General Equilibrium Analysis of Rice Pricing Policy in Indonesia*

Peter G. Warr and Prem J. Thapa**

Abstrak

Tulisan ini membahas pengaruh subsidi terhadap konsumsi beras. Dengan menggunakan model keseimbangan umum, rumah tangga dibagi ke dalam 10 kelompok menurut dampak kebijakan distribusi yang dilakukan. Dalam analisa ditunjukkan bahwa model kesimbangan umum dengan nama WAYANG ini, dapat diketahui pengaruh kebijaksanaan yang ditempuh terhadap distribusi (pemerataan) maupun terhadap perekonomian secara keseluruhan. Di samping itu ditujukan pula pengaruh hubungan antara tingkat intervensi kebijaksanaan terhadap kesejahteraan.

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1. INTRODUCTION

The economic crisis of the late 1990s had economic and political consequences which are still unfolding. Within the crisis affected countries, large numbers of rich and poor people were adversely affected. The effects on the poor operated through a contraction in the demand for labour, on the one hand, and increases in commodity prices, especially for internationally traded goods, on the other. These problems have apparently been more severe in Indonesia that anywhere else. Not all poor people in Indonesia were adversely affected. Some smallholder agricultural producers whose products are exported benefited substantially from the depreciation of the national currency, the rupiah. Nevertheless, most poor people, including most agricultural producers, seem to have been harmed, especially those who are net purchasers of food. Food prices have thus been a special concern in the policy response to the crisis.

The staple food of Indonesia, rice, has been a special focus of government intervention for decades. The National Logistics Planning Agency, Bulog, has been charged with regulating food markets, especially rice, and has enjoyed a monopoly in rice imports. One objective of Bulog's interventions in the rice market has been to stabilise domestic rice prices relative to international prices and it has done this effectively (Timmer 1996). Another objective has been to ensure adequate supplies to consumers and this has been reflected in suppression of the average level of domestic prices below the average levels of international prices[1]. In the absence of *Bulog's* interventions, domestic rice prices would have been more variable and their average level would apparently have been somewhat higher.

In the wake of the crisis, the large depreciation of the rupiah raised food prices to a degree that outstripped increases in money wages for those Indonesians fortunate enough to retain their jobs. The affordability

[1] This description is controversial in that some observers have disputed that average rice prices have been significantly below international relates. Nevertheless, to the extent that it is true, it applies to prices averaged over many years. It does not apply in each individual year. There have been years in which rice prices have been above international prices and years of the opposite. See Timmer (1996) for a fuller discussion.

of food for the poorest people thus became a special focus of policy concern and this was reflected in special measures intended to target additional food subsidies, especially for rice, to the poorest households. In these special market operations, rice is sold at prices equivalent to around 50 to 60 per cent of market prices, themselves significantly below international prices. As the depreciation of the rupiah continued, following the crisis, these subsidies grew in importance. The gap between international prices and domestic rice prices increased and the level of rice imports also increased substantially. These subsidies are the principle focus of this paper.

In addition to rice subsidies, the government also subsidises fertilisers. Political forces have played a large role in determining the levels and composition of these subsidies, but in part, the fertiliser subsidies may be seen as an attempt to counteract the lower level of rice production which results from the production tax implicit in the suppression of average domestic rice prices below average levels of international prices. Beyond this, the government adheres to an objective of rice self-sufficiency and fertiliser subsidies have thus been considered to be justified well beyond the rates that would raise rice production to the level it might have taken under an non-interventionist policy. As with rice subsidies, the budgetary cost of fertiliser subsidies became much larger in real terms in the wake of the economic crisis.

Under the special market operations (OPK) *Bulog* sells rice to low income families at *Rp 1.000 per kg.*, although there have been frequent claims that individual families are sometimes charged much more than this by local governments under the guise of transport or other costs. The rice concerned is usually third grade (25% broken). To calculate the approximate rate of subsidy implicit in that price, we may take the Bangkok price of US $250 per ton for 25% broken rice, add US $14 for transport cost and multiply by 1.2 for retail markups. At the current exchange rate of *Rp 8.050*/US $ this comes to approximately *Rp 2.550 per kg*. According to this calculation the rate of subsidy is currently around 60 per cent. Hard data on the distribution of subsidised sales by expenditure levels of recipient households is not currently available.

Under the special market operations, *Bulog* sold around 350,000 tons of rice at these subsidised prices between July, when the program started, and the end of December. The monthly amounts of subsidised sales

increased steadily over this period to just over 100,000 tons in December. At *cif* prices these sales were worth around US$ 110 million and the subsidy was worth around US$ 66 million.

A package of deregulation agreed with the World Bank and announced on 1 December 1998, includes the following features:

(i) Liberalisation of the rice market in which prices are determined by market mechanisms and in which general importers are permitted to import rice.

(ii) Special market operations for rice at subsidised prices are to be targeted to food insecure people, defined as those with incomes below the official poverty line.

(iii) The rates of rice subsidies are to be reduced to no more than 20 per cent.

(iv) All food subsidies for commodities other than rice are to be eliminated.

(v) Fertiliser subsidies are to be eliminated and their prices are to be determined by market mechanisms[2].

