Analysis of Growth and Stabilisation Policies for the Indonesian Livestock Sector - A Linked Modelling Approach

Ray Trewin
Australian National University (ANU),
Canberra, Australia

Mark Rosegrant
International Food Policy Research Institute (IFPRI),
Washington, USA

Erwidodo
Center for Agro-Socioeconomic Research (CASER),
Bogor, Indonesia

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ABSTRACT

ANALYSIS OF GROWTH AND STABILISATION POLICIES FOR THE INDONESIAN LIVESTOCK SECTOR - A LINKED MODELLING APPROACH

Ray Trewin (ANU), Mark Rosegrant (IFPRI) and Erwidodo (CASER)

A key issue for Indonesian policy makers as the economy grows and internationalises is how to maintain agricultural productivity growth and reap the benefits of stable prices without the increasing costs of current policies The Indonesian livestock sector is becoming a focus of attention in this regard because of the marked changes taking place in incomes and consumption patterns, and the production links with the important grains sector. Indonesian livestock supply and demand responses are estimated for incorporation into an extension of an Indonesian food crop supply and demand model (FCSD) in order to evaluate various policies such as those that affect input and output prices. These estimates are also incorporated into a Computable General Equilibrium (CGE) model of the Indonesian economy with an emphasis on agriculture (INDOGEM) to enable complementary analysis of such policies, taking account of additional aspects such as budgetary constraints.

Key words: Indonesian livestock policy analysis, econometric and CGE modelling, elasticities

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1. Introduction

Three fundamental development goals have underpinned Indonesian policies, namely: growth, equity and stability[1]. Agriculture is an important sector of the Indonesian economy, from both a consumption and production perspective, and any inefficiencies, inequities or instabilities in prices can have a major impact on incomes, the macroeconomy and overall stability. World markets for agricultural commodities have been unstable, leading to developing countries like Indonesia intervening in the operations of commodity markets by controlling imports, stocks, input costs and output prices. The benefits of these and other interventions in terms of agricultural development and stable prices have been offset by their high costs. The benefits of free trade have been appreciated by many developing countries in other areas such as manufacturing goods where instability is not so much of an issue, with growth in these areas putting these developing countries amongst the most dynamic economies in the world. As the Indonesian economy has grown and become more open to the world, maintaining agricultural productivity growth and stable prices yet avoiding an explosion in the cost of policies has become a key issue.

The livestock sector is becoming a focus of attention for Indonesian policy makers. This is because of the marked increases taking place in incomes and changes in consumption patterns from a heavy reliance on cereals towards higher valued goods such as livestock products, as well as the growing production links with the important grains sector. Changes in the structure of food demand provide incentives for agricultural diversification from traditional production patterns to a more flexible mix, including higher valued crops and livestock. While structural changes in supply and demand provide incentives for diversification, Indonesian policy makers believe a strong effort is still necessary to maintain productivity growth for major cereals, particularly rice. The already high level of adoption of modern rice varieties and heavy use of fertilisers, together with the continued difficulty in making new breakthroughs in yield potentials for rice make sustained growth in productivity for rice more troublesome. The problem is compounded by the sharp decline in investment in irrigation in the 1980's and the increasing real costs of future expansion of irrigation. An overriding concern of agricultural policy makers in Indonesia is therefore to develop policies to maintain sustainable agricultural growth in rice and other staple crops, while at the same time encouraging diversification in response to the changing structure of agricultural production and demand, as well as deliver stable prices and contain the costs of the policies. The government should direct itself as much as possible towards a non-market distorting role in relation to stable prices, that is facilitating the market to work better at getting long-term prices right, say through the development of private risk markets such as futures markets.

An important gap in information on the Indonesian grain sector concerns the availability of supply and demand elasticity estimates for livestock and livestock products, including poultry, milk, beef and hogs.

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[1] Stability or stabilisation has been used in various senses, ranging from general political, structural and macroeconomic (eg fiscal) stability to the specific effects on the prices and incomes of consumers and producers. It is a little like the concept of sustainability in this regard, having a multitude of possible meanings that require clarification before any analysis can be made relevant. Some of the stability meanings (eg political stability) will lose their relevance in respect of the issue discussed in this paper as agriculture's importance in production, employment and consumption diminishes. One common aspect of all the meanings concerns the perceived need for trade restrictions and other policies to insulate domestic markets from instability in world markets. However, the significance of this aspect of the stabilisation issue will be dependent on world market developments. A larger and more stable world market, which should result from multilateral internationalisation as envisaged under GATT, would lessen the need to insulate domestic from world markets. Regardless of this, there will be a need for interim measures until international agreements are in place and the benefits of freer trade realised. Thus, the issue of stabilisation will be relevant for some time in countries like Indonesia. Traditional schemes, some aimed directly at price stabilisation such as variable tariffs and buffer stocks, as well as new schemes, such as the use of financial instruments (eg future markets) as a means of stabilising incomes, are possible interim measures requiring analysis. Many other policies affecting growth, including price and trade restriction policies, have been justified on the basis of stabilisation and will also require analysis. The analysis in this paper takes a broad meaning of stabilisation. It is not just concerned with price stabilisation issues and policies such as input and output pricing. It is also concerned with the broader effects, like the budgetary impacts, of policies justified on the basis of stabilisation.

Such estimates are an important component of both the FCSD econometric (Rosegrant et al 1987) and INDOGEM CGE (Trewin et al 1993) models to be used in the analysis of responses to changed policies. Models of livestock supply responses, employing time series of livestock data, should be used to estimate the supply elasticities. Ideally, the livestock and livestock products demand elasticities should be estimated from an integrated full matrix of demand elasticities, employing household survey data, and using accepted econometric models (for example, the Almost Ideal Demand Systems (AIDS) model by Deaton and Muellbauer 1980 or the Bouis demand for characteristics system by Bouis 1992). More often than not, these elasticities are estimated from only a subset of the full set of commodities.

Estimated Indonesian livestock supply and demand elasticities are incorporated into an extension of the Indonesian FCSD model. This model has been used in the past to evaluate various policies such as those that affect input and output prices, for example price and investment policies in the Indonesian food crops sector. FCSD is a multi-market food crop supply and demand model which permits assessment of future supply and demand balances, net farm revenues, food consumption expenditures and import costs under alternative government policies on relative food prices, input prices and government expenditures such as on irrigation investment.

The same supply and demand elasticity estimates are also incorporated into INDOGEM, a CGE model of the Indonesian economy with an emphasis on agriculture. This model is used in complementary analysis of relevant policies, taking account of additional aspects. The general equilibrium analysis takes into account resource reallocation effects, say the impact of cheaper resources released as a result of policy change, on activity in other industries and on overall incomes, demand, and so on. It is also particularly useful in capturing intersectoral linkages, say between the grains and livestock industries, as well as broader impacts such as government budget implications following any reforms. Thus the complementary analysis enables an assessment of the relative importance of 'second round' effects and broader impacts of changed policies when compared with the analysis undertaken with the FCSD model. General equilibrium analysis can also give a more realistic picture of the changes in industry structure and social welfare (such as relative changes in real incomes that take into account the fact that farmers, for example, are both consumers and producers) following any reforms.

