
LOG(PFPY)	-0.351814	0.085163	0.051686	0.005086	-0.311741	0.674743

The coefficient covariance matrix (in table 5.2) shows that all the correlation value is lower than 0.8. It means that there is no significant multicollinearity among regressors.

5.2.1.3.The Result of LM Heteroskedasticity Test

The last preliminary test is the LM test which is conducted in order to find out whether there is a heteroskedasticity problem in the model or not. Before the value of LM could be calculated, Residual Covariance Matrix[20] should be arranged.

The result shows the value of LM 24.522, while the value of X^2-*table* (α=*0.05, df = 2*) is 5.991. Since the value of LM is higher than the value of X^2-

[20] Residual covariance matrix is presented in Appendix 3.

table, it can be concluded that the null hypothesis is rejected, which indicates the presence of heteroskedasticity problem. The summary of LM test is presented in table 5.3.

Table 5.3. The Result LM Heteroskedasticity Test

LM	:	24.522
X^2*-table (α = 0.05, df = 2)*	:	5.991
Result	:	LM is bigger than X^2*-table*, H_0 is rejected.
Conclusion	:	There is a heteroskedasticity problem in the model.

To overcome the heteroskedasticity problem, one of the treatments that could be taken is using *white cross-section*[21]. From all the preliminary tests that had been conducted, it could be concluded that Fixed Effect Methods (*cross-section weights*) is the appropriate methods used in estimating the model.

5.2.2. The Empirical Result and Interpretation

5.2.2.1.The empirical Result

The result of the estimation is summarized in table 5.4 and 5.5.

Table 5.4. The Estimation Result Using Fixed Effect Model

Average Feed Production [LOG (AFP)] As a Dependent Variables		
Variables	**Coefficient**	**Probability**
C	7.231	0.715
LOG (PM)	0.212	0.478
LOG (CMF)	-0.222	0.896
TARIFF	-0.337	0.086*
LOG (AFPPY)	0.710	0.000***
LOG (PSB)	-0.576	0.014**
LOG (PFPY)	0.639	0.081*
R^2	0.932	
Adj R^2	0.919	
DW-stat	1.902	

Note: *** The statistic significance at α =1%
** The statistic significance at α =5%
* The statistic significance at α =10%

[21] The result of FEM (*cross-section weights)* is attached in Appendix 4.

Table 5.5. The Fixed Effects

Cross-section	Fixed Effects
SUMATRA	7.56
JAVA	7.73
SULAWESI	6.41

From tables 4.4 above, it can be concluded that the regression result is as follows:

$$\ln(AFP)_{it} = -7.231 + 0.212 \ln(PM)_{it} - 0.222 \ln(CMF)_{it} - 0.337\ (TARIFF)t\ +$$
$$0.710 \ln(AFPPY)_i - 0.576 \ln(PSB)_{it} + 0.639 \ln(PFPY)_i + \varepsilon_{it} \ldots\ldots \quad (5.2)$$

5.2.2.2.The Interpretation of the Estimation Result

From the summary of estimation result presented in table 5.4 can be concluded that the adjusted R^2 of the model is 0.919. It means that this model is able to explain the variation of the import tariff of maize impact on feed production in Indonesia, especially in Sumatra, Java, and Sulawesi as much as 91.9%. Four variables have expected signs (tariff, the average feed production in the previous year, the price of soybean, and the price of feed in the previous year), while two other variables, the price of maize and consumption of maize for feed, have different signs from the expected.

From six variables, there were four variables are significant; AFPPY (α=1%), PSB (α=5%), TARIFF and PFPY (α=10%), while two others, PM and CMF are insignificant for all significant level. Fixed effects intercepts indicates that if there are any changes in independent variables, greater impact in feed production will be experienced by Java. However, the fixed effects intercepts show that Sumatra, Java, and Sulawesi are potential feed producers. The interpretation of the result will be discussed more detail as follow.

5.2.2.2.1. Import Tariff

The negative effect of tariff on feed production can be seen in the result of the estimated model which proves that tariff has a significant effect (α=10%) with only 8.6% possibility of making the first type error. It also shows that the increased of 1% tariff will caused the decreased of feed production as much as 0.34% (*ceteris paribus*). Furthermore, it indicates that the feed production has an inelastic relation with import tariff. In other words, the production of feed is not too responsive to the changes of import tariff.

