Westernization of the Asian Diet: The Case of Rising Wheat Consumption in Indonesia

Jacinto F. Fabiosa

Working Paper 06-WP 422
April 2006

Center for Agricultural and Rural Development
Iowa State University
Ames, Iowa 50011-1070
www.card.iastate.edu

Jacinto Fabiosa is a scientist at the Center for Agricultural and Rural Development (CARD) and is the technical director and international livestock and poultry analyst with the Food and Agricultural Policy Research Center (FAPRI) at Iowa State University.

This paper is from the NRI Indonesia Project USDA-CSREES/NRICGP Grant 00-35400-9252.

Questions or comments about the contents of this paper should be directed to Jacinto Fabiosa, Center for Agricultural and Rural Development, Iowa State University, Ames, IA, 50011-1070;. Phone: (515) 294-6183; Fax: (515) 294-6336; E-mail: jfabiosa@iastate.edu.

Abstract

With sustained income growth and fast urbanization, Indonesia will see a major shift in the growth of grain consumption from rice to wheat products. New demand estimates from consumption survey data give a relatively high income elasticity of demand for wheat-based products, in the range of 0.44 to 0.84, with 26% to 34% of this response coming from the impact of income on the probability of consumption for non-consuming households and the remaining impact coming from the response on the level of consumption for households currently consuming wheat products. Urban location of households also contributes an increase of 0.11% to 0.13% to consumption. In contrast, elasticities in rice show a negative impact of income and urbanization on the probability of consumption and a positive but small impact on the unconditional mean. A partial liberalization scenario shows the domestic wheat flour price declining by 13.66%, inducing consumption to increase by 7.06%, which translates into 7.04% growth in imports. This exerts an upward pressure on the world price, increasing it by 0.23%. A faster income growth scenario shows higher consumption (2.60%), imports (2.59%), and prices (0.09%). Countries with a proximity advantage such as Australia, China, and India will benefit from the growth in this market. But, with dependable supply, product quality assurance, and credit availability, North American suppliers may still remain in this market.

Keywords: double-hurdle demand, trade, Westernization of diet.

Westernization of the Asian Diet: The Case of Rising Wheat Consumption in Indonesia

1. Introduction

Two of the six stylized facts cited by Pingali (2004), which characterize the westernization of Asian diets, included the clear slowing of per capita consumption of Indonesia's main staple—rice—and the increased per capita consumption of wheat-based products. This pattern has been observed by other investigators as well. Huang and David (1993) observed that rising income and urbanization are driving forces in the rise of wheat consumption. As high income consumers demand more variety, on the one hand, and as more choices are made available in urban areas (Regmi and Dyck, 2001), especially easy-to-prepare food products, wheat products are becoming increasingly popular. Pingali and Rosengrant (1998) also claimed that whereas wheat is considered an inferior good in Western societies, in the traditional rice-eating countries in Asia, wheat is becoming a preferred staple. A report of the USDA's Foreign Agricultural Service, "Grain: World Markets and Trade," states that "Global Wheat Import Demand Shifts East," with traditional exporters China and Pakistan returning as major importers and other Asian countries expanding imports because of food consumption growth (Lohmar, 2004). The case in India (Gandhi, Zhou, and Mullen, 2001, and Joshi, 1998) is a good example, in which coarse cereal consumption declines sharply between rural and urban areas from 1.98 to 0.63 kg/month, but wheat consumption jumps from 4.40 to 4.72 kg/month. According to U.S. Wheat Associates, Asia is the fastest-growing wheat market in the world, and noodles are its fastest growing segment. On average, in Japan, South

Korea, Taiwan, Indonesia, Thailand, Malaysia, and Philippines, half of total wheat supply is consumed in the form of noodles and steamed breads.

These dietary changes have affected trade and production programs in major wheat exporting countries. The strong import growth in Asian market is influencing wheat-breeding programs in exporting countries, such as the Hard White Wheat program in the United States, to specifically gain market access and expand market share in Asia. Australia, a leading wheat supplier in Asia, has identity preservation programs to ensure end-users of the quality of their products.

Indonesia is a classic example of the Westernization of the diet and the resulting influence on trade. Indonesia's traditional main staple crop is rice. But, with the closing land frontier for rice production, the Government of Indonesia (GOI) promoted diversification in their consumption basket to include wheat-based products. This policy may be partially driven by the fact that rice is a very thin market, with only 7% of world production traded, such that any supply shortfall in Indonesia (or any other country) would drive up world prices when imports are needed. In contrast, 19% of wheat production is traded in the market, making the wheat market less volatile than the rice market.

On top of the GOI's consumption diversification efforts, rising consumer purchasing power and increasing urbanization have also increased the consumption of wheat-based products such as noodles, bread, cookies, and other snack items. Moreover, the GOI developed an interest in wheat flour fortification as part of its effort to improve the nutrition of its citizens.

However, with no domestic production of wheat and no flour milling capability prior to 1971, Indonesia imported all of its wheat flour requirements, averaging around 337 thousand metric tons (tmt) annually. During this period, it was often reported that, because of the long shipment time from source countries, imported flour reaching Indonesian ports was of degraded quality—infected by lice and musty in odor. All these factors contributed to the birth of the local flour milling industry in Indonesia, with the establishment of the first flour mill, PT. Bogasari Flour Mills, in 1971. The flour milling industry was further strengthened with the establishment of Indofood in 1994. Indofood is the largest instant noodles manufacturer in the world, with installed capacities of approximately 13 billion packs per annum. Immediately following its establishment, Indofood acquired the first and largest flour miller in Indonesia.

With domestic milling capacity established in the country, Indonesia shifted imported products from flour to wheat and reached for the first time an import level of a million metric tons of wheat in 1976. It took another 14 years to double the imports to two million in 1990. Afterwards, it only took three years to add another million in 1993, and another three years for imports to reach their peak of four million in 1996, prior to the macroeconomic crisis. Indonesia is in the top five leading wheat importing countries in the world, following only Egypt, Japan, and Brazil. Its imports represent 4% of total world wheat imports (see table 1).

In 1997, Indonesia was hit by a severe macroeconomic crisis, giving a big blow to the local flour milling industry, which had to import all of major raw material inputs. As part of the International Monetary Fund structural loan package during this crisis, the GOI agreed to liberalize the wheat market. This major change in policy regime forced

both domestic millers and foreign suppliers to adjust in order to seize new market opportunities.

The objectives of this paper are to (a) provide an overview and background of the wheat flour industry in Indonesia, including the structure of the wheat milling subsector, major products produced, changes in policy regimes, and the major trading partners in the supply of both wheat and flour; (b) estimate new demand elasticities of wheat products and rice; and (c) analyze the impacts of partial liberalization and faster income growth scenarios on the wheat sector.

