HOW FOOD POLICY AFFECTS THE POOR:
A GENERAL EQUILIBRIUM ANALYSIS FOR INDONESIA*

Peter Warr

Australian National University

Abstract

The distributional effects of food pricing policy are always controversial, particularly in developing countries. Indonesia is a good example, where rice is a net import and accounts simultaneously for a large share of consumers' budgets and a large share of total employment. For the poor, both the share of rice in total consumption and the dependence on rice production as a source of employment are much greater than they are for the general population. Imports of rice have been subject to both tariffs and quantitative restrictions, but the way this protection affects the poor has been hotly debated. Advocates of increased rice tariffs have emphasized reduction of poverty among farmers – net producers of rice – while opponents have stressed increases in poverty among net consumers.

An adequate analysis of the distributional effects of a tariff on rice imports needs to take account of its effects on different households' expenditures, disaggregated by household group, but also its effects on their incomes, operating through its effects on the labour market, as well as its effects on the returns to land. A general equilibrium framework is therefore essential and it must include a disaggregated household sector. This paper applies the *Wayang* general equilibrium model of the Indonesian economy to these issues. It concludes that protection of the rice sector increases poverty, but to a much smaller extent than opponents of the tariff have claimed. Moreover, these results are robust to variations in the key parametric assumptions of the analysis.

* Invited paper presented to the Econometric Society Australaia Meeting, Melbourne, 7-9 July 2004. Assistance from Glyn Wittwer of Monash University, Arriya Mungsunti and Colin Thompson of the Australian National University and Sulton Mawardi, Agus Priyambada and Yusuf Suharso of SMERU Research Institute, Jakarta, is gratefully acknowledged. The measurement of poverty employed in this paper draws upon the author's joint work with George Fane. Peter Rosner of Development Alternatives Inc. kindly provided the data used in Figures 1 and 2. The paper benefited from the comments of participants at earlier workshops at SMERU Research Institute and the Australian National University.

1. Introduction

Food pricing policy is controversial everywhere, but particularly in developing countries. Staple foods typically account simultaneously for a large share of consumers' budgets and a large share of total employment. In Indonesia, the staple food, rice, represents 7.5 per cent of average consumer expenditure. Its production employs 7.2 per cent of the total work force at the farm level alone. Anything which affects the price of rice has profound political and economic consequences. Rice is particularly important for the poor, where both the share of rice in total consumption and the dependence on rice production as a source of employment are much greater than they are for the general population. For example, for that part of the workforce with only primary school education or less, the production of paddy (rice produced at the farm level) accounts for 18 per cent of total employment.

Indonesia is a net importer of rice, though the magnitude of its imports varies from year to year depending on domestic production, international prices and the size of stocks. Over the 4 years following the crisis of 1997-98 (1998 to 2001, inclusive) rice imports were 9.1 per cent of total consumption of rice (Table 1). Indonesia is the world's largest rice importer, accounting for 18 per cent of the world's total imports between 1998 and 2000 (Table 2). Thailand is the largest exporter, followed by Vietnam and USA.

Prior to the 1997-98 crisis Indonesia's rice imports were monopolised by a public agency called Bulog. Figure 1 shows that except for the periods of the 1973 commodity price boom and the 1997-98 exchange rate crisis, the real price of rice in Indonesia has been relatively stable, but its post-crisis level has been above its level over the previous three decades, even though international rice prices have declined relative to other traded commodities. From this and from Figure 2 it is apparent that the effects of Bulog's market interventions were to stabilise rice prices relative to international prices at a level not significantly different from the trend level of world prices. With the exchange rate volatility of the crisis period, local currency prices of imported rice surged. For a brief period, Indonesian domestic prices remained well below exchange rate adjusted world prices, but from about 2000 onwards they have stabilised at levels 40 to 50 per cent *above* import prices.

The large difference between the domestic and import price arose from changes in rice import policy which followed the 1997-98 crisis. Bulog's monopoly on rice imports was abolished in 2000, but this agency still accounted for around 75 per cent of total imports. Private imports were subject to a specific tariff (rather than an *ad valorem* tariff) of Rp. 430 per kg, which in mid 2002 was around 25 per cent of the import price (c.i.f.). In addition, private sector rice imports were subject to "red lane" customs treatment, meaning stricter standards of customs inspection than other food items, and were also subject to special import licensing requirements.[1] The tariff plus these non-tariff barriers apparently account for the increased difference between the border price of imported rice and domestic prices.

In 2002 a 75 per cent increase in the tariff rate (from Rp, 430 to Rp. 750 per kg.) was proposed by the Ministry of Agriculture and Bulog, but the increase was reportedly blocked by the Ministry of Finance. In January 2004 rice imports were temporarily banned.[2] Six months later, at the time of writing, the ban remained.

The pro-tariff argument

The argument supporting a tariff or quantitative restriction on rice imports has come mostly from Bulog and the Ministry of Agriculture. It has been justified at several levels. First, it has been argued that without protection Indonesia's rice sector cannot achieve the goal of rice self-sufficiency – a strongly-held objective of many Indonesian political leaders despite its lack of any sound economic foundation.[3] Second, protection has been said to be necessary because world rice prices are 'distorted' by export subsidies in major exporting countries. This argument is seemingly no stronger than the first. If rice import prices were to be permanently depressed by exporter policies which amount to 'dumping', then no matter how 'distortionary' these policies may be, Indonesia's most rational policy would be to adjust to this feature of its international environment and reallocate resources accordingly, rather than to protect its domestic economy from the cheaper imports which the exporting countries now (so kindly) provide. Finally, and most controversially of all, a tariff has been said to be desirable because of its favourable

[1] These requirements are known as NPIK: *Nomor Pengonal Impor Khusus*.
[2] A ban on imports is not a tax measure and thus does not require Ministry of Finance approval.
[3] In its preoccupation with food self-sufficiency, Indonesia is not different from many other staple food importing countries, at least those which are also significant producers of these commodities.

income distributional effects. Compared with free trade, a tariff would supposedly reduce poverty by raising the incomes of poor farmers.[4]

The anti-tariff argument

Critics have focused in particular on the distributional effects of a rice tariff, arguing that an increase in the tariff will actually increase poverty incidence. The analysis distinguishes net producers of rice and net consumers and says that the tariff benefits the former at the expense of the latter. The net producers are sellers of rice, meaning farmers owning rice-producing land and renters of this land. The net consumers are rural landless labourers, producers of agricultural commodities other than rice, and virtually all urban residents. It is pointed out that there are large numbers of poor people in both groups, but many more, it is claimed, among the net consumers than the net producers. A tariff on rice would therefore raise poverty incidence rather than lowering it. Seemingly strong claims have been made about the degree to which poverty would decline if the tariff was reduced and, conversely, the degree to which poverty incidence would worsen if the tariff was increased, as proposed.[5]

One flaw in the argument that a tariff would worsen income distribution is that most, but not all, of those arguing this case have focused on *counting* the numbers of poor people in each group, disregarding the seemingly larger magnitude of the benefit received by each net producer from a tariff increase than the loss incurred by each net consumer. But this flaw is not necessarily decisive and there is a seemingly more serious problem with the case that has been made against the tariff.

A crucial assumption of the anti-tariff argument, as summarized above, is that the group benefiting from the tariff increase – 'net producers' – consists solely of land holders. Landless labourers employed in the rice sector, which includes vast numbers of poor people, are counted among the net consumers of rice – the losers from a tariff.

[4] Bulog has also claimed that protecting the rice industry is good for the environment, because it would keep irrigated land in rice production that might otherwise become idle. Few observers have agreed that the increased pesticide and fertilizer use that would follow, not to mention increased demand for irrigation water, could have environmental benefits. In any case, there seems little possibility that irrigated land not used for rice production would be left idle.

[5] Examples include a quantitative study by Ikhsan (2002) and the various Working Papers and Policy Briefs produced by the Indonesian Food Policy Program sponsored by Bappenas, the Department of Agriculture and Development Alternatives Incorporated. These reports are available at www.macrofoodpolicy.com.

These people derive their incomes not from the sale of rice but from the sale of their labour. It is implicitly assumed in the net producer / net consumer framework that an increase in the price of rice would affect the living costs of these people, through the price of rice, but not their incomes. This in turn assumes that an increase in the price of rice would not increase the aggregate demand for unskilled labour. If it did, the increase in labour demand would produce some combination of increased employment and increased real wages for landless labourers.

There is reason to think that these effects could be important. Suppose that rice producers respond to the increase in prices with an increase in output. The paddy (rice) industry is a large employer of unskilled labour and is also labour-intensive in its production technology, relative to the rest of the economy. An expansion of rice production would presumably increase the demand for unskilled labour significantly, and unskilled labour is the major asset of the poor. The anti-tariff argument ignores the effects that an expansion of rice production could have on the incomes of 'net consumers' via its effect on the demand for unskilled labour. This assumption could be valid only if rice production did *not* respond to an increase in the price of rice.

The nature of crop production is that supply response generally occurs only with some delay – say, six months to two years. The assumption of zero supply response, implying zero income effect for 'net consumers', may be roughly correct for the very short run – say periods of less than one year – but beyond this length of time it is not at all clear that the argument is valid. So long as it remains in place, a tariff increases the domestic price *permanently*. It seems likely that the long run supply response in the Indonesian rice industry would be highly inelastic, but this does not mean that it would be zero. Indeed, the notion that peasant farmers do not respond to price incentives, given sufficient time to adjust their production schedules, is one of the most thoroughly demolished myths in all of economics.

Supply response of domestic rice producers

Several empirical studies have looked at the issue of supply response in the Indonesian context and their results vary widely. An early study by Mubyarto (1975) estimated the long run elasticity of planting area with respect to price on Java to be very low, at 0.03. Tabor (1988) estimated that in Java the elasticity of planting area with respect to price was 0.22 in wet land rice production and 0.45 in dry land

production. A study by Hutauruk (1996) estimated the planting area response elasticity on Java to be 0.04 and off Java to be 0.78. Since the overall elasticity of supply includes the response of yield to price as well as the response of planted area, the implied output supply elasticities with respect to price will be larger than these estimates.

Finally, a recent paper by Irawan (2002) estimates short and long term elasticities of supply response for several regions and for both wet and dry land rice production. The short term estimates for wet land rice are: Java 0.11, Sumatra 0.12, Sulawesi 0.45 and Kalimantan 0.02. His long run estimates are: Java 0.13, Sumatra 0.52, Sulawesi 1.25 and Kalimantan 0.21. His estimates for dry land rice supply response are generally about 50 per cent larger than the above estimates. For example, the long run estimate for dry land rice supply response for Java is 0.21 and for Sulawesi it is above 2.