These provisions are due to be implemented at the commencement of the new financial year, beginning 1 April, 1999. Clearly, they are very substantial policy changes. Measures (i) and (iv) apparently do not rule out the use of border interventions such as tariffs or import subsidies, but they do greatly reduce the scope of Bulog's role. According to the scheme, the rice subsidies are to remain, but at reduced rates. Our objective in this paper is to examine the effects of changing the subsidy rate within the neighbourhood of the 20 per cent subsidy rate set as the target. In the course of this analysis we shall explore the effects of alternative schemes for targeting the rice subsidy by household group. For this purpose we utilise a general equilibrium model of the Indonesian economy recently constructed and named WAYANG, after the Indonesian puppet theatre.

The following section describes the general features of the WAYANG model. Section 3 outlines the simulation exercises performed

[2] This provision applies to urea, SP-36 and Potassium Chloride.

with it. We then summarise the results in Section 4 and Section 5 concludes.

2. THE WAYANG MODEL

A detailed paper describing the full model is available (Warr *et al.* 1998). 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. WAYANG is a conventional, real, micro-theoretic general equilibrium model of the Indonesian economy. Its features are designed primarily to enable it to address micro-economic policy issues relevant for Indonesia. The principal distinguishing features of WAYANG are: (i) its solid empirical basis; (ii) its disaggregated industry and commodity structure; and (iii) its detailed income distributional capabilities.

This section briefly describes the major elements of WAYANG model (section 2.1), its theoretical structure (section 2.2) and its data base (section 2.3). Features of the WAYANG parameter file 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.

There are two principal versions of the WAYANG model: a national version and a regional version. The regional version is larger and somewhat more complex. For the purposes of this paper, it will be sufficient to describe the national version. The features of the model are:

2.1.1. Industries

The national model contains 65 producer goods and services produced by 65 corresponding industries - 23 agricultural industries and 22 non-

agricultural[3]. 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. In the normal closure used for experiments with WAYANG the level of exports of an exportoriented industry are treated as being endogenous, while the exports of an import-competing industry are treated as being exogenous[4]. 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.

2.1.2. 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 in fact 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.

2.1.3. Factors of production

The mobility of factors of production is a critical feature of any general equilibrium system. 'Mobility' should be interpreted to mean mobility

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3 Agricultural industries are here defined to include three natural resource extraction industries: wood (21), hunting and other forest products (22) and sea fishing and other marine products (23).

4 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.

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.

Within the WAYANG structure, a wide degree of flexibility is permitted in the treatment of factor mobility. This is illustrated by the treatment of labour. Four types of labour are identified: agricultural labour, production labour, administration labour and professional labour. The first two forms of labour are relatively less skilled than the other two.

Obviously, agricultural labour is used primarily in agriculture and production labour is used primarily in industry. The degree to which they substitute of one another is a crucial question and one where the model user has considerable flexibility. If they are treated as perfect substitutes, this is equivalent to assuming and one factor of production, say 'unskilled labour', is mobile across the entire economy, implying that their wages must be equalised. If they do not substitute for one another at all, this is equivalent to assuming that agricultural and industrial labour are discrete types of labour and there is no need for their wages to move together. These two characterisations of the labour market may be expected to have quite different implications for adjustment of the various industries, as well as very different income distributional implications.

The other two factors of production are capital and land and again the user has considerable flexibility in specifying the degree of mobility of these factors across industries. For example, it is possible to assume that capital is mobile across all industries, that it is immobile (fixed) in every industries, or that it is mobile among only some industries. A common assumption is that there are two kinds of capital - one that is mobile among agricultural industries and another mobile among non-agricultural industries, but with no mobility between them. 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. Nonagricultural capital is thought of as industrial machinery and buildings. Any combination of these treatments is possible within WAYANG.

Land is used primarily in agriculture but its mobility among agricultural industries is a matter which users of the model can determine. Land can be mobile among all agricultural industries, fixed in each, or mobile among only some sets of industries. When factors are immobile - industry specific - changes in relative prices do not cause any reallocation of these inputs across industries. In some cases, as with capital, this may be thought of as a short run treatment, as a movement to other sectors is assumed to require sufficient re-tooling costs as to render such reallocations economically infeasible. In a long run setting, the amounts available of each of these region and sector-specific capital resources would adjust as a result of the investments made in each time period of the model. When capital is treated as industry-specific the length of run implicit in the model's comparative static adjustment processes should be thought of as being between two and four years.

2.1.4. Households

The model contains ten households - seven rural and three urban - differentiated by socio-economic group. They are based on the households defined in the 1993 *Social Accounting Matrix* produced by the Central Bureau of Statistics in Jakarta (BPS)[5]. The households are described below. The sources of income of each of these households are different, depending on their ownership of factors of production, as derived from the *BPS Social Accounting Matrix*, and their demand behaviour also differs from one another, as reflected in the set of demand elasticities entering the WAYANG data base.