2. Evolution of Policy Regimes

The dynamics driving the wheat and wheat flour markets in Indonesia have changed significantly because of major changes in policy. Prior to the liberalization of the wheat market in the late 1990s, BULOG (Badan Urusan Logistik), the Indonesian national logistics agency, was the sole legal importer of wheat. BULOG bought the wheat and owned it throughout the milling process, paying only milling fees to the millers. Wheat millers were not involved with direct selling or distribution to consumers. Even if BULOG did not take possession of the flour, it directed the distribution of wheat flour to distributors through the Association of Sugar and Flour Distributors (APEGTI—Asosiasi Penyalur Gula dan Tepung Terigu), cooperatives, and food industries. While wheat stocks were in the hands of millers, wheat flour stocks were managed by distributors and traders.

BULOG's primary policy instrument was the administered price on both the wheat price and the ex-factory wheat flour price. Although it also set retail prices of flour

it did not have any way to enforce its set prices other than influencing the delivery of flour to particular markets. Ex-factory wheat flour prices were 25% higher than the world price because of several charges included in the administered price calculation such as VAT, other taxes, and BULOG fees. Millers received milling fees, mark-up, and sale of by-products. This amounted to earnings that were 2% higher than their counterparts in the United States. The main drawback of this pricing policy was the lack of consistent product quality and quality differentiation in the market. Lavoie (2003) reported that countries that import wheat through a state-trading enterprise are less sensitive to quality issues compared to countries with private traders importing wheat. With millers' income dependent only on quantity milled, wheat input quality and wheat flour output quality were not major operational considerations of millers. Instead, the incentive structure encouraged millers to maximize profit by increasing the milling recovery, which resulted in lower-quality flour. The U.S. milling recovery is 73%. Indonesia uses 74% milling recovery in the administered price calculation, but actual milling recovery for some wheat types reached 80%. Moreover, a very small price differential across wheat flour types provided no adequate market signal to reflect quality requirements of wheat flour end users. Preferential treatments were often the basis of who got the best quality flour.

Liberalization of Indonesia's wheat sector was listed as a requirement in the letter of intent signed by Indonesia for receiving an International Monetary Fund loan during the crisis. BULOG's monopoly power was eliminated with the liberalization of the wheat market. Wheat millers and other wheat flour users were then permitted to import wheat or flour directly from foreign suppliers and they could also sell their wheat flour products directly to the market. Wheat flour (in wheat equivalent) imports jumped from 0.34% of

total imports in the early stage of the liberalization (i.e., 1998) to 18% in 1999. This proportion has gone down to 10% in the most recent period.

This new policy presented new challenges to and necessitated changes in the operations of wheat millers. New silos for wheat storage facilities were needed. Product financing became an important consideration with millers' full ownership of imported wheat or wheat flour. For this reason, several USDA programs such as PL-480, Section 416 (b), and the GSM credit guarantee programs became important factors in millers' decisions to source their import requirements.

Indonesia claims that the wheat sector is currently governed by a "tariff-only" regime. In the Uruguay Round, the tariff for both wheat and wheat flour is reduced from 30% to 27%. However, the current applied import tariff of wheat is zero. The applied wheat flour tariff is 5% plus 10% VAT and 2.5% of sales tax. Some stakeholders in the sector are putting pressure on the GOI to consider raising duties to around 20%-25% on flour, which is still within the WTO bound schedule. Recently, the GOI has imposed anti-dumping import duties on wheat flour from India and China of 11.44% and 9.50%, respectively.

Furthermore, current policy requires that all flour including imports should be fortified with iron (Fe), Zinc (Zn), vitamin B (Riboflavin and Thiamin) and folic acid. This is implemented by the national standards agency (BSN—Badan Standard Nasional).

3. Wheat and Wheat Flour Consumption

Owing to government policy on food diversification, increased consumer purchasing power, fast urbanization, and rapid growth in the fast food restaurant and

bakery industries, consumption of wheat-based products in Indonesia has increased significantly in the last few years. Table 2 shows the per capita consumption per month for common wheat-based products. The most popular wheat-based food products consumed in Indonesia are instant noodles, which report the highest proportion of respondents with positive consumption at 37%, followed by sweetened bread 27%, crackers and cookies 13%, and plain bread 13%. The popularity of noodles may be due to their low cost, convenience, and flavor. In terms of level, per capita wheat flour consumption was highest in the form of instant noodles, at 0.13 kg per month for the entire sample average (0.35 kg per month average for those with positive consumption), followed by wheat flour purchased by households, then plain bread, and fried-boiled noodles (which can be wet or dry). The same pattern is shown in the 1999 survey, where instant noodle per capita consumption is at 0.125 kg, followed by wheat flour purchased by households, then by plain bread, and fried-boiled noodles. Wet cake is a new item added in the 1999 data and accounts for 0.04 kg.

Wheat flour consumed in the form of instant noodles accounted for 34% to 38% of total wheat consumption in Indonesia. This is followed by wheat flour bought by households for home production-consumption, with a share of 19% to 20%. Wheat flour consumed in bread form accounts for 9% to 16%.

Using aggregate consumption (actually disappearance) data from the PS&D database of USDA, table 3 shows that wheat consumption in Indonesia is still very low, at 16.13 kg per person (in wheat equivalent) compared to selected countries in Asia. It ranks only higher than Thailand in a group of eight countries. The potential room for expansion of wheat flour demand is significant. Indonesia’s per capita wheat

consumption is 72 kg per person per year lower compared with China's per capita consumption; 35 kg lower compared with its closest Islamic neighbor, Malaysia; and 15 kg lower than the Philippines, a country with comparable per capita income.

4. Wheat Flour Double-Hurdle Demand Model

Wheat demand in developed countries like the United States is well studied (Chai, 1972; Barnes and Shields, 1998; Wilson and Gallagher, 1990; Mohanty and Peterson, 1999; and Marsh, 2003). Most of these studies disaggregate wheat into classes (e.g., Hard Red Winter, Hard Red Spring, etc.) and use annual disappearance data for consumption. Wheat import demand of major importing countries (e.g., for Japan: Chen and Kim, 1998; Parcell and Stiegert, 2001) has also been studied (Wilson, 1994; Satyanarayana and Johnson, 1998; Dahl and Wilson, 2000; Jin, Cho, and Koo, 2003; Adhikari, Paudel, Houston, and Paudel, 2003). With the exception of Wilson, most of these studies specify a single equation (in either level or share) and use actual annual time-series import data. Wilson uses a translog demand system. Only Wilson reports demand elasticities for Indonesia. However, the numbers are suspicious. The Canadian Western Red Spring (CWRS) has a negative expenditure elasticity, while the Hard Red Winter (HRW) has the highest expenditure elasticity of 1.80, when other studies have shown that CWRS and HRW are close substitutes, having high protein content and identical color. Only the Australian Standard White (ASW) elasticity of 1.50 is significant at the 10% level. Moreover, for the own-price elasticities, the CWRS and ASW have positive own-price elasticities, while the rest have the expected negative sign and are large in magnitude. The high expenditure and price elasticities may be due to the fact that what is estimated is

a conditional demand. If in the first-stage group expenditure allocation the wheat price is inelastic, then these elasticities need to be adjusted downward to derive the unconditional elasticities.

