Reducing Indonesia's Deforestation-based Greenhouse Gas Emissions

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Abstract

Indonesia has set a target of reducing emissions of greenhouse gases by 26% by the year 2020. This paper analyzes the effectiveness of three alternative policies as means of achieving this goal: (i) a subsidy to the use of land in forestry; (ii) a sales tax on palm oil; and (iii) a reduction in the levy on timber production used to finance the existing Reforestation Fund. The analysis uses a general equilibrium model of the Indonesian economy characterized by explicit treatment of land use, disaggregated by industry and by region. The results of the analysis indicate that the subsidy cost of permanently reducing carbon emissions by 26% is a little over US$1 per metric tonne of carbon emissions abated. This cost needs to be compared with that of alternative instruments and with the price of carbon that might be agreed under the proposed international REDD (Reducing Emissions through Deforestation and Land Degradation) scheme to be administered globally through the World Bank and the United Nations.

1. Introduction

In (2009) the President of Indonesia announced to the G-20 international leaders summit in Pittsburgh that Indonesia had an ambitious goal for reducing its emissions of greenhouse gases (GHGs). By 2020 the carbon dioxide equivalent of these emissions would be reduced by 26 per cent relative to what would otherwise have happened under business-as-usual (BAU) conditions. Further, with appropriate international assistance these emissions would be reduced by an additional 15 per cent, leading to a total reduction of 41 per cent, relative to business-as-usual.[1] Finding the means by which these impressive goals can be achieved in practice is a challenging task for policy analysts and is the subject of this paper.

A major source of Indonesia's total emissions of GHGs is the carbon dioxide released into the atmosphere when forests are converted to agricultural land. This conversion of land use is occurring rapidly and the term 'business-as-usual' implies its continuation. Indonesian sources have estimated the current rate of conversion of forest to agricultural land at 1.32 million hectares per year.[2] Slowing the rate at which land under forest is converted to agricultural land is central to achieving the President's announced targets. Indeed, it is a necessary condition because available data suggests that land use change accounts for 80 per cent of Indonesia's total emissions.

Table 1 indicates that Indonesia's total emissions of GHG account for 5.9 per cent of global emissions. At a global level, emissions from land use change and forestry account for 16.3

[1] The President's speech was delivered on 25 September 2009. A transcript of the speech is available at: http://redd-indonesia.org/publikasi/detail/read/indonesia-presidents-speech-on-climate-change-at-2009-g-20-meeting-1/ [accessed 8 August 2010]

[2] Presentation by Ruandha Agung Sugardiman, Ministry of Forestry, Government of Indonesia, 'Defining the National Reference Emission Level - Forestry Sector' at the Monitoring, Reporting, and Verification meeting

per cent of total emissions, but at 1,459 million metric tonnes per year, Indonesia's estimated emissions from land use change account for 80.4 per cent of its total emissions of 1,815 million metric tones and 27.1 per cent of global emissions from land use change. Indonesia's emissions from land use alone thus change account for 4.7 per cent of global emissions from all sources. Its importance in this respect is exceeded only by Brazil, which accounts for 6.6 per cent of total emissions from all sources and 34 per cent of total emissions from land use change alone. Brazil's emissions from land use change represent 84 per cent of its total emissions.

[Table 1 about here]

A mechanism has been proposed by which the international community might assist nations like Indonesia to reduce the very large effect that changes in land use have on emissions of GHGs. The scheme is called REDD (Reducing Emissions from Deforestation and Forest Degradation).[3] Under this scheme, which would be administered globally by the World Bank in collaboration with the United Nations, countries will be compensated for slowing the rate at which forests are cleared. Although the details of this proposed scheme remain tantalizingly unclear, the question arises of how Indonesia might respond to its existence. Central to this is how the existence of payments to the Indonesian central government could be translated into changes in incentives at the local level and thereby influence the actual rate of land conversion. Even if the REDD scheme, or a scheme like it, does not eventuate, finding a mechanism by which Indonesia's central government can reduce the rate of land conversion at the local level is essential if the President's goal of a 26 per cent reduction in GHGs is to be attained.

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of UNREDD countries in Mexico, June 2010. It is possible that the 1.32 million hectares refers only to legally sanctioned land conversions and that it may thereby understate the total rate of conversion.

[3] The website noted above contains a great deal of useful information on REDD and its relevance for Indonesia.

The REDD scheme, assuming it becomes a reality, will provide revenues to Indonesia at the central government level in return for reducing the country's estimated emissions. In the case of land use change, the REDD authority concerned will determine these payments through data on vegetation cover, obtained through satellite imagery. The policy question for Indonesia is how the internal policy environment should respond to the existence of such a scheme. In particular, how might the incentives provided to Indonesia through REDD be used to influence decisions on land use at the local level?

This study explores three possible instruments though which emissions through land use change might be reduced sufficiently to comply with the President's targets. Because the Indonesian Ministry of Finance has been assigned the primary responsibility for achieving the targets, we focus here on fiscal instruments. The three mechanisms are each in two parts: (a) a prohibition on conversion of protected native forests to other uses; and (b) an additional change in a tax or subsidy instrument. Under (b), three tax or subsidy instruments are analyzed: (i) a subsidy to the use of land in forestry; (ii) an increase in the sales tax on raw palm oil; and (iii) a reduction in the levy on timber production used to finance the existing Reforestation Fund.

Any one or a combination of the three policy instruments could prove to be attractive to policy makers. Policy (i) is analyzed in greatest detail in this report. The meaning of the subsidy on land use in forestry is that it is a payment for the retention of commercial forest land in that form of usage rather than conversion to agricultural use. It is assumed here that the payment of this proposed subsidy would be based upon satellite imagery, in parallel with the operation of the REDD scheme itself.

The focus of this paper is on the use of fiscal instruments to influence the most important source of emissions in Indonesia – the conversion of forest land, especially commercial forest, to agricultural uses. These agricultural uses vary across the country, but the best known is the production of estate crops, most notably palm oil. Section 2 of the paper discusses, at a theoretical level, the impact that tax or subsidy policy instruments designed to influence land use might have on the target of emissions reduction. Section 3 makes the case for using a general equilibrium treatment of these issues in empirical application and then summarizes the general equilibrium model of the Indonesian economy that is to be used for this purpose. Section 4 describes the simulations that are performed with this model. The simulated effects of using a subsidy for land use in forestry for this purpose are discussed in Section 5 and the effects of the palm oil sales tax and amended financing of the Reforestation Fund are discussed in Section 6. Section 7 concludes.

2. Land use change and GHG emissions

Data on the importance of the major categories of land use are provided in Table 2. The first column of data shows official Indonesian records of land use in the year 2003, derived from the Indonesian Ministry of Forestry. According to these data, non-cultivated natural forest occupies 49.4 million hectares and production forest occupies an additional 83.7 million hectares. Not all of this land officially classified as production forest is legally available for conversion to agricultural use. The legally convertible portion is only 22 million hectares. The remaining 61.7 million hectares is not legally available for conversion. Assuming that the current conversion of 1.32 million hectares per year cited above occurs only in the legally convertible forest land, this legally convertible portion would be exhausted after 17 years from 2003, which coincides with the year 2020.

Satellite-based data on actual vegetation cover gives a bleaker picture of Indonesia's actual forest cover. These data are summarized in the second column of Table 2. They show non-cultivated natural forest occupying 33.7 million hectares and production forest an additional 50.1 million hectares. Rather than a total of 133 million hectares under forest cover in 2003 (non-cultivated natural forest plus production forest), as indicated by the official data, the satellite data suggests a total of 83.8 million hectares. The difference of 50 million hectares lies almost entirely in the category of 'other land', which consists mainly of partially degraded land. Official data classifies this land as forested, whereas satellite imagery reveals it to be only partially covered by forest. These satellite-derived data are used as the basis for the analysis of this paper.

[Table 2 about here]

Figure 1 illustrates in stylised form the effect of the policy mix to be analysed in this study: a prohibition on conversion of protected natural forest land to other uses combined with a fiscal instrument designed to encourage the retention of land in production forest and discourage its conversion to crop land.

Line A shows a hypothetical time path of total Indonesian emissions of CO_2 arising from changes in land use under business-as-usual (BAU) conditions. These emissions should be regarded as additions to the global stock of atmospheric CO_2. They arise because as land is moved from forestry to agricultural uses, total emissions rise. The slope of line A is the annual addition to the global stock of CO_2 arising from changes in land use within Indonesia. This slope depends on the rate at which land is reallocated each year from forestry

to agricultural use under BAU conditions and the change in emissions that occurs when one hectare of land is reallocated in this way.

Suppose this annual rate of BAU emissions from land use change (the slope of path A) is a. Now suppose that at time T_0 the Indonesian government introduces a policy measure that reduces the rate at which land is moved from commercial forestry to agricultural production, thereby reducing the annual volume of emissions arising from land use change. If the policy remains in place permanently, the time path of emissions from land use change becomes line B. Let the proportional reduction in annual emissions resulting from this policy measure be λ, implying that the slope of line B is $a(1-\lambda)$.

Finally, suppose that the emissions reduction policy is discontinued after t years, at time $T_0 + t$, and is not reinstated thereafter. After this, the annual path of emissions diverges from path B and reverts to the same slope as path A. This path is shown by line C. It is parallel to path A beyond time $T_0 + t$, meaning that beyond this time paths A and C differ only by their vertical value. The existence of the emissions reduction policy meant that total emissions over the period T_0 to $T_0 + t$ was $ta(1-\lambda)$ whereas if BAU had prevailed over this same period emissions would have been ta, a difference of $ta\lambda$. This vertical difference between paths A and C persists permanently, meaning that the existence of the emissions reduction policy for t years produced a permanent reduction in Indonesia's total emissions of $ta\lambda$ tonnes. If the annual subsidy cost over this period was S the total cost was tS and the subsidy cost per tonne of CO_2 sequestered permanently was $S/a\lambda$.[4]

[4] An important assumption of this discussion is that the BAU rate of conversion of forest land to agricultural land continues to remain feasible within the period of the analysis. If forest land becomes exhausted within the period of the analysis path A becomes horizontal. The policy of subsidizing forest land will delay the time at which this exhaustion occurs but will not permanently prevent it because path B will eventually intersect the horizontal portion of path A.