2.1.5. Market behaviour

The microeconomic behaviour assumed within WAYANG is competitive profit maximisation on the part of all firms and utility maximisation on the part of consumers. Markets for final outputs, intermediate goods and factors of production all clear at prices which are determined endogenously within the model. Variations to this assumption are possible, however, and this is important for factors of production, especially labour. Labour can be unemployed in WAYANG and this is

[5] BPS is an Indonesian abbreviation for *Biro Pusat Statistik* (Central Bureau of Statistics), Jakarta.

accomplished in modelling terms through closure decisions, by allowing real or nominal wages to be fixed (exogenous) and thereby allowing the supply of labour to be demand-determined (endogenous). Thus, 'market clearing' as defined here, does *not* necessarily mean full employment.

2.2. Theoretical Structure

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

- A complete consumer demand system based on the 20 consumer goods, for each of the 10 individual households.
- A factor demand system which 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 production functions of all non-agricultural industries, using a constant elasticity of substitution (CES) aggregation.
- An intermediate good demand system which assumes that intermediate goods are used in each industry in proportion to the output produced (the Leontief assumption).
- Zero profit conditions for each industry determining specific factor returns from commodity prices, intermediate good prices and mobile factor returns.
- Demands for imported and domestically produced versions of each good, incorporating Armington elasticities of substitution between the two.
- Market clearing conditions for each commodity and factor of production ensuring that aggregate demand does not exceed aggregate supply for that commodity or factor.
- A set of equations determining the incomes of the 10 households from their (exogenous) ownership of factors of production, reflecting data derived from the 1993 *Social Accounting Martix*, 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 households 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.

The nominal exchange rate between the rupiah and the US dollar is 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. Thus, for example, if all prices are flexible a ten per cent increase in the exchange rate will result in a ten per cent increase in all nominal domestic prices but no change in any quantity determined within the model.

Production functions assume constant returns to scale. This assumption enters the model via the factor demand functions, which are homogeneous of degree one in output, and through the zero profit conditions, which equate unit commodity prices to unit costs of production. All behavioural functions are homogeneous of degree zero in prices. There are four mobile or semi-mobile primary factors of production: skilled labour, unskilled labour, agricultural mobile capital and non-agricultural mobile capital. In addition, each industry also uses an industry-specific fixed factor. Two factors are freely mobile across all 20 agricultural industries: unskilled labour and mobile agricultural capital. Three primary factors are freely mobile among the 40 non-agricultural industries: skilled labour, unskilled labour and non-agricultural mobile capital. Only unskilled labour is freely mobile across all 60 industries.

Skilled labour is defined as those in the work force with more than a specified level of education. Skilled labour is not used in agriculture because agricultural census data confirm that very little educated labour is engaged in agricultural production. Mobile agricultural capital consists of equipment such as tractors and cultivation equipment with a variety of agricultural uses but little or no non-agricultural use. Mobile non-agricultural capital includes non-agricultural land and structures such as

buildings not necessarily devoted to any particular production activity. When relative prices change, it is possible for owners of such assets to rent them out to other non-agricultural producers facing more profitable circumstances.

Industry-specific capital, consisting of assets devoted to a particular line of production activity, also exists in each of the 60 industries. In agriculture, this means land. Outside agriculture, it means industry-specific production equipment. Changes in relative prices do not cause a reallocation of such capital inputs to other sectors in the short run, because of the re-tooling costs involved. The length of run implicit in the model's comparative static adjustment processes should be thought of as being between two and four years.

2.3. Data Base

This section provides a description of INDOSAM: a disaggregated Social Accounting Matrix (SAM) for Indonesia, with a 1993 base. This SAM is intended to serve as the *data base* for WAYANG, but it has other potential uses as well. The year 1993 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, the Central Bureau of Statistics, BPS, were used to construct INDOSAM-93: (i) the 1990 input-output tables (subsequently referred to as IO 90); (ii) the updated input output table for 1993 (subsequently IO 93); (iii) the 1993 social accounting matrix (subsequently SAM 93). The IO 90 and SAM 93 are available from BPS in published form. The IO 93 is an unpublished and preliminary update of the 1990 input output tables, kindly provided to the authors by BPS. 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[6].

[6] The final two references listed, (Statistical Year Book 95) and (IFS 96), were also used to verify some data contained in the Indonesian sources cited when the meaning or accuracy of published data seemed to require checking.

2.3.1. The principal data sources

The 1993 social accounting matrix produced by *BPS* (SAM 93) provided the starting point for the data base but substantial additions to the information in SAM 93 were required. SAM 93 contains 22 production sectors, which is insufficient for the purposes of this study. In addition, the SAM 93 does not include the detail of tax payments and household sources of income that are required. The updated 1993 input output table (IO 93) is a revision of the 1990 IO table (IO 90), published previously, and specifies 66 production sectors. For the purposes of the present study, modifications to the data contained in IO 93 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 93) 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).

2.3.2. 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 Files

The elasticity files used in WAYANG were borrowed from empirical estimates derived econometrically for a similar model of the Thai economy, known as PARA. The elasticity files concerned were the consumer demand system and the factor demand elasticities. In both cases, these elasticities 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 and the elasticities of export demand were set at default values. All Armington elasticities were set at 2 and all export demand elasticities were set at 20.

2.5. Characteristics of Households

Since our study focuses on the way external shocks affect the various households of the model it is important to summarise the characteristics of the ten households represented in WAYANG. Table 1 provides this summary. The seven rural households account for 73% of total population and 61% of total consumption expenditure. The four poorest household categories, measured in terms of expenditure, are all rural. Povertys in Indonesia as elsewhere in the developing world, is overwhelmingly a rural phenomenon.