Theoretically, tariff imposition has negative effects on country's welfare. Although it increase producer's surplus, but it decreases consumer's surplus even more. As the government decides to impose tariff on imported maize, farmers who plants maize as their main crops will gain bigger profit, due to the high level of maize price in domestic market. Hence, the higher price of imported maize may urge consumers to reduce their consumption of imported maize and change their preference to domestic maize. Therefore, import tariff commonly use as a protection of domestic products from import surge.

Most of the maize used in feed industry is imported since domestic production of maize is not enough to satisfy domestic demand of maize which mostly comes from feed industry. Tariff imposition on imported maize will cause the increase of imported maize price in domestic market. Hence, as the consumers of maize, feed producers will have fewer surpluses due to the imposition of tariff.

Due to the high level of imported maize price, feed producers tend to reduce the volume of imported maize, which latter on will decrease the stock of raw materials. Since feed production is depend on the availability of the raw material which mostly is still imported, so that the decrease of imported maize will reduce total feed production volume. Therefore, it can be concluded that import tariff has a negative effect on the production of feed even though feed production is not too responsive to the changes of tariff level.

5.2.2.2.2. Domestic Price of Soybean

Other important ingredient in feed is soybean. Due to its high content of protein, soybean is very important for animal growth, so that it can not be replace by other substances and becomes one of the main ingredients in feed. Consequently, the increase of soybean price has a propensity to urge the increase of production cost of feed industry. As a result of the increase of soybean price, feed producers are likely to decrease their production of feed. The negative relation between price of soybean and feed production is demonstrated by the coefficient of soybean price in the estimation result.

The result shows that the increase of soybean price as much as 1% will push down the production of feed as much as 0.58% (*ceteris paribus*). Additionally, the effect of soybean price on feed production is significant in the

given significant acceptance level (α =5%), and there is a possibility of making first type error as much as 1.4%. The coefficient value of soybean price in the simulation result also indicates the inelastic relation between soybean price and feed production, which means that feed production is not too responsive to the changes of soybean price.

5.2.2.2.3. The price of Feed in Previous Year

It was expected that the price of feed in the previous year would have a positive effect to the feed production in recent year. If the price of feed in the previous year was high, feed producers are likely to hope that the price will increase or at least, stay in the same high level in the present year. With such promising high level of price, they will use this opportunity to pull up their production in order to gain bigger profit.

Just as expected, the result of the estimation shows that the price of feed in the previous year has a positive relation with the feed production. It points out that as the price of feed in previous year increases 1%, the production of feed will go the same way or increases 0.64% (*ceteris paribus*). Moreover, the effect of feed price in previous year on feed production is significant for given significant level (α = 10%), with the possibility of making type one error 8.1%. From the result also can be concluded that the relation among them is inelastic. It indicates that feed production is less responsive to the changes of feed price in previous year.

5.2.2.2.4. The Average Feed Production in Previous Year

As showed in the estimation result, the average production of feed in the previous year has a positive relation with the average production of feed in the present year. It shows a significant relation (α = 1%) with the possibility of making type one error only 0%. As the production of feed in the previous year showed an increase of 1%, the production of feed in the present year has a tendency to increase as much as 0.71% (*ceteris paribus*).

The result also proves that there is an inelastic relation between feed production in previous year and feed production in present year, which indicates that feed production in present year is not too responsive to the changes in feed production in previous year.

All producers are likely to increase their productivity so that their productivity is close to the maximum production capacity level. As they have reached the higher production capacity level, they will get higher profit. The raise of the production capacity could be done by adding more production inputs, such as labors, machineries, or new technology to the production process.

5.2.2.2.5. Domestic Price of Maize

From the estimation result can be concluded that the effect of domestic price of maize on feed production is not significant for all significant level (α =1%, 5%, and 10%) and there is a possibility of making the first type error about 47.8%. Moreover, the impact of domestic price of maize on the production of feed is not as expected. It was expected that the domestic price of maize would give a negative effect to the production of feed. Maize is the main ingredients of feed due to the fact that 50% of feed content is maize. Therefore, the increase of maize price would cause the increase of production costs. Due to the increase of production cost, producers are likely to reduce their production.