[Figure 1 about here]

3. The INDONESIA E3-L Model

3.1 Overview: the value of a general equilibrium treatment

The effect that tax or subsidy interventions may have on land use and therefore on carbon emissions is not a simple matter and involves the way that enterprises respond to changes in their incentive structure. These responses may be far from uniform across the country, because different regions face very different agro-ecological conditions. The responses of firms affect factor returns, including returns to land, capital and labour. If subsidies are involved, and Indonesian taxpayers are required to finance these subsidies, a complete analysis needs to take account of the economic effects of raising these funds through increased taxes. Policy analysts are also interested in the broader economic effects of such interventions. For example, how are imports and exports affected? What is the impact on other economic objectives of the government, such as the desire for food security? Is achievement of the President's goals regarding carbon emissions consistent with the maintenance of food security?

An analysis is needed which takes account of these issues within a theoretically coherent and data-consistent framework. The economic consequences of large interventions of the kind discussed above are inherently general equilibrium matters. In this section we describe a general equilibrium model of the Indonesian economy, named INDONESIA E3-L (Economy-Equity-Environment-Land), designed specifically for the analysis of these phenomena, with a strong emphasis on land use and its economic determinants at a national

and regional level, along with the implications of land use for greenhouse gas emissions. [5] Most structural features of INDONESIA E3-L are standard for general equilibrium models of this type. Its distinctive features are its regionally disaggregated treatment of land use and its detailed focus on land use, designed to facilitate analysis of the way tax, subsidy and other shocks affect decisions on land use, along with the implications of these decisions for carbon emissions and other economic variables of interest.

The advantage of working with a general equilibrium model is that it becomes possible to conduct controlled experiments, which focus on the consequences for land use and emissions that arise from different economic shocks, taken one at a time. It is also possible to consider the effect of alternative assumptions about economic parameters about which there is some uncertainty. It is thereby possible to analyse the extent to which the results of the simulated results are affected by variations in the assumed numerical values of these parameters.

As well as disaggregating land use by region, INDONESIA E3-L also has a disaggregated industry and commodity structure, with 43 industries and 43 corresponding commodities. The microeconomic behaviour assumed within it is competitive profit maximization on the part of all firms and competitive utility maximization on the part of consumers. In the simulations reported in this paper, the markets for final outputs, intermediate goods and factors of production are all assumed to clear at prices that are determined endogenously within the model.[6] The nominal exchange rate between the Indonesian currency (the rupiah) and the US dollar can be thought of as being fixed exogenously. The role within the model of the exogenous nominal exchange rate is to determine, along with international prices, the

[5] The analysis builds upon an earlier model named INDONESIA-E3, described in Yusuf (2006), but adds to it a detailed treatment of land use and a regionally disaggregated land use structure.

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

nominal domestic price level. Given that prices adjust flexibly to clear markets, a 1 percent increase in the rupiah/dollar exchange rate will result in a 1 percent increase in all nominal domestic prices, leaving all real variables unchanged.

3.2 Model structure

The 43 sectors represented in the model comprise agriculture (16), other primary industries (5), forestry (1), industry (16), including utilities and construction, and services (5). The theoretical structure of the model is based on the ORANI-G model (Horridge, 2000) with several modifications, of which the most important are the multi-region and land allocation features mentioned above. The land allocation feature is fully integrated within the general equilibrium structure.

The theoretical structure of INDONESIA E3-L includes the following major components:

- A land allocation system that recognises that land is incompletely mobile between economic activities, represented by elasticities of transformation that can be varied parametrically.
- A production structure that disaggregates agriculture (16 sectors) and forestry (one sector) into five regional components.
- A household consumption demand system, derived from the linear expenditure system.
- A factor demand system, based on the assumption of CES production technology, that relates the demand for each primary factor to industry outputs and prices of each of the primary factors, reflecting 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.
- A distinction between four kinds of labour: skilled and unskilled, each of which is divided

into paid and unpaid, which are 'nested' within the industry production functions. In each industry, all four kinds of labour enter a CES production function to produce 'labour', which itself enters a further CES production function for industry output.

- The household supplies of each of the four kinds of labour are assumed to be exogenous.
- Leontief assumptions for the demand for intermediate goods. Each intermediate good in each industry is assumed to be demanded in fixed proportion to the gross output of the industry.
- Demands for imported and domestically produced versions of each good, incorporating Armington elasticities of substitution between the two.
- A set of export demand functions, indicating the elasticities of foreign demand for Indonesia's exports.
- A set of equations determining the household incomes from their (exogenous) ownership of factors of production, reflecting data derived from the 2003 *Social Accounting Matrix*, the (endogenous) rates of return to these factors, and any net transfers from elsewhere in the system.
- Rates of import tariffs, excise taxes and subsidies across commodities, rates of business taxes, value added taxes and corporate income taxes across industries, and rates of personal income taxes across household types which reflect the structure of the Indonesian fiscal system, using data from the Indonesian Ministry of Finance.
- A set of macroeconomic identities which ensure that standard macroeconomic accounting conventions are observed.

The demand and supply equations for private-sector agents are derived from the solutions to these agents' microeconomic optimization problems (cost minimization for firms and utility maximization for households). The agents are assumed to be price-takers, with producers operating in competitive markets with zero profit conditions, reflecting the assumption of

constant returns to scale.

3.3 Social accounting matrix

The land allocation feature of the model required significant modifications to the database used for constructing the CGE model. In contrast to other ORANI-G based CGE models, which are based solely on an Input-Output table, this model requires many pieces of additional information available only from an enhanced Social Accounting Matrix. The Indonesian Social Accounting Matrix 2003 serves as the core database for the INDONESIA E3-L model, combined with official Indonesian data on land use allocation across industries, disaggregated by the five regions identified in the model: Sumatra, Java-Bali, Kalimantan, Sulawesi and Eastern Indonesia. Analyses of the land use implications of economic policies have in the past been constrained by the absence of a Social Accounting Matrix (SAM) with disaggregated regions and explicit treatment of land allocation. The database of the model relates to 2003.

3.4 Factors of production

The mobility of factors of production is a central feature of any general equilibrium system. 'Mobility' refers here to the capacity to reallocate the factor between 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 intersectoral mobility of factors of production be consistent with the length of run that the model is intended to represent.

All four categories of labour are assumed to be mobile across all sectors. Capital is immobile across sectors, reflecting a short-run to intermediate-run focus for the analysis. Within each

region, land is incompletely mobile across sectors, depending on returns to land in different sectors and the finite elasticities of transformation between effective units of land in different uses. The analytical structure of the model is summarised in Figure 2. The left hand side of the diagram (labelled ‘extension’) shows the structural assumptions added to the model to facilitate the analysis of land use. The key feature of this extension is that land is imperfectly mobile between uses.

[Figure 2 about here]

As land is converted from production forest to a cropping activity such as palm oil, the suitability of the land for the new use declines as more land is converted. It is helpful to think of a production possibilities frontier for *effective units of land* that is concave to the origin. Effective units means that the area of land is adjusted by its productivity in the use concerned. On one axis is effective units of land in forestry production and on the other is effective units of land in crop production. The concavity of the frontier means, for example, that the marginal productivity of each physical hectare of forest land converted to crop production declines as more such land is converted. Land is not homogeneous. As land conversion continues the suitability of the former forest land for production of crops declines. The degree to which this diminishing productivity occurs is measured by the elasticity of transformation.

If land was perfectly mobile between the two activities with no diminishing productivity the production possibility frontier would be linear and the elasticity of transformation would be infinite. If land was completely immobile between the two, as in the case where forest land was totally unusable for palm oil production, the production possibility frontier would be a right angle and the elasticity of transformation would be zero. In between are the realistic

intermediate cases of diminishing productivity, implying a concave production possibility frontier and an elasticity of transformation between zero and infinity. Figure 3 illustrates this intermediate case. A subsidy to land use in forestry changes the price relative returns to land facing producers from p_A to p_B, inducing a movement from land use A to land use B, away from palm oil and towards forestry, relative to what would otherwise have occurred.

[Figure 3 about here]

Estimates in the literature of the elasticity of transformation for land use between forestry and crop production suggest values of about 0.5. An example is Lee, Hertel, Rose and Avetisyan (2009). However, this parameter must be considered uncertain and in Section 5 of the paper it will be varied parametrically over a wide range to see the degree to which the results depend on the particular value that is used. A second parameter that is important for the functioning of the model is the CES elasticity of substitution between factors of production used in forestry and in crops. This parameter will also be varied parametrically in Section 5.

Four types of labour are identified, 'unskilled' and 'skilled', based on the educational characteristics of the workforce, each of which is divided into 'paid' and 'unpaid'. Skilled labour is defined as those workers with lower secondary education or more. The paid and unpaid categories are based on the Indonesian Labour Force Survey. Unpaid labour means labour supplied within the household and therefore not paid a formal wage.

Table 3 summarizes the importance of the factors of production discussed above within the context of the cost structures of the major industry categories. It notable that 'skilled' labour is unimportant in agriculture. Although paid labour is more important than unpaid labour for the Indonesian economy as a whole, the reverse applies within the agricultural and forestry

sectors. Table 4 summarises initial land allocation by 17 sectors (the 16 agricultural sectors plus forestry) disaggregated by region. The forestry sector is concentrated in Eastern Indonesia, Kalimantan and Sumatra.