In summary, the available econometric evidence supports the view that in Indonesia the overall elasticity of supply response of rice is low, but not zero. The estimates are higher in the long run than the short run, higher in dry land conditions than wet land conditions and generally higher off-Java than on-Java. Estimates of the long run elasticity of output with respect to price in the range of 0.2 to 0.4 would be consistent with the available evidence. Nevertheless, it must be recognised that considerable uncertainty remains as to the true value of this key parameter.

The optimal tariff argument

In the case of Indonesia's rice imports there is a possible further case for a tariff which rests on economic efficiency alone – known as the 'optimal tariff argument'. Strangely, the current debate on the rice tariff has largely ignored this argument, even though its potential implications are quite significant. Over the last decade Indonesia has been the world's largest importer of rice and seemingly possesses a degree of monopsony power. To the extent that the world price is affected by the volume of Indonesian imports, the marginal cost of Indonesia's imports exceeds the world price. In these circumstances, starting from a position of zero tariff, it is possible to raise national income by introducing a positive tariff. The gains in national income are achieved through an improvement in the terms of trade – the tariff induces a reduction in the price of imports relative to exports by reducing the quantity of imports. In a

famous contribution, Harry Johnson demonstrated that if the elasticity of supply of imports to a country is ε, then the proportional rate of tariff which maximises national income is 1/ε. For example, if the elasticity of world supply was 5, the optimal tariff would be 20 per cent.

How important could the optimal tariff argument be in the case of Indonesia's rice imports? Econometric estimates of the supply of imported rice to Indonesia have apparently not been undertaken, but a closely related question has been studied at length. This is the elasticity of demand for rice on the world market for the world's largest exporter, Thailand. The direct connection between these two matters arises as follows. Suppose first that Thailand exported one million tons *additional* rice onto the world market. The world price would fall, somewhat. Now suppose that Indonesia imported one million tons *less* rice from the world market. Again, the world price would fall, and the effect would be virtually identical to that resulting from the increase in Thailand's exports. Indeed, because Indonesia's rice imports come primarily from Thailand, the types of rice involved are essentially the same.

Studies of the elasticity of demand for Thailand's rice exports have produced estimates ranging from -2.5 to -5.[6] If the volume of Indonesia's imports was the same as the volume of Thailand's exports, the elasticity of supply of rice imports to Indonesia would be the same as this but with the opposite sign. For example, over the three years 1998 to 2000, Indonesia's rice imports were about 70 per cent of the level of Thailand's rice exports, implying elasticities of supply of 3.6 to 7.2. These elasticities imply optimal tariffs of 28 per cent and 14 per cent, respectively.

The central problem with this analysis, however, and with the econometric studies on which it are based, is that the estimated elasticities almost certainly understate the true long run elasticities of supply. The reason is that if the world price were to rice, say because a major importer like Indonesia restricted its imports, relative to the level they would otherwise have taken, new suppliers would almost certainly enter the world market. But because these suppliers are not exporters at current world prices, their supply behaviour is not reflected in available statistical data. This means that the optimal tariffs which can be estimated from arguments like those above are almost certainly *upper bounds* on the reasonable values that an

[6] This literature is reviewed in detail in P. G. Warr 'Welfare Effects of an Export Tax: Thailand's Rice Premium', *American Journal of Agricultural Economics*, vol. 83 (4), (November 2001), 903-920.

optimal tariff could take. It would seem likely that the long run elasticity of supply of rice imports to Indonesia would lie between 7 and 10 and therefore that tariffs in the neighbouhood of 10 to 14 per cent would be the largest that could be justified through the optimal tariff argument. Nevertheless, the true value of the long run elasticity of supply of rice imports to Indonesia must be considered uncertain.

The 'optimal' tariffs discussed above relate to the maximisation of national income and ignore the distributional effects of the tariffs being discussed. Of course, any such tariffs would also have distributional consequences, which need to be considered in determining the appropriate level of any tariff. The analysis presented in this paper shows how this can be done, simultaneously with each of the other issues emphasized in the above discussion.

The case for a general equilibrium treatment

An adequate analysis of the distributional consequences of a tariff on rice imports needs to take account of its effects on households' expenditures, disaggregated by household group, but also its effects on their incomes. This requires incorporation of its effects on the wages of unskilled labour as well as the returns to land. In doing this, the rice industry should not be considered in isolation. An increase in unskilled wages would affect profitability in other industries, with effects on outputs and prices in those industries as well, with subsequent consequences for factor returns. These effects would in turn have repercussions on household incomes. These effects would then have to be balanced against the effects on consumers of an increase in the price of rice. But the consumption of rice could not be considered in isolation either. An increase in the price of rice would have implications for the demand for other staple foods, such as those based on corn and wheat flour, another significant import. Finally, the tariff would raise significant amounts of government revenue. The way this revenue was spent by the government would also influence the net distributional effects of the tariff.

For analyzing the distributional effects of trade policy, a general equilibrium treatment is essential. The debate over Indonesia's rice tariff illustrates this point. The economic issues involved are complex and interrelated. A framework is required which accounts for these interactions and which simultaneously satisfies all relevant

market clearing conditions and macroeconomic constraints. To address issues of poverty and inequality, such a framework must include a disaggregated household sector. Moreover, as the above discussion has shown, the full effects of a rice tariff depend on the values of key economic parameters, including the supply response of domestic producers and the elasticity of supply of rice imports to Indonesia. But the true values of these parameters are quite uncertain. A framework is therefore needed in which the values of key parameters can be varied to determine the sensitivity of the results to the assumed values of these parameters.

The following section describes the features of a general equilibrium model of the Indonesian economy, called *Wayang*, which is capable of providing such an analysis. The next section applies this model to the analysis of the distributional effects of an increase in Indonesia's rice tariff, in particular its effects on poverty incidence. The discussion includes considerable sensitivity analysis around the assumed values of key parameters. The final section concludes.

2. The *Wayang* General Equilibrium Model

The *Wayang* general equilibrium model of the Indonesian economy (Warr *et al.* 1998; Wittwer 1999; Warr and Wittwer 2005) is a conventional, real, micro-theoretic general equilibrium model of the Indonesian economy. It identifies ten different types of households, defined by socio-economic groups. Working with a general equilibrium model with a disaggregated household sector makes possible controlled experiments which focus on the consequences for household incomes, expenditures, poverty and inequality that arise from different economic shocks, taken one at a time. Its features are designed primarily to enable it to address micro-economic policy issues relevant for Indonesia.[7]

As well as disaggregating households, *Wayang* also has a disaggregated industry and commodity structure. The microeconomic behaviour it assumes is competitive profit maximisation on the part of all firms and competitive utility maximisation on the part of consumers. In the simulations reported in this paper, the markets for final outputs, intermediate goods and factors of production are all assumed to clear at

prices that are determined endogenously within the model.[8] The nominal exchange rate between the rupiah and the US dollar can be thought of as being fixed exogenously. The role within the model of the exogenous nominal exchange rate is to determine, along with international prices, the nominal domestic price level. Given that prices adjust flexibly to clear markets, a 1 percent increase in the rupiah/dollar exchange rate will result in a 1 percent increase in all nominal domestic prices, leaving all real variables unchanged.

This section briefly describes the major elements of the *Wayang* model (section 2.1). The household sector of the model is crucial for analysis of poverty incidence and its most important features are summarised in this overview. The theoretical structure of the model and its data base are described in sections 2.2 and 2.3. Important features of the *Wayang* parameter estimates are described in Section 2.4**.**

2.1 Overview of the model

The structure of the model itself is relatively conventional. *Wayang* belongs to the class of general equilibrium models which are linear in proportional changes, sometimes referred to as Johansen models, after the seminal work of Johansen (1964), which also used this approach. *Wayang* shares many structural features with the highly influential ORANI general equilibrium model of the Australian economy (Dixon, *et al.* 1982), which also belongs to this Johansen category, but these features have been adapted in light of the realities of the Indonesian economy. The principal features of the model are summarized below:

Industries

The national model contains 65 producer goods and services produced by 65 corresponding industries - 18 agricultural industries, 5 'resource industries' (forestry, fishing, mining and quarrying) and 42 other industries. Each industry produces a single output, so the set of commodities coincides with the set of industries. The various industries of the model are classified as either 'export-oriented' or 'import-competing'. The level of exports of an export-oriented industry are treated as being

[7] A detailed paper describing the technical features of the full model is available (Wittwer 2000). The present summary is intended to be as non-technical as possible to enable non-specialist readers to grasp the essential features of the model.

[8] Variations to this assumption are possible. For example, the possibility of unemployment can be introduced by varying the closure to make either real or nominal wages exogenous, thereby allowing the level of employment to be endogenously determined by demand.

endogenous, while the exports of an import-competing industry are treated as being exogenous.[9] The criterion used to classify these industries is the ratio of an industry's imports to its exports. If this ratio exceeds 1.5, then the industry is regarded as producing an importable. If the import/export ratio is less than 0.5, then the industry is deemed to be export-oriented. For ratios between 0.5 and 1.5, additional relevant information is used in classifying the industry.

Commodities

Wayang contains two types of commodities - producer goods and consumer goods. Producer goods come from two sources: domestically-produced and imported. All 65 producer goods are in principle capable of being imported, although some have zero levels of imports in the data base – services and utilities representing most of the examples. The 20 consumer goods identified in the model are each transformed from the producer goods, where the proportions of domestically produced and imported producer goods of each kind used in this transformation is sensitive to their (Armington) elasticities of substitution and to changes in their relative prices.

Factors of production

The mobility of factors of production is a critical feature of any general equilibrium system. 'Mobility' is used here to mean mobility across economic activities (industries), rather than geographical mobility. The greater the factor mobility that is built into the model, the greater is the economy's simulated capacity to respond to changes in the economic environment. It is clearly essential that assumptions about the mobility of factors of production be consistent with the length of run that the model is intended to represent.

Two types of labour are identified: 'unskilled labour' and ‘skilled labour’. They are distinguished by the educational characteristics of the workforce: skilled labour is defined as those workers with lower secondary education or more. Indonesian labour force data indicate that very little educated labour is used in agriculture. We therefore assume that no skilled labour is employed in agriculture, but that skilled labour is fully mobile across all non-agricultural sectors. However, unskilled labour is assumed

[9] Given that the exported and domestically sold good are treated as being identical, this assumption is necessary to make it possible to separate the domestic price of the import competing good from the price of the exported good. Otherwise, the Armington structure we have described above would be redundant.

to be mobile across the entire economy. These assumptions imply that unskilled wages must be equal in all sectors and that skilled wages must be equal in all non-agricultural sectors.

There are two kinds of mobile capital - one that is mobile among agricultural sectors, and another that is mobile among non-agricultural industries. It is assumed that mobile agricultural capital cannot be used outside agriculture and mobile non-agricultural capital cannot be used in agriculture. In this treatment, agricultural capital is thought of as machinery such as tractors of various kinds, which can be used in a variety of agricultural activities. Non-agricultural mobile capital is thought of as industrial machinery and buildings.