As already mentioned in the previous chapter, most of maize used in feed production is imported maize. Thus, the fluctuation of maize price in international market will affect the price of maize in domestic market. Moreover, the fluctuation of maize price in domestic market is also greatly determined by the level of domestic maize production and the exchange rates level (Swastika *et al.*, 2005).

During harvest time, maize production is higher than the demand, so that maize price in domestic market is pushed down. As a contrast, when the level of maize production is lower than demand, maize price would be automatically pulled up. The price of maize in domestic market will also pushed down as the value rupiah is appreciated. On the other hand, the depreciation of rupiah will pull up the price of maize in domestic market.

Nevertheless, the result of the estimation shows that the price of maize has an insignificant effect on feed production. In author's opinions, it may happen due to the fact that it can be noticed that the increase of maize price is followed by the increase of feed price. It means that feed producers try to overcome the effects

that may appear when the maize price increases not by reducing the production of feed but by increasing the price of feed.

The same opinion was stated by the Secretary General of National Board of Maize, Maxdeul Sola, who argued that the increase of maize price was greatly affected to the rise of feed price (Harga Sulit Terkendali, n.d). This opinion is also can be proven by looking at the data showed in table 5.6.

Table 5.6. Price of Feed, Domestic and International price of Maize, and Feed Production

Year	Feed		Price of Maize	
	Production (Tons)	Price (Rp/kg)	Domestic (Rp/100kg)	International (US$/bushel)
1991	1,740,878	1,082	72,113	2.45
1992	1,806,508	1,232	76,131	2.54
1993	1,916,068	1,471	88,148	2.38
1994	3,340,409	1,525	87,954	2.46
1995	3,550,382	1,769	106,599	2.76
1996	4,295,594	2,115	125,402	3.76
1997	4,444,969	2,480	135,592	2.73
1998	2,085,795	2,538	223,237	2.32
1999	2,774,214	4,542	297,390	2.03
2000	4,497,144	4,902	286,359	2.04
2001	4,991,553	4,975	337,311	2.03
2002	6,983,549	5,588	348,801	2.22
2003	5,734,094	5,656	354,655	2.31
2004	5,975,402	5,757	377,950	2.50
2005	6,226,882	6,826	407,759	2.07
2006	7,200,630	7,269	443,743	2.54
2007	7,700,033	7,761	544,499	3.73

Sources: various sources (processed)

The table showed that by the time the price of maize in domestic and international market increase, the production and the price of feed also performs an increase. As an example, on 1995, the price of maize in domestic increased from Rp87,954.26/100kg to Rp106,599.70/100kg, while international price of maize increased from US$2.46/bushel to US$2.76/bushel. Nevertheless, the production of feed on the same year increased from 3,340,409 tons to 3,550,382 tons. The increase of maize's price was followed by the increase of feed price which went up from Rp1,525.45/kg to Rp1,768.98/kg. To summarize, domestic price of maize has insignificant effect on feed production because the increase of

maize price is followed by the increase of feed price rather than the decrease of feed production.

5.2.2.2.6. Consumption of Maize for Feed

The estimation result shows that the effect of maize consumption for feed on feed production is not significant in all significant level. Additionally, the relation of maize consumption for feed with feed production is inelastic. It indicates that the production of feed is less responsive to the changes of the consumption of maize for feed.

In this study, maize consumption for feed represents the amount of maize demand as feed. Swastika et al. (2005) stated that the production of feed was determined by market and non market forces, such as the price of raw materials and other factors that might disturb the distributional system of raw materials. It indicates that feed production is determined by the availability or supply of raw materials (inputs) rather than the demand of inputs itself.

CHAPTER 6
CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The objective of this study is to analyze the impact of import tariff of maize, as the main content of cattle feed, on feed production in Sumatera, Java, and Sulawesi, and to analyze other determinant factors that may affect the production of feed in those islands. In order to address this objective, a panel data observation over the period 1991-2007 is used, using the fixed effect method.