[Table 3 about here]

[Table 4 about here]

Table 5 summarises data on the carbon content of one hectare of land in different uses. The actual carbon content of a particular land use, say production forest, depends on local conditions. The data are presented as averages by land use type, such as forest use or crop and by region. The available data do not differentiate fully between all of the crops identified in the INDONESIA E3-L model, so some land use types shown in the table use the same data. On average, forest land sequesters about twice as much carbon as crop land. A useful 'back of the envelope' number is that for Indonesia as a whole, the average difference between the amount of carbon sequestered in one hectare of production forest and one hectare of crop land is around 316 metric tones (expressed as carbon dioxide equivalent). This means that when one hectare of forest land is cleared and converted to crop land an average of 316 metric tones of carbon dioxide is released into the atmosphere.

[Table 5 about here]

4. Simulations

4.1 The shocks

Six sets of shocks are applied to the model.

1. A subsidy applied to land use in all production forest sufficient to induce a reduction in total carbon emissions of 26 per cent, relative to business-as-usual (BAU). The budgetary cost of the subsidy is met domestically through an across the board increase in the rate of commodity taxes.
2. An additional subsidy applied to land use in all production forest sufficient to induce an *additional* reduction in total carbon emissions of 15 per cent, relative to BAU. The budgetary cost of the additional subsidy is met internationally through foreign aid.
3. An sales tax on raw palm oil sufficient to sufficient to induce an exogenous reduction in total carbon emissions of 26 per cent, relative to BAU.[7] The revenue raised from the tax is used to finance an across the board reduction in the rate of commodity taxes.
4. An additional sales tax on raw palm oil sufficient to sufficient to induce an *additional* reduction in total carbon emissions of 15 per cent, relative to BAU. The revenue raised from the tax is matched by a reduction in foreign aid.
5. A reduction in the timber output levy that is currently used to finance the Reforestation Fund, sufficient to induce a reduction in total carbon emissions of 26 per cent, relative to BAU. The revenue lost from the reduction in the levy is restored to the government budget domestically through an across the board increase in the rate of commodity taxes.
6. An additional reduction in the timber output levy that is currently used to finance the Reforestation Fund, sufficient to induce an *additional* reduction in total carbon emissions of 15 per cent, relative to BAU. The revenue lost from the reduction in the levy is restored to the government budget through through foreign aid

[7] An export tax on palm oil was also analyzed. The results showed that an export tax that drove palm oil exports to zero was still insufficient to achieve a 26% reduction in emissions, relative to BAU.

The difference between Shocks 1 and 2, between Shocks 3 and 4 and between Shocks 5 and 6 is in the financing of the incentives. They correspond to the President's 26% and 15% reductions, respectively, as explained above.

Shocks 3 and 4 capture the point that palm oil is considered the most important agricultural commodity produced on land converted from forestry to crops. There is currently a sales tax rate of 1.25 per cent on raw palm oil. Raising this tax rate makes palm oil production less profitable. It is thereby a possible means of discouraging conversion of forest land to crops. Shocks 5 and 6 are based on the fact that the Reforestation Fund has two components: a subsidy to replanting production forest that has been logged, and a levy on timber production which finances the replanting subsidy. The replanting subsidy encourages retention of land use in forestry while the timber levy discourages it. We analyse the effect of financing the replanting subsidy out of general tax revenue rather than through a timber production levy.

In modelling terms, the rate of the subsidy/tax mentioned above is endogenous to the simulations and the reduction in carbon emissions is exogenously specified to be 26%. The simulations therefore calculate the rate of the subsidy/tax that is sufficient to achieve the emissions target and simultaneously calculate the overall adjustment to the general sales tax rate that is sufficient to finance the subsidy or to absorb the revenue raised by the tax.

4.2 Model closure

The simulations are conducted with balanced trade (exogenous balance on current account). This ensures that the potential effects of the shock being studied 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

fixed exogenously. The government budget deficit is held fixed in nominal terms, except in the case of Simulation B3, discussed below. This is achieved by endogenous across-the-board adjustments to the rate of commodity taxes so as to restore the base level of the budgetary deficit. The combined effect of these features of the closure is that the full effects of changes in policy are channeled into household expenditures – the variable on which our welfare measure is based – and not into effects, such as changes in the balance of trade, that are not captured within the single period focus of the model.

4.3 Parametric assumptions

Two parametric assumptions seem particularly important for the results: the elasticity of transformation between land use in production forest and crops and the CES elasticity of substitution between factors of production in the forestry and crops sectors. The assumptions are listed at the top of Tables 5 and 6. Simulation sets A1 and B1 are those considered by the authors to be most reasonable, but in the tables of results to be shown below these two parameters are varied widely.

5. A subsidy on land use in forestry

We now turn to the effects of using a subsidy to land use in forestry to achieve the President's stated goals. This analysis corresponds to Shocks 1 and 2. Tables 6 through 25 summarise the results. Table 6 contains the core result. The subsidy on land used in forestry costs Rp. 9,786 per tonne of carbon dioxide emissions abated. This corresponds to about US $ 1.08 at current exchange rates. The total annual subsidy cost to Indonesia is Rp. 3,712 billion, equivalent to about US$ 408 million. An additional 15 per cent reduction financed

from abroad requires a further annual subsidy of Rp. 1,909 billion, equivalent to US$ 210 million. These amounts are substantial but seemingly feasible.

[Tables 6 to 25 about here]

The subsidy leads to a reduction in the annual rate of land conversion of 1.2 million hectares compared with business-as-usual (BAU). This in turn corresponds to a reduction in emissions associated with land use change of 379 million metric tones per year relative to what would have happened under BAU. It is important that these are *annual* outcomes and that they are *cumulative*. It is helpful to refer again to Figure 1. Payment of the annual subsidy to production forest results in path B rather than path A (BAU). The *slope* of path B (the annual rate of emissions) is lower than that of path A by 379 million metric tones per year, corresponding to 1.2 million metric tones that is not converted from forestry to crops but which would have been so converted under BAU.

By remaining on path B for, say, ten years, the area of land that is *not* converted from forest to crops, but which would have been converted under BAU is 12 million hectares, leading to $10 \times 379 = 3{,}790$ million metric tones of CO_2 equivalent that is not emitted but which would have been emitted under BAU. Given that Indonesia's estimated annual emissions from land use change are 1,459 million metric tonnes the existence of this subsidy for 10 years would reduce Indonesia's accumulated emissions from land use change by an amount equivalent to 2.6 years of total emissions from land use change.

If the subsidy was discontinued after ten years, the outcome would thereafter be path C, the slope of which is the same as BAU. The annual rate of emissions reverts to the BAU annual rate. Nevertheless, the fact that the subsidy had been in place for ten years meant that during that period a lower rate of emissions was achieved and this permanently reduced Indonesia's

total, accumulated emissions from land use change by 3,790 million metric tonnes. The key point is that the lower rate of annual emissions continues for as long as the subsidy remains in place and the permanent reduction in total emissions from land use change relative to BAU accumulates accordingly.

How sensitive is the subsidy cost of CO_2 equivalent to the key parametric assumptions of the model? When the parametric assumptions are varied as shown in the first two rows of the table, the subsidy cost per tonne rises to as much as $1.24. Figures 4 and 5 show the effects of varying the two parameters concerned systematically across a wide range. The figures relate to Simulation Set A only. A total of 400 simulations were performed to derive these two figures. The two figures summarise the same set of results, but using different diagrammatic formats. By far the most important parameter affecting the results is the elasticity of transformation between forestry and crops. At very low values of this parameter it is costly to use price incentives to encourage use of land in forestry because a high price intervention is required to move land from crops to forestry (or to prevent movement in the other direction that would otherwise have occurred. Even under the extreme assumption of a value of this elasticity below 0.05 the subsidy cost per tonne of carbon dioxide abated does not reach US$3.50.

[Figure 4 about here]

[Figure 5 about here]

6. Output tax on palm oil and financing of Reforestation Fund

This section discusses the effects of using the two alternative fiscal instruments described above to achieve the President's emissions targets, as represented by Shocks 3 to 6. Tables 26

through 45 contain the simulated results. The two instruments are an increased sales tax on palm oil and a reduction in the timber levy used to finance the reforestation fund.

[Tables 26 to 45 about here]

An increase in the sales tax rate on raw palm oil reduces the profitability of palm oil production but not that of alternative crops, including rice and other estate crops. The palm oil tax is a relatively blunt instrument for reducing emissions due to land use change. A huge rate of tax – 215.5 per cent – would be required to achieve the President's 26% emissions reduction target. The base level of this sales tax was a mere 1.25 per cent, so the increase brings the overall rate to 216.75 per cent. This huge tax results in a 44 per reduction in the output of palm oil (Table 28) and a 34 per cent reduction in land use in palm oil (Table 45). There are no significant effects on food security, at least in terms of rice: output of paddy increases slightly (Table 28) and the consumer price of milled rice declines (Table 33). Land use in estate crops other than palm oil increases significantly (Table 45) because competition from the palm oil industry for available land is greatly reduced.

The very large rate of production tax on palm oil is highly distortionary and inefficient. The negative effect on real GDP and real household consumption (Table 27) is many times larger than the small effect of the land use subsidy for forestry (Table 7). In addition, the palm oil tax produces a large reduction in real wages of unskilled labour and returns to land (Table 27) which suggest a negative effect on rural incomes and presumably a worsening effect on poverty incidence. It is difficult to recommend this instrument as a means of achieving the President's goals on emission reduction.