This current study departs from these earlier demand estimates in several respects. First, the demand specifications in earlier studies are all conditional demand, assuming that the first-stage decision of aggregate wheat consumption is given, and only the allocation between wheat classes and sources are examined. In many developing countries, the first-stage decision of consumers may be of equal or more significance than the second-stage allocation. Second, all earlier studies used annual aggregate disappearance or import data in estimation. Third, what is estimated by all studies is actually a wheat miller's derived demand for wheat, not the final demand of households for wheat-based products. As a result, all studies did not include demographic factors in their demand specification. But it is well established in the demand literature that such demographic factors (e.g., urbanization) may be an equally strong driver of changes in wheat consumption patterns.

Indonesia offers a unique opportunity since, with no domestic production of wheat, import demand for wheat and wheat flour in Indonesia is directly determined by domestic consumption. Available national household consumption survey data allows examination of household level final consumption of wheat-based products. Demographic characteristics are included in the model and a separate estimate is provided for noodles, the most popular and fastest-growing wheat-based product consumed by households in Indonesia (and most of Asia).

In this paper, demand for wheat products in wheat flour equivalent is estimated using a double-hurdle model of the sample selection kind developed by Heckman (1979). Several studies have used this general specification, including Blaylock and Blissard, 1992; Haines, Guilkey, and Popkin, 1988; Jones, 1989; Jones and Yen, 2000; Newman, Henchion, and Matters, 2001; Yen, 1993, 1994; Yen and Huang, 1996; and Yen and Jensen, 1995; Yen, Jensen, and Wang, 1996. This specification is necessary to adequately address the many zero observations (Amemiya, 1973; and Maddala, 1983) as shown in table 2, where even instant noodles, which had the highest proportion of households with positive consumption, had only 37% non-zero consumption. In the double-hurdle model, the consumption decision of households is represented as a two-step process. First, households decide whether or not to consume. This is interchangeably referred to as the censoring (selection) rule or participation decision. After a consumption decision is arrived at, households then decide next how much to consume. The standard sample selection model is used since the observed consumption level in the data is not a random sample but is systematically chosen from the entire population. The following model description borrows from Fabiosa, 2005. The model has a censoring rule [1a] that determines participation in the market and a regression equation [1c] that estimates the level of consumption, i.e.,

[1a] $$z_i^* = w_i'\gamma + \upsilon_i$$

[1b] $$z_i = \begin{cases} 1 & if \quad z_i^* > 0 \\ 0 & if \quad z_i^* \le 0 \end{cases}$$

[1c] $$y_i = x_i'\beta + \varepsilon_i \quad if \quad z_i = 1$$

where the error terms are independently (across observations) and jointly normally distributed, i.e.,

[1d] $$\begin{pmatrix} \upsilon \\ \varepsilon \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho\sigma_\varepsilon \\ \rho\sigma_\varepsilon & \sigma_\varepsilon \end{pmatrix}\right].$$

Since the variance of the censoring equation [1a] is not identified, it is normalized to unity in [1d]. Equation [1a] represents the first stage of the consumption decision. From this specification we derive two important equations. The first is the probability for a positive consumption, which can be determined in [2],

[2] $$\Pr(z = 1) = \Pr(w_i'\gamma + \upsilon_i > 0) = \Pr(\upsilon_i > -w_i'\gamma) = 1 - \Phi(-w_i'\gamma) = \Phi(w_i'\gamma)\cdot$$

The second equation is the conditional mean given in [3], i.e.,

[3] $$E(y_i \mid z_i^* > 0) = x_i'\beta + \rho\sigma_\varepsilon \frac{\phi(w_i'\gamma)}{\Phi(w_i'\gamma)}\cdot$$

The three types of elasticities are the elasticity of participation from [2], the elasticity of the conditional mean from [3] (i.e., for those with positive consumption), and the elasticity of the unconditional mean, which accounts for both.[1] It is assumed that the vector of explanatory variables in [1a] and [1c] have the same elements. The elasticity of participation is,

[4] $$e^p = \frac{\partial\Phi(w_i\gamma)}{\partial x_i}\frac{x_i}{\Phi} = \phi\gamma_i \frac{x_i}{\Phi},$$

and the elasticity of the conditional mean is

[5] $$e^c = \frac{\partial E(y_i \mid z_i = 1)}{\partial x_i}\frac{x_i}{E(y_i \mid z_i = 1)}$$

[1] A slightly different formula is used for the impact of binary regressors (e.g., dummy variables).

$$e^c = \left[\beta_i - \gamma_i \rho \sigma_\varepsilon \left(\frac{\phi}{\Phi} \right) \left\{ \left(\frac{\phi}{\Phi} \right) - w_i \gamma \right\} \right] \left[\frac{x_i}{\beta_i x + \rho \sigma_\varepsilon \left(\frac{\phi}{\Phi} \right)} \right].$$

The elasticity of the unconditional mean accounts for both [4] and [5], i.e.,

[6] $$e^u = \frac{\partial E(y_i)}{\partial x_i} \frac{x_i}{E(y_i)}$$

$$e^u = \left[\Phi \left\{ \beta_i - \gamma_i \rho \sigma_\varepsilon \left(\frac{\phi}{\Phi} \right) \left\{ \left(\frac{\phi}{\Phi} \right) - w_i \gamma \right\} \right\} + \left\{ \beta_i x + \rho \sigma_\varepsilon \left(\frac{\phi}{\Phi} \right) \right\} \gamma_i \phi \right] \left[\frac{x_i}{\left\{ \beta_i x + \rho \sigma_\varepsilon \left(\frac{\phi}{\Phi} \right) \right\} \Phi} \right].$$

It is common knowledge that an estimation of the model using only equation [1c] presents several serious problems. To avoid these problems, the model is estimated with the likelihood function in [7]. The first term accounts for the contribution to the likelihood function of all the observations with no actual consumption. The second term accounts for the contribution of all the observations with positive consumption. This probability is equal to the density function at the level of observed consumption multiplied by the conditional probability distribution from the censoring rule given that an actual positive consumption was observed.

[7] $$LLF = \sum_{i \in \{z_i = 0\}} \ln[1 - \Phi(w_i \gamma)] +$$

$$\sum_{i \in \{z_i = 1\}} \{ \ln \phi \left(\frac{y_i - x_i \beta}{\sigma_\varepsilon} \right) - \ln \sigma + \ln \Phi \left(\frac{w_i \gamma + \rho \frac{y_i - x_i \beta}{\sigma_\varepsilon}}{\sqrt{1 - \rho^2}} \right) \}.$$

Maximization of the likelihood function in [7] will give consistent and efficient parameter estimates assuming that the uncensored disturbances are normal and homoskedastic.[2]

The elasticity of the unconditional mean can be disaggregated into two effects (similar to Cragg, 1971). This is accomplished by dividing both sides of equation [6] by the LHS, normalizing it to unity. The resulting first term in the RHS of equation [6] is the effect of a change in any (continuous) independent variable on the level of consumption for those that already have a positive consumption, weighted by the probability to consume. The second term is the effect on the probability to consume weighted by the conditional mean.