The paper is structured as follows. The next section discusses some background on livestock issues and policies, especially those related to growth and stabilisation, and trends in the livestock sector. This is followed by a section setting out the livestock and livestock products supply and demand specifications, as well as available data, prior to the estimation of the required elasticities. The policy analysis is undertaken in two parts; one using the extended econometric FCSD model and the other using the INDOGEM CGE model. The separate policy analyses are brought together in a concluding section.

2. Background on the Indonesian livestock sector

Given the still large size of Indonesia's agricultural sector, especially in an employment sense, and its strong linkages with other rapidly growing sectors of the economy, overall development goals of growth, equity and stability are just as applicable to agriculture. Conversely, agricultural policies have a broad impact and analysis of them should consider macroeconomic aspects, such as the trade, overall inflationary and the budgetary impacts of the policies, as well as the usual microeconomic aspects. Self-sufficiency, and the underlying policies supporting it, have been justified on the basis of meeting the overall development goals, both at the micro and macroeconomic levels. Self-sufficiency has been most evident in rice but it is also evident, in intent at least, in a number of livestock policies. It is this last aspect that highlights difficulties with a broad self-sufficiency strategy given limited resources. Rice self-sufficiency has hindered the development of other sectors through attracting resources, raising input costs and restricting trade in competing products. The livestock sector given its strong reliance on feed grains is a prime example of these aspects. A broad self-sufficiency strategy in the sense of self-sufficiency in many individual commodities will be counterproductive, working against many of the development goals and raising costs. A broad self-sufficiency strategy in the sense of total calories produced would be a more

preferable alternative. The key issue is, what policies will keep agricultural output expanding without adverse effects on broader government objectives such as stabilisation and a balanced budget.

As stated above, agriculture is still an important sector of the Indonesian economy. Although halving over the last two decades, agriculture's share of GDP is still the largest of any sector at around 20 per cent. Agriculture is dominated by smallholder production and currently employs around 50 per cent of the workforce. It has strong linkages with some of the rapidly growing manufacturing sub-sectors that make intensive use of agricultural inputs and hence to the recent expansion in exports. About two thirds of consumer expenditures are allotted to food and a significant share of the government budget is dedicated to the agricultural sector in the form of infrastructure investment, subsidies and so on. It also receives substantial protection as a result of government policies, such as those supporting the government procurement agency (BULOG), that restrict trade in competing products like imported feed grains. Indonesian agriculture is characterised by extensive government controls, both indirect and otherwise.

Livestock is currently not a large component of Indonesian agriculture, making up about 10 per cent of agriculture in terms of contribution to GDP, but is growing more rapidly than the dominant foodcrops component (see Table 1). Most of the growth, especially for sectors requiring large investments in processing and marketing, is located on Java. Indonesia's livestock numbers have more than doubled over the last decade, with the more commercial poultry numbers leading the growth with a five fold increase to around 600 million head despite policies limiting the size of enterprises. Cattle numbers were around 10.4 and pigs around 3.5 million head in 1991. Growth rates for domestic production of meats have been predicted by various agencies to be somewhere between 4.1 and 5.4 per cent per annum into the next century. Livestock production like the majority of Indonesian agriculture is mainly undertaken by smallholders involved in a range of agricultural production, using basic technologies and with relatively low levels of productivity. It also faces a number of other constraints, some induced by policies, such as the high feed costs, and others related to a scarcity of cheap land and good quality forage, difficulties in disease control, and a lack of basic infrastructure, for example in slaughtering, processing and marketing meats. However, livestock production can still produce profits that rival those from even the most productive rice areas and holds the potential of forward linkages to further processing and high value exports.

Currently, livestock products are a small but growing and important source of Indonesian food consumption. Indonesia's per capita consumption of meat was 5.8 kg in 1991 compared to 33.8 kg in Malaysia. Growth rates in Indonesian meat consumption into the next century have been predicted by the World Bank to be about 5.8 per cent overall and 10 per cent for intensive poultry meats (World Bank 1992). Despite significant levels of assistance, domestic production has not been able to keep pace with the growth in demand and Indonesia has become a growing importer of some livestock products. The Directorate General of Livestock Services has predicted an excess demand for beef in Indonesia of around 65000 tonnes by the year 2000 (Penn 1993). Currently, early stage processed meats face tariffs of 20 to 30 per cent and more elaborately processed meats tariffs of up to 70 per cent. Most meat imports take place under licences allocated to state trading companies. The processing and marketing stages are generally highly concentrated and involve cooperatives representing the interests of farmers.

Food consumption patterns in Indonesia are changing rapidly in line with strong income growth. Consumption of higher valued products such as meats are diminishing the traditional dominance of cereal staples (see Table 2). This increased demand for higher value products can be met from increased imports or an expansion in domestic production of these products instead of traditional cereal staples. Such structural adjustment towards greater diversification in domestic production may lead to benefits in the form of higher farm incomes, increased employment, improved consumer welfare and a more favourable macroeconomic and trade situation. The real value of these outcomes will depend on the efficiency with which resources are used in particular activities. However, government intervention has distorted the way in which resources can be allocated to particular activities. Example interventions include policies related to the use of tariffs, subsidies (for example, on credit), taxes and stockholding that have altered domestic input and output prices relative to world prices.

Before discussing policies that impact on specific components of the livestock sector, there are a number of more general policies that can impact on the livestock sector. In relation to non-livestock policies, feed grains are in competition with rice production which enjoys a favoured policy position in respect of input subsidies (for example, on seeds, fertilisers and irrigation infrastructure), price support and extension services. In addition, most trade in feed stuffs is controlled by the government through BULOG, the food logistics agency. These non-livestock policies have a detrimental effect on the livestock sector. In relation to general livestock policies, the government may intervene directly in the market to stabilise general meat prices. Interregional trade of all livestock is also regulated through a quota system.

Turning to policies affecting components of the livestock sector, the dairy industry has a number of specific policies aimed at fostering the development of the local dairy industry, in particular an import ratio requirement in which the quantity of milk imported is conditional on the quantity of domestic milk locally absorbed at set prices. An import tariff of 5 per cent on dairy raw materials and 30 per cent on end products also apply. Moreover, there exists import licensing which allows only a few designated companies to import specific milk products. Other restrictions are applied to investment in milk processing, with all milk processing activities being closed to foreign investment and only a few opened to domestic and non-facility investment. Assistance is provided to dairy producers through a special credit program for small farmers to purchase imported cattle. (See Erwidodo and Trewin 1994 for more details on these specific dairy policies.) The recent GATT negotiations require the conversion of the protection offered by the import ratio into an equivalent amount of protection in the form of import tariffs. -•-

In relation to specific beef cattle policies, there is a special credit program for small farmers to purchase imported cattle, similar to that applying to dairy cattle. In recent years cattle imports have been subject to a 15 per cent tariff and various quarantine and health regulations. The tariff barriers increase as the degree of processing increases, with imports of fresh, chilled and frozen beef, pork, lamb and mutton being subject to tariffs of 20 to 30 per cent. More elaborately processed meats face tariffs of up to 70 per cent. Imports of meat must also be certified to have been slaughtered in a manner consistent with Muslim law. No quotas apply but most meat imports must be through licensed importers, generally state trading companies In addition, beef cattle expo :s are strictly prohibited.