The sources of income for the various households are important for the general equilibrium properties of the model and these are summarised in Table 2.

Table 1
Classification of Wayang Households

Household Categories	Population in households		Annual Consumption		Annual per capita
	Total in 1993 (million)	Shore %	Total volie ion rupiah)	Shore %	expen-diture ('000 Rp)
Rural Households		(73.2)		(60.9)	
HH1 Landless	18.70	10.0	8.877.9	4.7	474.8
HH2 Small Cultivator (<0.5 ha.)	51.30	27.3	36.511.5	19.4	711.7
HH3 Medium Cultivator (0.5 to 1 ha.)	11.60	6.2	9.145.7	4.8	788.4
HH4 Large Cultivator (> 1 ha)	12.00	6.4	13.606.7	7.2	1.143.8
HH5 Non-Agricultural Labour: low income	16.60	8.8	12.164.1	6.4	732.8
HH6 Rural Non-Labour Households	2.90	1.5	3.317.1	1.8	1143.8
HH7 Non-Agricultural Labour: high income	24.30	13.0	31.308.5	16.6	1.288.4
Urban Households		(26.8)		(39.0)	
HH8 Urban labour: low income	23.30	12.4	21.272.9	11.3	913.0
HH9 Urban non-labour Household	4.80	2.6	5.274.7	2.8	1.098.9
HH10 Urban labour: high income	22.10	11.8	47.080.2	25.0	2.130.3
All households	187.60	100.0	188.599.4	100.0	1.005.3

Table 2
Sources of Gross Households Factor Incomes

Household Categories	Skilled labour	Unskilled labour	Land	Capital	Total
Rural Households					
HH1 Landless	1.9	45.9	3.3	48.9	100
HH2 Small Cultivator (<0.5 ha.)	5.0	42.8	7.1	45.1	100
HH3 Medium Cultivator (0.5 to 1 ha.)	4.5	52.6	6.2	36.8	100
HH4 Large Cultivator (> 1 ha)	4.8	65.8	3.9	24.5	100
HH5 Non-Agricultural Labour: low income	26.1	33.2	5.2	35.5	100
HH6 Rural Non-Labour Households	5.8	14.5	1.7	78.0	100
HH7 Non-Agricultural Labour: high income	29.7	39.0	2.1	29.2	100
Urban Households					
HH8 Urban labour: low income	20.7	11.2	3.4	64.7	100
HH9 Urban non-labour Household	14.1	18.4	5.5	62.0	100
HH10 Urban labour: high income	37.2	14.8	0.5	47.5	100
All households	23.4	28.8	2.9	44.9	100

Source: Wayang database

3. THE SIMULATIONS

Our simulations required first amending the standard form of the model to incorporate subsidies on consumer goods. This required changes to the equation set and the data base. The consumer demand equations were amended to incorporate household-specific subsidies on each commodity. The government revenue used to finance these subsidies was then allowed for by adding a new equation which aggregates government spending on consumption subsidies and incorporating this term into the overall government budget balance equation. The data base was amended to allow for a base level of a 20 per cent subsidy on rice consumption. To preserve the balance of the existing data base the value of the reduced consumer spending this represented was added to household savings. The additional government revenue required to finance the consumption subsidies was similarly incorporated without disturbing the balance of the system by subtracting this amount from government savings.

3.1. Model closure

The objective of the simulations is, in part, to derive effects that changes in the levels of consumption subsidies have on household welfare. Within the single-period horizon of the model, the measure of household welfare is its real consumption. The macroeconomic closure must be made compatible with this measure by ensuring that the full economic effects of the shocks to be introduced are channelled into current-period household consumption and do not 'leak' into other directions, with real-world welfare implications not captured by the welfare measure. In this context, issues of macroeconomic closure may thus be seen in part as devices for minimising inconsistencies between the use of a single-period model to analyse welfare results and the multi-period reality that the model represents. The real values of the current account balance, real government spending and real investment are each held fixed in the chosen closure because in all these cases, changes to the real value of the variables concerned have real world consequences not captured by the welfare measure.

To prevent intertemporal and other welfare leakages from occurring, the simulations are conducted with balanced trade (exogenous balance on current account), to ensure that the potential benefits from the export

tax do not flow to foreigners, through a current account surplus, or that increases in domestic consumption are not achieved at the expense of borrowing from abroad, in the case of a current account deficit. 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 and this is achieved by across-the-board adjustments to personal income tax rates, in response to changes in government revenue so as to restore the base level of the budgetary deficit.

Closure decisions are also required for the markets for skilled and unskilled labour. The WAYANG model has no explicit labour supply behaviour within it and model closure decisions must provide the equivalent of labour supply information. The labour supply assumption employed here is that levels of aggregate employment are exogenous, and thus that the aggregate supply of skilled and unskilled labour are fixed.