The levy on timber output that currently finances the Reforestation Fund is currently set at about 6 per cent. Reducing this levy encourages land use in forestry and has less distortionary

effects on the structure of agriculture than the palm oil tax discussed above. To achieve the large reduction in emissions required by the President's target, the levy must be reduced to zero and then replaced by a subsidy. The revenue currently raised by the levy is 2,436 billion Rupiah (source: Center for International Forestry Research). An additional and very large subsidy of just under 20 billion Rupiah (61.5 % of the value of timber output) would then be required, with a total negative effect on revenue 22,364 billion Rp. The subsidy cost of this instrument is 58,961 Rp. per tonne of carbon dioxide emissions abated, or US$6.49 per tonne, which is six times the estimated subsidy cost of a subsidy to land use in forestry. The subsidy to land use in forestry is a more efficient instrument because it is targeted more directly at the relevant economic variable – land use in forestry production.

7. Conclusions

The main source of deforestation in Indonesia is said to be the conversion of production forest to the production of crops such as palm oil. This paper argues that a subsidy to the use of land in production forest combined with an effective prohibition on conversion of protected natural forest to other uses can achieve the President's announced goals at a seemingly feasible (but substantial) cost. We present evidence that it is a more efficient instrument than either a tax on palm oil or a substitution of a subsidy to timber production for the existing levy on timber production, which finances the Reforestation Fund.

We estimate that by using a subsidy to land use in forestry Indonesia could achieve the President's stated goal of a 26 per cent reduction in emissions relative to business-as-usual at an annual subsidy cost to Indonesian taxpayers equivalent to US$ 408 million, or $ 1.08 per tonne of carbon dioxide emissions abated. The total amount of land diverted from conversion from forest to crops is 1.2 million hectares per year (Table 18). That is, 1.2 million hectares that would otherwise be converted from forest to crop use each year is retained as forest

under this policy. The effect is cumulative. After ten years of the policy 12 million hectares of forest land that would otherwise have been converted to crop use is retained as forest, at a total subsidy cost of around US$ 4 billion.

Estimates of the price of carbon that might emerge under the REDD scheme have varied from US$ 5 to US$ 10 per metric tonne of carbon dioxide equivalent – several times the estimated cost to Indonesia of achieving the announced targets by means of a subsidy to land use in production forests. The policy seems worthy of consideration by Indonesian policy makers. It must be emphasized that the results described above are dependent on the assumption that a prohibition on conversion of protected natural forest to other uses is effectively enforced.

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Table 1 Greenhouse gas emissions (Carbon dioxide equivalent) by sector in 2005

	Energy	Electricity & Heat	Manufacturing & Construction	Transport	Other Fuel Combustion	Fugitive Emissions	Industrial Processes	Land-Use Change & Forestry	Total
Indonesia	338.9	125.3	93.1	73.9	38.7	8	16.9	1,459.0	1,814.8
Brazil	331.5	58.6	97.3	137.1	34.1	4.5	18.3	1,830.0	2,179.8
China	5,059.8	2,668.1	1,594.0	332.1	465.6	--	532.6	-47.3	5,545.1
Australia	387.5	243.1	46.5	79.1	18.4	0.4	4.5	--	392
USA	5,808.9	2,732.9	627.3	1,806.0	618.2	24.3	50.3	-117.1	5,742.1
European Union	3,273.3	1,249.7	541.6	834.6	644	3.5	101.8	--	3,375.1
World	26,400.1	12,335.8	5,230.1	5,369.0	3,270.9	194.2	1,172.5	5,376.2	32,948.8

Source: Climate Analysis Indicators Tool (CAIT) Version 7.0. (Washington, DC: World Resources Institute, 2010).
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Table 2 Land use 2003 (million hectares)

Land use	Official data	Satellite-based data
Non-cultivated natural forest	49.4	33.8
Cultivated land	125.3	91.7
Production forest	83.7	50.1
Paddy	11.5	11.5
Other crops	9.1	9.1
Estate crops	21.0	21.0
Other land	13.1	62.3
Total	187.8	187.8

Source: Official data are from *Statistics of Forestry*, Ministry of Forestry 2003 and from Ministry of Agriculture: Agriculture Statistics Database at http://database.deptan.go.id [accessed June, 2010].

Table 3 Factor costs and cost shares

	Unskilled Paid	Unskilled Unpaid	Skilled Paid	Skilled Unpaid	Capital	Land	Total
Billion Rp.							
Crops	42,273	93,787	2,932	155	38,843	35,860	213,849
Forestry	3,303	4,465	627	118	5,098	4,993	18,604
Other primary	39,430	39,326	9,802	735	176,545	-	265,838
Industry	170,719	46,680	58,368	9,384	432,534	-	717,685
Services	47,752	23,562	252,004	112,232	359,518	-	795,070
Total	303,477	207,819	323,733	122,624	1,012,539	40,854	2,011,045
Cost share (%)							
Crops	19.8	43.9	1.4	0.1	18.2	16.8	100
Forestry	17.8	24.0	3.4	0.6	27.4	26.8	100
Other primary	14.8	14.8	3.7	0.3	66.4	-	100
Industry	23.8	6.5	8.1	1.3	60.3	-	100
Services	6.0	3.0	31.7	14.1	45.2	-	100
Total	15.1	10.3	16.1	6.1	50.3	2.0	100

Source: Authors' calculations.

Table 4 Land area by crops (thousand hectares)

Crop	Sumatra	Java-Bali	Kalimantan	Sulawesi	Eastern Indonesia	INDONESIA
Paddy	3,055.5	5,521.3	879.7	1,247.7	540.7	11,244.8
Maize	664.9	1,937.9	48.0	398.4	299.5	3,348.8
Root crops	492.5	1,192.2	59.8	144.8	229.2	2,118.5
Beans	69.8	579.9	9.3	61.8	146.1	866.9
Veg. & fruits	414.8	855.7	83.4	140.5	156.1	1,650.5
Rubber	2,309.8	130.7	819.1	24.1	6.5	3,290.1
Sugar cane	110.1	208.6	2.2	17.0	-	337.9
Coconut	1,356.2	967.2	283.3	764.6	541.8	3,913.1
Oil palm	4,079.6	25.4	1,001.9	126.8	49.8	5,283.6
Other estate crops	10.5	291.2	3.5	255.5	256.2	817.1
Tobacco	5.1	225.6	-	1.5	24.7	256.9
Coffee	800.9	189.7	47.0	149.9	99.0	1,286.4
Tea	19.7	122.0	-	1.9	-	143.6
Cloves	63.1	151.1	4.3	156.4	67.4	442.3
Cacao	139.2	65.8	45.8	589.9	118.3	959.0
Other agriculture	439.9	82.6	48.1	151.6	180.9	903.0
Forest products	7,204.0	1,055.0	18,144.0	3,227.0	20,481.0	50,111.0
Total	21,235.6	13,601.9	21,479.4	7,459.5	23,197.3	86,973.6

Source: Authors' calculations using data from Government of Indonesia,, Ministry of Agriculture. Data relate to the year 2005.

Table 5 Carbon content of crops and forest (metric tones of carbon dioxide equivalent per hectare)

	Regjon 1 Sumatra	Region 2 Java-Bali	Region 3 Kalimantan	Region 2 Sulawesi	Region 2 Eastern Indonesia
1 Paddy	322	217	436	412	258
2 Maize	394	301	404	431	423
3 Root crops	394	301	404	431	423
4 Beans	394	301	404	431	423
5 Veg. & fruits	394	301	404	431	423
6 Rubber	270	359	261	352	440
7 Sugar cane	270	359	261	352	440
8 Coconut	270	359	261	352	440
9 Oil palm	270	359	261	352	440
10 Other estate crops	270	359	261	352	440
11 Tobacco	270	359	261	352	440
12 Coffee	270	359	261	352	440
13 Tea	270	359	261	352	440
14 Cloves	270	359	261	352	440
15 Cacao	270	359	261	352	440
16 Other agriculture	394	301	404	431	423
17 Livestock	0	0	0	0	0
18 Forest Products	661	378	701	635	661

Source: Authors' calculations using data from Government of Indonesia, Ministry of Forestry, *Forest Statistics*, 2003.

Table 6 Subsidy to land use in forestry: Effects on the subsidy cost of emission abatement

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources					Simulation Set B: Additional 15% Emissions Reduction With International Assistance				
	Sim-A1	Sim-A2	Sim-A3	Sim-A4	Sim-A5	Sim-B1	Sim-B2	Sim-B3	Sim-B4	Sim-B5
Parametric assumptions										
Sigma-Crops	0.750	0.600	0.900	0.750	0.750	0.750	0.600	0.900	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.300	0.700	0.500	0.500	0.500	0.300	0.700
Changes in CO2 emissions resulting from land use change										
% change	-26.0	-26.0	-26.0	-26.0	-26.0	-20.27	-20.27	-20.27	-20.27	-20.27
Million tonnes CO2	-379.3	-379.3	-379.3	-379.3	-379.3	-218.8	-218.8	-218.8	-218.8	-218.8
Subsidy to forestry use of land										
Rate of subsidy (%)	55.7	55.8	55.6	60.8	53.4	16.5	16.5	16.5	16.3	16.5
Subsidy cost (billion Rp)										
Sumatra	387.8	388.9	386.9	448.4	361.9	114.7	115.1	114.4	137.0	105.3
Java-Bali	49.3	49.3	49.2	57.0	46.0	10.5	10.5	10.6	12.9	9.6
Kalimantan	1,426.7	1,430.7	1,423.9	1,639.7	1,335.5	777.9	780.1	776.3	897.4	726.7
Sulawesi	188.2	188.8	187.9	217.3	175.8	64.7	64.9	64.6	76.5	59.7
Eastern Indonesia	1,660.1	1,664.8	1,656.8	1,906.8	1,554.4	940.9	943.6	939.0	1,083.4	879.8
INDONESIA	3,712.14	3,722.47	3,704.64	4,269.26	3,473.67	1,908.7	1,914.2	1,904.8	2,207.2	1,781.1
Subsidy per tonne of CO2 abated – Indonesia										
Rp. / tonne	9,786	9,813	9,766	11,254	9,157	8,722	8,747	8,704	10,086	8,139
$US/ tonne (at Rp. 9,091=$US1)	1.08	1.08	1.07	1.24	1.01	0.96	0.96	0.96	1.11	0.90

Source: Authors' calculations.