Some conclusion can be summarized as follows:

a. Tariff has a significant and negative impact on feed production in Sumatera, Java, and Sulawesi. The study indicates that although feed production is less responsive to the increase of tariff rate, the increase of tariff will cause a decline of feed production. Since most of the maize used in feed production is imported, the imposition of import tariff on maize is likely to increase imported maize price and decrease the amount of imported maize. Hence, the stock of maize for feed production might decrease and then followed by decrease in feed production.
b. The price of soybeans has a negative impact on feed production. As one of the important ingredients of feed, soybean is irreplaceable. Therefore, the increase of soybean price is likely to be followed by the decrease of production feed, even though feed production is less responsive to the fluctuation of soybean price.
c. The price of feed in previous year demonstrates a positive impact on feed production though the relationship among them is relatively inelastic. It means that although feed production is not too responsive to the increase of feed price in previous year, but the increase of feed price in previous year tends to increase feed production. The increase of feed price in previous year might encourage feed producers to increase their production volume in order to rise up their profit.
d. The feed production in the previous year gives a significant positive impact on feed production although it is rather inelastic. It indicates that the increase of

feed production in previous year will significantly be followed by the increase of feed production in the recent year, even though feed production in the recent year is less responsive to the increase of feed production in previous year. By increasing their production volume to the level closer to the maximum production capacity, feed producers will have the opportunity to gain a bigger profit.

e. The impact of domestic price of maize is insignificant. It was expected that this variable would give a negative impact on the average feed production in Sumatera, Java, and Sulawesi. Since most of maize used in feed production is imported, the fluctuation of maize price in international market and the fluctuation of exchange rates might give greater impact to the price of maize in domestic market. In addition, the increase of maize price in domestic market is usually resolved by feed producers by increasing the price of feed and not by reducing the production of feed.
f. Maize consumption for feed has an insignificant impact on feed production. It means that the rise of maize consumption for feed will not followed by the increase of feed production. Moreover, the production of feed is not too responsive to the increase of maize consumption for feed.

6.2 Recommendation

6.2.1 Policy Implication

a. The imposition of tariff on maize may increase the price of maize in domestic market. As the price of maize increases, producers of maize or farmers may gain higher profits. The increase of domestic price will encourage farmers to increase their productivity which further increases national production of maize. Since maize production increases, Indonesia would be able to reduce its dependency on imported maize. It means that the increase of maize production will decrease the volume of imported maize. In other words, the imposition of import tariff will protect maize production from the import surge. On the other hand, the imposition of tariff, which increases the price of maize in domestic market, will push down feed production. The decrease of feed production is caused by the shortage of raw materials that are mostly still

imported. Therefore, before deciding to impose tariff on imported maize, government must also consider the impact of tariff imposition on other sectors, so that import tariff will not only protect maize producers but also consumers of maize, including feed producers.

b. The shortage of imported maize due to the imposition of tariff can be resolved by increasing domestic production of maize. If domestic production of maize is big enough to satisfy domestic demand of maize, particularly for feed, feed producers may replace imported maize with domestic maize and reduce their dependency on imported maize. It means that the imposition of tariff should be followed by the increase of domestic maize production. Thus, government should do some efforts to increase domestic production, such as encouraging and facilitating the intensification of maize plantation in some provinces that are the central production of maize or other provinces that has a big potential to become a new central production of maize. This can only happen if there is an intensive cooperation among the Ministry of Trade, as the policy maker of tariff imposition, and Ministry of Agriculture as governmental institution that is responsible for developing agricultural sector in Indonesia.

c. In order to develop feed industry in Indonesia, government should also realize other factors that may affect feed production, such as price of soybean which significantly affects feed production. As one of the important ingredients in feed, soybeans have a crucial role in feed production. Since domestic production of soybeans is not big enough to fulfill domestic demand, most of soybean used in feed production is imported. Therefore, government should also concern about domestic production of soybeans and the imposition of tariff on soybeans.