3.2. The shocks

The shocks applied were in every case an increase in the rate of subsidy on rice from the base rates of 20% to 50%. The simulations reported differ as to which household or combination of households receive this increased subsidy. This increase in the subsidy rate multiplies the rate of subsidy by 2.5 and thus corresponds to a 150% increase in the rate of the subsidy. This increase in the subsidy rate was first applied to all households and we refer to this as simulation A. Then we applied this rate of increase in the subsidy (an increase from a 20% subsidy rate to a 50% subsidy rate) for individual households only, holding the subsidy rate for all other households constant at the base rate of 20%. We do this for each of the five poorest households identified in the model. The first four of these, households 1, 2, 3 and 5, are the poorest rural households and the fifth is the poorest urban household, household 8. Thus simulation B1 increases the subsidy rate for household 1 alone, and simulations B2, B3, B5 and B8 apply the same rate of subsidy increase to households 2, 3, 5 and 8.

4. RESULTS

The results of the simulations are reported in **Table 3**.

Table 3
Simulation Results – Effects of Increases in Rice Consumption Sybsidies: Fixed Aggregate Employment
(All numbers are Percentage rate changes, unless otherwise specified)

SIMULATION	A	B1	B2	B3	B5	B8
SHOCKS Rice consumption subsidy rate increased from 20% to 50%	All households	hh1 only	hh2 only	hh3 only	hh5 only	hh8 only
A. Macro Results:						
A.1 Overall Economy						
Gross Domestic Product						
Nominal (local currency)	-1.314	-0.018	-0.282	-0.082	-0.030	-0.090
Real	- 1.074	-0.015	-0.234	-0.066	-0.024	-0.075
GDP Deflator	-0.240	-0.003	-0.048	-0.016	-0.006	-0.015
Consumer Price Index	-4.080	-0.072	-0.948	-0.269	-1.302	-0.252
Wage						
nominal Skilled	-2.208	-0.030	-0.462	-0.150	-0.052	-0.138
Unskilled	1.026	0.012	0.214	0.070	0.024	0.065
real Skilled	1.872	0.042	0.486	0.119	1.250	0.114
Unskilled	5.106	0.084	1.162	0.339	1.326	0.317
Returns to Variable Capital (nominal)						
Non-agriculture	-0.540	-0.006	-0.114	-0.036	-0.012	-0.030
Agriculture	3.714	0.048	0.780	0.250	0.089	0.241
Returns to Land						
paddy land	14.580	0.186	3.084	0.948	0.352	0.972
beans land	2.160	0.024	0.432	0.162	0.048	0.119
maize land	5.460	0.066	1.128	0.390	0.128	0.324
Employment						
Skilled	•	•	•	•	•	•
Unskilled	•	•	•	•	•	•
A.2 External Sector						
Export Revenue (foreign currency)	0.066	0.000	0.012	0.006	0.000	0.000
Import Bill (foreign currency)	0.072	0.000	0.012	0.006	0.000	0.000
A.3 Government Budget						
Nominal Revenue (local currency)	7.752	0.102	1.698	0.504	0.198	0.576
Nominal Expenditure (local currency)	7.752	0.102	1.698	0.504	0.198	0.576
Budget Deficit (in levels)						

Contd.....

SIMULATION	A	B1	B2	B3	B5	B8
SHOCKS Rice consumption subsidy rate increased from 20% to 50%	All households	hh1 only	hh2 only	hh3 only	hh5 only	hh8 only
A.4 Household Sector						
Consumption						
Nominal (local currency)	-2.160	-0.030	-0.462	-0.132	-0.054	-0.152
Real	1.920	0.042	0.486	0.137	1.248	0.100
B. Sectoral Results (aggregates)						
Agriculture	1.506	0.018	0.312	0.101	0.036	0.097
Manufactures	1.374	0.018	0.288	0.093	0.030	0.088
Services	-0.174	0.000	-0.036	-0.012	-0.006	-0.012
Natural Resources	-0.450	-0.006	-0.096	-0.018	-0.012	-0.036
Agricultural Processing	4.512	0.006	0.936	0.294	0.108	0.300
C. Sectoral Results (by industry)						
domestic supply						
paddy	5.934	0.078	1.254	0.384	0.142	0.396
beans	0.030	0.000	0.000	0.006	0.000	0.000
maize	0.384	0.000	0.078	0.030	0.000	-0.066
imports						
paddy	*	*	*	*	*	*
beans	4.200	0.054	0.876	0.282	0.102	0.270
maize	9.450	0.120	1.980	0.636	0.222	0.612
milledrice	12.660	0.162	2.676	0.822	0.306	0.846
D. Government Budgetary Position						
Revenue:						
Personal Income tax collection	30.420	0.324	5.424	1.980	0.648	2.064
(personal income tax rate shifter)	30.720	0.330	5.490	1.998	0.654	2.088
Corporate tax	0.360	0.000	0.084	0.018	0.006	0.019
Indirect taxes						
Excise	0.972	0.012	0.204	0.066	0.024	0.060
Business	0.492	0.006	0.102	0.036	0.012	0.030
Other	0.714	0.012	1.500	0.048	0.018	0.048
Tariff	0.138	0.000	0.030	0.012	0.000	0.006
Expenditure:						
government consumption	-0.048	-0.006	-0.108	-0.036	-0.012	-0.036
consumption subsidy	159.0	2.8	36.7	10.5	5.0	9.8
Changeinvalueof Consump.Subsidy**	7123.8	123.4	1644.6	470.3	224.4	438.6
Change in total gov. expenditure **	5131.8	68.0	1123.2	334.6	129.9	381.6
**in billion Rupiah 1993 constant prices						

Contd.....