In every sector, it is assumed that there is constant elasticity of substitution (CES) production technology with diminishing returns to scale to variable factors alone. However, we introduce a sector specific fixed factor in every sector to assure that there are constant returns to scale in production to all factors. We refer to the set of specific factors in the agricultural sectors as ‘land’, and to the set of those in the non-agricultural sectors as ‘fixed capital’. The assumption of constant returns means that all factor demand functions are homogeneous of degree one in output. In each sector, there is a zero profit condition, which equates the price of output to the minimum unit cost of production. This condition can be thought of determining the price of the fixed factor in that sector.

Households

The model contains ten household types - seven rural and three urban - differentiated by socio-economic group. The sources of income of each of these household types depend on their ownership of factors of production. These differ among households and are estimated from the 1995 BPS *Social Accounting Matrix*. The parameters of the consumption demand equations for the various household types also differ. An approximate disaggregation to the level of individual households makes it possible to derive estimates of poverty and inequality from data on the incomes and expenditures of the 10 broad household types.

Since our focus is on income distribution, the households of the model are of particular interest. The source of the factor ownership matrix is the "Social Accounting Matrix" published by BPS. The document exists only in the Indonesian

language. The households are described as follows. The original Indonesian language descriptions are in square brackets:

1. Agricultural employees- Agricultural workers who do not own land [*Rumahtangga buruh tani*]

2. Small farmers - Agricultural workers with land < 0.5 ha [*Rumahtangga petani gurem (yang memiliki lahan pertanian < 0.5 ha*)]

3. Medium farmers - Agricultural workers with land 0.5 ~ 1 ha [*Rumahtangga pengusaha pertanian (yang memiliki lahan 0.5 ~ 1 ha)*]

4. Large farmers - Agricultural workers with land >1 ha [*Rumahtangga pengusaha pertanian (yang memiliki lahan >1 ha*)]

5. Rural low income - non-agricultural households, consisting of small retail store owners, small entrepreneurs, small personal service providers, and clerical and manual workers in rural areas [*Rumahtangga bukan pertanian golongan rendah di desa*]

6. Rural non-labour households, consisting of non-labour force and unclassified households in rural areas [*Rumahtangga bukanAngkatan kerja di desa*]

7. Rural high income - non-agricultural households consisting of managers technicians, professionals, military officers, teachers, large entrepreneurs, large retail store owners, large personal service providers, and skilled clerical workers in rural areas [*Rumahtangga bukan pertanian gol. atas di desa*]

8. Urban low income households, consisting of small retail store owners, small entrepreneurs, small personal service providers, and clerical and manual workers in urban areas [*Rumahtangga bukan pertanian golongan rendah di kot*a]

9. Urban non-labour households, consisting of non-labour force and unclassified housedhods in urban areas [*Rumahtangga bukan Angkatan kerga di kota*]

10. Urban high income households, consisting of managers, technicians, professionals, military officers, teachers, large entrepreneurs, large personal service providers, and skilled clerical workers in urban areas [*Rumahtangga bukan pertanian gol. Atas di kota*].

In the social accounting matrix each household's sources of income are classified into several sources. A summary of the sources and disposal of income appearing in the social accounting matrix is:

1. Wages and salaries [*Upah dan gaji*]
2. Rent from capital [*Pendapatan kapital*]
3. Incoming transfer [*Penerimaan transfer*]
4. Total above [*Jumlah pendapatan*]
5. Income tax [*Pembayaran pajak lansung*]
6. Net income [*Pendapatan rumahjtangga setelah pajak*]
7. Final consumption [*Pengeluaran konsumsi akhir rumatangga*]
8. Outgoing transfer [*Penbyaran transfer*]
9. Saving [*Tabungan*]

The categories "wages and salaries" and "rent from capital" are each subdivided into various sub-categories. These categories in the SAM do not correspond exactly to those of the model. In agriculture, returns to land and capital are not separated in the SAM, but returns to owner-provided labour are separated from returns to hired labour. A previous study on the cost structure of paddy production was used to allocate returns among the land and capital categories and the various farming households received the same proportionate breakdown of this total. For agriculture, the principle used was that machinery was considered "mobile" capital. Of course, mobile here means mobile across crops - tractors are the best example. This involves error in so far as some machinery is crop-specific. Land was considered immobile. It is best to think of what is called ‘land’ here as all immobile forms of agricultural capital, which includes much true land in the short run but not all of it. In non-agriculture the principle used was that plant and buildings were classified as ‘mobile’. A factory building can be used for many purposes. Machinery was considered ‘immobile’, because most of it is more industry-specific than tractors are in agriculture.

2.2 Theoretical Structure

The analytical structure of the model includes the following major components:

- Household consumption demands, of each of the 10 broad household types, for 20

categories of consumer goods, one of which is rice. These are derived from the linear expenditure system.

- The household supplies of skilled and unskilled labour, assumed to be exogenous.
- A factor demand system, based on the assumption of CES production technology, that relates the demand for each primary factor to industry outputs and prices of each of the primary factors. This reflects the assumption that factors of production may be substituted for one another in ways that depend on factor prices and on the elasticities of substitution between the factors.
- The distinction between skilled and unskilled labour, which are 'nested' within the sectoral production functions. In each non-agricultural sector, skilled and unskilled labour enter a CES production function to produce 'effective labour'. Effective labour, variable capital and fixed capital then enter the production functions for domestic output.
- Leontief assumptions for the demand for intermediate goods. Each intermediate good in each sector is thus demanded in fixed proportion to the gross output of the sector.
- Demands for imported and domestically produced versions of each good, incorporating Armington elasticities of substitution between the two.
- A set of equations determining the incomes of the 10 household types from their (exogenous) ownership of factors of production, reflecting data derived from the official 1995 *Social Accounting Matrix*, the (endogenous) rates of return to these factors, and any net transfers from elsewhere in the system.
- Rates of import tariffs and excise taxes across commodities, rates of business taxes, value added taxes and corporate income taxes across industries, and rates of personal income taxes across household types which reflect the structure of the Indonesian tax system, using data from the Indonesian Ministry of Finance.
- A set of macroeconomic identities which ensures that standard macroeconomic accounting conventions are observed.

2.3 Data Base

This section provides a description of INDOSAM: a disaggregated social

accounting matrix (SAM) for Indonesia, with a 1995 base. This SAM is intended to serve as the data base for *Wayang*, but it has other potential uses as well. The year 1995 is currently the latest for which it is possible to assemble the information required for construction of a social accounting matrix for Indonesia.

Three principle data sources, all compiled by the government's principal statistical agency, BPS, were used to construct INDOSAM-95: (i) the 1995 input-output tables (subsequently referred to as IO 95); (ii) the updated input output table for 1995 (subsequently IO 95); (iii) the 1995 social accounting matrix (subsequently SAM 95). The table specifies 66 sectors. Other, supplementary, data sources were also used in the construction of specific tables, as described below. Abbreviations are used for these supplementary sources in the text and full references are provided at the end of the paper.

The principal data sources

The 1995 social accounting matrix produced by BPS (SAM 95) provided the starting point for the data base but substantial additions to the information in SAM 95 were required. SAM 95 contains 22 production sectors, which is insufficient for the purposes of this study. In addition, the SAM 95 does not include the detail of tax payments and household sources of income that are required. The 1995 input output table specifies 66 production sectors. For the purposes of the present study, modifications to the data contained in IO 95 were needed for the following reasons.

a) The table specifies only total intermediate goods and services transactions for each pair of producing and purchasing industries, at producer prices. Unlike the 1990 table, these transactions are not divided into goods and services from domestic and imported sources.
b) The table includes a sector (number 66, labelled "unspecified sector"), which is included as a balancing item. Sector 66 does not describe a true sector of the economy and in any case the data for this sector indicates negative final demand, an economic impossibility.
c) The updated table (IO 95) derived from BPS was not fully balanced. The major imbalances were that: (i) for most industries defined in the table, the industry-specific elements of row 210 (total input) were not equal to those of row 600 (total output) and (ii) the elements of row 200 (total imports) plus row 600 (total

output) were not equal to those of row 700 (total supply).

These problems were overcome as follows:

a) The shares of imported intermediate goods and domestically produced intermediate goods for each cell of the table, as implied by the published 1990 IO table, were used to divide intermediate goods transactions into domestic and imported components.
b) Sector 66 was aggregated with the much larger sector 65 (labelled "other services"). This eliminated the problem of negative final demands. The resulting table thus has 65 sectors.
c) The revised table was balanced using the RAS adjustment method to ensure that all required accounting identities were observed.

2.4 Elasticity estimates

The elasticity estimates used in *Wayang* for the consumer demand system and the factor demand system were taken from empirical estimates derived econometrically for a similar model of the Thai economy, known as PARA. These parameters were amended to match the differences between the data bases for *Wayang* and PARA so as to ensure the homogeneity properties required by economic theory. The Armington elasticities of substitution between imports and domestically produced goods were set equal to 2, except for rice, where the assumed value was 6 (this parameter is varied in the results below). All export demand elasticities were set equal to 20. The elasticity of supply of imports to Indonesian were assumed to be infinite (import prices were set exogenously) except for rice, where the assumed elasticity was 10 (a parameter which is also varied in the discussion below).

2.5 Modeling changes in poverty[10]

Changes in poverty and inequality, at the level of individual households, are estimated from changes in income and expenditure for broad household groups. The measures of Indonesian poverty and inequality used here are based on household expenditure because this is how the official Indonesian data on poverty are derived. However,

[10] For a fuller discussion of the methods used, see Fane and Warr (2002).

since consumption is assumed to be directly proportional to after-tax income, the choice between income and expenditure based poverty measures is unimportant.

The Gini coefficient is used to measure inequality. Two familiar measures of poverty are reported: the 'headcount' rate, defined as the proportion of the population below the poverty line and the 'poverty gap', defined as the proportion of total national consumption that would just suffice (if provided by an external donor at unchanged prices and given other sources and uses of income) to raise the consumption of those below the poverty line.

It is assumed that, while households belonging to different groups may own factors in different proportions, those belonging to any one group all own the various factors of production in the same proportions:

$$F_k^{h,j} = \theta^{h,j}.F_k^h, \quad \textit{for all } h, j \textit{ and } k, \tag{1}$$

where $F_k^{h,j}$ is the amount of factor k owned by individual household j in household group h and F_k^h is the arithmetic mean over j of $F_k^{h,j}$ for all households in group h. Taking expectations in equation (1) shows that the arithmetic mean of $\theta^{h,j}$ over j for all households in group h is unity.