Table 7 Subsidy to land use in forestry: Macroeconomic effects (per cent change from base unless otherwise stated)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources					Simulation Set B: Additional 15% Emissions Reduction With International Assistance				
	Sim-A1	Sim-A2	Sim-A3	Sim-A4	Sim-A5	Sim-B1	Sim-B2	Sim-B3	Sim-B4	Sim-B5
Parametric assumptions										
Sigma-Crops	0.750	0.600	0.900	0.750	0.750	0.750	0.600	0.900	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.300	0.700	0.500	0.500	0.500	0.300	0.700
Macroeconomic results (per cent change)										
Real GDP	-0.050	-0.050	-0.050	-0.050	-0.050	-0.037	-0.037	-0.037	-0.037	-0.037
Real household consumption	-0.075	-0.076	-0.075	-0.075	-0.075	0.004	0.003	0.005	0.022	-0.003
Export volume index	-0.010	-0.010	-0.010	-0.016	-0.008	-0.036	-0.036	-0.037	-0.050	-0.031
Import volume index	-0.013	-0.013	-0.013	-0.020	-0.010	0.129	0.128	0.129	0.160	0.116
GDP price index	0.158	0.160	0.156	0.164	0.155	0.166	0.168	0.165	0.187	0.158
Consumer price index	0.264	0.267	0.261	0.269	0.262	0.258	0.261	0.257	0.281	0.248
Real factor returns										
Wage: skilled	-0.601	-0.606	-0.597	-0.627	-0.590	-0.320	-0.325	-0.317	-0.312	-0.324
Wage: unskilled	-0.414	-0.414	-0.414	-0.446	-0.401	-0.221	-0.220	-0.221	-0.228	-0.218
Capital	-0.477	-0.480	-0.475	-0.505	-0.466	-0.269	-0.271	-0.267	-0.274	-0.266
Land	10.425	10.505	10.366	10.408	10.431	7.894	7.956	7.847	7.892	7.894
Change in nominal GDP (Rp billion)										
Consumption	2,638	2,680	2,607	2,716	2,604	3,677	3,699	3,661	4,246	3,434
Investment	-177	-175	-178	-140	-192	-85	-85	-85	-31	-108
Stock	-43	-41	-43	-41	-43	-71	-70	-72	-80	-68
Government	-144	-145	-144	-137	-147	10	9	11	56	-9
Net export	0	0	0	0	0	-803	-797	-807	-1,020	-710
Total	2,274	2,319	2,241	2,398	2,221	2,728	2,756	2,708	3,171	2,539

Source: Authors' calculations.

Table 8 Subsidy to land use in forestry: Effects on output by industry (per cent change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources					Simulation Set B: Additional 15% Emissions Reduction With International Assistance				
	Sim-A1	Sim-A2	Sim-A3	Sim-A4	Sim-A5	Sim-B1	Sim-B2	Sim-B3	Sim-B4	Sim-B5
Output (per cent change)										
Paddy	-0.098	-0.100	-0.097	-0.098	-0.098	-0.062	-0.064	-0.061	-0.059	-0.064
Maize	-0.241	-0.245	-0.238	-0.240	-0.241	-0.171	-0.175	-0.169	-0.168	-0.173
Root crops	-0.200	-0.202	-0.198	-0.199	-0.200	-0.139	-0.142	-0.138	-0.134	-0.141
Beans	-0.710	-0.712	-0.709	-0.707	-0.711	-0.608	-0.608	-0.608	-0.611	-0.607
Veg. & fruits	-0.564	-0.567	-0.563	-0.561	-0.566	-0.424	-0.426	-0.422	-0.417	-0.427
Rubber	-0.217	-0.217	-0.217	-0.222	-0.215	-0.182	-0.182	-0.182	-0.194	-0.177
Sugar cane	-0.139	-0.140	-0.138	-0.139	-0.139	-0.081	-0.082	-0.080	-0.075	-0.084
Coconut	-1.176	-1.168	-1.181	-1.172	-1.177	-0.893	-0.887	-0.898	-0.894	-0.893
Oil palm	-0.898	-0.897	-0.899	-0.894	-0.900	-0.666	-0.665	-0.666	-0.666	-0.665
Other estate crops	-0.774	-0.775	-0.774	-0.776	-0.773	-0.638	-0.638	-0.638	-0.649	-0.633
Tobacco	-0.138	-0.139	-0.136	-0.138	-0.138	-0.079	-0.080	-0.078	-0.073	-0.082
Coffee	-2.902	-2.822	-2.965	-2.904	-2.902	-2.124	-2.055	-2.178	-2.144	-2.115
Tea	0.248	0.187	0.294	0.251	0.247	0.151	0.109	0.183	0.129	0.160
Cloves	-3.012	-2.919	-3.085	-3.010	-3.013	-2.330	-2.245	-2.397	-2.346	-2.323
Cacao	-0.633	-0.632	-0.633	-0.636	-0.631	-0.459	-0.459	-0.459	-0.469	-0.455
Other agriculture	-0.219	-0.220	-0.219	-0.219	-0.219	-0.149	-0.149	-0.148	-0.146	-0.150
Livestock	-0.105	-0.107	-0.104	-0.104	-0.106	-0.061	-0.062	-0.060	-0.054	-0.064
Forest products	0.423	0.423	0.424	0.423	0.423	0.182	0.182	0.182	0.176	0.185
Fisheries	-0.028	-0.029	-0.028	-0.027	-0.029	-0.011	-0.012	-0.011	-0.008	-0.013
Agricultural service	-0.150	-0.150	-0.149	-0.150	-0.150	-0.120	-0.120	-0.119	-0.121	-0.119
Coal mining	0.005	0.005	0.005	0.005	0.005	-0.001	-0.001	-0.001	-0.002	0.000
Oil & gas	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.000	0.001

Source: Authors' calculations.

Table 9 Subsidy to land use in forestry: Effects on output by industry - continued (per cent change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources					Simulation Set B: Additional 15% Emissions Reduction With International Assistance				
	Sim-A1	Sim-A2	Sim-A3	Sim-A4	Sim-A5	Sim-B1	Sim-B2	Sim-B3	Sim-B4	Sim-B5
Output (per cent change) - cont'd										
Food, bev. tobacco	-0.142	-0.143	-0.141	-0.142	-0.142	-0.083	-0.084	-0.082	-0.077	-0.085
Milled rice	-0.100	-0.102	-0.099	-0.100	-0.100	-0.063	-0.065	-0.062	-0.060	-0.065
Textile products	-0.009	-0.009	-0.008	-0.014	-0.007	-0.017	-0.017	-0.017	-0.026	-0.013
Wood products	0.524	0.523	0.525	0.523	0.524	0.229	0.228	0.230	0.219	0.233
Chemicals	-0.061	-0.061	-0.062	-0.066	-0.059	-0.064	-0.064	-0.065	-0.076	-0.059
Pulp paper	0.001	0.000	0.002	-0.001	0.002	-0.014	-0.015	-0.014	-0.020	-0.012
Oil refinery	0.009	0.009	0.009	0.008	0.009	0.007	0.007	0.007	0.006	0.007
Rubber products	-0.506	-0.506	-0.506	-0.511	-0.504	-0.405	-0.405	-0.405	-0.420	-0.398
Plastics	-0.139	-0.140	-0.139	-0.143	-0.138	-0.112	-0.112	-0.112	-0.117	-0.111
Ceramic products	0.019	0.018	0.019	0.021	0.018	0.005	0.005	0.005	0.004	0.006
Cement	0.016	0.015	0.016	0.016	0.015	0.003	0.003	0.003	0.001	0.004
Ferrous metals	0.058	0.058	0.059	0.057	0.059	0.010	0.010	0.010	-0.003	0.016
Machinery	0.021	0.021	0.021	0.017	0.023	0.022	0.022	0.022	0.017	0.025
Other manufacturing	0.138	0.136	0.140	0.118	0.147	0.011	0.010	0.011	-0.032	0.029
Utilities	-0.012	-0.012	-0.012	-0.012	-0.011	0.009	0.009	0.009	0.013	0.007
Construction	-0.001	-0.001	-0.001	-0.001	-0.001	0.000	0.000	0.000	0.000	0.000
Trade	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.003	-0.002	-0.003	-0.002
Other services	0.005	0.005	0.005	0.006	0.004	0.016	0.016	0.016	0.021	0.014
Hotel & restaurant	-0.069	-0.070	-0.068	-0.067	-0.069	-0.047	-0.048	-0.047	-0.044	-0.049
Transport	-0.034	-0.034	-0.033	-0.035	-0.033	-0.014	-0.014	-0.013	-0.013	-0.014
Banking & finance	0.030	0.030	0.030	0.032	0.030	0.013	0.013	0.013	0.012	0.013

Source: Authors' calculations.