SIMULATION	A	B1	B2	B3	B5	B8
SHOCKS Rice consumption subsidy rate increased from 20% to 50%	All households	hh1 only	hh2 only	hh3 only	hh5 only	hh8 only
E. Income Distribution						
E.I Nominal Gross Income Changes						
Rural HH1 (rural landless)	0.412	0.005	0.086	0.028	0.010	0.026
HH2 (small farmer)	0.384	0.005	0.079	0.028	0.009	0.023
HH3 (medium farmer)	0.450	0.006	0.093	0.032	0.011	0.028
HH4 (large famler)	0.512	0.006	0.106	0.036	0.012	0.032
HH5 (non-ag. labour: poor)	-0.231	-0.003	-0.049	-0.015	-0 006	-0.015
HH6 (rural non-labour)	-0.186	-0.002	-0.039	-0.013	-0.004	-0.011
HH7 (non-ag. labour: rich)	-0.320	-0.004	-0.067	-0.021	-0.008	-0.020
	0.000	0.000	0.000	0.000	0.000	0.000
Urban HH8 (urban labour: low income)	-0.555	-0.007	-0.116	-0.038	-0.013	-0.035
HH9 (urban non-labour)	-0.285	-0.004	-0.060	-0.019	-0.007	-0.018
HH10 (urban labour: high income)	-0.891	-0.011	-0.185	-0.061	-0.021	-0.056
E.2 Real Gross Income Changes (deflated by household specific CPI)						
Rural HH1 (rural landless)	2.330	1.672	0.140	0.043	0.016	0.044
HH2 (srmdl farmer)	5.339	0.002	5.214	0.011	0.004	0.009
HH3 (mediumfarmer)	6.072	0.001	0.012	6.016	0.001	0.003
HH4 (largefarmer)	6.136	0.001	0.019	0.006	0.002	0.006
HH5 (non-ag. rural labour: poor)	1.957	0.003	0.043	0.014	1.757	0.014
HI6 (rural non-labour)	2.561	0.005	0.090	0.029	0.010	0.028
HH7 (non-ag. rural labour: rich)	5.167	-0.006	-0.103	-0.033	-0.012	-0.032
Urban HH8 (urbanlabour:lowincome)	1.733	0.001	0.064	0.021	0.007	0.020
HH9 (urban non-labour)	1.908	0.004	-0.195	-0.064	-0.022	-0.059
HH10 (urban labour: high income)	3.444	-0.012	-0.195	-0.064	-0.022	-0.059
E.3 Real Consumption Expenditures						
Rural HH1 (rural landless)	1.283	1.642	-0.044	-0.023	-0.006	-0.026
HH2 (smaAl farmer)	3.288	-0.020	4.807	-0.119	-0.039	-0.127
HH3 (medium farmer)	3.600	-0.033	-0.551	6.489	-0.066	-0.211
HH4 (large fammer)	4.046	-0.030	-0.504	-0.185	-0.060	-0.193
HHS (non-ag. rural labour: poor)	0.154	-0.017	-0.281	-0.105	1.730	-0.110
HH6 (rural non-labour)	-0.272	-0.024	-0.396	-0.148	-0.048	-0.157
HH7 (non-ag. rural labour: rich)	2.832	-0.041	-0.686	-0.245	-0.081	-0.252
Urban HH8 (urbanlabour lowincome)	0.632	-0.012	-0.206	-0.076	-0.025	1.716
HH9 (urban non-labour)	-0.660	-0.024	-0.398	-0.148	-0.048	-0.156
HH10 (urban labour: high income)	1.482	-0.038	-0.636	-0.225	-0.075	-0.225

Contd.....

SIMULATION	A	B1	B2	B3	B5	B8
SHOCKS Rice consumption subsidy rate increased from 20% to 50%	All household s	hh1 only	hh2 only	hh3 only	hh5 only	hh8 only
F. Prices						
F.1 Domestic producer prices						
Agricultural commodities						
paddy	3.792	0.048	0.798	0.250	0.091	0.252
beans	1.572	0.018	0.324	0.110	0.036	0.096
maize	2.334	0.030	0.486	0.163	0.054	0.144
cassava	0.264	0.000	0.048	0.030	0.000	0.006
vegfruit	-0.210	0.000	0.054	0.000	-0.006	-0.030
F.2 Consumer price of rice						
market price (without subsidy)	7.524	0.018	0.342	0.106	0.042	0.108
price to subsidized consumer household(s)	-31.5	-39.0	-38.7	-38.9	-39.0	-38.9
F.3 CPI BY Household						
Rural HH1 (rural landless)	-1.918	-1.667	-0.054	-0.015	-0.006	-0.018
HH2 (small farmer)	-4.955	0.003	-5.135	0.016	0.005	0.014
HH3 (mediumfarmer)	-5.622	0.005	0.081	-5.984	0.009	0.024
HH4 (large farmer)	-5.623	0.005	0.088	0.030	0.010	0.026
HH5 (non-ag. rural labour: poor)	-2.189	-0.006	-0.092	-0.028	-1.763	-0.029
HH6 (rural non-labour)	-2.747	-0.008	-0.129	-0.042	-0.015	-0.039
HH7 (non-ag. rural labour: rich)	-5.487	0.002	0.036	0.012	0.004	0.011
Urban HH8 (urban labour: low income)	-2.288	-0.008	-0.127	-0.041	-0.014	-1.721
HH9 (urban non-labour)	-2.192	-0.008	-0.124	-0.040	-0.014	-0.038
HH10 (urban labour: high income)	4.335	0.001	0.009	0.003	0.001	0.003
G. Rice conswnption quantib by household						
Aggregate rice consumption	7.52	0.10	1.59	0.49	0.18	0.50
Rural HH1 (rural landless)	6.60	7.83	--	--	--	--
HH2 (small farmer)	7.50	--	9.36	--	--	--
HH3 (mediumfarmer)	7.68	--	--	10.71	--	--
HH4 (large farmer)	7.98	--	--	--	--	--
HH5 (non-ag. rural labour: poor)	5.82	--	--	--	8.11	--
HH6 (rural non-labour)	5.34	--	--	--	--	--
HH7 (non-ag. rural labour: rich)	7.08	--	--	--	--	--
Urban HH8 (urban labour: lowincome)	8.64	--	--	--	--	11.92
HH9 (urban non-labour)	7.02	--	--	--	--	--
HH10 (urban labour: high income)	7.86	--	--	--	--	--