Let w_k be the price of factor k and assume that the total expenditure of each individual household in household group h is a fraction γ_h of pre-tax income:

$$E^{h,j} = \gamma_h.\sum_k w_k \theta^{h,j} F_k^h = \theta^{h,j} \gamma_h.\sum_k w_k F_k^h = \theta^{h,j}\, E^h. \tag{2}$$

The first equality in (2) is definitional. The second can be derived by taking expectations in the first and recalling that E^h is the arithmetic mean of $E^{h,j}$ over j and that the arithmetic mean of $\theta^{h,j}$ over j is unity.

For each broad household group h, $\theta^{h,j}$ is assumed to be log normally distributed over j with mean μ_h and standard deviation σ_h. In practice, as explained in footnote 6, only two separate values of σ_h were used, rather than ten, because one common value of the standard deviation was imposed on all rural groups, and another

on all urban groups. Equation (2) shows that although factor prices affect the mean of the logarithm of household expenditures, they do not affect the standard deviation of the *logarithm* of individual household expenditures. It is therefore appropriate to assume that σ_h remains constant throughout all the simulations. From the assumption of log normality, it follows that:[11]

$$\mu_h = \log_e[AM_j(\theta^{h,j})] - 0.5\sigma_h^2 = -0.5\sigma_h^2 \qquad (3)$$

where $AM_j(\theta^{h,j})$ is the arithmetic mean over j of $\theta^{h,j}$. Since this mean is unity, its logarithm is zero. The parameter σ_h was estimated separately for urban and rural households by searching for the values that replicate official estimates of the national headcount poverty rate and Gini coefficient.[12] Equation (3) makes it possible to derive μ_h from σ_h. Since the values of E^h before and after various shocks are given by the WAYANG model, equation (2) can be used to derive the distributions of individual household expenditures within each of the 10 broad groups. It is then straightforward to estimate how the shocks affect poverty and inequality at the national level.[13]

The seven rural households account for 73 percent of the total population, but only 61 percent of total consumption expenditure. The four poorest household groups, measured in terms of average expenditure, are all rural. However, since it is assumed that factor ownership, and hence income, is log normally distributed within each household group, it follows that some members of each group are below the poverty line, and in fact poverty incidence is higher in the poorest urban household

[11] The first equality in (3) is an application of a well-known property of the lognormal distribution.

[12] A spreadsheet was used to approximate the lognormal distribution by dividing households in each broad group into over 200 sub-groups defined in terms of narrow income bands. Initially, arbitrary values of the rural and urban standard deviations, σ_h, were imposed and the proportion of households in each broad group within each narrow income band was estimated, using equation (3) to derive μ_h for each broad group from the imposed value of σ_h and the data base values of the actual arithmetic mean of household income for the broad group. Given the estimated proportions of each household group in each narrow income band, it was straightforward to derive the implied values of the national headcount poverty rate and Gini coefficient. A search was then conducted over the values of the rural and urban standard deviations to find the ones that reproduced the actual national headcount poverty rate and Gini coefficient.

[13] Using the same spreadsheet approach and the same estimated standard deviations that are described in footnote 6, it was straightforward to estimate the changes in the headcount poverty rate, the poverty gap and the Gini coefficient due to changes in the arithmetic means of the real incomes of each household group that were implied by the WAYANG simulation results for each shock analyzed.

than in all but one of the rural households. Nevertheless, poverty is mainly a rural phenomenon: 77 percent of all poor households in Indonesia are rural.

Unskilled labour is the single most important income source for the four poorest rural household groups (that is rural 1, 2, 3 and 5), which together account for 76 per cent of total poverty. Land is an important income source for rural household groups 2 and 3, which together account for over a third of all poverty. Capital that is mobile within the agricultural sector is a relatively minor source of income for all households, but its ownership is heavily concentrated in the poorest households. Unskilled labour, mobile agricultural capital and land are the factors with the greatest relative importance for the poor, while for the non-poor the corresponding factor is skilled labour. Fixed capital and mobile non-agricultural capital are slightly more important sources of income for the non-poor than for the poor.

3. Simulations and Results

3.1 The shock

The data base of the model was calibrated to reflect a 25 per cent tariff on rice imports. The shock then applied to this solution was an increase in this tariff rate from 25 to 45 per cent.

3.2 The closure

Since household consumption within the single-period horizon of the model is chosen as the welfare indicator, and is the basis for the calculation of poverty incidence, the macroeconomic closure must be made compatible with this measure. This is done by ensuring that the full economic effects of the shocks to be introduced are channeled into current-period household consumption and do not 'leak' into other directions, with real-world intertemporal welfare implications not captured by the welfare measure. The choice of macroeconomic closure may thus be seen in part as a mechanism for minimizing inconsistencies between the use of a single-period model to analyze welfare results and the multi-period reality that the model represents.

To prevent intertemporal and other welfare leakages from occurring, the simulations are conducted with balanced trade (exogenous balance on current account). For example, this ensures that any benefits from a tariff do not flow to foreigners, through a current account surplus. For the same reason, real government spending and real investment demand for each good are each held fixed exogenously. The government budget deficit is held fixed in nominal terms. This is achieved by endogenous across-the-board adjustments to personal income tax rates so as to restore the base level of the budgetary deficit.

The combined effect of these features of the closure is that the full effects of the tariff increase are channeled into household consumption and not into effects which are not captured within the single period focus of the model.

3.3 The results: Simulation A

The starting point for the results is Simulation A, the features of which are summarised in the first column of Tables 5a and 5b. For the purposes of the parametric variations performed below, it should be noted that in this core simulation (Simulation A):

- The assumed value of the elasticity of supply of rice imports to Indonesia is 10.
- CES technology is assumed in all industries and the assumed elasticities of substitution are 0.5 in all industries except rice where the assumed value is 0.25.[14]
- The Armington elasticity of substitution in rice demand (the elasticity of substitution in demand between imported and domestically produced rice) is 6, which implies that imported and domestically produced rice are relatively close substitutes.

[14] As will be explained below, this lower value of the elasticity of substitution for rice is chosen to be consistent with the low values of the elasticities of supply response which have been estimated empirically for the Indonesian rice sector.

Each of these parametric assumptions will subsequently be varied, but for the time being it is sufficient to focus on the results of Simulation A. The macroeconomic results are summarised in Table 5a. The import price of rice declines as the volume of imports contracts, but not enough to prevent the domestic price – both the producer price and the consumer price – from increasing. The increase in the domestic price stimulates rice production and reduces consumption. The increase in rice production induces an increase in unskilled wages relative to skilled wages. The reason for this result is that rice production uses large quantities of unskilled labour, according to our education-based definition of this category, but very little skilled labour.

The simulated effects on poverty and inequality are summarised in Table 5b. The results have the following important features.

(i) *Overall poverty incidence rises*. Although real wages rise in response to the expansion of rice production, this effect on the incomes of the poor is quantitatively less important than their increased living costs, resulting in a reduction in the real expenditures of the poor and an increase in poverty incidence. Poverty incidence increases in both rural areas and urban areas, but the increase in urban areas is larger. The urban poor benefit less from the increase in unskilled wages than do the rural poor and receive almost no benefit from the increased return to land.

(ii) *Overall inequality (measured by the Gini coefficient) declines slightly*. However, rural inequality increases while urban inequality declines. The increase in rural inequality is a consequence of the increase in the return to land, which rises more than the return to unskilled labour. The decline in urban inequality arises from the increase in unskilled wages relative to skilled wages and from a decline in the return to capital.

(iii) *The simulated effects are small.* This is the most surprising feature of the results and it is helpful to provide some back-of-the-envelope calculations to explain it.

- The power of the tariff, given by $T = (1 + t)$, where t is the proportional rate of the tariff, rises from 1.25 to 1.45, a proportional increase of 16 per cent. If import prices did not change, the landed price of imports would thus increase by 16 per cent, but the c.i.f. import price declines by 4.3 per cent as a result of the large decline in the volume of imports. As a result, the increase in the domestic price of imported rice is 11.7 per cent.

- The consumer price of rice increases, but by much less than the 11.7 per cent increase in the price of imports because imports and domestically produced rice are imperfect (though relatively close) substitutes. The price of domestically produced rice increases by 1.88 per cent. The rice entering the consumption basket is a composite of this and imported rice, where the share of imports in consumption in the data base of the model is just over 7 per cent. The consumer price of rice thus increases by 0.93 (1.88) + 0.07 (11.7) = 2.5 per cent.

- Since the share of rice in the average consumer's budget is 7.5 per cent (higher for poor groups), the increase in the cost of living for the average household is 0.075 (2.5) = 0.188 per cent.

- If incomes did not change, this 0.188 per cent increase in the cost of living would result in a 0.188 per cent decline in real consumption expenditure for the 'average' household. But incomes do increase, particularly the return to land and the return to unskilled labour. These income increases thus mean that no household suffers a loss of real consumption expenditure as large as 0.188 per cent (Table 5b). The effects are truly small.

(iv) *The effects differ considerably among poor households*. Poor households are not affected uniformly. For some households the income effects resulting from a tariff increase outweigh the increase in their cost of living. It may be noted that the estimated changes in poverty incidence by household in each instance have the opposite sign from the change in the average real consumption of that household, shown in the first 10 rows of Table 5b. Poverty incidence increases in all three urban households and in rural households 2 and 6. Rural households 1, 3, 4, 5 and 7 experience a reduction in poverty incidence. Inspection of the factor ownership data in

Table 4 indicates that these results are strongly related to the share of the household's income that is derived from the returns to unskilled labour. It will be recalled that the returns to this factor increase with the tariff. Those households with high shares of income deriving from unskilled labour gain from the tariff increase. Those with lower shares lose from it, but the losers outnumber the gainers. Moreover, the fact that the size of the poverty gap increases indicates that among the poor the magnitude of the losses outweighs the magnitude of the gains.

3.4 Effects of varying key parameters

To what extent do the results summarised above depend on the assumed values of key parameters? This question is important, because the above discussion indicates that considerable uncertainty attaches to the true values of several parameters which seem particularly relevant for the results. These include: the elasticity of supply of rice imports to Indonesia; the elasticity of supply response of paddy with respect to its price; and the Armington elasticity of substitution in demand between domestically produced and imported rice.

(i) *The elasticity of supply of rice imports*

Simulation A assumes that imports of rice are available to Indonesia with an elasticity of supply of 10. A 10 per cent increase in the volume of Indonesia's imports induces a 1 per cent increase in the international price. Simulations B, C and D show the effects of varying this parameter. Values of 2.5, 5 and 20 are considered, in addition to the value of 10 underlying Simulation A. The implications for poverty incidence at the national, rural and urban levels are summarised in Figure 3. For values of this elasticity in excess of about 3, poverty incidence rises and for values less than this, it falls, as in Simulation B. The reason is that the lower the elasticity of supply of imports the greater is the terms of trade gain from a given tariff. This point is confirmed by inspection of the row "Import price of rice (US$)" in Table 5a.