Specific poultry policies include a number that are aimed at fostering small scale operations, including extension programs and restrictions on the size of flocks where any of the product is sold on the domestic market. There have also been restrictions on the importing of breeding stock. In addition, chicken meat may be exported only with a special permit or licence.

In relation to specific pig policies, these are in the main similar to those outlined for beef cattle, namely escalating import tariffs and a variety of non-tariff barriers. However, pork can be exported but only with a special permit or licence.

The key issue to be addressed in analytic terms is what would be the impact of various changes to the policies outlined above on agricultural production, employment, the supplies of inputs, consumption, trade and on the macroeconomy (for example, on inflation). The next section considers the quantitative specification of supply and demand relationships for livestock and livestock products that could be applied in various models to analyse such policies.

3. The specification of the supply and demand of livestock and livestock products

As a precursor to detailing the specification of the supply and demand of livestock and livestock products to be used in the analysis, it is useful to consider the general structure of the specification of supply and demand components already incorporated in the FCSD model. It is also useful in this regard to consider the specification of livestock and livestock products supply and demand used in other models.

Supply response parameters for the FCSD model were estimated for rice, corn, cassava, and soybean in Indonesia using panel data for eight regions over 1969-90. Estimation is undertaken in three blocks of equations. The first block of equations determines the quasi-fixed input; total investment in area planted to the four crops. The estimating equation is derived from the normalised quadratic value function, with changes in total area a function of prices and public investments in research, extension, and irrigation. The second block determines the allocation of total area to each of the four crops, conditioned on the level of investment in total cropped area. The model of area allocation is derived from a multinomial logistic function, which determines shares of total crop area allocated to each crop as a function of expected prices and level of investment in quasi-fixed inputs (total area). The third block determines yield responses and input demand, conditioned on the allocation of area and technique choice. The system for estimating yield response and input demand for each crop is a function of output and input prices, and public investment in research, extension, and irrigation (Rosegrant, Kasryno and Perez 1994). The output elasticities estimated from this supply response system which are incorporated in the FCSD model, are shown in Table 3.

On the demand side of the FCSD model, per capita demand for food crops can be estimated as a function of per capita consumption expenditures, the own-prices of crops, and the prices of complementary and substitute food commodities These could be estimated for different income classes and regions. Demand functions for crop use for feed could also be specified. Most Indonesian demand specifications are similar in the sense of being based on multiple stage budgeting processes as described in Deaton and Muellbauer (1980). Due to the similarity in theoretical specifications of the FCSD model to those specified in a large number of recent studies of food demand in Indonesia, own price, cross price and income elasticities have been synthesised from these studies rather than estimated independently. As with the supply side, the equations are calibrated to a base year. As an alternative to the Deaton and Muellbauer (1980) approach, a food demand system based on demand for energy, variety and taste characteristics, requiring the prior specification of few elasticities and avoiding any separability assumptions (Bouis 1990), was used to provide estimates. These are provided in Table 4. However, the main differences in the models appear in the supply specifications, a couple of specific examples of which are described next.

In the Bappenas Agricultural Sector Model (BASM) (Altemeier et al 1992), products from the livestock sector (commercial chicken meat and other meat products) are functions of revenues minus expenditures on inputs from other sectors, in particular the feed sector. Commercial chicken meat production is a function of input prices (feed prices, wages), output prices, and the total commercial chicken population. Total commercial chicken population is a function of the lagged population, and current and lagged (2 periods) additional investment. Other meat production is determined from lagged production with a growth rate applied.

Perez (1994) specified Philippine supply equations for hogs, chicken broilers and chicken layers (eggs) in conjunction with an input demand equation for feed consumption. These specifications were theoretically derived using Hotelling's Lemma applied to a specified normalised quadratic profit function. These could be written as linear functions of expected output and input prices, and the quantities of quasi-fixed inputs. Expected prices were assumed to be equal to last year's prices; that is the naive expectations assumption was applied. The quasi-fixed variables consisted of risk variables[2] and time trend.

In contrast to the Bappenas Model, livestock populations do not enter the specifications outlined in Perez (1994). This may be appropriate for intensive livestock production where often livestock is reared and slaughtered within the year but may be inappropriate for more long-lived livestock production such as from beef cattle. Beef cattle can be considered a capital good with an optimal age of consumption (Jarvis 1980), not unlike a growing tree[3]. Estimating standard supply specifications may capture what appears a perverse negative supply response to increasing prices but which is really a rational response of herd build up (delayed consumption) in light of an expected increase in future prices. However, regardless of their

[2] The square root of a weighted moving average of the proportional variability in actual from expected incomes, as reflected by last year's income, over the last 3 years with declining weights of 0.60, 0.25 and 0.15.
[3] See Dee 1991 for the introduction of such a specification for steady state forestry into a CGE model.

theoretical derivation the 'flows' and 'stocks' specifications can approximate each other through identity relationships between 'flows' and 'stocks', for example between past slaughterings, 'births' and livestock populations. Thus, it will often be an empirical question, especially given data limitations, as to which specification is preferred.

Data is a problem with any modelling of the Indonesian livestock sector. For example, the 161 Sector Indonesian Input-Output Table does not have beef cattle and hogs as separate sectors, necessitating the use of auxiliary information to split this composite sector in the table so that appropriately disaggregated analysis can be undertaken. Some information on the age structure of existing stock is available, even by sex, but generally not publicly at the regional level or in great detail. Other required data on production, yields, inputs, prices, consumption, trade and incomes is generally available. For example, regional populations and population growth rates are available from the Central Bureau of Statistics (BPS) and can be disaggregated into expenditure classes using information from the Social Accounting Matrix (SAM) or more directly from the SUSENAS consumption/expenditure survey. In general, data related to market transactions such as on flows and prices is more readily available and more reliable, suggesting specifications based on such data will be preferred.