Data from the SUSENAS survey for 1996, 1999, and 2002 are used in the estimation of the double-hurdle model using SAS version 9.0. The data have 60,406 to 60,675 households in the sample. The explanatory variables in both equations are the same, and include total expenditure (including food and non-food);[3] wheat flour price; prices of substitute products including rice, corn, and tubers; urban-rural dummy; number of children in the household; and provincial dummy.

As shown in tables 4a to 4c, the estimate using the three datasets gave very significant ρ values ranging from -0.29 to -0.32 for wheat flour equivalent, -0.22 to -0.32 for wheat noodles, and -0.12 to -0.18 for rice, suggesting the appropriateness of the double-hurdle model. That is, in the population, there are unmeasured influences on selection that are related to the unmeasured influences on the level of consumption. Specifically, since ρ is negative, the levels of consumption in the selected group are likely

[2] It should be noted that it is possible that the likelihood function is not globally concave in ρ.
[3] This closely approximates household income.

to be smaller than those in the unselected group. The table also gives the elasticity estimates for the participation and the unconditional level of consumption decisions in wheat. Both the own-price and income elasticities are of the expected sign and significant, with a negative own-price elasticity and positive income elasticity in both the participation and unconditional consumption equations for wheat and wheat noodles. However, income already has a negative effect on the participation decision but a small and positive effect on the elasticity of conditional mean. Moreover, for the unconditional mean all the cross-price elasticities are positive with respect to rice, corn, and tuber prices, suggesting that these commodities are substitute products to wheat. With the exception of the rice price in the 1999 dataset, all relevant elasticities of the unconditional mean consumption are significant. In the 1999 and 2002 survey, rice is a complement to wheat in the participation equation only. For the unconditional mean, wheat flour consumption has an income elasticity that ranges from 0.443 to 0.844. This elasticity number combines the positive impact of income on the probability of participation in wheat consumption and the positive impact of income on the level of wheat consumption for those that are already consuming wheat. The contribution to the responsiveness of consumers from the participation equation with respect to changes in income is smaller compared to the contribution from the responsiveness of consumers who are already consuming wheat. However, its magnitude is still substantial, representing 26% to 35% of the income elasticity of the unconditional mean of consumption.

The own-price of wheat is statistically significant in both the participation and consumption equations but the magnitudes of elasticity are very different, much larger for the consumption equation—from -0.023 to -0.032 in the participation equation compared

to -0.470 to -0.514 in the unconditional mean of consumption equation, representing only 4.87% to 6.18% of the total response to price changes.

Table 4b presents the same set of elasticities for noodle demand. Noodles are the most popular wheat-based product and have the fastest growth. It is again shown that the double-hurdle model is appropriate, with the ρ values significantly different from zero. The income elasticity for the unconditional mean ranges from 0.264 to 0.661, which is slightly smaller than the total wheat income elasticity. The responsiveness of noodle consumption is almost equally shared by the increase in the probability of noodle consumption and the increase in the consumption of households who are already consuming noodles. The contribution of the responsiveness of the probability of consumption is slightly higher for noodles than for the aggregate wheat-based products. The noodle price has the expected negative elasticity, with its absolute value much higher in the unconditional mean equation than in the probability of consumption. Also, the price of other wheat products has a negative elasticity in the equation for probability of consumption, making this a complement to noodles, while it has a positive sign in the unconditional mean equation (except for 1996, which is not significant), making it a substitute for noodles for households already consuming noodles. The impact of urban location on noodle consumption is positive and significant for both the probability of consumption and the unconditional mean equations. Moreover, the magnitude of the impact is much larger compared to the aggregate wheat-based products. This may be due to the convenience factor in noodle consumption, which may be a more important consideration for urban than for rural consumers, compared to other wheat-based products, particularly flour.

For comparison purposes we present the same set of elasticities for rice in table 4c. Even with participation in rice consumption already in the range of 97% to 99%, the double-hurdle model is still appropriate as shown by the significant ρ values (although smaller than wheat in absolute value). In contrast to wheat products, the elasticity of the unconditional mean of rice consumption with respect to income is very small, in the range of 0.013 to 0.0565 only. Moreover, income has a small and negative effect on the probability of consumption. A similar pattern is shown by the effect of urban location, which has a negative effect on the probability of consumption and positive but small effect on the unconditional mean. Given the changes in income and fast urbanization in Indonesia, these elasticities suggest that over time wheat consumption will continue to grow faster while growth in rice consumption, if any, will be slower.

Urban households also showed higher consumption of wheat products compared to rural households with a positive elasticity with respect to the urban dummy variable ranging from 0.024 to 0.053 in the participation equation and 0.105 to 0.126 in the unconditional mean of consumption equation. The same pattern is shown for the impact of location on wheat noodle consumption. The impact on the probability of participation ranges from 0.085 to 0.095 and the impact on the unconditional mean of consumption is 0.177 to 0.203. In contrast, the impact of location on rice consumption is mixed in terms of direction. Some are positive but others are negative. However, all the magnitudes are small. These location impacts are significant considering that the Food and Agriculture Organization estimates that in 2005, close to half of the Indonesian population reside in what is considered urban area compared to only 22% five years ago.

5. Wheat Flour Milling Sub-sector

Indonesia boasts the biggest flour milling factory in a single location in the world. The domestic flour milling industry has five wheat milling plants with total milling capacity of 6.39 million metric tons (mmt) of wheat in a 300-day-per-year operation (see table 5). The combined silo storage capacity of all plants is 878 tmt. The biggest two of the plants are owned by the same company—PT. Bogasari Flour Mills (BFM)—and represent 74.64% of Indonesia's milling capacity. Figure 1 shows that four of the plants are located on the island of Java and the other one has operations based on the island of Sulawesi. This factory in Sulawesi is a joint venture between local and foreign investors. The most recent report indicates that the milling sector is operating below capacity, at about 60 to 70%. There is still plenty of room for demand growth likely without facing a constraint on the supply side in terms of processing capacity.

Table 6 shows the share of wheat flour uses by type of producer and product category. In terms of wheat flour use by type and scale of operation, only in noodle products is there higher use of wheat flour by large-scale industries (LSI) at 51%, followed closely by small- to medium-scale industries (SMSI) at 46%. In biscuit products, SMSI wheat flour use accounts for a bigger share at 73%, with only 22% for LSI. The share of SMSI is even higher in bakery products at 91%, followed by household industries at 6%, and only 3% for LSI. In the SMSI classification, 57% of wheat use is by small-scale and the other 47% is by medium-scale producers.

Prior to the liberalization, Indonesia imported mostly wheat for flour processing. In some years, feed quality wheat was imported from the European Union for processing for industrial purposes. In the post-liberalization period, around 9% to 18% of the imports

are in the form of wheat flour; the rest are wheat as raw materials for flour processing. The recovery rate of the wheat milling industry in Indonesia is 75% (wheat flour); 24% wheat pollard for animal feed and plywood glue, and around 0.5% to 1% impurities. Most local wheat flour is sold for the domestic market; only a very small quantity is exported. Around 80% of wheat pollard is used by local feed industries and 20% is pelletized and exported for animal feed, mainly to Korea and Taiwan.