If the elasticity of supply of imports is below 3, the 'optimal' (national income maximising) tariff on rice imports exceeds 33 per cent. When the tariff is increased from 25 per cent to 45 per cent the increase in national income arising from the gain in the terms of trade generates sufficient income gains for the poor, through increased factor returns, to outweigh the negative effect that the tariff has on their cost of living. Poverty incidence then declines slightly. But it is argued above that values of this parameter below about 5 are implausible. It would therefore seem very unlikely that the terms of trade effect of the tariff increase could be sufficient to reduce poverty incidence.

(ii) *The elasticity of supply response of paddy with respect to its price*

It can be shown that the partial equilibrium elasticity of supply response with respect to the price of output is related to the parameters of the model by the equation $E_S = \sigma S_V /(S_F H_P)$, where E_S is the familiar partial equilibrium elasticity of supply response, σ is the elasticity of substitution between factors of production in the CES production function for paddy, S_V and S_F are the shares of variable and fixed factors, respectively in primary factor cost in paddy production (the variable factors are labour and mobile capital; the fixed factors are land and fixed capital), and H_P is the share of primary factors (labour, capital and land) in total costs in paddy production (the share of all inputs except intermediate, material inputs).

The parametric assumptions underlying Simulation A imply an elasticity of supply response of 0.31. It is possible to vary this implied elasticity by varying the assumed elasticity of substitution. Simulations E, F, G and H, summarised in Tables 6a and 6b do this. The assumed elasticities of substitution of 0.15, 0.2, 0.3 and 0.35 imply elasticities of supply response of 0.186, 0.248, 0.372 and 0.434, respectively. This would seem to cover the full range of plausible values of this parameter. The results are summarised in Figure 4. Poverty incidence increases throughout the range. As expected, low values of supply response imply larger

increases in poverty incidence, but implausibly large elasticities of supply response (well outside the range considered here) would be required to turn the increase in poverty incidence into a reduction.

Supply response is also influenced by the share of fixed versus variable factors in total costs, as is indicated by the equation for E_S, above. The importance of this issue has been investigated by varying factor shares in the paddy industry as follows. In Simulation A the shares in total costs of land, unsillled labour, mobile capital and material intermediate inputs were: (43, 23, 21 and 23) per cent, respectively. Three variations were performed. In each case the share of intermediate inputs remained at 23, but the shares of the three primary factors (land, unskilled labour and mobile capital) were varied as follows:

A1: (53, 23, 11)

A2: (33, 23, 31)

A3: (53, 13, 21).

Household sources of factor incomes were adjusted in each case to ensure that the total incomes received by households from ownership of each factor corresponded to total payments to that factor on the production side. Recalling that the partial equilibrium elasticitiy of supply corresponding to Simulation A was 0.31, the elasticities corresponding to each of these additional experiments were: A1, 0.25; A2, 0.49; and A3, 0.20. The simulated level of poverty incidence (resulting from the tariff increase) rose in each case. The proportional increases in the headcount measure of poverty incidence were (recalling that the increase in Simulation A was 0.048): A1, 0.05 3; A2, 0.041; A3, 0.092. Varying factor shares across a seemingly plausible range does not change the result that poverty incidence increases as a result of the tariff. Moreover, it does not change a small increase into a large one.

(ii) *The Armington elasticity of substitution in rice demand*

The small effect that a rice tariff has on the domestic price derives in part from the size of the Armington elasticity that we have assumed. Although the assumed value of 6 is quite high, its value could certainly be questioned. Simulations I, J, K and L, summarised in Tables 7a and 7b show the effects of varying this parameter across the range 2 to 10. The results on poverty incidence are summarised in Figure 5. The higher the assumed Armingtion elasticity, the larger the effect of the tariff on the domestic price. This in turn magnifies somewhat the poverty increasing effect of the tariff, but throughout the range poverty increases. Variations in the assumed Armington elasticities will not turn the simulated poverty increase into a reduction in poverty, nor will they turn a 'small' increase in poverty incidence into a 'large' one.

4. Conclusions

The analysis presented in this paper indicates that an increase in the rice tariff from 25 per cent to 45 per cent, as proposed, would increase poverty incidence. It is not possible to justify the tariff increase by claiming that it reduces poverty. This result is based on a general equilibrium analysis which varies the values of key parametric assumptions across the seemingly plausible range. For all plausible parametric assumptions, poverty incidence increases as a result of the tariff increase.

The results of this study also indicate that the increase in poverty incidence caused by a rice tariff is quite small. The effects of a tariff are primarily redistributive. Its effects on national income are very small indeed. But the redistribution induced by a tariff does not discriminate clearly between poor and non-poor households. Redistribution among the poor occurs as well as redistribution between poor and non-poor households. Some poor groups gain from the tariff (those gaining a large share of their incomes from unskilled labour and land) while other poor groups lose. This should not be a surprise. One should not expect changes in trade policy to have powerful effects on aggregate poverty incidence.

References

Aitchison, J. and J.A.C. Brown (1957). *The Lognormal Distribution, with Special Reference to its Uses in Economics*, Cambridge, U.K.: Cambridge University Press.

Dixon, P.B., B.R. Parmenter, J. Sutton and D.P. Vincent (1982). *ORANI: A Multisectoral Model of The Australian Economy*, Amsterdam: North-Holland.

Dollar, David and Aart Kraay (2000). 'Growth *Is* Good for the Poor', *mimeo*, Washington, D.C.: World Bank. Online at: http://www.worldbank.org/poverty.

George Fane and Peter Warr (2002). 'How Economic Growth Reduces Poverty: A General Equilibrium Analysis for Indonesia', in A. Shorrocks and R. Van der Hoeven (eds.), *Perspectives on Growth and Poverty*, United Nations University Press, 217-34.

Ravallion, Martin and Gaurav Datt (1996). 'How Important to India's Poor Is the Sectoral Composition of Economic Growth?', *World Bank Economic Review* **10**, 1–25.

Thomas, Vinod (2000). *The Quality of Growth*, Washington, D.C.: The World Bank.

Warr, Peter G. (2001). 'Welfare Effects of an Export Tax: Thailand's Rice Premium', *American Journal of Agricultural Economics*, vol. 83 (4), (November), 903-920.

Warr, Peter G., Marpudin Aziz, Helder da Costa and Prem J. Thapa (1998). 'WAYANG: An Empirically-Based Applied General Equilibrium Model of the Indonesian Economy', *mimeo*, Australian National University.

Warr, Peter G. and Glyn Wittwer (2005). *Policy, Inequality and Poverty in Indonesia: A General Equilibrium Analysis*, Cheltenham, U.K. and Northampton, MA, USA: Edward Elgar Ltd., forthcoming.

Wittwer, Glyn (1999). 'WAYANG: A General Equilibrium Model Adapted for the Indonesian Economy, Centre for International Economic Studies, University of Adelaide, prepared for ACIAR project no. 9449.Online at: *www.adelaide.edu.au/cies/indlist.htm*.

World Bank (2000). *World Development Report, 2000/2001*, New York: Oxford University Press.

Table 1. Indonesia: Rice production, consumption and trade, 1990 to 2001

	Harvested area (Ha)	Gabah production (GKG) - (Ton)	Rice production (Ton)	Rice consumption (Million Ton)	Import Volume (Ton)	Import Value (000 US$)
1990	10,502,357	45,178,751	28,552,971	24.41	6,378	2,907
1991	10,281,519	44,688,247	28,242,972	24.70	168,933	52,476
1992	11,103,317	48,240,009	30,487,686	24.99	566,441	159,049
1993	11,012,776	48,181,087	30,450,447	25.42	3,093	1,269
1994	10,733,830	46,641,524	29,477,443	25.85	268,802	68,736
1995	11,438,764	49,744,140	31,438,296	26.28	1,306,218	374,101
1996	11,569,729	51,101,506	32,296,152	26.16	2,040,203	731,055
1997	11,140,594	49,377,054	31,206,298	26.55	1,095	5,349
1998	11,716,499	49,199,844	31,094,301	26.86	2,793,907	831,763
1999	11,963,204	50,866,387	32,147,557	27.29	3,055,414	817,591
2000	11,793,475	51,898,852	32,800,074	27.72	3,502,090	925,562
2001	11,419,935*)	50,197,883*)	31,725,062*)	27.97	644,732	134,912

*Note:*Assumed rate of gabah conversion to rice = 63.2%

Consumption is estimated based on the total population and estimates of per capita consumption.

Source:Dept. of Agriculture, Jakarta.

Table 2. World Rice Trade by Country

	1998		1999		2000	
Country	000 ton	%	000 ton	%	000 ton	%
Export						
Taiwan	55	0.2	135	0.5	125	0.6
Myanmar	98	0.3	57	0.2	200	0.9
EU	346	1.2	300	1.2	300	1.3
Argentina	500	1.8	650	2.6	550	2.5
Uruguay	625	2.2	675	2.7	650	2.9
Australia	641	2.3	675	2.7	600	2.7
Japan	642	2.3	225	0.9	400	1.8
Pakistan	1,841	6.6	1,641	6.5	1,850	8.3
USA	3,211	11.5	2,665	10.6	2,500	11.2
Vietnam	3,774	13.5	4,537	18.0	4,200	18.8
China	3,965	14.1	2,920	11.6	2,400	10.7
India	5,305	18.9	2,855	11.4	1,500	6.7
Thailand	6,389	22.8	6,677	26.5	5,900	26.4
Others	633	2.3	1,138	4.5	1,175	5.3
Total export	28,025	100.0	25,150	100.0	22,350	100.0
Import						
Sri Lanka	168	0.6	160	0.6	150	0.7
Peru	220	0.8	150	0.6	150	0.7
China	244	0.9	175	0.7	200	0.9
Mexico	295	1.1	340	1.4	350	1.6
Japan	484	1.7	700	2.8	700	3.1
Iran	537	1.9	1,084	4.3	900	4.0
Senegal	559	2.0	871	3.5	600	2.7
Ivory Coast	641	2.3	465	1.8	500	2.2
EU 2)	787	2.8	750	3.0	750	3.4
Saudi Arabia	906	3.2	865	3.4	800	3.6
Brazil	1,438	5.1	925	3.7	1,000	4.5
Philippines	2,086	7.4	915	3.6	500	2.2
Bangladesh	2,545	9.1	1,475	5.9	500	2.2
Indonesia	6,080	21.7	4,144	16.5	3,500	15.7
Others	11,035	39.4	12,131	48.2	11,750	52.6
Total import	28,025	100.0	25,150	100.0	22,350	100.0

Note: 2000 data are estimates. EU data excludes trade among EU countries.
Source: *The Rice Trader*, 1998-2002.