Table 10 Subsidy to land use in forestry: Effects on producer prices by industry (per cent change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources					Simulation Set B: Additional 15% Emissions Reduction With International Assistance				
	Sim-A1	Sim-A2	Sim-A3	Sim-A4	Sim-A5	Sim-B1	Sim-B2	Sim-B3	Sim-B4	Sim-B5
Producer price (per cent change)										
Paddy	2.379	2.426	2.345	2.375	2.381	1.883	1.923	1.855	1.910	1.872
Maize	1.671	1.708	1.644	1.671	1.671	1.374	1.404	1.352	1.402	1.361
Root crops	2.656	2.694	2.629	2.654	2.657	2.214	2.246	2.190	2.246	2.199
Beans	1.618	1.619	1.617	1.623	1.616	1.382	1.380	1.383	1.402	1.373
Veg. & fruits	1.751	1.758	1.746	1.750	1.751	1.454	1.459	1.449	1.482	1.442
Rubber	1.932	1.929	1.934	1.922	1.936	1.458	1.456	1.459	1.466	1.455
Sugar cane	0.185	0.231	0.152	0.183	0.186	0.129	0.164	0.104	0.152	0.119
Coconut	2.927	2.906	2.942	2.929	2.926	2.175	2.159	2.187	2.194	2.167
Oil palm	1.960	1.955	1.964	1.961	1.960	1.407	1.403	1.410	1.421	1.401
Other estate crops	1.263	1.263	1.262	1.269	1.260	1.038	1.037	1.038	1.047	1.034
Tobacco	0.177	0.193	0.165	0.183	0.174	0.231	0.243	0.223	0.252	0.222
Coffee	1.169	1.123	1.204	1.172	1.167	1.007	0.967	1.039	1.068	0.981
Tea	-1.013	-0.939	-1.070	-1.025	-1.008	-0.724	-0.673	-0.763	-0.709	-0.731
Cloves	1.825	1.761	1.874	1.831	1.822	1.370	1.316	1.413	1.388	1.362
Cacao	4.688	4.676	4.695	4.685	4.689	3.282	3.281	3.281	3.292	3.277
Other agriculture	3.133	3.137	3.129	3.135	3.132	2.385	2.393	2.380	2.407	2.376
Livestock	0.117	0.121	0.115	0.121	0.116	0.148	0.151	0.146	0.172	0.138
Forest products	-2.836	-2.837	-2.836	-2.845	-2.832	-1.321	-1.320	-1.321	-1.325	-1.319
Fisheries	-0.107	-0.106	-0.109	-0.108	-0.107	0.043	0.043	0.042	0.079	0.027
Agricultural service	-0.062	-0.056	-0.066	-0.067	-0.059	0.033	0.037	0.030	0.053	0.024
Coal mining	0.018	0.018	0.018	0.021	0.017	0.004	0.004	0.004	0.004	0.004
Oil & gas	0.062	0.062	0.061	0.072	0.057	0.000	0.000	0.000	0.000	0.000

Source: Authors' calculations.

Table 11 Subsidy to land use in forestry: Effects on producer prices by industry – continued (per cent change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources					Simulation Set B: Additional 15% Emissions Reduction With International Assistance				
	Sim-A1	Sim-A2	Sim-A3	Sim-A4	Sim-A5	Sim-B1	Sim-B2	Sim-B3	Sim-B4	Sim-B5
Producer price (per cent change) - cont'd										
Food, bev. tobacco	0.278	0.281	0.276	0.286	0.275	0.255	0.257	0.254	0.280	0.245
Milled rice	1.969	2.007	1.941	1.975	1.966	1.536	1.568	1.513	1.562	1.525
Textile products	0.024	0.025	0.024	0.035	0.020	0.020	0.020	0.020	0.033	0.015
Wood products	-0.559	-0.559	-0.560	-0.556	-0.561	-0.227	-0.227	-0.227	-0.208	-0.235
Chemicals	0.052	0.052	0.052	0.065	0.047	0.020	0.020	0.020	0.031	0.015
Pulp paper	0.015	0.015	0.014	0.024	0.011	0.026	0.027	0.026	0.041	0.020
Oil refinery	0.008	0.008	0.008	0.013	0.006	0.002	0.002	0.002	0.008	0.000
Rubber products	0.418	0.417	0.418	0.428	0.413	0.305	0.304	0.305	0.317	0.299
Plastics	0.141	0.141	0.141	0.152	0.136	0.103	0.103	0.103	0.114	0.098
Ceramic products	-0.006	-0.005	-0.006	-0.002	-0.007	0.016	0.016	0.016	0.029	0.010
Cement	-0.054	-0.053	-0.054	-0.054	-0.054	-0.013	-0.013	-0.013	-0.002	-0.018
Ferrous metals	0.050	0.050	0.050	0.059	0.046	0.001	0.001	0.001	0.003	0.000
Machinery	0.028	0.028	0.028	0.041	0.023	0.002	0.002	0.003	0.013	-0.002
Other manufacturing	0.037	0.038	0.037	0.051	0.032	0.000	0.000	0.000	0.008	-0.003
Utilities	-0.092	-0.092	-0.092	-0.090	-0.093	0.007	0.006	0.008	0.034	-0.004
Construction	-0.061	-0.061	-0.062	-0.052	-0.065	-0.027	-0.026	-0.027	-0.012	-0.033
Trade	-0.197	-0.198	-0.195	-0.195	-0.197	-0.054	-0.057	-0.053	-0.023	-0.068
Other services	-0.076	-0.076	-0.075	-0.071	-0.077	0.006	0.005	0.006	0.031	-0.005
Hotel & restaurant	0.104	0.106	0.103	0.110	0.102	0.147	0.148	0.146	0.173	0.135
Transport	0.034	0.035	0.033	0.044	0.030	0.034	0.034	0.033	0.050	0.026
Banking & finance	-0.106	-0.107	-0.106	-0.104	-0.108	-0.009	-0.010	-0.008	0.016	-0.020

Source: Authors' calculations.

Table 12 Subsidy to land use in forestry: Effects on consumer prices by commodity (per cent change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources					Simulation Set B: Additional 15% Emissions Reduction With International Assistance				
	Sim-A1	Sim-A2	Sim-A3	Sim-A4	Sim-A5	Sim-B1	Sim-B2	Sim-B3	Sim-B4	Sim-B5
Consumer price (per cent change)										
Paddy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Maize	1.604	1.639	1.578	1.604	1.603	1.316	1.345	1.295	1.343	1.304
Root crops	2.656	2.693	2.628	2.654	2.656	2.213	2.245	2.190	2.246	2.199
Beans	1.088	1.089	1.087	1.095	1.085	0.904	0.902	0.904	0.917	0.898
Veg. & fruits	1.849	1.857	1.843	1.848	1.850	1.538	1.544	1.533	1.567	1.525
Rubber	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sugar cane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coconut	3.018	2.997	3.033	3.020	3.017	2.247	2.230	2.259	2.266	2.239
Oil palm	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other estate crops	1.921	1.921	1.920	1.923	1.919	1.599	1.598	1.599	1.613	1.593
Tobacco	0.177	0.193	0.165	0.183	0.174	0.231	0.243	0.223	0.252	0.222
Coffee	1.168	1.123	1.204	1.172	1.167	1.007	0.967	1.039	1.068	0.981
Tea	-1.014	-0.940	-1.071	-1.026	-1.009	-0.724	-0.673	-0.763	-0.709	-0.731
Cloves	2.050	1.978	2.106	2.055	2.048	1.553	1.491	1.602	1.574	1.544
Cacao	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other agriculture	3.135	3.140	3.132	3.138	3.134	2.388	2.396	2.382	2.410	2.378
Livestock	0.119	0.123	0.116	0.122	0.118	0.154	0.156	0.152	0.178	0.143
Forest products	-2.843	-2.844	-2.843	-2.852	-2.839	-1.323	-1.323	-1.323	-1.328	-1.321
Fisheries	-0.107	-0.106	-0.109	-0.108	-0.107	0.043	0.043	0.042	0.079	0.027
Agricultural service	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coal mining	-0.064	-0.065	-0.064	-0.077	-0.059	0.005	0.005	0.005	0.005	0.005
Oil & gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Source: Authors' calculations.

Table 13 Subsidy to land use in forestry: Effects on consumer prices by commodity – continued (per cent change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources					Simulation Set B: Additional 15% Emissions Reduction With International Assistance				
	Sim-A1	Sim-A2	Sim-A3	Sim-A4	Sim-A5	Sim-B1	Sim-B2	Sim-B3	Sim-B4	Sim-B5
Consumer price (per cent change) - cont'd										
Food, bev. tobacco	0.279	0.282	0.277	0.286	0.276	0.258	0.260	0.257	0.283	0.248
Milled rice	1.969	2.007	1.941	1.975	1.966	1.536	1.568	1.513	1.562	1.525
Textile products	0.020	0.021	0.020	0.031	0.016	0.022	0.022	0.022	0.036	0.016
Wood products	-0.567	-0.566	-0.568	-0.565	-0.569	-0.230	-0.229	-0.230	-0.211	-0.238
Chemicals	0.049	0.049	0.049	0.062	0.043	0.023	0.023	0.023	0.035	0.018
Pulp paper	0.004	0.005	0.004	0.013	0.000	0.031	0.031	0.031	0.048	0.023
Oil refinery	-0.052	-0.053	-0.052	-0.057	-0.051	0.003	0.002	0.003	0.010	0.000
Rubber products	0.190	0.190	0.190	0.201	0.185	0.106	0.106	0.106	0.111	0.105
Plastics	0.132	0.132	0.132	0.143	0.127	0.091	0.091	0.091	0.101	0.087
Ceramic products	-0.014	-0.013	-0.015	-0.011	-0.015	0.018	0.018	0.017	0.032	0.011
Cement	-0.062	-0.061	-0.062	-0.063	-0.061	-0.013	-0.013	-0.013	-0.002	-0.018
Ferrous metals	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Machinery	0.028	0.028	0.028	0.040	0.023	0.002	0.002	0.002	0.013	-0.002
Other manufacturing	0.036	0.036	0.036	0.049	0.030	0.000	0.000	0.000	0.008	-0.003
Utilities	-0.092	-0.092	-0.091	-0.089	-0.093	0.007	0.006	0.008	0.034	-0.004
Construction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Trade	-0.199	-0.200	-0.197	-0.197	-0.199	-0.054	-0.057	-0.053	-0.023	-0.068
Other services	-0.083	-0.083	-0.083	-0.079	-0.085	0.006	0.005	0.007	0.032	-0.005
Hotel & restaurant	0.105	0.107	0.103	0.110	0.102	0.151	0.152	0.150	0.178	0.139
Transport	0.035	0.036	0.034	0.045	0.031	0.033	0.033	0.032	0.049	0.026
Banking & finance	-0.115	-0.116	-0.114	-0.112	-0.116	-0.009	-0.011	-0.008	0.017	-0.020

Source: Authors' calculations.