Due to these data limitations, preliminary estimates for this paper have used standard Nerlovian supply response functions in order to capture the lags in adjustment of livestock responses to changes in prices (Simatupang 1994) Because of the preliminary nature of these estimates, synthetic livestock supply response elasticities based on the range of estimates described above (see Table 5) have been used in the analysis described in this paper

The estimated livestock supply and demand elasticity values compare to recent and comprehensive estimates produced for the Bappenas Agricultural Sector Model (Altemeier 1992). The BASM demand elasticity estimates were based mainly on 1987 SUSENAS data using the LA AIDS (Linear Approximation Almost Ideal Demand System) specification. The own price elasticities were -0.51 and -0.65 for beef and poultry respectively. The expenditure estimates were 0.79 for beef and 0.84 for poultry. These estimates were derived from those given in CARD (1990), namely own-price elasticities of -0.51, -0.58, -1.11 and -0.92 for beef (urban Java, rural Java, urban off-Java and rural off-Java), and -0.73, -0.79, -0.98 and -0.72 for poultry (urban Java, rural Java, urban off-Java and rural off-Java). Corresponding expenditure elasticity estimates were 0.96, 0.66, 0.58 and 0.74, and 0.89, 0.69, 0.77 and 0.68. The BASM supply elasticity estimate for commercial chicken meat production with respect to price was 0.54. Other approximate estimates are available from Anderson and Tyers (1992). They give relatively high estimates of -1.40 for elasticities of direct demand with respect to the price of ruminant and non-ruminant meats, and corresponding income elasticities of demand estimates of 1.0 and 1.1. Estimates of 0.90 and 0.35 for short-run elasticities of supply with respect to the price of ruminant and non-ruminant meats, and long-run estimates of 1.76 and 1.00 were also produced. Given the variation in available estimates, some sensitivity analysis of the impact of variations in the estimates should be undertaken.

As major policies have broad impacts, analysis of them should be comprehensive covering both the impacts at the micro and macro levels. This will require the use of both sectoral and macro level models. However, Indonesian sectoral and economy-wide models have not been linked to enable consistent analysis of the sectoral and economy-wide impact of pricing, stabilisation and investment policies. Parameter estimates obtained for use in the extended FCSD model could be incorporated into INDOGEM in conjunction with similar underlying theoretical specifications and compatible data to enable consistent policy analysis (See Trewin, Erwidodo and Rachmat 1994 for more discussion of the approach.)

INDOGEM does not take the above supply and demand parameters directly into its specification. On the demand side, it takes as parameters the household expenditure elasticities and the Frisch parameter from which can be determined the own and cross price elasticities in household consumption. Thus, for the above demand parameters to be taken into INDOGEM would require the application of the formula relating the Frisch parameter, household budget shares and the expenditure and the price elasticities (see Dee 1991 and NCDS 1990). On the supply side, it takes as parameters the elasticities of substitution

between various primary factors. These are determined from a formula relating them to output supply elasticities, shares of fixed factors in total factor costs and shares of primary factor inputs in total costs (see NCDS 1990)[4].

One potentially useful way of linking the two models is iteratively. Consider the case of the impacts to a price shock. Certain impacts could be estimated from both the sectoral and the CGE model. In addition, estimates from the CGE model of the 'second round' impacts on variables assumed exogenous in the sectoral model, such as incomes, could be fed back into the sectoral model and the impacts to the price shock re-estimated. That is, certain variables assumed exogenous in the FCSD model were 'endogenised' by incorporating the impacts of the shock on these variables as estimated from INDOGEM. This approach would take into account the 'second round' effects, generally important in CGE model but ignored in sectoral models, as well as provide the production detail generally only obtainable from a sectoral model. Traditionally a CGE model will not have very sophisticated production relationships, mainly using Cobb-Douglas or CES specifications, and try to introduce some sophistication through a nesting structure (see McDougall 1993). Introducing sophisticated production relationships would diminish some of the advantages of the CGE approach (eg ease of modification), possibly make estimation intractable or end up with an estimated specification that is only well behaved in certain neighbourhoods. The above iterative approach may be a relatively simple way of incorporating both the interconnections appropriately captured in CGE models and the production detail able to be specified in sectoral models.

4 Analysis of policies affecting livestock

The FCSD and INDOGEM models referred to above have been used in a number of policy analyses, including analysis of price and investment policies in the Indonesian food crops sector (for example, Rosegrant et al 1987). In the analyses, a baseline is compared to scenarios in which some policy reform has been introduced. Various assumptions are made in the analyses, for example in the case of the FCSD model assumptions are made concerning population growth rates, prices of inputs and outputs, wages, areas under intensification, and so on. Projected results, for example on areas, yields, production, consumption and trade, are then compared. A key comparison in relation to the issues being considered in this paper is that between a continuation of current policies that result in a wedge between domestic and international prices versus policies that equate these prices.

Various livestock and related industries have received high levels of protection in Indonesia from tariff and non-tariff (eg controls on feed grain imports) policies. The impact on production and so on of the removal of protection on livestock and grain industries can be simulated by shocking prices to the extent of the nominal rates of protection in the various industries. The nominal rate of protection is the ratio of the difference between the domestic price and border price of a commodity to its border price, expressed as a percentage. The values used in this study are given in Table 6.

As mentioned earlier, it is often assumed in analysis using the FCSD model that there are no second round effects between changes in outputs, incomes, prices and so on. For example, GDP and yields are assumed to be exogenous in the model. In contrast, CGE models take such broader interrelationships more into account. In the analysis using the FCSD model reported in this paper, the impact of all effects of the shock on changes in GDP and yield trends are introduced into the FCSD model simulations after being measured from INDOGEM simulations. In the case of changes in yield trends, this is measured in INDOGEM in terms of changes in specific domestic commodity output levels.

CGE model analysis

A number of authors (for example, Kanbur 1984 and Timmer 1991) pointed out that past analysis of the growth and price stabilisation issues (for example, Newbery and Stiglitz 1981) have been deficient

[4] The calculated value for beef livestock appeared too high on the basis of a priori information so the default value of 1 was applied.

because factors such as linkages to the macroeconomy and price expectations have not been given appropriate consideration. Timmer (1991) suggests general equilibrium analysis is required, incorporating dynamic investment functions embodying expectations that capture stability considerations.

There has been some computable general equilibrium analysis along the lines just suggested. For example, De Janvry and Sadoulet (1987) analysed agricultural price policies in various countries (but not Indonesia) using CGE models. Various price regimes, price incentives in the short and long run, investment priorities, and food subsidies with different targets and sources of finance were simulated. The outcomes were critically dependent on the wage determination mechanisms imposed. Behrman et al (1989) analysed the impact of commodity price instability on Indonesia using a CGE model with alternative specifications of foreign exchange and labour markets. However, this work was based on a 1980 SAM, parameter estimates did not make use of available time series of data and the model did not fully represent the costs of commodity instability (for example, adjustment costs and stabilising through stocks was ignored).

Similar analysis to that just described was undertaken with the INDOGEM CGE model recalibrated on the basis of the 1990-91 Indonesian Input-Output tables. The version of INDOGEM used in the analysis contains 22 sectors of which about half are agricultural. The sectors are rice, maize, soybeans, other food crops, estate crops, dairy livestock, beef cattle livestock, pigs, poultry, other livestock, fisheries, forestry, mining, dairy processing, food processing, slaughtering, processed meats, other agricultural processing, fertiliser, mineral processing, other manufacturing, and services.