Table 3. Expenditure and poverty incidence by household group

Household group:	% of total population in this group	Mean per capita expenditure (Rp. 000/yr.)	% of this group in poverty	% of all poor people in this group
Rural 1	10.0	456	38.9	28.9
Rural 2	27.3	625	15.1	30.9
Rural 3	6.2	687	10.5	4.9
Rural 4	6.4	1011	1.5	0.7
Rural 5	8.8	610	16.5	10.9
Rural 6	1.5	1219	0.5	0.1
Rural 7	13.0	1268	0.3	0.3
Urban 1	12.4	789	21.3	19.7
Urban 2	2.6	916	15.4	2.9
Urban 3	11.8	2336	0.8	0.7
Indonesia	100.0	957	13.4	100.0
Memo items:				
Poverty line (Rp 000 per year)				369.5
Headcount poverty rate (%)				13.4
Poverty gap (%)				1.1
Gini coefficient (%)				39.6

Source: database of WAYANG model.

Table 4. Factor ownership of the broad household groups

Shares in household income (%):	Unskilled labour	Skilled labour	Mobile agric. capital	Mobile non-agric. capital	Fixed capital	Land
Rural 1	83.7	1.9	3.5	5.1	3.3	3.6
Rural 2	30.4	5.5	6.3	11.0	39.6	5.0
Rural 3	49.7	4.9	1.4 5	8.0	27.0	17.7
Rural 4	56.7	5.8	0.9	6.9	16.4	11.9
Rural 5	40.0	7.7	1.2	8.8	20.8	8.5
Rural 6	12.2	5.6	2.9	21.6	51.1	4.2
Rural 7	38.7	34.0	1.1	9.1	24.2	5.8
Urban 1	10.4	22.2	2.0	16.3	53.3	4.2
Urban 2	17.0	15.0	2.2	18.3	47.7	6.6
Urban 3	13.2	38.3	1.3	10.8	38.2	1.9
All poor households	45.0	10.2	2.4	10.0	26.1	10.2
All households	27.8	24.6	1.6	11.0	33.4	7.0
Ratio, poor households to all	1.62	0.41	1.50	0.92	0.78	1.45

Source: database of WAYANG model.

Notes: For each household, the shares do not add to 100, because households also pay, or receive, transfers from other households, the government and the rest of the world.

Table 5a. Simulated Macroeconomic Effects of a Rice Tariff:

Varying rice import supply elasticity

(per cent change)

Shock:	**Increase tariff from 25 to 45%**				
	Simulation:	**A**	**B**	**C**	**D**
Parameter varied:	**Import supply elasticity**	**10**	**2.5**	**5**	**20**
Overall economy					
Gross Domestic Product					
	Nominal (local currency)	0.209	0.141	0.177	0.232
	Real	-0.011	-0.006	-0.009	-0.013
Consumer Price Index		0.251	0.014	0.207	0.283
GDP Deflator		0.220	0.147	0.186	0.245
Wage (real)	Skilled	0.088	0.069	0.079	0.095
	Unskilled	0.213	0.135	0.176	0.239
Consumer price of rice (Rp.)		1.797	1.042	1.441	2.056
Producer price of paddy (Rp.)		2.305	1.333	1.847	2.316
Import price of rice ($US)		-4.332	-8.846	-6.557	-2.585
Paddy production		0.527	0.304	0.422	0.602
External sector (foreign currency)					
Export Revenue		-0.028	-0.019	-0.024	-0.032
Import Bill		-0.021	-0.014	-0.018	-0.024
Government budget (local currency)					
Revenue (local currency)		0.190	0.183	0.187	0.193
	Tariff	0.543	1.241	0.873	0.302
Expenditure					
	Nominal (local currency)	0.130	0.183	0.111	0.193
	Real				
Household sector					
Consumption					
	Nominal (local currency)	0.251	0.173	0.215	0.281
	Real	-0.002	0.014	0.008	-0.002

Source: Author's computations.

Table 5b. Simulated Distributional Effects of a Rice Tariff: Varying rice import supply elasticity

Shock:	**Increase tariff from 25 to 45%**				
	Simulation:	**A**	**B**	**C**	**D**
Parameter varied:	**Import supply elasticity**	**10**	**2.5**	**5**	**20**
Real consumption expenditures (deflated by household-specific CPI) % change					
Rural	rural1	0.015	0.021	0.018	0.014
	rural2	-0.082	-0.035	-0.06	-0.098
	rural3	0.072	0.054	0.064	0.078
	rural4	0.061	0.048	0.055	0.066
	rural5	0.076	0.057	0.067	0.083
	rural6	-0.062	-0.022	-0.043	-0.075
	rural7	0.125	0.086	0.107	0.139
Urban	urban1	-0.029	-0.004	-0.017	-0.037
	urban2	-0.006	0.01	0.002	-0.011
	urban3	-0.065	-0.024	-0.046	-0.079
Changes in poverty and inequality (% change)					
Indon h-count poverty %		0.048	-0.010	0.020	0.066
Rural h-count poverty %		0.044	-0.015	0.016	0.063
Urban h-count poverty %		0.059	0.007	0.034	0.076
Indon-poverty gap %		0.054	-0.028	0.015	0.080
Rural-poverty gap %		0.046	-0.037	0.007	0.073
Urban-poverty gap %		0.073	-0.005	0.035	0.098
Gini Indonesia (%)		-0.003	-0.001	-0.002	-0.003
Gini rural (%)		0.060	0.035	0.048	0.069
Gini urban (%)		-0.012	-0.007	-0.010	-0.014
Levels of poverty incidence (%)		*Base level*	*Post-simulation levels*		
Rural	rural1	*38.874*	38.861	38.855	38.858	38.862
	rural2	*15.142*	15.187	15.161	15.175	15.196
	rural3	*10.525*	10.494	10.501	10.497	10.491
	rural4	*1.520*	1.514	1.515	1.515	1.514
	rural5	*16.528*	16.484	16.495	16.489	16.480
	rural6	*0.457*	0.459	0.458	0.458	0.459
	rural7	*0.347*	0.344	0.345	0.344	0.343
Urban	urban1	*21.299*	21.311	21.301	21.306	21.315
	urban2	*15.409*	15.411	15.405	15.408	15.412
	urban3	*0.784*	0.786	0.785	0.786	0.787

Source: Author's computations

Table 6a. Simulated Macroeconomic Effects of a Rice Tariff:

Varying elasticity of substitution in paddy production

(per cent change)

Shock:	**Increase tariff from 25 to 45%**				
	Simulation:	**E**	**F**	**G**	**H**
Parameter varied:	**Elasticity of Substitution**	**0.15**	**0.2**	**0.3**	**0.35**
Overall economy					
Gross Domestic Product					
	Nominal (local currency)	0.227	0.217	0.203	0.198
	Real	-0.011	-0.011	-0.012	-0.012
Consumer Price Index		0.278	0.263	0.242	0.235
GDP Deflator		0.238	0.228	0.214	0.209
Wage (real)	Skilled	0.080	0.084	0.091	0.094
	Unskilled	0.178	0.198	0.225	0.235
Consumer price of rice (Rp.)		2.164	1.955	1.674	1.575
Producer price of paddy (Rp.)		2.439	2.202	1.885	1.773
Import price of rice ($US)		-4.207	-4.279	-4.374	-4.408
Paddy production		0.420	0.481	0.562	0.591
External sector (foreign currency)					
Export Revenue		-0.024	-0.026	-0.030	-0.031
Import Bill		-0.016	-0.019	-0.023	-0.025
Government budget (local currency)					
Revenue (local currency)		00.206	0.197	0.185	0.181
	Tariff				
Expenditure					
	Nominal (local currency)	0.132	0.131	0.130	0.129
	Real				
Household sector					
Consumption					
	Nominal (local currency)	0.281	0.265	0.244	0.236
	Real	0.003	0.003	0.002	0.002

Source: Author's computations.

Table 6b. Simulated Distributional Effects of a Rice Tariff:
Varying elasticity of substitution in paddy production

Shock:	**Increase tariff from 25 to 45%**				
	Simulation:	**E**	**F**	**G**	**H**
Parameter varied:	**Elasticity of Substitution**	**0.15**	**0.2**	**0.3**	**0.35**
Real consumption expenditures (deflated by household-specific CPI) % change					
Rural	rural1	-0.002	0.008	0.022	0.027
	rural2	-0.103	-0.091	-0.075	-0.069
	rural3	0.091	0.080	0.066	0.060
	rural4	0.082	0.070	0.054	0.048
	rural5	0.076	0.076	0.077	0.077
	rural6	-0.075	-0.068	-0.058	-0.054
	rural7	0.158	0.140	0.114	0.105
Urban	urban1	-0.038	-0.033	-0.025	-0.022
	urban2	-0.022	-0.013	0.000	0.005
	urban3	-0.068	-0.066	-0.064	-0.063
Changes in poverty and inequality (% change)					
Indon h-count poverty %		0.082	0.062	0.034	0.024
Rural h-count poverty %		0.083	0.060	0.029	0.018
Urban h-count poverty %		0.080	0.068	0.051	0.044
Indon-poverty gap %		0.100	0.073	0.036	0.023
Rural-poverty gap %		0.100	0.069	0.026	0.010
Urban-poverty gap %		0.098	0.084	0.061	0.053
Gini Indonesia (%)		-0.042	-0.042	-0.044	-0.044
Gini rural (%)		0.139	0.122	0.098	0.089
Gini urban (%)		-0.069	-0.068	-0.066	-0.065
Levels of poverty incidence (%)		*Base level*	*Post-simulation levels*		
Rural	rural1	*38.874*	38.876	38.867	38.854	38.850
	rural2	*15.142*	15.199	15.192	15.183	15.180
	rural3	*10.525*	10.485	10.490	10.496	10.499
	rural4	*1.520*	1.512	1.513	1.515	1.515
	rural5	*16.528*	16.484	16.484	16.483	16.483
	rural6	*0.457*	0.459	0.459	0.459	0.459
	rural7	*0.347*	0.343	0.343	0.344	0.344
Urban	urban1	*21.299*	21.315	21.313	21.310	21.308
	urban2	*15.409*	15.416	15.413	15.409	15.407
	urban3	*0.784*	0.787	0.786	0.786	0.786

Source: Author's computations.