In order to meet wheat-based food industry demands for flour, local flour mills produce flour with high protein (>12%), medium protein (10%-11%), and low protein (8%-9%) content. Approximately 75% of Indonesia's domestic flour production is made up of high-protein flour that is used for instant noodle and bakery products, while the remainder consists of medium- and low-protein flour used for wet noodle and cake products.

Table 6 shows the share of wheat flour uses by type of producer and product category. More than half of wheat flour in Indonesia is used in noodle production distributed as follows: instant noodle at 20%, dry noodle at 8%, and wet noodle at 32%. Wet noodle is uncooked and is a popular Chinese noodle mostly distributed in shops and restaurants. Dry noodle, a popular Japanese noodle, has a longer shelf life. Instant noodle is sold with spices and is ready for consumption by simply adding hot water and leaving for five minutes. The next flour use is for bakery products (bread, cake, and pastry) at 20%, biscuit products (cookies, wafer, crackers, and other snack items) at 10%, and the remaining 10% is wheat flour use for various products by households.

The pasta industry is growing rather slowly because of the longer time it takes to prepare pasta and the more complicated procedure. Lack of familiarity with the taste of

pasta also limits the growth of the market in Indonesia. BFM produces pasta mainly for export.

With the liberalization of wheat imports, the local milling industry is strategizing to compete successfully with imports. For example, BFM began producing three new brands of flour geared toward market niches: high-quality flour for modern, upscale bakeries, which require consistency of flour quality; Segitiga Merah for more economical cakes and pastries; and Lencana brand flour for cookies.

To compete with this lower-priced, imported wheat flour, at least two milling companies have begun to produce low-quality flour: Lencana brand (BFM), and Soka brand (Panganmas). The new lower quality and cost flour is about 10% protein, the same as the regular medium-protein flour (Segitiga Biru, Melati, Beruang Biru, and Kompas brands), but has higher ash content and/or is lower in other quality factors.

PT. Indofood Sukses Makmur (ISM), one of the Salim Group's food division companies, controls 85% to 90% of the instant noodle market. The Salim Group also owns the main flour mill, BFM.

6. Wheat and Wheat Flour Foreign Suppliers

With no domestic production of wheat, Indonesia depends entirely on foreign suppliers. Table 7 shows the major wheat suppliers in Indonesia. In the mid-1990s Australia, Canada, Argentina, and Saudi Arabia accounted for most of the wheat supply in Indonesia. In the last three years, Saudi Arabia dropped out as a major supplier (14% to 25% market share), while Argentina significantly reduced its market share from 15% to 1%. Canada's market share also declined from 30% to 15%. The U.S. market share

increased slightly, partly because of credit and aid programs given to the country. Australia captured most of the market share lost by other countries, with its share reaching 58%. The ASW is a major source of flour mixed to produce medium-protein flour used for noodle production. Asian neighboring countries such as China and India are penetrating the market, albeit with a small share of 3% to 18% in 2003. The supply of wheat flour is more evenly divided among a number of foreign suppliers, led by China at 22%, followed by India at 20%, and then Australia at 16% (see table 8).

Table 9 gives the domestic wheat price of leading wheat exporters to Indonesia. In the last two years, India and China have the lowest price, followed by Argentina. Australia's wheat price is the highest.[4] Whatever advantage the U.S. might have in its domestic price over its competitors in Indonesia, if any, is offset when transport cost is considered.

Australia's dominance in Indonesia's wheat market is primarily driven by competitive prices as well as the suitability of the ASW variety for noodle production. Compared to both Canada and the U.S., Australian CIF prices are around 4% to 9% lower. A big contributing factor is Australia's proximity to Indonesia. The freight cost from the U.S. to Indonesia is two times greater compared to the cost from Australia to Indonesia. Australia, Canada, and the U.S. all provide some type of credit scheme to Indonesia.

The Australian government—through the Australian Wheat Board (AWB)—has provided Indonesia with a credit scheme that is similar to the U.S. GSM-102 program. The Canadian Wheat Board (CWB) has provided Indonesia with food aid in the form of

[4] With the AWB dominating the export of wheat from Australia, it is likely that the final export price may vary (mostly downward) compared to the daily domestic wheat price.

wheat. It has also offered export credit facilities. These are important post-liberalization trade instruments for the sector since importers now actually take ownership of the imported products when in the past the GOI through BULOG owned both the wheat and wheat flour throughout the movement of the products in the value chain.

Australia, Canada, and the U.S. are continuing to develop wheat varieties that are suitable for noodle production. Australia has a variety-release system and identity preservation systems that provide the Hard White Wheat (HWW) varieties for Asian markets. Canada has also developed its own HWW varieties that can produce clean noodles with good texture. The U.S. is also developing HWW varieties with characteristics suitable for this market (Lin and Vocke, 2004).

7. Analysis of Alternative Scenarios

A partial equilibrium model for the agricultural sector of Indonesia was developed to analyze alternative scenarios. The model covers the following commodities: rice, cotton, sugar, wheat, corn, soybeans, palm oil complex, beef, pork, poultry, lamb, milk, cheese, butter, non-fat dry milk, and whole milk powder. A standard supply and demand framework is specified for each commodity. For the crops, the supply side includes equations for area, yield, and production, while the demand side includes equations for consumption, feed use, and stock. For the meats and dairy, the supply side includes equations for breeding stock, calving rate, mortality, slaughter number, and slaughter weight, while the demand side includes equations for consumption and stock. Domestic price evolves by a price transmission equation from the world price. Net trade is a residual to balance the markets. A reduced-form equation determines the world price,

which is expressed as a function of net trade. An average elasticity from the three estimates was used in the model. Also, a double-log price transmission model was estimated with wholesale flour price as a dependent variable and a landed flour price that included the world price converted into local currency plus transportation. It is shown that the domestic flour price is very responsive to changes in the world flour price, with a transmission elasticity of 0.98.

This study explores the impact of two scenarios on the wheat flour sector in Indonesia. A partial liberalization scenario examines the impacts of removing the border duty of 5%, the 10% VAT, and the 2.5% sales tax for wheat flour. A second scenario examines the impacts of a fast income growth. The faster growth rate scenario increases Indonesia's growth rate to approach China's growth rate in 2003, which is the highest in Asia. This amounted to an increase of four percentage points in growth rates.

With the removal of the 5% duty on wheat flour, the 10% VAT, and the 2.5% sales tax (see table 10), the wholesale wheat flour price in Indonesia drops by 13.66%. This induces consumption to increase by 7.06%. Without any domestic production, the increase in consumption fully translates to an increase in the wheat net imports by 7.04%. Indonesia's increase in wheat import demand exerts an upward pressure on world price, increasing it by 0.23%.

In the faster income scenario, an additional 4 percentage points in real income growth in Indonesia raises consumption by 2.60%, translating into a 2.59% increase in net trade. This additional demand puts upward pressure on prices, increasing the world price by 0.09% and the domestic wholesale wheat flour price by 0.09%.

Larger changes would be expected if a full liberalization scenario is analyzed, in which the domestic wheat flour price is allowed to converge fully to the world price.