6.2.2 Recommendation for Further Study

a. This study includes factors that may determine feed production from the supply side only. Therefore, it is suggested that further study on feed production also includes factors that determine feed production from the demand side, such as the volume of demand for feed.

b. This study also does not take the market structure of feed, which is oligopoly, into consideration as one of determinant factors of feed

production. Since market structure will also likely to affect the production of output, it would be better if in further study market structure is also taken in to account.

c. Last but not least, this study only investigates feed production in provinces in Java, Sumatera, and Sulawesi. Thus, the author suggests that further study may include other provinces since the government has a plan to develop some mini feedmills in certain provinces. Therefore a better portrait of feed production will be provided.

LIST OF REFERENCES

1. Bernheim, B. Douglas and Michael D. Whinston. (2008). *Microeconomics*. New York: Irwin McGraw-Hill.

2. Biro Pusat Statistik. (1995-2006). *Statistik Perusahaan Peternakan Unggas (1994-2005)*. Jakarta.

3. Direktorat Jenderal Peternakan. (1996-2009). *Buku Statistik Peternakan 1995-2008 (Statistical Book on Livestock 1995-2008)*. Jakarta.

4. Erwidodo, Hermanto, and Herena Pudjihastuti. (2003). Impor Jagung: Perlukah Tarif Impor Diberlakukan? Jawaban Analisis Simulasi. *Jurnal Agro Ekonomi*. 21: 2 (Oktober). 175-195.

5. Feenstra, Robert C. (2004). *Advanced International Trade Theory and Evidence*. New Jersey: Princeton University Press.

6. Gujarati, Damodar N. (2003). *Basic Econometrics (4th ed.)*. Singapore: McGraw-Hill Higher Education.

7. *Harga Sulit Terkendali Peternak Unggas Nasional Makin Terjepit* (2007, September 08). September 13, 2009. http://www.kompascybermedia.com

8. *Impact of El Nino on Global Grain Production Not as Large as Originally Feared*. (n.d.). September 13, 2009. http://www.fas.usda.gov/cmp/highlights/elnino.html

9. *Indonesian Commercial Newsletter Market Intelligence Report on Animal Feed Industry in Indonesia May 2008*. (2008). August 14, 2008. http://www.datacon.co.id/animal%20feed%20industry.html

10. Iriany, R. Neni, M. Yasin H.G., and Andi Takdir M. (2007). Asal, Sejarah, Evolusi, dan Taksonomi Tanaman Jagung. *Jagung: Teknik Produksi dan Pengembangan*. Jakarta: Pusat Penelitian dan Pengembangan Tanaman Pangan Departemen Pertanian.

11. *Jagung dan Industri Pakan Ternak*. (n.d.). November 15, 2009. http://foragri.multiply.com/journal/item/2/

12. Kariyasa, Ketut, Bonar M. Sinaga, and M. O. Adnyana. (2004). Proyeksi Produksi dan Permintaan Jagung, Pakan, dan Daging Ayam Ras di Indonesia. *SOCA (Socio-Economic of Agriculture and Agribusiness)*. Vol. 4: 2 (July).

13. Kariyasa, Ketut and Bonar M. Sinaga. (2004). Faktor-faktor yang Mempengaruhi Perilaku Pasar Jagung di Indonesia. *Jurnal Agro Ekonomi*. 22: 2 (Oktober). 167-194.

14. Kasryno, Faisal et al. (2007). Gambaran Umum Ekonomi Jagung Indonesia. *Jagung: Teknik Produksi dan Pengembangan*. Jakarta: Pusat Penelitian dan Pengembangan Tanaman Pangan Departemen Pertanian.

15. Krugman, Paul R. and Maurice Obstfeld. (2006). *International Economics Theory and Policy (7th ed.)*. Boston: Pearson Addison Wesley.

16. Lokollo, Erna M. Budiman Hutabarat, and Dewa K. S. Swastika. (2006). Feed Crops in Southeast Asia: An Integrated Report. *CAPSA Working Paper* No. 94.

17. *Maize Production and Consumption in Indonesia*. (n.d). Juli 23, 2009. http://**worldfood.apionet.or.jp/**

18. Ministry of Agriculture Republic of Indonesia. (2008). *Statistik Pertanian (Agricultural Statistics) 2008*. Jakarta.