Table 7a. Simulated Macroeconomic Effects of a Rice Tariff: Varying factor shares in paddy production

(per cent change)

Shock:	**Increase tariff from 25 to 45%**			
	Simulation:	**I**	**J**	**K**
Parameter varied:				
Overall economy				
Gross Domestic Product				
	Nominal (local currency)	0.221	0.199	0.225
	Real	-0.011	-0.012	-0.011
Consumer Price Index		0.267	0.239	0.278
GDP Deflator		0.233	0.210	0.236
Wage (real)	Skilled	0.090	0.086	0.072
	Unskilled	0.215	0.211	0.149
Consumer price of rice (Rp.)		2.059	1.590	2.160
Producer price of paddy (Rp.)		0.320	1.791	2.435
Import price of rice ($US)		-4.243	-4.024	-4.208
Paddy production		0.449	0.588	0.422
External sector (foreign currency)				
Export Revenue		-0.025	-0.031	-0.023
Import Bill		-0.018	-0.024	-0.015
Government budget (local currency)				
Total revenue (local currency)		0.201	0.181	0.205
	Tariff revenue	0.582	0.513	0.599
Total expenditure (local currency)		0.136	0.126	0.205
Household sector				
Consumption				
	Nominal (local currency)	0.270	0.240	0.281
	Real	0.003	0.002	0.003

Source: Author's computations.

Table 7b. Simulated Distributional Effects of a Rice Tariff: Varying factor shares in paddy production

Shock:	**Increase tariff from 25 to 45%**			
	Simulation:	**I**	**J**	**K**
Parameter varied:				
Real consumption expenditures (deflated by household-specific CPI) % change				
Rural	rural1	0.013	0.017	-0.012
	rural2	-0.087	-0.077	-0.102
	rural3	0.078	0.067	0.092
	rural4	0.068	0.056	0.085
	rural5	0.079	0.075	0.066
	rural6	-0.066	-0.059	-0.075
	rural7	0.135	0.117	0.159
Urban	urban1	-0.031	-0.027	-0.040
	urban2	-0.009	-0.003	-0.030
	urban3	-0.067	-0.063	-0.062
Changes in poverty and inequality (% change)				
Indon h-count poverty %		0.053	0.041	0.092
Rural h-count poverty %		0.049	0.037	0.095
Urban h-count poverty %		0.064	0.055	0.085
Indon-poverty gap %		0.061	0.046	0.115
Rural-poverty gap %		0.053	0.037	0.119
Urban-poverty gap %		0.078	0.067	0.104
Gini Indonesia (%)		-0.002	-0.004	0.008
Gini rural (%)		0.065	0.055	0.084
Gini urban (%)		-0.012	-0.012	-0.007
Post-shock levels of poverty incidence (%)		*Base level*	*Post-simulation levels*	
Rural	rural1	*38.874*	38.863	38.859	38.885
	rural2	*15.142*	15.190	15.184	15.198
	rural3	*10.525*	10.491	10.496	10.485
	rural4	*1.520*	1.514	1.515	1.512
	rural5	*16.528*	16.482	16.484	16.489
	rural6	*0.457*	0.459	0.459	0.459
	rural7	*0.347*	0.343	0.344	0.343
Urban	urban1	*21.299*	21.312	21.311	21.316
	urban2	*15.409*	15.412	15.410	15.419
	urban3	*0.784*	0.787	0.786	0.786

Source: Author's computatio

Table 8a. Simulated Macroeconomic Effects of a Rice Tariff: Varying Armington elasticities in rice demand

(per cent change)

Shock:	**Increase tariff from 25 to 45%**				
	Simulation:	**L**	**M**	**N**	**O**
Parameter varied:	**Armington elasticitity in rice demand:**	**2**	**4**	**8**	**10**
Overall economy					
Gross Domestic Product					
	Nominal (local currency)	0.122	0.175	0.233	0.250
	Real	-0.006	-0.009	-0.013	-0.014
Consumer Price Index		0.150	0.211	0.279	0.300
GDP Deflator		0.129	0.184	0.245	0.264
Wage (real)	Skilled	0.050	0.073	0.099	0.106
	Unskilled	0.115	0.174	0.239	0.259
Consumer price of rice (Rp.)		0.942	1.460	2.034	2.210
Producer price of paddy (Rp.)		2.305	1.061	1.645	2.291
Import price of rice ($US)		-2.226	-3.449	-5.006	-5.540
Paddy production		0.278	0.429	0.595	0.645
External sector (foreign currency)					
Export Revenue		-0.015	-0.023	-0.032	-0.035
Import Bill		-0.011	-0.017	-0.024	-0.026
Government budget (local currency)					
Total revenue (local currency)		0.189	0.190	0.191	0.191
	Tariff revenue	1.613	0.963	0.247	0.027
Total expenditure (local currency)		0.076	0.109	0.145	0.157
Household sector					
Consumption					
	Nominal (local currency)	0.151	0.213	0.282	0.303
	Real	0.001	0.002	0.003	0.003

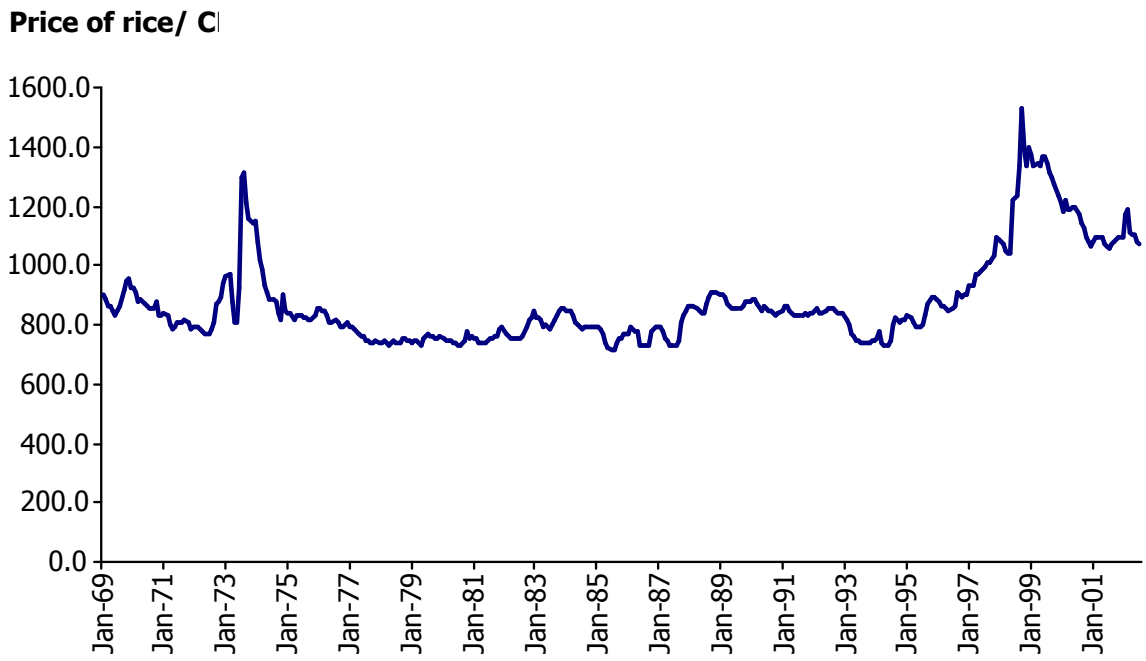
Source: Author's computations.

Table 8b. Simulated Distributional Effects of a Rice Tariff: Varying Armington elasticities in rice demand

Shock:	**Increase tariff from 25 to 45%**				
	Simulation:	**L**	**M**	**N**	**O**
Parameter varied:	**Armington elasticitity in rice demand**	**2**	**4**	**8**	**10**
Real consumption expenditures (deflated by household-specific CPI) % change					
Rural	rural1	0.009	0.013	0.017	0.018
	rural2	-0.043	-0.066	-0.093	-0.101
	rural3	0.038	0.059	0.082	0.089
	rural4	0.032	0.05	0.069	0.075
	rural5	0.041	0.062	0.086	0.094
	rural6	-0.032	-0.050	-0.070	-0.077
	rural7	0.066	0.102	0.142	0.154
Urban	urban1	-0.015	-0.023	-0.032	-0.035
	urban2	0.000	-0.004	-0.007	-0.008
	urban3	-0.034	-0.053	-0.073	-0.079
Changes in poverty and inequality (% change)					
Indon h-count poverty %		0.023	0.037	0.054	0.058
Rural h-count poverty %		0.021	0.034	0.050	0.054
Urban h-count poverty %		0.030	0.047	0.066	0.072
Indon-poverty gap %		0.026	0.041	0.061	0.066
Rural-poverty gap %		0.021	0.035	0.052	0.057
Urban-poverty gap %		0.036	0.057	0.080	0.088
Gini Indonesia (%)		-0.002	-0.002	-0.003	-0.003
Gini rural (%)		0.031	0.049	0.068	0.074
Gini urban (%)		-0.007	-0.010	-0.014	-0.015
Levels of poverty incidence (%)		*Base level*	*Post-simulation levels*		
Rural	rural1	*38.874*	38.866	38.863	38.859	38.858
	rural2	*15.142*	15.165	15.178	15.193	15.198
	rural3	*10.525*	10.508	10.499	10.489	10.486
	rural4	*1.520*	1.517	1.515	1.514	1.513
	rural5	*16.528*	16.504	16.492	16.478	16.473
	rural6	*0.457*	0.458	0.458	0.459	0.459
	rural7	*0.347*	0.345	0.344	0.343	0.343
Urban	urban1	*21.299*	21.305	21.309	21.313	21.314
	urban2	*15.409*	15.409	15.410	15.411	15.411
	urban3	*0.784*	0.785	0.786	0.787	0.787

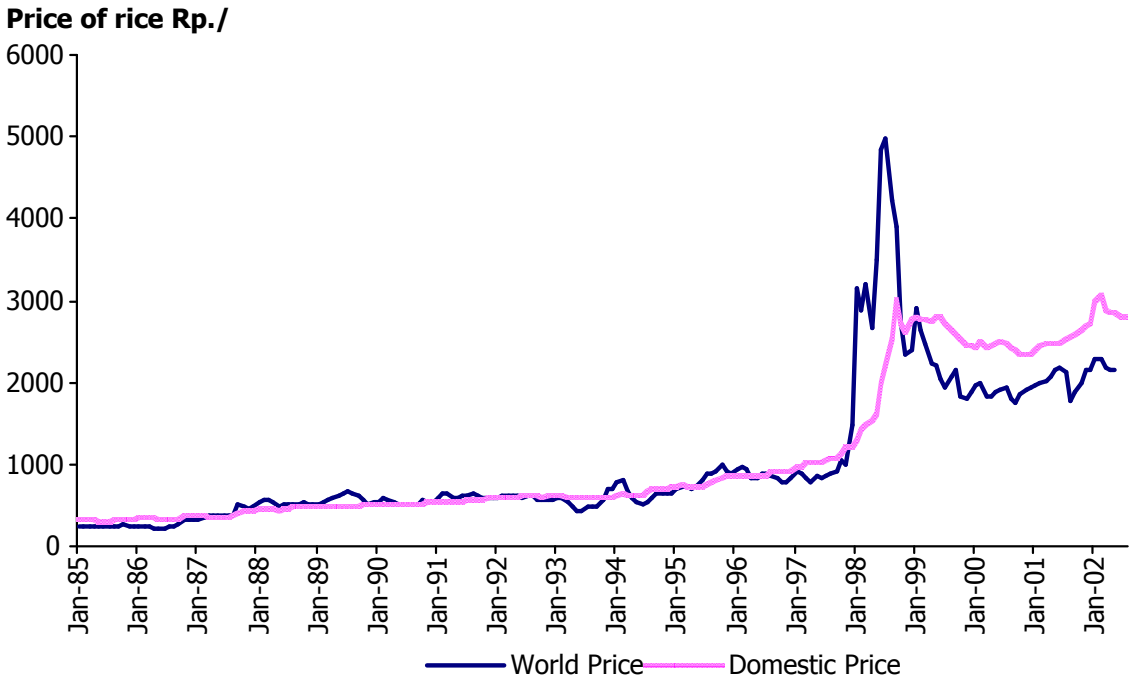
Source: Author's computations.