4.1. Simulation A:

An increase in the subsidy rate across all households from 20 to 50% increases aggregate consumption of rice by around 7.5%. The market price of rice, allowing for the subsidy, declines by 31% but net of the subsidy the price increases by 7.5%. The relatively small increase in the unsubsidised price indicates that the aggregate market supply for rice as a consumer good is relatively elastic. This aggregate supply comes from two sources, domestic production and imports, which are imperfect substitutes (all Armington elasticities are set at 2.0). Imports of rice increase by 12.6% and domestic production of paddy increases by 6%. In the base year used for the data base, imports were under 1% of total rice supplies.

The increase in the producer price of paddy (3.8%) induces a large increase (14.6%) in the return to paddy land. Since paddy production is labour intensive, the increased profitability of rice also induces an expansion in the demand for unskilled labour which raises real wages for unskilled labour, economy-wide, by 5.1%. Real wages for skilled labour increase also, but by a much smaller amount. Returns to capital outside agriculture decline, a consequence of the increase in real wages squeezing the return to capital.

The decline in the consumer price of rice forces down the aggregate consumer price index by 4% (rice comprises 12.2% of total expenditure). This, combined with the factor income changes described above leads to an increase in the real gross incomes of all households. This is not the same as an increase in disposable incomes, however, because the government's subsidisation of rice has a budgetary cost. Aggregate budgetary expenditures increase by 7.8% and deflating this by the consumer price index, real government expenditures increase by 11.8%. Financing this increased level of expenditure requires increased taxes and the tax that adjusts in our simulations is the personal income tax rate. This tax rate increases by 30.4%.

The households which emerge as the largest net gainers (largest increases real consumption expenditure) are those which benefit most from the increases in the return to land and unskilled labour, but which are not significant parts of the personal income tax base. These are the small, medium and especially the large land owners. Rural owners of

capital (household 6) lose, primarily from the increase in their income tax obligations, as do urban owners of capital (household 9).

It is by no means the case that the households which gain the most from the rice subsidy are those for which rice forms the largest part of their total expenditure. The poorest households tend to be those for which the share of rice in their total expenditures is the highest. The response of factor returns and their implications for households' real incomes is what is overlooked by this perspective and this is one of the contributions a general equilibrium treatment can provide.

4.2. Simulations B1 to B8:

When the increased rice subsidy is applied to household 1 (the poorest rural household) alone, it gains in terms of aggregate real consumption and its gain is somewhat larger than the case where all households receive the subsidy. Comparing the return to household 1 in these two cases, the reduction in the price of rice to household 1 is larger in simulation B 1 because when the subsidy is also applied to all other households, the unsubsidised price of rice is bid up, making the subsidy inclusive price larger in simulation A than in B1. This effect outweighs the benefit household 1 receives from the bidding up of the return to unskilled labour that results when all other households also receive the subsidy.

Similarly, when other households are the sole recipients of a rice subsidy (simulations B2, B3, B5 and B8), household 1 is a small net loser, resulting from the bidding up of the unsubsidised price of rice which it faces. Each household gains from being a recipient of the subsidy, but is a small net loser from the granting of the subsidy to other households.

4.3. Simulations C and D1: Changing the labour market closure

The above results were derived with fixed levels of total employment. While this must no be confused with an assumption *offfull* employment, in the post-crisis environment the assumption of exogenous employment is clearly artificial. How do the results change when this assumption is amended. The economic crisis reduced real wages considerably. It could not be argued that real wages were fixed. That assumption would be as unrealistic as fixed aggregate employment. Nominal wages showed

much greater stability. Accordingly, we experiment with this labour market closure for both skilled and unskilled workers. Nominal wages are assumed to be 'sticky'. Supplies of skilled and unskilled labour were thus assumed to be infinitely elastic and these exogenous nominal wages.