19. Nachrowi, Nachrowi D., and Hardius Usman. (2006). *Pendekatan Populer dan Praktis Ekonometrika untuk Analisis Ekonomi dan Keuangan*. Jakarta: Lembaga Penerbit Fakultas Ekonomi Universitas Indonesia.

20. Purwanto, Siwi. (2007). Perkembangan Produksi dan Kebijakan dalam Peningkatan Produksi Jagung. *Jagung: Teknik Produksi dan Pengembangan*. Jakarta: Pusat Penelitian dan Pengembangan Tanaman Pangan Departemen Pertanian.

21. Pyndick, Robert S. and Daniel L. Rubinfeld. (1998). *Econometric Models and Economic Forecasts (4th ed.)*. New York: Irwin McGraw-Hill.

22. Pyndick, Robert S. and Daniel L. Rubinfeld. (2005). *Microeconomics (6th ed.)*. New Jersey: Pearson Prentice Hall.

23. Rachman, Benny. (2003). Dinamika Harga dan Perdagangan Komoditas Jagung. *SOCA (Socio-Economic of Agriculture and Agribusiness)*. Vol. 3: 1 (February).

24. Saleh, Chaerul, Sumedi, and Erizal Jamal. (2005). Analisis Pemasaran Jagung di Indonesia. *Ekonomi Jagung Indonesia*. Jakarta: Badan Pengembangan dan Penelitian Pertanian Departemen Pertanian.

25. Salvatore, Dominick. (2007). *International Economics (9th ed.)*. New Jersey: John Wiley and Sons Inc.

26. Sarasutha, I G. P., Suryawati, and Margaretha SL. (2007). Tataniaga Jagung. *Jagung: Teknik Produksi dan Pengembangan*. Jakarta: Pusat Penelitian dan Pengembangan Tanaman Pangan Departemen Pertanian.

27. Sekretariat Direktorat Jenderal Tanaman Pangan. (2008). *Database Tanaman Pangan*. Jakarta.

28. Swastika, Dewa K. S. et al. (2005). The Status and Prospect of Feed Crops in Indonesia. *UNESCAP-CAPSA Working Paper* No.81.

29. Tangendjaja, Budi and Elizabeth Wina. (2007). Limbah Tanaman dan Produk Sampin Industri Jagung untuk Pakan. *Jagung: Teknik Produksi dan Pengembangan*. Jakarta: Pusat Penelitian dan Pengembangan Tanaman Pangan Departemen Pertanian.

30. Tangendjaja, Budi. (n.d.). *Feed Millings Industry in Indonesia*. November 15, 2009. http://www.fao.org/DOCREP/004/AB986E/ab986e08.htm.

31. Zubachtirodin, M. S. Pabbage, and Suband. (2007). Wilayah Produksi dan Potensi Pengembangan Jagung. *Jagung: Teknik Produksi dan Pengembangan*. Jakarta: Pusat Penelitian dan Pengembangan Tanaman Pangan Departemen Pertanian.

Appendix 1

The Result of Pooled Least Square Model Regression (no weights)

Dependent Variable: LOG(AFP?)				
Method: Pooled Least Squares				
Date: 10/17/09 Time: 12:37				
Sample: 1991 2007				
Included observations: 17				
Cross-sections included: 3				
Total pool (balanced) observations: 51				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(PM?)	0.619408	0.661564	0.936280	0.3541
LOG(CMF?)	0.070145	0.257278	0.272643	0.7864
TARIFF?	-0.498672	0.345308	-1.444136	0.1556
LOG(AFPPY?)	0.928272	0.049899	18.60318	0.0000
LOG(PSB?)	0.003920	0.663775	0.005906	0.9953
LOG(PFPY?)	-0.587850	0.821427	-0.715645	0.4779
R-squared	0.893144	Mean dependent var		12.90982
Adjusted R-squared	0.881271	S.D. dependent var		2.245065
S.E. of regression	0.773583	Akaike info criterion		2.434563
Sum squared resid	26.92937	Schwarz criterion		2.661836
Log likelihood	-56.08135	Durbin-Watson stat		2.162633

Appendix 2

The Result of Fixed Effect Model Regression (no weights)