The main aspects of the economic environment reflected in the closure of the model used in the analysis were as follows. Real wages of unskilled workers were assumed exogenous and employment levels endogenous. The reverse situation was assumed for professional workers, reflecting the relative scarcity of various workers. Industry rates of return on capital and capital stocks were allowed to adjust through investment and inter-industry capital flows, thus the model is a comparative static, long run one in nature. Land was assumed mobile between agriculture and forestry. Exports for the forestry were held exogenously fixed, reflecting the assumption that the log export ban remains in place. Exports for the agricultural sector have in past modelling been treated as exogenously fixed, reflecting an assumption that agricultural export prospects may be limited. However, such an assumption becomes questionable when undertaking analysis of liberalisation policies and has been relaxed. Various components making up the real public sector borrowing requirement, such as other government expenditures and revenues, were also held exogenously fixed reflecting budget constraints.

The results of the analyses were measured in terms of changes in GDP, overall prices, exports and imports, commodity and factor activity levels, income and consumption. In interpreting these results it should be remembered that INDOGEM is a comparative static model that provides a solution of the impact of an external shock at one point in future time, the underlying economic environment remaining unchanged. If the impact of a shock, such as a cut in tariffs, was required in conjunction with a changing economic environment, such as an underlying growth rate in total output and consumption, then a dynamic 'forecasting' version of the model would be required (see Adams et al 1993 on such a development in the case of the ORANI model). Thus in the following analysis it is assumed that in terms of changes in variables induced by some shock, it makes no significant difference whether the base year was 1990 or 2001, and whether the underlying growth was fixed at zero or otherwise. The forecasting aspect will be picked up by the integrated FCSD model.

A number of specific simulations were studied (see Table 7). The first of these analysed the impact of changes in the relative levels of protection (via across the board shocks to the exogenous tariff rates). CGE models can simulate changes in protection more directly and comprehensively than sectoral models through changes in tariff levels, government revenues and so on. The key responses in domestic output to a 100 per cent cut in tariffs across the board were a rise in forestry of 7.3 per cent, food processing of 3.7 per cent and other manufacturing of 8.4 per cent, and a fall in soybean of 2.8 per cent, beef cattle livestock of 1.1 per cent and slaughtering of 1.3 per cent. At the macro level, prices as measured by the GDP deflator dropped 1.5 per cent, aggregate imports and exports both increased by 12.9 and 18.6 per cent

respectively, government revenues dropped 1.8 and expenditures by 0.7 per cent, aggregate consumption increased by 4.2 per cent, agricultural workers employment increased by 3.4 per cent and that of production workers by 2.7 per cent, and real GDP increased 5.8 per cent. In general, these results are generated by the decrease in overall prices resulting from the cut in tariffs which stimulated increase in trade (exports more so than imports) and GDP growth. Some sectoral results will be affected by other specific sectoral aspects such as distortions (eg taxes) and rigidities (eg fixed factor intensity)

The above results were obtained using the new parameter settings for agricultural supply and demand elasticities. These new setting did result in some significantly different outcomes. For example under the old settings, in particular the assumption that all substitution elasticities between primary factors in each industry were unity, beef cattle livestock and slaughtering activity rose. The new settings result in beef cattle livestock activity having a relatively much higher supply responsiveness than other agricultural activity. This in conjunction with the strong linkages to slaughtering activity, which has a large nominal rate of protection and hence is very much adversely affected by the tariff cuts, causes the observed fall in beef cattle livestock and slaughtering activity under the new parameter settings.

The sensitivity of the results to other settings were also tested. The results did not appear sensitive to the settings of the Frisch parameter, the results for values of -2 and -4 being almost the same as those for the standard setting of -3. The results, however, were sensitive to the choice of closure, for example the choice of whether particular agricultural exports were fixed had a significant impact on the level of activity of that particular commodity, but little impact at the macro level.

The above simulations were undertaken assuming that world prices remain unchanged. Recent reforms in world agricultural trade are expected to lead to significant improvements in world prices for many agricultural products. Using some published estimates (for example, Brandao and Martin 1993) as a basis, the following price rises were derived - rice, maize, soybeans and food processing to rise by 5 per cent; other food crops and estate by 2 per cent; dairy and dairy processing by 10 per cent; beef, pork, other livestock, slaughtering and processed meats by 6 per cent, and poultry by 3 per cent. Such increases may make Indonesian agricultural industries more able to compete for resources with other Indonesian industries. To investigate this aspect, simulations were undertaken where it was assumed that international prices of agricultural products (as reflected in the price of agricultural imports) increased by the above amounts. Simulations comparing the situation of a reduction in agricultural tariffs of 10 per cent, with and without the price rises, are also reported in Table 7. The main macroeconomic results are an increase in real GDP and exports, and a decline in imports, as a result of the price rises. Domestic supplies of individual commodities change markedly in some cases, in particular soybean and dairy processing supplies increased markedly whilst beef, poultry, slaughtering and services decreased with the rise in prices. These results are driven by the combined effects of the shocks causing some imports to be relatively cheaper and changing the relative ability of industries to compete for resources.

The next simulation considered the impact of an exogenous change in output (represented in the INDOGEM simulations by an increase in neutral output-augmenting technical change) under flexible prices[5]. This simulation was similar to one undertaken by de Janvry and Sadoulet (1987). It is of particular interest to the situation where a reduction in tariffs leads to an improvement in the efficiency of a particular sector. It is also of some interest to the FCSD model results which are based on the assumption that there are underlying growth rates in yields regardless of any policy reforms. Simulations comparing the situation of a reduction in agricultural tariffs of 10 per cent with the price rises and export tax cuts, with and without the productivity gains in agriculture, are reported in Table 7. The main macroeconomic results are a significant increase in real GDP and imports, and a decline in exports, as a result of the productivity gains. Marked increases in household demand appear to be driving these outcomes. Domestic supplies of individual commodities change markedly in some cases, in particular all

[5] That is, relevant prices to households were made endogenous (flexible) in the closure, with the reverse applying for the corresponding consumption taxes.

agricultural commodity supplies increased significantly. The major exporting, mining related industries supplies fell.

Sectoral model analysis

The results from the baseline and trade liberalisation simulations using the extended FCSD model incorporating the livestock sector are given in Tables 8a and b . The baseline run of the FCSD model assumes that, even in the absence of trade reform, there is an underlying rate of growth in GDP, an underlying exogenous growth in productivity for livestock (due to unspecified technical change and investment), and an underlying growth in crops productivity due to assumed rates of growth in public investment in research, extension and irrigation[6]. Growth in livestock production yields are assumed to follow historical and projected trends in the sector. These are 4.5 per cent for poultry, 3 per cent for beef, 4.45 per cent for pork and 6.25 per cent for milk. Population growth is assumed to be 1.6 per cent and per capita income growth (ceteris paribus) assumed to be 4 4 per cent.

Trade liberalisation is modelled as if it takes effect in the year 2001. Price changes are equal to the removal of the protection described above and are assumed to take place within the year 2001. It is assumed general equilibrium shocks due to trade liberalisation (for example, additional GDP growth from the movement of resources between sectors) are additive to the underlying growth rates discussed above. The growth in domestic commodity output levels induced in each sector by the liberalisation obtained from INDOGEM are assumed to take place over the five year period from the year 2001 to 2005. This was introduced into the FCSD model analysis as changes to the yield trends (the percentages were 0.2 for rice, corn, and pork, -0.5 for soybeans; 0.3 for poultry; -0.2 for beef; and 0.5 for milk). Additional GDP growth as a consequence of liberalisation was also assumed to take place over the five year period and was introduced into the FCSD model analysis as an addition to growth in income per capita (0.7 per cent).