8. Summary and Conclusions

Indonesia is not a producer of wheat but has the largest wheat miller in a single location and is the largest instant noodle producer in the world. Indonesia ranks in the top five leading wheat importing countries in the world, with its imports representing 4% of the world import market. The build-up of the domestic capacity to produce wheat flour was a direct result of the policy regime before 1996 in which a state enterprise (BULOG) was vested as the sole importer and distributor of wheat and wheat flour. The macroeconomic crisis in the late 1990s forced the GOI to liberalize the wheat sector.

A new demand elasticity estimate based on consumption survey data shows high income elasticity for wheat products. The response to income changes can come in the form of an increase in the probability of consumption for households not currently consuming wheat products and an increase in the level of consumption for households that are current consumers. The same pattern is shown for noodles consumption. In contrast, income and urbanization have a negative impact on the probability of rice consumption and a small positive impact on the unconditional mean. Given the trend in income growth and urbanization in Indonesia, what these elasticities suggest is that wheat consumption will grow faster, while growth in rice consumption will be much slower.

A partial liberalization and fast income growth scenarios were analyzed using the new demand estimates. A partial liberalization removed the applied duty, VAT, and sales tax. Under the liberalization scenario, the domestic wholesale price declines by 13.66%.

As a result, wheat flour consumption expands by 7.06%. With no domestic wheat production, the increase in consumption fully translates into an increase in imports (a 7.04% increase). The increased demand for wheat from Indonesia puts upward pressure on the world price of wheat, increasing it by 0.23%.

The impact of the fast income growth scenario was also analyzed. The fast income growth scenario increased Indonesia's most likely growth rate by assuming its income growth rate approaches that of the fastest growing economy in Asia—China. Consumption (2.60%), imports (2.59%), world price (0.09%), and domestic price (0.09%) all increased in the fast growth scenario.

The analysis clearly showed that consumption of wheat products in Indonesia is constrained by the low income of consumers and the high price of wheat flour in the domestic market relative to the world price. Income improvements and removal of trade barriers sustaining the price wedge will raise consumption and imports. The five leading countries that may be able to capture this growing market include Australia, Canada, the United States, China, and India. With the cost of transportation already high and expected to continue to rise, those with a proximity advantage such as Australia, China, and India are in a better position to capture this market. However, dependability of supply, assurance of quality, and extension of credit arrangements may enable North American suppliers to penetrate and compete in this market.

References

Adhikari, M., L. Paudel, J. E. Houston, and B. N. Paudel. 2003. "Measuring the Impacts of US Export Promotion Program for Wheat in Selected Importing Regions," Selected Paper prepared for presentation at the Southern Agricultural Economics Association Annual Meeting, Mobile, Alabama, February 1-5, 2003.

Amemiya, T. 1973. "Regression Analysis when the Dependent Variable is Truncated Normal," *Econometrica* 41:997-1017.

Barnes, J. N., and D. A. Shields. 1998. 'The Growth in U.S. Wheat Food Demand," *Wheat Yearbook*, USDA, Economic Research Service, March, pp. 21-29.

Blaylock, J.R., and W.N. Blisard. 1992. "U.S. Cigarette Consumption: The Case of Low-Income Women," *American Journal of Agricultural Economics* 74: 698-705.

Chai, J. C. 1972. *The U.S. Food Demand for Wheat by Class*, Department of Agricultural and Applied Economics, University of Minnesota. Staff Paper P72-14.

Chen, K., and R. Kim. 1998. "Estimation of Source- and Quality-Differentiated Import Demand under Aggregate Import Quota: An Application to Japan's Wheat," Rural Economy Staff Paper 98-09, Department of Rural Economy, University of Alberta Edmonton, Canada.

Cragg, J.G. 1971. "Some Statistical Models for Limited Dependent Variables with Application to the Demand for Durable Goods," *Econometrica* 39: 829-844.

Dahl, B., and W. Wilson. 2000. "Grades/Classes of Hard Wheats Exported from North America: Analysis of Growth and Market Segments," *Review of Agricultural Economics* 22(1): 172-191.

Fabiosa, J.F. 2005. "Growing Demand for Animal-Protein-Source Products in Indonesia: Trade Implications," CARD Working Paper 05-WP 400, Center for Agricultural and Rural Development, Iowa State University.

Gandhi, V.P., Z-Y. Zhou, and J. Mullen. 2001. "Wheat Economy of India: Development, Nature and Trade Prospects," abstract available at http://www.aarc.usyd.edu.au/abstract.html#13.

Haines, P.S., D.K. Guilkey, and B.M. Popkin. 1988. "Modeling Food Consumption Decisions as a Two-Step Process," *American Journal of Agricultural Economics* 70: 543-552.

Heckman, J.J. 1979. "Sample Selection Bias as a Specification Error," *Econometrica* 47: 153-161

Huang, J., and C. David. 1993. "Demand for Cereal Grains in Asia: The Effect of Urbanization." *Agricultural Economics* 8: 107-124.

Jin, H.J., G. Cho, and W.W. Koo. 2003. "Third Country Effects on U.S. Wheat Export Performance in Asian Countries," Agribusiness and Applied Economics Report No. 503, Department of Agribusiness and Applied Economics, North Dakota State University.

Jones, A.M. 1989. "A Double-Hurdle Model of Cigarette Consumption," *Journal of Applied Econometrics* 4: 23-39.

Jones, A.M., and S.T. Yen. 2000. "A Box-Cox Double-Hurdle Model," *The Manchester School* 68: 203-221.

Joshi, P.D. 1998. "Changing Pattern of Consumption Expenditure in India and Some Selected States," National Sample Survey Organisation, New Delhi.

Lavoie, N. 2003. "The Impact of Reforming Wheat Importing State-Trading Enterprises on the Quality of Wheat Imported." Paper presented at the American Agricultural Economics Association Annual Meeting Montreal, Canada, July 27-30.

Lin, W., and G. Vocke. 2004. "Hard White Wheat at a Crossroads," Electronic Outlook Report WHS-04K-01, Economic Research Service, USDA, www.ers.usda.gov.

Lohmar, B. 2004. "China's Wheat Economy: Current Trends and Prospects for Imports," Electronic Outlook Report WHS-04D-01, Economic Research Service, USDA, www.ers.usda.gov.

Maddala, G.S. 1983. "Limited Dependent and Qualitatitive Variables in Econometrics," Cambridge: Cambridge University Press.

Marsh, T. L. 2003. "Elasticities for U.S. Wheat Food Use by Class," proceedings, 2003 Meetings of the *Australian Agricultural and Resource Economics Society*, Fremantle, WA.

Mohanty, S., and E. W. F. Peterson. 1999. "Estimation of Demand for Wheat by Classes for the United States and the European Union," *Agricultural and Resource Economics Review* 28(2): 158-168

Newman, C., M. Henchion, and A. Matters. 2001. "A Double-Hurdle Model of Irish Household Expenditure on Prepared Meals," Trinity College Dublin Economic Papers 200119.

Parcell, J., and K. Stiegert. 2001. "Japanese Demand for Wheat Characteristics: A Market Share Approach," Paper presented at the Western Agricultural Economics Association Annual Meetings, Logan, Utah, July 8-11.