Dependent Variable: LOG(AFP?)				
Method: Pooled Least Squares				
Date: 10/17/09 Time: 12:38				
Sample: 1991 2007				
Included observations: 17				
Cross-sections included: 3				
Total pool (balanced) observations: 51				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-43.52182	46.84703	-0.929020	0.3582
LOG(PM?)	0.628640	0.666117	0.943739	0.3507
LOG(CMF?)	4.259395	4.090570	1.041272	0.3037
TARIFF?	-0.588222	0.335499	-1.753277	0.0869
LOG(AFPPY?)	0.561898	0.123118	4.563909	0.0000
LOG(PSB?)	-0.537514	0.699575	-0.768343	0.4466
LOG(PFPY?)	-0.579022	0.832865	-0.695218	0.4907
Fixed Effects (Cross)				
_SUMATERA--C	0.396697			
_JAVA--C	0.819267			
_SULAWESI--C	-1.215964			
	Effects Specification			
Cross-section fixed (dummy variables)				
R-squared	0.914428	Mean dependent var		12.90982
Adjusted R-squared	0.898129	S.D. dependent var		2.245065
S.E. of regression	0.716563	Akaike info criterion		2.330084
Sum squared resid	21.56542	Schwarz criterion		2.670994
Log likelihood	-50.41713	F-statistic		56.10208
Durbin-Watson stat	1.889339	Prob(F-statistic)		0.000000

Appendix 3

The Result of the LM Test

The Residual Covariance Matrix

	_SUMATERA	_JAVA	_SULAWESI
_SUMATERA	0.08922	0.00674	-0.06770
_JAVA	0.00674	0.08189	-0.07405
_SULAWESI	-0.06770	-0.07405	1.09744

	_SUMATERA	_JAVA	_SULAWESI
_SUMATERA	0.99174	0.99938	1.00629
_JAVA	0.99938	0.99242	1.00688
_SULAWESI	1.00629	1.00688	0.90081

The sum of the diagonal on matrix above describes $\sum_{i=1}^{n}\left[\frac{\sigma_i^2}{\sigma^2}-1\right]^2$, i.e. 2.8849745. After multiplying it with T/2, i.e. 17/2 = 8.5, the result would be 24.522284. The result then has to be compared with the χ^2 (α =0.05, df =2) table. Since the LM value is higher than the χ^2 (α =0.05, df =2) table, 5.99147, the null hypothesis is rejected indicating that there is a hateroskedasticity problem.

Appendix 4

The Result of Fixed Effect Model Regression

(Cross-section weights, white cross-section)

Dependent Variable: LOG(AFP?)				
Method: Pooled EGLS (Cross-section weights)				
Date: 11/01/09 Time: 22:53				
Sample: 1991 2007				
Included observations: 17				
Cross-sections included: 3				
Total pool (balanced) observations: 51				
Linear estimation after one-step weighting matrix				
White cross-section standard errors & covariance (d.f. corrected)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.231193	19.64872	0.368024	0.7147
LOG(PM?)	0.211982	0.295750	0.716760	0.4775
LOG(CMF?)	-0.222456	1.693149	-0.131386	0.8961
TARIFF?	-0.336820	0.191329	-1.760423	0.0856
LOG(AFPPY?)	0.710011	0.116950	6.071073	0.0000
LOG(PSB?)	-0.575703	0.223477	-2.576115	0.0136
LOG(PFPY?)	0.639120	0.357811	1.786198	0.0813
Fixed Effects (Cross)				
_SUMATERA--C	0.325407			
_JAVA--C	0.498803			
_SULAWESI--C	-0.824210			
Effects Specification				
Cross-section fixed (dummy variables)				
Weighted Statistics				
R-squared	0.932350	Mean dependent var		23.31086
Adjusted R-squared	0.919465	S.D. dependent var		12.32285
S.E. of regression	0.633449	Sum squared resid		16.85281
F-statistic	72.35574	Durbin-Watson stat		1.902426
Prob(F-statistic)	0.000000			
Unweighted Statistics				
R-squared	0.906803	Mean dependent var		12.90982
Sum squared resid	23.48704	Durbin-Watson stat		1.971665