Figure 1 Real price of rice, Indonesia, 1969 to 2001



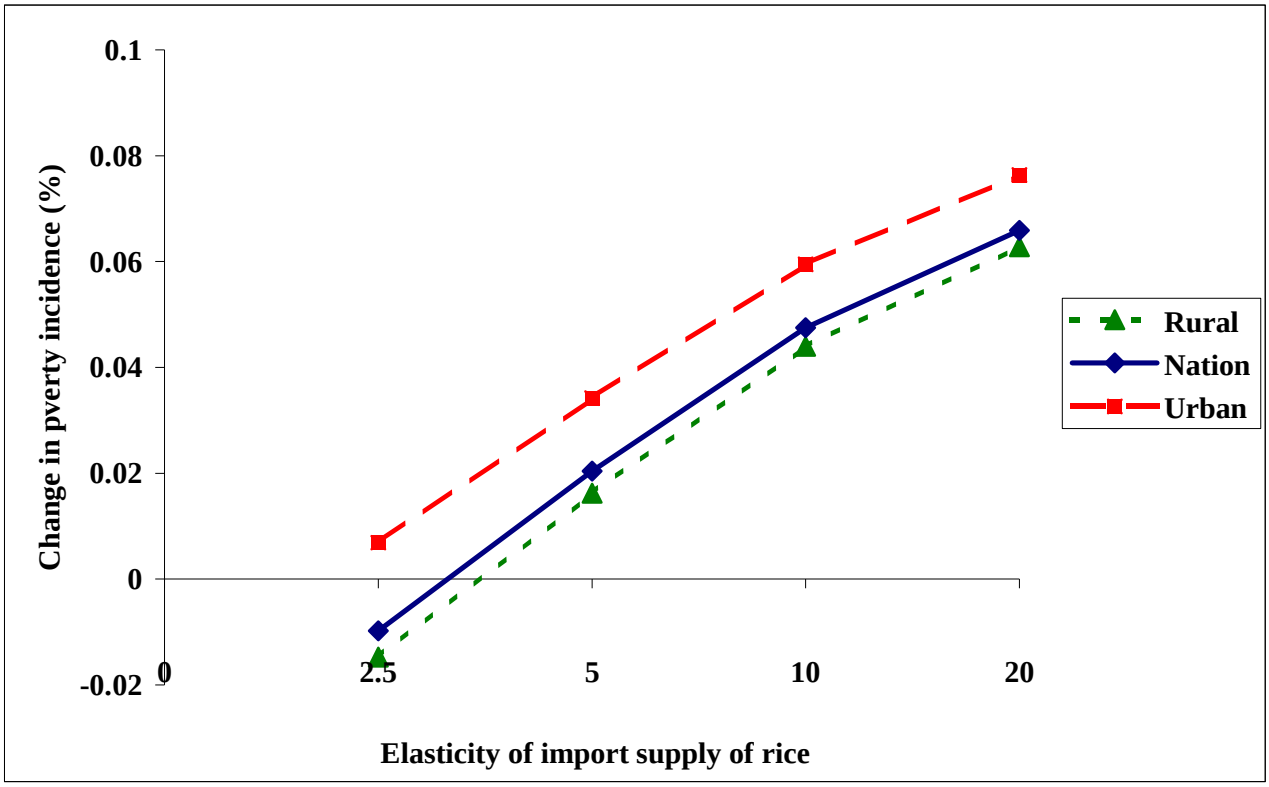
Source: Bulog (rice prices) and BPS (CPI).

Figure 2 World price and domestic price of rice, Indonesia, 1985 to 2002



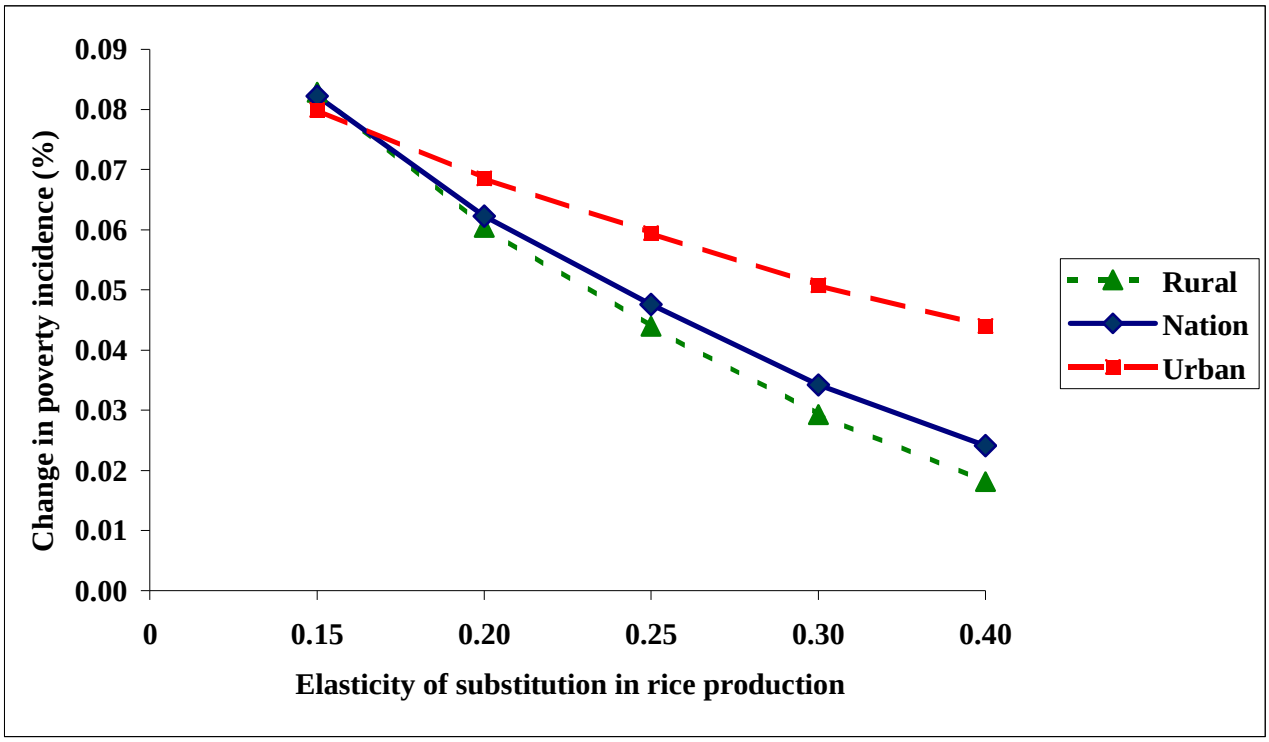
Source: Bulog (rice prices) and BPS (exchange rates).

Figure 3. Simulated changes in poverty incidence:
Varying elasticity of import supply of rice



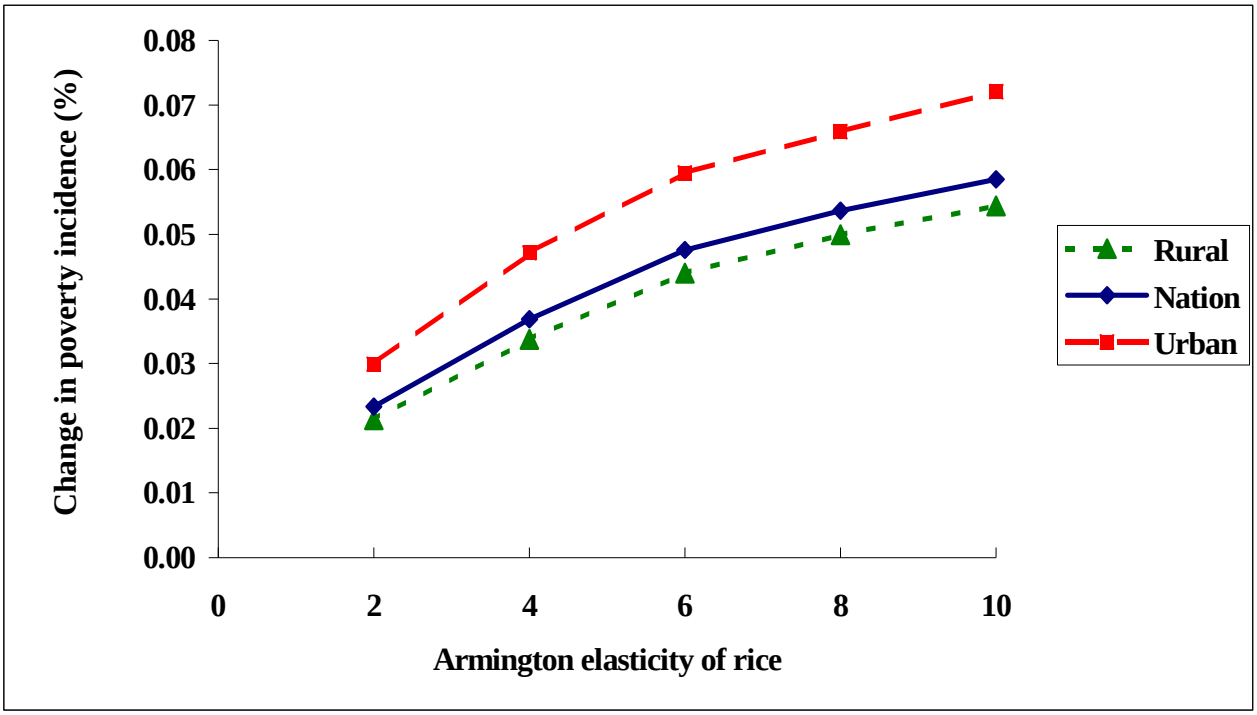
Source: Author's computations.

Figure 4. Simulated changes in poverty incidence:
Varying elasticity of substitution in rice production



Source: Author's computations.

Figure 5. Simulated changes in poverty incidence:
Varying Armington elasticity of substitution in rice demand



Source: Author's computations.