Table 14 Subsidy to land use in forestry: Effects on land use - Sumatra ('000 Ha.)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources					Simulation Set B: Additional 15% Emissions Reduction With International Assistance				
	Sim-A1	Sim-A2	Sim-A3	Sim-A4	Sim-A5	Sim-B1	Sim-B2	Sim-B3	Sim-B4	Sim-B5
Land use change: Sumatra (000 Ha)										
Paddy	-67.3	-68.9	-66.1	-67.3	-67.3	-39.5	-40.5	-38.7	-39.3	-39.5
Maize	-14.4	-14.8	-14.2	-14.4	-14.4	-8.7	-8.9	-8.5	-8.6	-8.7
Root crops	-11.5	-11.7	-11.3	-11.5	-11.5	-7.0	-7.1	-6.9	-6.9	-7.0
Beans	-2.0	-2.0	-2.0	-2.0	-2.0	-1.3	-1.3	-1.3	-1.3	-1.3
Veg. & fruits	-11.8	-11.8	-11.7	-11.7	-11.8	-7.3	-7.4	-7.3	-7.3	-7.3
Rubber	-84.5	-84.3	-84.7	-84.6	-84.5	-49.7	-49.6	-49.7	-49.8	-49.6
Sugarcane	-1.7	-1.8	-1.6	-1.7	-1.7	-0.9	-1.0	-0.8	-0.9	-0.9
Coconut	-51.7	-51.4	-52.0	-51.7	-51.7	-31.7	-31.5	-31.9	-31.7	-31.8
Oil palm	-153.4	-152.8	-153.7	-153.2	-153.5	-90.8	-90.5	-91.0	-90.7	-90.8
Other estate crops	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2
Tobacco	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Coffee	-41.1	-39.9	-42.1	-41.1	-41.1	-25.7	-24.8	-26.3	-25.8	-25.6
Tea	-0.2	-0.2	-0.1	-0.2	-0.2	-0.1	-0.1	0.0	-0.1	-0.1
Clove	-3.4	-3.3	-3.5	-3.4	-3.4	-2.2	-2.1	-2.3	-2.2	-2.2
Cacao	-5.0	-5.0	-5.0	-5.0	-5.0	-2.8	-2.8	-2.8	-2.8	-2.8
Other agriculture	-15.2	-15.2	-15.2	-15.2	-15.2	-8.6	-8.7	-8.6	-8.6	-8.6
Forest products	463.6	463.5	463.6	463.4	463.6	276.4	276.4	276.5	276.4	276.5
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Authors' calculations.

Table 15 Subsidy to land use in forestry: Effects on land use – Java-Bali ('000 Ha.)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources					Simulation Set B: Additional 15% Emissions Reduction With International Assistance				
	Sim-A1	Sim-A2	Sim-A3	Sim-A4	Sim-A5	Sim-B1	Sim-B2	Sim-B3	Sim-B4	Sim-B5
Parametric assumptions										
Sigma-Crops	0.750	0.600	0.900	0.750	0.750	0.750	0.600	0.900	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.300	0.700	0.500	0.500	0.500	0.300	0.700
Land use change: Java-Bali (000 Ha)										
Paddy	-22.1	-23.2	-21.4	-22.3	-22.1	-11.4	-12.2	-10.9	-11.4	-11.4
Maize	-7.2	-7.5	-6.9	-7.2	-7.1	-4.2	-4.5	-4.0	-4.2	-4.2
Root crops	-6.4	-6.5	-6.3	-6.4	-6.4	-4.0	-4.1	-3.9	-3.9	-4.0
Beans	-6.0	-5.9	-6.1	-6.0	-6.0	-4.8	-4.7	-4.8	-4.8	-4.8
Veg. & fruits	-8.9	-8.8	-9.0	-8.9	-8.9	-6.0	-5.9	-6.1	-6.0	-6.0
Rubber	-2.5	-2.4	-2.5	-2.5	-2.5	-1.4	-1.4	-1.5	-1.5	-1.4
Sugarcane	0.5	0.4	0.6	0.5	0.6	0.6	0.5	0.7	0.6	0.6
Coconut	-19.8	-19.2	-20.2	-19.8	-19.7	-12.6	-12.2	-12.9	-12.7	-12.6
Oil palm	-0.5	-0.5	-0.5	-0.5	-0.5	-0.3	-0.3	-0.3	-0.3	-0.3
Other estate crops	-3.1	-3.0	-3.1	-3.1	-3.1	-2.3	-2.3	-2.4	-2.4	-2.3
Tobacco	0.3	0.2	0.4	0.3	0.3	0.2	0.1	0.2	0.2	0.2
Coffee	-6.4	-6.1	-6.7	-6.4	-6.4	-4.2	-3.9	-4.4	-4.2	-4.2
Tea	1.3	1.1	1.4	1.3	1.3	1.0	0.8	1.1	0.9	1.0
Clove	-5.5	-5.2	-5.8	-5.5	-5.5	-3.8	-3.6	-4.0	-3.8	-3.8
Cacao	-1.2	-1.2	-1.2	-1.2	-1.2	-0.6	-0.6	-0.7	-0.7	-0.6
Other agriculture	-1.4	-1.3	-1.4	-1.4	-1.4	-0.8	-0.7	-0.8	-0.8	-0.8
Forest products	88.8	89.1	88.6	89.1	88.6	54.7	54.9	54.6	54.9	54.6
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Authors' calculations.

Table 16 Subsidy to land use in forestry: Effects on land use - Kalimantan ('000 Ha.)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources					Simulation Set B: Additional 15% Emissions Reduction With International Assistance				
	Sim-A1	Sim-A2	Sim-A3	Sim-A4	Sim-A5	Sim-B1	Sim-B2	Sim-B3	Sim-B4	Sim-B5
Parametric assumptions										
Sigma-Crops	0.750	0.600	0.900	0.750	0.750	0.750	0.600	0.900	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.300	0.700	0.500	0.500	0.500	0.300	0.700
Land use change: Kalimantan (000 Ha)										
Paddy	-59.8	-60.2	-59.5	-59.7	-59.8	-32.9	-33.1	-32.7	-32.8	-32.9
Maize	-3.2	-3.3	-3.2	-3.2	-3.2	-1.8	-1.8	-1.8	-1.8	-1.8
Root crops	-4.1	-4.2	-4.1	-4.1	-4.1	-2.3	-2.3	-2.3	-2.3	-2.3
Beans	-0.7	-0.7	-0.7	-0.7	-0.7	-0.4	-0.4	-0.4	-0.4	-0.4
Veg. & fruits	-6.2	-6.2	-6.2	-6.2	-6.2	-3.5	-3.5	-3.5	-3.5	-3.5
Rubber	-67.0	-67.0	-67.1	-67.0	-67.0	-36.8	-36.8	-36.8	-36.9	-36.8
Sugarcane	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Coconut	-23.6	-23.5	-23.7	-23.6	-23.6	-13.2	-13.2	-13.3	-13.2	-13.2
Oil palm	-82.9	-82.8	-83.0	-82.9	-83.0	-45.7	-45.6	-45.8	-45.7	-45.7
Other estate crops	-0.3	-0.3	-0.3	-0.3	-0.3	-0.1	-0.1	-0.1	-0.1	-0.1
Tobacco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coffee	-4.5	-4.4	-4.6	-4.5	-4.5	-2.6	-2.5	-2.6	-2.6	-2.6
Tea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Clove	-0.4	-0.4	-0.4	-0.4	-0.4	-0.2	-0.2	-0.2	-0.2	-0.2
Cacao	-3.7	-3.7	-3.7	-3.7	-3.7	-2.0	-2.0	-2.0	-2.0	-2.0
Other agriculture	-3.8	-3.8	-3.8	-3.8	-3.8	-2.1	-2.1	-2.1	-2.1	-2.1
Forest products	260.5	260.6	260.4	260.3	260.5	143.7	143.8	143.6	143.7	143.7
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Authors' calculations.