Pingali, P. 2004. "Westernization of Asian Diets and the Transformation of Food Systems: Implications for Research and Policy," ESA Working Paper No. 04-17, Economic and Social Department, Food and Agriculture Organization of the United Nations, Rome.

Pingali, P., and M.W. Rosengrant. 1998. "Supplying Wheat for Asia's Increasingly Westernized Diets." *American Journal of Agricultural Economics* 80(5): 954-959.

Regmi, A., and J. Dyck. 2001. "Effects of Urbanization on Global Food Demand." In: *Changing Structures of Global Food Consumption and Trade,* edited by Anita Regmi. ERS WRS 01-1. Washington DC: Economic Research Service, USDA.

SAS. 2004. Qualitative and Limited Dependent Variable Model (QLIM), Chapter 22, pp. 1319-1355.

Satyanarayana, S., and D.D. Johnson. 1998. "Credit Guarantee Programs and U.S. Market Share in Selected Wheat Import Markets," Agricultural Economics Report No. 398, Department of Agribusiness and Applied Economics, North Dakota State University.

USDA-FAS. Various. Attaché reports on Indonesia. http://ffas.usda.gov/scriptsw/AttacheRep/default.asp.

USDA-FAS. 2005. "Grain: World Markets and Trade." FG01-05. http://www.fas.usda.gov/grain/circular/2005/01-05/graintoc.htm.

Wilson, W. W. 1994. "Demand for Wheat Classes by Pacific Rim Countries," *Journal of Agricultural and Resource Economics* 19(1): 197-209.

Wilson, W. W., and P. Gallagher. 1990. "Quality Differences and Price Responsiveness of Wheat Class Demands," *Western Journal of Agricultural Economics* 15: 254-264.

Yen, S. T. 1993. "Working Wives and Food Away from Home: The Box-Cox Double Hurdle Model," *American Journal of Agricultural Economics* 75: 884-895.

Yen, S. T. 1994. "Cross-Section Estimation of US Demand for Alcoholic Beverage," *Applied Economics* 26: 381-383.

Yen, S. T., and C. L. Huang. 1996. "Household Demand for Finfish: A Generalized Double-Hurdle Model," *Journal of Agricultural and Resource Economics* 21: 220-234.

Yen, S. T., and H. H. Jensen. 1995. “Determinants of Household Expenditures on Alcohol,” CARD Working Paper 95-WP 144, Center for Agricultural and Rural Development, Iowa State University.

Yen, S. T., H. H. Jensen, and W. B. Wang. 1996. “Cholesterol Information and Egg Consumption in the US: A Nonnormal and Heteroscedastic Double-Hurdle Model,” *European Review of Agricultural Economics* 23: 343-356.

Table 1. Leading wheat importing country in the world

	Import Level			Market Share		
	1996	2000	2004	1996	2000	2004
Country	Thousand Metric Tons			Percent		
Indonesia	4201	4069	4,400	4.27	4.00	4.07
EU	2503	3159	5,500	2.54	3.11	5.08
Brazil	5111	7201	5,000	5.20	7.09	4.62
Japan	6264	5885	5,700	6.37	5.79	5.27
Egypt	6893	6050	7,500	7.01	5.95	6.93
World	98379	101620	97616	100.00	100.00	100.00

SOURCE: PS&D View, USDA Database.
Note: In 2004, EU is EU25.

Table 2. Per capita monthly consumption of cereals and other wheat-based products

	1996 Data			1999 Data		
	Sample	Q>0		Sample	Q>0	
	Level	Level	Percent	Level	Level	Percent
Wheat flour	0.078	0.790	0.098	0.063	0.600	0.104
Wheat noodle	0.016	0.637	0.026	0.010	0.551	0.019
Instant noodle	0.130	0.350	0.371	0.125	0.336	0.374
Macaroni	0.005	0.229	0.022	0.001	2.107	0.018
Plain bread	0.060	0.472	0.128	0.031	0.054	0.079
Sweetened bread	0.020	0.074	0.269	0.013	0.396	0.238
Crackers & cookies	0.017	0.132	0.131	0.005	0.056	0.114
Fried-boiled noodles	0.050	0.134	0.375	0.030	0.075	0.401
Instant noodle	0.003	0.085	0.040	0.005	0.170	0.030
Wheat-rice noodle				0.000	0.029	0.014
Wet cake				0.044	0.124	0.356

SOURCE: SUSENAS.

Table 3. Per capita wheat consumption in selected countries

	1970s	1980s	1990s	Growth
	Kilograms per capita			Percent
China	49.31	85.56	88.53	0.35
South Korea	51.29	68.71	86.08	2.53
Singapore	59.29	52.61	66.32	2.61
Malaysia	30.60	37.11	51.09	3.77
Taiwan	39.24	39.78	45.01	1.32
Philippines	14.72	16.99	30.65	8.04
Indonesia	6.28	9.19	16.13	7.56
Thailand	2.54	4.14	10.99	16.52

SOURCE: USDA-FAS and FAO.
Note: In wheat equivalent.

Table 4a. Wheat demand elasticity estimates

	Participation	S. Error	Mean	S. Error	Share
1996 Data					
Expenditure	0.209	0.012	0.665	0.022	31.364
Wheat Price	-0.032	0.003	-0.514	0.023	6.185
Rice Price	0.017	0.017	0.269	0.038	6.206
Corn Price	0.007	0.005	0.056	0.012	12.331
Tuber Price	0.029	0.005	0.110	0.011	26.499
Urban Location	0.053	0.002	0.123	0.013	43.089
ρ	-0.291	0.011			
1999 Data					
Expenditure	0.220	0.013	0.844	0.025	26.069
Wheat Price	-0.025	0.003	-0.490	0.019	5.198
Rice Price	-0.053	0.016	0.039	0.034	-134.624
Corn Price	0.021	0.005	0.082	0.012	25.902
Tuber Price	0.005	0.003	0.060	0.008	8.276
Urban Location	0.034	0.002	0.105	0.008	32.381
ρ	-0.297	0.011			
2000 Data					
Expenditure	0.153	0.011	0.443	0.016	34.537
Wheat Price	-0.023	0.002	-0.470	0.015	4.876
Rice Price	-0.030	0.013	0.354	0.024	-8.511
Corn Price	0.022	0.004	0.083	0.010	26.837
Tuber Price	0.011	0.003	0.099	0.008	11.230
Urban Location	0.024	0.002	0.126	0.006	19.048
ρ	-0.325	0.010			

SOURCE: Estimated from SUSENAS data.