Table 4 shows the results. They are presented only for an across the board increase in rice subsidies and for an increase applied only to household 1. These results may then be compared with results for simulations A and B 1. The results are surprisingly insensitive to the change of labour market treatment. The decline in the consumer price index is similar to above and real wages for skilled and unskilled labour rise, but in the case of the unskilled the increase is smaller than that obtained under simulations A and B 1. Employment for skilled workers declines but the increase in demand for unskilled labour in paddy production induces an increase in aggregate employment of unskilled workers. The net effect on the interests of the various households is very similar to that obtained with completely inelastic labour supply assumptions. Artificial assumptions about labour supply are therefore not the source of our results.

Table 4
Simulation Results – Effects of Increases in Rice Consumption Subsidies: Fixed Nominal Wages
(All numbers are Percentage rate changes, unless otherwise specified)

SIMULATION	C	D1
SHOCKS Rice consumption subsidy rate increased from 20% to 50%	All households	hh1 only
A. Macro Results:		
A.1 Overall Economy		
Gross Domestic Product		
Nominal (local currency)	-1.054	-0.014
Real	-1.098	0.055
GDP Deflator	0.044	0.001
Consumer Price Index	-3.881	-0.069
Wage		
nominal Skilled		
Unskilled		

Contd.....

SIMULATION	C	D1
SHOCKS Rice consumption subsidy rate increased from 20% to 50%	All households	hh1 only
real Skilled	3.881	0.069
Unskilled	3.881	0.069
Returns to Variable Capital (nominal)		
Non-agriculture	-0.277	-0.003
Agriculture	3.762	0.048
Returns to Land		
paddy land	15.24	0.196
beans land	3.67	0.046
maize lanu	7.62	0.097
Employment		
Skilled	-0.918	-0.012
Unskilled	0.578	0.007
A.2 External Sector		
Export Revenue (foreign currency)	0.187	0.024
Import Bill (foreign currency)	0.177	0.024
A.3 Government Budget		
Nominal Revenue (local currency)	8.058	0.107
Nominal Expenditure (local currency)	8.058	0.107
Budget Deficit (in levels)		
A.4 Household Sector		
Consumption		
Nominal (local currency)	-1.884	-0.025
Real	1 997	0044
Nominal Gross Income Changes		
Rural HH1 (rural landless)	0.402	0.005
HH2 (smdl farmer)	0.458	0.006
HH3 (medium farmer)	0.468	0.006
HH4 (large fanrer)	0.420	0.005
HH5 (non-ag. labour:poor)	0.110	0.001
HH6 (rural non-labour)	0.022	0.000
HH7 (non-ag. labour: rich)	-0.007	0.000
Urban HH8 (urbanlabour:lowinconne)	-0.107	-0.001
HH9 (urban non-labour)	0.078	0.001
HH10 (urban labour: high income)	-0.350	-0.004

Contd.....

SIMULATION	C	D1
SHOCKS Rice consumption subsidy rate increased from 20% to 50%	All households	hh1 only
Real Gross Income Changes (deflated by household specific CPI)		
Rural HH1 (rural landRess)	2.114	1.670
HH2 (smdl farmer)	5.288	0.001
HH3 (nrdium farmer)	6.024	0.000
HH4 (large farmer)	6.011	0.000
HH5 (non-ag. rural labour: poor)	2.057	0.004
HH6 (rural non-labour)	2.410	0.004
HH7 (non-ag. rural labour: rich)	5.342	-0.004
Urban HH8 (urbanlabour lowincome)	1.809	0.002
HH9 (urban non-labour)	1.941	0.004
HH10 (urban labour: high income)	3.770	-0.008
Real Consumption Expenditures		
Rural HH1 (rural landless)	1.059	1.639
HH2 (smdl farmer)	3.216	-0.020
HH3 (nzdium farmer)	3.512	-0.034
HH4 (large farmer)	3.872	-0.032
HH5 (non-ag. rural labour: poor)	0.235	-0.016
HH6 (rural non-labour)	-0.444	-0.026
HH7 (non-ag. rural labour: rich)	3.000	-0.039
Urban HH8 (urbanlabour:lowincome)	0.699	-0.011
HH9 (urban non-labour)	-0.654	-0.024
HH10 (urban labour high income)	1.819	-0.034

5. CONCLUSIONS

A consumption subsidy on rice has effects on different consumers that are not identical to those that would be predicted on the basis of the share of rice in the total expenditure of these households. Household incomes and household tax obligations are affected as well. Household incomes are affected by the factor market consequences of the subsidies. In so fare as domestic producer prices of rice are increased by the consumption subsidies, factors of production that are used intensively in rice production enjoy increased returns. Households who own these factors benefit. The way factor markets respond depends on labour market conditions as well as other factors and in the post-crisis environment the way these circumstances are modelled will affect the simulated results.

Finally, subsidies have to be paid for. The manner in which the government revenue cost of the subsidies is met will therefore influence the distributional consequences across households.

These issues illustrate the value of a general equilibrium treatment of the effects of interventions like a rice subsidy. The present paper is a preliminary attempt to draw out the general equilibrium mechanisms that are involved. Its overall results on the effects of a rice subsidy are provisional. Subsequent work will refine these analyses further.

6. REFERENCES

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