The baseline results show Indonesia near self-sufficiency (domestic production close to domestic consumption) in rice and corn (although imports in absolute terms would continue to increase over time); declining exports of cassava, and rapidly growing imports of beef, wheat and soybeans. Milk imports decline over time. Poultry and pork are slowly growing export commodities.

The most significant impacts of the liberalisation are solid to strong increases in the consumption of corn, soybean, poultry, beef, pork and milk. Generally, these consumption impacts are coupled with production declines (or very small gains in the case of pork and beef). Thus on the production side, the price declines following the removal of protection tend to dominate the shocks to yields and per capita growth, with resultant declines in production, especially where the shocks to yields are negative as in the case of soybeans (5.5 per cent decline). An interesting result is the slight increase in beef production. Declines in the price of feeds and competing enterprises (milk, poultry, pork) in conjunction with the underlying growth assumed for the economy offset the smaller direct price effects and slightly negative yield shock. The combined consumption and production effects lead to reductions in exports (or increases in imports) of the commodities just discussed, with particularly large increases in milk imports, the most highly protected commodity. Compared to the commodities just discussed, there is very little impact on the consumption of rice, wheat and cassava. Production of rice increases, since there is both the output impact and positive cross price effects from price declines in other crops. The result is a shift from a small import to export position for rice.

The extended FCSD model simulations were repeated in conjunction with the increases in world agricultural commodity prices mentioned earlier. The overall results were similar except net exports became more 'positive' (export orientated) apart from the poultry and wheat components, this outcome

[6] Consistency cannot be expected between outcomes for similar variables in both models. This is mainly due to the fact that the FCSD model is analysing the impact of liberalisation with underlying economic growth. INDOGEM, being a static CGE model, can only analyse growth as a shock that takes place in conjuction with liberalisation. A liberalisation shock on its own assumes that the 1990 underlying economic environment is maintained.

reflecting the relative increase in prices for competing enterprises. Rice and wheat even became small exporters in the baseline projections.

Overall, the results indicate that the Indonesian economy gains from liberalisation, real GDP growing substantially. Indonesian food consumers would be substantial net gainers from liberalisation. Farmers would lose very little in the aggregate (and very likely a net gain in producer surplus, since rice and cassava account for a large number of farmers and value added), with some winners (rice, cassava, and possibly beef and pork), and the main losers being those who have received the biggest subsidies and protection in the past, for example soybeans.

5 Conclusion

In this paper, growth and stabilisation policies for the Indonesian livestock sector have been analysed with linked sectoral and CGE models. Equity as well as the growth and stability impact of relevant policies have been analysed. Impacts at the industry and macroeconomic levels have both been considered.

An important gap in the ability to undertake analysis of livestock policies is the availability of supply and demand elasticity estimates for livestock and livestock products. Some preliminary estimates have been compiled in this paper and modelling making use of these estimates suggests that in general the estimates are reasonable. Conversion of traditional elasticity estimates into a form suitable as input to the CGE model did produce some extreme values and surprising results from the CGE analysis so further work on the estimates would appear warranted.

Growth and stabilisation policies were firstly analysed using INDOGEM, a CGE model with an emphasis on agriculture. Key outcomes of a simulation of the full removal of protection were significant increases in real GDP, aggregate consumption, agricultural and production workers employment, and trade, in conjunction with falls in overall prices. There were increases in some downstream agricultural enterprises such as food processing but some heavily protected agricultural sectors such as soybeans declined. The changes are towards a more diversified and efficient agricultural sector which would be able to address the issue of instability more effectively. The sensitivity of the results to the choice of parameter values and closures were tested and some individual commodity results were found sensitive to these choices. Appropriate validation of the estimates in conjunction with a clear understanding of the effect of the choice of closure should underlie such analysis. The above simulation was repeated in association with an increase in world agricultural prices, a cut in export taxes and productivity growth. The increase in world prices lead to an increase in real GDP and exports, and a decline in imports. Domestic supplies of individual commodities changed quite markedly in response to the changes in relative prices altering the competitiveness, both internal and external, of the various commodities. The lowering of export taxes had expected effects, raising exports and lowering imports, as well as increasing real GDP. Likewise the introduction of technical growth in agriculture had expected effects with a significant increase in real GDP. Imports increased and exports declined, driven by an increase in household demand as a result of the higher incomes. Domestic supplies of all agricultural commodities increased but those of major exporting, non-agricultural industries competing for resources fell.

The same policies as just discussed were also analysed using an extension of the FCSD model that incorporated the Indonesian livestock sector as well as the crop sector. Basically the same elasticity estimates as were used in the INDOGEM model simulations were used in the FCSD model analysis except the substitution elasticity for beef cattle estimated from the corresponding supply elasticity was lowered for use in INDOGEM. However, the FCSD model analysis assumed an underlying growth in GDP and productivity regardless of any liberalisation preventing comparisions with the CGE model results which assumed a static underlying economic environment in its simulations. Other factors also negated strict comparability of the results. For example, the CGE model gives greater emphasis to the interrelationships between sector resources, the macroeconomy and so on, whilst the sectoral model has a more sophisticated specification of production. Thus, whilst some specific results may turn out to be comparable, such as the decline in soybean and the increase in rice production, as well as the general increase in commodity

imports especially those of milk, many specific results will not be comparable. Still the models can and should be linked, for example through the use of the same elasticity estimates, and used in such a way that they complement each other. One linkage approach is to incorporate into the FCSD model the INDOGEM estimates of the impact of the shock on key variables assumed exogenous in the FCSD model. That is, 'endogenise' key variables such as GDP that are assumed exogenous in the FCSD model. These measured GE effects could be important, for example the 'price' effects of a tariff shock may suggest the production of a commodity will decline but these effects will be counteracted by the GE 'income' effect that results from the more efficient allocation of resources. So the linkage with the CGE model though 'endogenising the exogenous' will lead to an improvement in the realism of the detailed sectoral forecasts provided by the extended FCSD model. Regardless of the lack of directly comparable specific results the general conclusions from both analyses are the same - the removal of tariff protection leads to gains, especially to consumers, with the main losers being those producers currently enjoying high levels of protection. The next step in the development of the integrated models should be to incorporate as much as possible of the dynamic and production detail of the extended FCSD model into a dynamic version of INDOGEM that would be capable of taking into account the impact, say of expectations on investment, and able to produce dynamic forecasts of the impact of various shocks

A number of very general policy recommendations could be made on the basis of the above analysis. Tariff cuts, even unilateral ones, would lead to an improvement in economic welfare in Indonesia. However, there would be some losers from such cuts, especially producers in some currently highly protected sectors The losses these producers would experience would be lessened by an increase in world prices that would result from multilateral reductions in protection to these industries. The losses would be lessened even further by efficiency improvements in these industries, an aspect that could result from increased research and development, and greater international competition, especially in the case of highly concentrated downstream processing industries (see Erwidodo and Trewin 1994 for more specific policy details in the case of the Indonesian dairy industry). Further analysis of other relevant policies such as the use of subsidies and investment in infrastructure would be necessary before more detailed policy recommendations could be made on the issues covered in this paper.