Table 4b. Wheat noodle demand elasticity estimates

	Participation	S. Error	Mean	S. Error	Share
1996 Data					
Expenditure	0.253	0.006	0.489	0.010	51.712
Noodle Price	-0.177	0.009	-0.500	0.015	35.467
Other Wheat Price	-0.023	0.006	-0.004	0.009	547.101
Urban Location	0.095	0.004	0.184	0.014	51.455
ρ	-0.325	0.018			
1999 Data					
Expenditure	0.307	0.008	0.661	0.017	46.417
Noodle Price	-0.473	0.027	-0.972	0.041	48.615
Other Wheat Price	-0.018	0.007	0.006	0.011	-300.414
Urban Location	0.085	0.004	0.177	0.013	47.983
ρ	-0.266	0.018			
2000 Data					
Expenditure	0.127	0.005	0.264	0.007	48.022
Noodle Price	-0.289	0.020	-0.722	0.028	40.031
Other Wheat Price	-0.019	0.006	0.016	0.009	-122.392
Urban Location	0.093	0.004	0.203	0.010	45.795
ρ	-0.216	0.018			

SOURCE: Estimated from SUSENAS data.

Table 4c. Rice demand elasticity estimates

	Participation	S. Error	Mean	S. Error	Share
1996 Data					
Expenditure	-0.002	0.001	0.022	0.002	-7.236
Rice Price	-0.005	0.005	-0.370	0.019	1.465
Wheat Price	-0.001	0.001	0.002	0.002	-21.754
Corn Price	0.006	0.002	0.006	0.003	99.251
Tuber Price	0.006	0.002	-0.020	0.003	-29.995
Urban Location	0.004	0.0005	-0.033	0.001	-13.174
ρ	-0.177	0.034			
1999 Data					
Expenditure	-0.009	0.002	0.055	0.002	-15.813
Rice Price	-0.012	0.007	-0.333	0.020	3.580
Wheat Price	-0.005	0.001	-0.003	0.002	156.198
Corn Price	0.001	0.001	-0.026	0.004	-2.105
Tuber Price	-0.001	0.001	-0.031	0.003	3.369
Urban Location	-0.004	0.0006	-0.056	0.001	6.961
ρ	-0.121	0.026			
2002 Data					
Expenditure	-0.004	0.001	0.013	0.002	-27.168
Rice Price	-0.004	0.005	-0.433	0.023	1.031
Wheat Price	-0.007	0.002	-0.005	0.002	140.980
Corn Price	0.005	0.002	-0.003	0.003	-144.978
Tuber Price	-0.004	0.001	-0.034	0.003	10.974
Urban Location	-0.011	0.0012	0.028	-0.001	-40.702
ρ	-0.156	0.029			

SOURCE: Estimated from SUSENAS data.

Table 5. Profiles of wheat millers

	BS Jkt	BS Sby	BSU	SBR	PM
Founded	1971	1972	1982	1994	1997
Plant Size (ha)	33	13	4	2.6	6
Unloading Unit	5	3	3	1	1
Unloading Capacity (mt/hr)	1,800 2,000	1,800	500	300	400
Milling Capacity (mt/day)	10,000	5,900	2,900	1,500	1,000
Milling Capacity (mt/year)*	3,000,000	1,770,000	870,000	450,000	300,000
Silo Capacity (mt)	404	215	118	66	75

* Based on 300 days per year.
BS Jkt – PT ISM Bogasari Flour Mills – Jakarta, West Java Factory
BS Sby – PT ISM Bogasari Flour Mills – Surabaya, East Java Factory
BSU – PT Berdikari Sari Utama Flour Mills – Ujung Pandang, S. Sulawesi
SBR – PT Sriboga Raturaya Flour Mills – Semarang, Central Java
PM – PT Panganmas Inti Persada Flour Mills – Cilacap, Central Java

Table 6. Type of wheat flour users and product categories

	LSI	SMSI	Small	Household	Total
Noodle	51.22	45.71	3.06		54.20
Biscuit	22.45	72.67	4.87		13.74
Bakery	3.43	90.50	6.07		27.46
Household				100.00	4.60
Total	31.79	59.62	4.00	4.60	100.00

LSI – large-scale industry
SMSI – small- to medium-scale industry

Table 7. Market share of major sources of wheat imports

	1995	1996	1997	1998	1999	2000	2001	2002	2003
	Percent								
U.S.	0	11	14	2	1	14	19	15	5
Australia	38	34	53	57	58	53	55	58	48
Canada	21	19	31	31	32	21	19	15	17
India							5	7	18
EU	1			0		11	1	2	2
Argentina	14	15	1	6	7		1	1	3
China				0				2	3
Saudi A	25	14							
Others		1	1	2	2	1	0	0	2
Total	100	100	100	100	100	100	100	100	100
Total Trade	3,234	3,603	3,821	3,742	4028	3,037	4,371	2,294	3,473

SOURCE: USDA-FAS attaché reports.
Note: FY July-June.

Table 8. Market share of major sources of wheat flour imports

	2000	2001	2002	2003
	Percent			
United States	0.20			
U A E	29.86	24.56	7.96	11.52
Australia	9.04	19.82	23.53	15.71
China		10.65	27.34	21.99
Belgium	12.97	8.88	7.61	13.35
Netherlands	6.88	5.92		
Korea	2.36	4.73	4.15	0.26
France	8.25	4.14		
Japan		3.85	2.08	1.57
Turkey	3.14	3.55		3.93
Oman	2.36	3.55		
Malaysia			6.92	5.76
Singapore	3.54		6.57	2.88
India			6.23	19.63
Germany	16.70		2.42	1.31
Others	7.07	10.36	5.19	2.09
Total	100.00	100.00	100.00	100.00
	Thousand Metric Tons			
Flour Imports	509	338	289	382
Grain Equivalent	687	457	390	516

SOURCE: USDA-FAS attaché reports.
Note: FY July-June.

Table 9. Domestic wheat price (in US$ per metric ton) of selected exporters

	Australia(1)	Argentina(2)	China(3)	India(4)	United States(5)
1995	190	164	208	129	177
1996	214	201	219	125	207
1997	169	158	189	166	160
1998	145	123	175	124	126
1999	129	117	177	135	112
2000	125	111	139	165	114
2001	144	121	141	137	127
2002	156	121	133	131	149
2003	166	152	141	150	146

1. Australia price is based on unit value.
2. Argentina price is based on unit value.
3. China price is wholesale price grade 2 and 3.
4. India price is Delhi price for milling wheat.
5. U.S. price is No. 1 Hard Red Winter, FOB Gulf of Mexico ports.

Table 10. Impacts of partial liberalization and income growth scenarios

	2007	2010	2013	Average
Consumption				
Baseline (tmt)	4,762	5,301	5,884	5,132
Percent Change				
Partial Liberalization	6.91	7.14	7.37	7.06
Income Growth	2.57	2.62	2.67	2.60
Net Exports				
Baseline (tmt)	-4,776	-5,311	-5,896	-5,151
Percent Change				
Partial Liberalization	6.89	7.13	7.35	7.04
Income Growth	2.56	2.61	2.67	2.59
Wholesale Price				
Baseline (R/kg)	2,861	3,122	3,393	3,041
Percent Change				
Partial Liberalization	-13.66	-13.66	-13.65	-13.66
Income Growth	0.08	0.09	0.10	0.09
World Price				
Baseline ($/mt)	139	144	148	142
Percent Change				
Partial Liberalization	0.21	0.23	0.25	0.23
Income Growth	0.09	0.10	0.11	0.09

Figure 1. Location of wheat millers in Indonesia