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Table 1: Gross domestic product of Indonesia at constant 1983 price, 1983-1989 (Rp. billion)

Industrial origin	1983	1985	1990	1992
Agriculture	17696	19209	22357	24139
	(22.8)	(22.6)	(19.4)	(18.4)
Farm food crops	11030	12064	13558	14558
	(14.2)	(14.2)	(11.8)	(11.1)
Farm non-food crops	2330	2330	2980	3244
	(3.0)	(3.1)	(2.6)	(2.5)
Estate crops	338	595	743	814
	(0.5)	(0.7)	(0.6)	(0.6)
Livestock	1787	2124	2328	2650
	(2.3)	(2.5)	(2.0)	(2.0)
Forestry	1010	850	1003	980
	(1.3)	(1.0)	(0.9)	(0.7)
Fishery	1243	1359	1745	1892
	(1.6)	(1.6)	(1.5)	(1.4)
Mining and Quarrying	16107	15480	17489	18993
	(20.7)	(18.2)	(15.2)	(14. 5)
Manufacturing Industry	9896	13431	22277	26856
	(12.7)	(15.8)	(19.3)	(30.5)
Electricity, gas & water	314	316	726	928
	(0.4)	(0.4)	(0.6)	(0.7)
Construction	4597	4508	6673	8171
	(5.9)	(5.3)	(5.8)	(6.2)
Transport & communication	4098	4487	6368	7595
	(5.4)	(5.3)	(5.5)	(5.8)
Trade	12009	12363	18567	21103
	(16.3)	(14.6)	(16.1)	(16.2)
Gross Domestic Product	77676	84959	115110	131102
	(100)	(100)	(100)	(100)

Source: CBS, Indonesia

Table 2: Household's Expenditure Shares on Food in Indonesia (%)

Expenditure on	1980	1981	1984	1987	1990	1993
Cereals	34.48	33.89	30.58	28.57	29.89	24.3
Tubers	2.46	1.63	1.99	1.86	1.66	1.49
Fish	9.20	10.82	8.96	8.76	9.38	9.15
Meat	4.86	3.97	4.23	4.67	4.84	5.22
Eggs and milk	3.56	2.58	3.65	4.41	4.56	5.10
Vegetables	7.72	9.49	9.04	8.83	8.86	8.73
Nuts	4.07	3.72	3.58	3.95	4.06	3.93
Fruits	4.46	3.56	4.28	5.25	5.50	4.81
Other food	14.13	16.43	15.54	14.85	14.88	14.87
Processed food and beverages	6.61	5.53	9.79	10.59	8.40	13.51
Liquors	0.21	0.10	0.29	0.18	0.20	0.19
Tobacco and cigarettes	8.24	8.29	8.07	8.09	7.77	8.70

Source: SUSENAS

Table 3: Output elasticities for rice, corn, cassava and soybean, Indonesia

	Expected Crop Price					Fertilizer Price	Wage	Land Price	Price, Other Inputs	Research Stock	Irrigation Stock	Extension Stock
	Rice	Corn	Cassava	Soybean	Other Crops							
Short Run												
Rice	0.26	-0.01	-0.02	-0.01	-0.05	-0.02	-0.04	-0. 04	-0.07	0.22	0.18	0.11
Corn	-0.05	0.30	-0.01	-0.01	-0.09	-0.02	-0.08	-0.07	-0.03	0.64	0.07	0.04
Cassava	0.25	-0.10	0.11	-0.03	-0.11	0.00	-0.04	-0.08	0.00	0.31	0.08	0.01
Soybean	-0.44	-0.04	0.31	0.40	-0.15	0.01	-0.03	-0.12	0.06	0.45	-0.03	0.01
Long Run												
Rice	0.20	-0.01	-0.01	-0.01	-0.98	-0.02	-0.03	-0.06	-0.07	0.28	0.22	0.11
Corn	-0.01	0.31	0.00	0.00	-0.14	-0.01	-0.08	-0.11	0.04	0.65	0.11	0.04
Cassava	0.31	-0.09	0.12	-0.02	-0.17	0.01	-0.03	-0.13	0.00	0.33	0.12	0.01
Soybean	-0.37	-0.02	0.33	0.41	-0.24	0.01	-0.01	-0.18	0.07	0.47	0.01	0.01

Source: Rosegrant, Kasryno, and Perez (1994)

Table 4: Demand elasticities with respect to commodity prices and income

	Own and cross price elasticities									Income elasticities
	Rice	Corn	Cassava	Soybean	Poultry	Beef	Pork	Milk	Wheat	
Outputs										
Rice	-0.24	0.00	0.01	0.02	0.01	0.01	0.01	0.01	0.00	0.10
Corn	0.74	-0.92	0.00	0.03	0.01	0.01	0.01	0.01	0.00	0.04
Cassava	0.38	0.00	-0.71	0.06	0.02	0.02	0.01	0.02	0.00	0.02
Soybean	-0.05	0.00	0.00	-1.01	0.00	0.00	0.00	0.00	0.00	0.37
Poultry	-0.01	0.00	0.00	0.02	-1.05	0.00	0.00	0.00	0.00	0.56
Beef	-0.08	0.00	0.00	-0.01	0.00	-1.02	0.00	0.00	0.00	0.67
Pork	-0.06	0.00	0.00	0.00	0.00	0.00	-1.03	0.00	0.00	0.64
Milk	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	-1.03	0.00	0.59
Wheat	0.50	0.00	0.00	0.01	0.01	0.00	0.00	0.00	-0.96	0.24

Table 5: Long run output elasticities for livestock, Indonesia.

	With respect to the Price of						
	Poultry	Beef	Pork	Milk	Rice	Corn	Soybean
Output of Poultry	1.25	-0.05	-0.10	-0.05	-0.20	-0.55	-0.25
Beef	-0.05	0.68	-0.05	-0.15	-0.20	-0.20	-0.03
Pork	-0.10	-0.05	1.24	-0.05	-0.60	-0.30	-0.14
Milk	-0.05	-0.15	-0.05	0.55	-0.15	-0.12	-0.03

Table 6: Weighted average of NRP in Indonesia

INDOGEM Sectors	NRP
Rice	0
Maize	10
Soybean	10
Other food crop	19
Estate crop	3
Dairy	30
Beef	7
Pork	7
Poultry	17
Other livestock	0
Fishery	12
Forestry	0
Mining	1
Dairy processing	22
Food processing	11
Slaughtered meat	26
Processed meat	1
Other agric. processing	14
Fertilizer	4
Mineral processing	1
Other manufacturing	17
Services	0

Table 7: Elasticities of economic variables with respect to some simulations

	100% across the board (new settings)	100% across the board (old settings)	10% reductions in agricultural tariffs	10% reductions in agricultrual tariffs + price rises	10% reductions in agricultural tariffs, price rises + export tax cuts	10% reduction in agricultural tariffs, price rises, export tax cuts + 10% gains in agricultural efficiency
Macro-economic variables						
Rent GDP	5.8	5.7	-0.0	0.1	0.2	3.9
GDP deflator	-1.5	-1.2	0.0	-0.1	-0.1	1.7(CPI-0.0)
Aggregate imports	12.9	14.3	0.2	-0.3	-0.4	16.0
Aggregate exports	18.6	14.3	-0.2	1.0	1.4	-28.2
Tot.nom.govt.revenue	-1.8	-1.2	-0.2	1.0	1.4	-28.2
Tot.nom.govt.expenditure	-0.7	0.1	0.0	-0.1	-0.2	6.0
Agricultural workers	3.4	6.0	0.0	0.0	0.2	7.4
Production workers	2.7	4.4	0.1	0.1	-0.5	20.4
Aggregate consumption	4.2	6.0	0.1	0.1	-0.3	19.7

	100% across the board (new settings)	100% across the board (old settings)	10% reductions in agricultrual tariffs	10% reductions in agricultural tariffs + price rises	10% reductions in agricultural tariffs, price rises + export tax cuts	10% reduction in agricultural tariffs, price rises, export tax cuts + 10% gains in agricultural efficiency
Domestic Commodity Supply						
Rice	0.9	2.7	0.0	-0.1	-0.2	1.0
Maize	0.9	2.3	0.0	-0.0	0.1	15.6
Soybean	-2.8	-1.8	-0.3	1.4	1.3	25.6
Other Food	0.1	1.9	-0.0	-0.2	-0.2	11.7
Estate	3.4	3.9	-0.0	0.1	1.1	37.9
Dairy	2.4	3.2	-0.0	0.1	0.1	11.5
Beef	-1.1	0.9	0.1	-0.3	-0.4	21.2
Pork	0.9	2.6	0.0	-0.1	0.1	2.6
Poultry	1.7	3.1	0.1	-0.3	0.6	16.6
Other livestock	2.8	3.7	0.0	-0.1	0.7	10.8
Fishery	2.4	3.0	0.1	-0.2	-0.3	13.1
Forestry	7.2	7.3	0.0	0.0	-0.0	2.8
Mining	0.5	0.3	-0.0	0.0	0.1	-1.7
Dairy processing	2.1	2.5	-0.2	0 9	0.8	22.8
Food processing	3.7	4.2	0.2	0.1	0.0	32.1
Slaughtering	-1.3	0.8	0.1	-0.3	-0.5	32.2
Processed meat	2.1	3.5	0.1	0.0	-0.1	21.1
Other agric. processing	2.6	2.6	0.0	-0.2	-0.2	49.3
Fertilizer	3.1	3.9	-0.0	0.1	0.2	-5.0
Mineral processing	3.2	3.3	-0.0	0.0	0.1	-0.1
Other manufacturing	8.4	8.2	-0.0	0.0	-0.0	2.7
Services	1.1	3.1	0.1	00.4	-0.5	19.0

Table 8a Projected Indonesian crop - livestock demand and supply (thousand mt) - baseline

	Production	Food Demand	Feed Demand	Total Demand	Net Exports
Rice					
2001	38841	39038		39038	-198
2002	39626	39835		39835	-209
2003	40428	40647		40647	-220
2004	41245	41477		41477	-231
2005	42080	42323		42323	-243
Corn					
2001	8539	3872	4656	8528	12
2002	8804	3940	4880	8820	-16
2003	9077	4010	5115	9125	-48
2004	9358	4082	5362	9444	-85
2005	9648	4154	5622	9776	-128
Cassava					
2001	16001	674	11587	12261	3740
2002	16342	686	12144	12830	3513
2003	16691	697	12729	13426	3264
2004	17046	709	13344	14053	2993
2005	17409	721	13990	14712	2698
Soybean					
2001	1284	1631	1297	2928	-1139
2002	1531	1584	1359	3043	-1212
2003	1874	1738	1425	3163	-1289
2004	1917	1794	1494	3288	-1371
2005	1962	1852	1566	3418	-1456
Peanuts					
2001	826	788		788	37
2002	863	820		820	42
2003	902	854		854	48
2004	942	889		889	54
2005	984	925		925	60
Beef					
2001	455	429		429	25
2002	470	449		449	20
2003	581	460		460	89
2004	592	491		491	99
2005	604	513		513	109
Pork					
2001	199	184		184	15
2002	208	192		192	16
2003	217	200		200	17
2004	227	209		209	18
2005	237	219		219	18
Milk					
2001	677	845		845	-172
2002	715	880		880	-165
2003	760	917		917	-157
2004	808	956		956	-148
2005	858	996		996	-138
Wheat					
2001		2487		2487	-2487
2002		2553		2553	-2553
2003		2621		2621	-2621
2004		2690		2690	-2690
2005		2762		2762	-2762

Table 8b: Projected Indonesian crop-livestock demand and supply (thousand mt) - liberalisation

	Production	Food Demand	Feed Demand	Total Demand	Net Exports
Rice					
2001	38989	38755		38755	234
2002	39852	39572		39572	279
2003	40733	40407		40407	327
2004	41635	41259		41259	376
2005	42556	42129		42129	427
Corn					
2001	8365	4132	4650	8781	-416
2002	8639	4206	4883	9089	-450
2003	8922	4282	5129	9411	-489
2004	9215	4359	5388	9748	-533
2005	9517	4438	5662	10099	-582
Cassava					
2001	16174	663	11058	11721	4452
2002	16518	674	11613	12288	4231
2003	16870	686	12198	12884	3986
2004	17230	697	12815	13512	3718
2005	17597	709	13465	14174	3423
Soybean					
2001	1727	1751	1295	3047	-1320
2002	1758	1812	1360	3173	-1415
2003	1789	1875	1429	3304	-1515
2004	1821	1941	1501	3442	-1621
2005	1854	2008	1577	3586	-1732
Poultry					
2001	803	881		881	-77
2002	842	920		920	-78
2003	883	961		961	-78
2004	925	1004		1004	-78
2005	970	1048		1048	-79
Beef					
2001	373	450		450	-77
2002	384	473		473	-89
2003	394	497		497	-102
2004	405	522		522	-116
2005	416	548		548	-131
Pork					
2001	204	193		193	11
2002	213	202		202	11
2003	223	212		212	11
2004	233	222		222	11
2005	244	233		233	11
Milk					
2001	643	1014		1014	-371
2002	686	1061		1061	-375
2003	732	1110		1110	-378
2004	781	1161		1161	-380
2005	833	1214		1214	-391
Wheat					
2001		2484		2484	-2484
2002		2555		2555	-2555
2003		2627		2627	-2627
2004		2701		2701	-2701
2005		2777		2777	-2777