Table 17 Subsidy to land use in forestry: Effects on land use - Sulawesi ('000 Ha.)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources					Simulation Set B: Additional 15% Emissions Reduction With International Assistance				
	Sim-A1	Sim-A2	Sim-A3	Sim-A4	Sim-A5	Sim-B1	Sim-B2	Sim-B3	Sim-B4	Sim-B5
Parametric assumptions										
Sigma-Crops	0.750	0.600	0.900	0.750	0.750	0.750	0.600	0.900	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.300	0.700	0.500	0.500	0.500	0.300	0.700
Land use change: Sulawesi (000 Ha)										
Paddy	-40.0	-40.6	-39.6	-40.1	-40.0	-23.1	-23.5	-22.8	-23.1	-23.1
Maize	-12.7	-12.9	-12.5	-12.7	-12.7	-7.4	-7.5	-7.3	-7.4	-7.4
Root crops	-4.8	-4.9	-4.8	-4.8	-4.8	-2.9	-2.9	-2.8	-2.8	-2.9
Beans	-2.4	-2.4	-2.4	-2.4	-2.4	-1.5	-1.5	-1.5	-1.5	-1.5
Veg. & fruits	-5.4	-5.4	-5.4	-5.4	-5.4	-3.3	-3.3	-3.2	-3.2	-3.3
Rubber	-1.1	-1.1	-1.1	-1.1	-1.1	-0.6	-0.6	-0.6	-0.6	-0.6
Sugarcane	-0.4	-0.4	-0.4	-0.4	-0.4	-0.2	-0.2	-0.2	-0.2	-0.2
Coconut	-36.7	-36.5	-36.9	-36.7	-36.7	-22.0	-21.8	-22.1	-22.0	-22.0
Oil palm	-6.0	-6.0	-6.0	-6.0	-6.0	-3.5	-3.5	-3.5	-3.5	-3.5
Other estate crops	-9.8	-9.9	-9.8	-9.8	-9.8	-6.1	-6.1	-6.1	-6.2	-6.1
Tobacco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coffee	-9.2	-8.9	-9.3	-9.2	-9.2	-5.6	-5.4	-5.7	-5.6	-5.6
Tea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Clove	-10.0	-9.7	-10.2	-10.0	-10.0	-6.3	-6.1	-6.4	-6.3	-6.3
Cacao	-27.0	-26.9	-27.1	-27.1	-27.0	-15.2	-15.2	-15.2	-15.2	-15.1
Other agriculture	-6.7	-6.7	-6.7	-6.7	-6.7	-3.8	-3.8	-3.8	-3.8	-3.8
Forest products	172.4	172.5	172.4	172.5	172.4	101.5	101.5	101.4	101.5	101.5
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Authors' calculations.

Table 18 Subsidy to land use in forestry: Effects on land use - Eastern Indonesia ('000 Ha.)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources					Simulation Set B: Additional 15% Emissions Reduction With International Assistance				
	Sim-A1	Sim-A2	Sim-A3	Sim-A4	Sim-A5	Sim-B1	Sim-B2	Sim-B3	Sim-B4	Sim-B5
Parametric assumptions										
Sigma-Crops	0.750	0.600	0.900	0.750	0.750	0.750	0.600	0.900	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.300	0.700	0.500	0.500	0.500	0.300	0.700
Land use change: Eastern Indonesia (000 Ha)										
Paddy	-38.7	-38.9	-38.5	-38.7	-38.7	-21.1	-21.3	-21.0	-21.1	-21.1
Maize	-21.3	-21.5	-21.2	-21.4	-21.3	-11.7	-11.8	-11.7	-11.7	-11.7
Root crops	-16.7	-16.8	-16.6	-16.7	-16.7	-9.2	-9.3	-9.2	-9.2	-9.2
Beans	-11.3	-11.3	-11.3	-11.3	-11.3	-6.5	-6.5	-6.5	-6.5	-6.5
Veg .& fruits	-12.1	-12.1	-12.1	-12.1	-12.1	-6.8	-6.8	-6.7	-6.7	-6.8
Rubber	-0.6	-0.6	-0.6	-0.6	-0.6	-0.3	-0.3	-0.3	-0.3	-0.3
Sugarcane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coconut	-47.1	-46.9	-47.2	-47.1	-47.0	-26.2	-26.1	-26.2	-26.2	-26.2
Oil palm	-4.3	-4.3	-4.3	-4.3	-4.3	-2.4	-2.3	-2.4	-2.4	-2.4
Other estate crops	-19.9	-19.9	-19.9	-19.9	-19.9	-11.3	-11.3	-11.3	-11.3	-11.3
Tobacco	-1.6	-1.7	-1.6	-1.6	-1.6	-0.9	-0.9	-0.9	-0.9	-0.9
Coffee	-9.8	-9.7	-9.9	-9.8	-9.8	-5.5	-5.4	-5.6	-5.5	-5.5
Tea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Clove	-6.9	-6.8	-7.0	-6.9	-6.9	-3.9	-3.9	-4.0	-4.0	-3.9
Cacao	-10.0	-10.0	-10.0	-10.0	-10.0	-5.4	-5.4	-5.4	-5.4	-5.4
Other agriculture	-15.1	-15.1	-15.1	-15.1	-15.1	-8.1	-8.1	-8.1	-8.1	-8.1
Forest products	215.4	215.5	215.3	215.6	215.3	119.3	119.3	119.3	119.3	119.3
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Authors' calculations.

Table 19 Subsidy to land use in forestry: Effects on land use - Indonesia ('000 Ha.)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources					Simulation Set B: Additional 15% Emissions Reduction With International Assistance				
	Sim-A1	Sim-A2	Sim-A3	Sim-A4	Sim-A5	Sim-B1	Sim-B2	Sim-B3	Sim-B4	Sim-B5
Parametric assumptions										
Sigma-Crops	0.750	0.600	0.900	0.750	0.750	0.750	0.600	0.900	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.300	0.700	0.500	0.500	0.500	0.300	0.700
Land use change: INDONESIA (000 Ha)										
Paddy	-227.9	-231.8	-225.1	-228.1	-227.8	-128.0	-130.5	-126.1	-127.7	-128.1
Maize	-58.9	-60.0	-58.0	-58.9	-58.8	-33.8	-34.5	-33.3	-33.7	-33.8
Root crops	-43.5	-44.1	-43.2	-43.6	-43.5	-25.3	-25.6	-25.0	-25.2	-25.3
Beans	-22.4	-22.3	-22.4	-22.4	-22.4	-14.5	-14.4	-14.5	-14.5	-14.4
Veg. & fruits	-44.3	-44.4	-44.3	-44.3	-44.3	-26.8	-26.8	-26.8	-26.7	-26.9
Rubber	-155.7	-155.4	-155.9	-155.8	-155.7	-88.9	-88.7	-89.0	-89.1	-88.8
Sugarcane	-1.7	-1.9	-1.6	-1.7	-1.7	-0.6	-0.7	-0.5	-0.6	-0.6
Coconut	-178.9	-177.5	-179.9	-178.9	-178.9	-105.7	-104.8	-106.4	-105.7	-105.7
Oil palm	-247.1	-246.4	-247.6	-246.9	-247.3	-142.6	-142.2	-142.9	-142.5	-142.7
Other estate crops	-33.4	-33.4	-33.4	-33.4	-33.3	-20.1	-20.1	-20.1	-20.2	-20.1
Tobacco	-1.4	-1.6	-1.4	-1.5	-1.4	-0.8	-0.9	-0.8	-0.8	-0.8
Coffee	-71.1	-69.1	-72.6	-71.1	-71.1	-43.5	-42.1	-44.6	-43.7	-43.5
Tea	1.1	0.9	1.2	1.1	1.1	0.9	0.7	1.0	0.8	0.9
Clove	-26.2	-25.3	-26.8	-26.2	-26.2	-16.5	-15.9	-16.9	-16.5	-16.4
Cacao	-46.9	-46.8	-47.0	-47.0	-46.9	-26.0	-26.0	-26.0	-26.1	-26.0
Other agriculture	-42.2	-42.2	-42.2	-42.2	-42.2	-23.4	-23.4	-23.4	-23.4	-23.4
Forest products	1,200.6	1,201.2	1,200.2	1,201.0	1,200.4	695.7	696.0	695.4	695.8	695.6
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Authors' calculations.

Table 20 Subsidy to land use in forestry: Effects on land use - Sumatra (per cent change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources					Simulation Set B: Additional 15% Emissions Reduction With International Assistance				
	Sim-A1	Sim-A2	Sim-A3	Sim-A4	Sim-A5	Sim-B1	Sim-B2	Sim-B3	Sim-B4	Sim-B5
Parametric assumptions										
Sigma-Crops	0.750	0.600	0.900	0.750	0.750	0.750	0.600	0.900	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.300	0.700	0.500	0.500	0.500	0.300	0.700
Land use change: Sumatra (% change)										
Paddy	-2.203	-2.255	-2.165	-2.203	-2.203	-1.321	-1.355	-1.295	-1.316	-1.323
Maize	-2.172	-2.226	-2.132	-2.172	-2.172	-1.331	-1.366	-1.305	-1.325	-1.333
Root crops	-2.335	-2.380	-2.302	-2.335	-2.335	-1.446	-1.475	-1.425	-1.440	-1.449
Beans	-2.827	-2.846	-2.813	-2.825	-2.827	-1.938	-1.942	-1.934	-1.939	-1.937
Veg. & fruits	-2.833	-2.856	-2.816	-2.832	-2.834	-1.818	-1.831	-1.808	-1.810	-1.822
Rubber	-3.660	-3.651	-3.666	-3.663	-3.659	-2.231	-2.227	-2.234	-2.239	-2.228
Sugarcane	-1.550	-1.634	-1.490	-1.551	-1.550	-0.824	-0.883	-0.781	-0.818	-0.826
Coconut	-3.814	-3.788	-3.833	-3.812	-3.815	-2.434	-2.414	-2.448	-2.432	-2.434
Oil palm	-3.759	-3.745	-3.769	-3.754	-3.762	-2.312	-2.304	-2.318	-2.310	-2.313
Other estate crops	-2.846	-2.864	-2.833	-2.849	-2.845	-1.911	-1.917	-1.907	-1.921	-1.907
Tobacco	-1.668	-1.741	-1.615	-1.671	-1.667	-1.047	-1.094	-1.014	-1.043	-1.049
Coffee	-5.136	-4.987	-5.252	-5.138	-5.136	-3.381	-3.263	-3.472	-3.397	-3.374
Tea	-0.800	-0.966	-0.674	-0.798	-0.800	-0.340	-0.455	-0.254	-0.360	-0.331
Clove	-5.392	-5.215	-5.529	-5.391	-5.392	-3.699	-3.553	-3.814	-3.713	-3.694
Cacao	-3.588	-3.580	-3.593	-3.592	-3.586	-2.105	-2.106	-2.104	-2.112	-2.102
Other agriculture	-3.448	-3.448	-3.448	-3.449	-3.447	-2.032	-2.037	-2.028	-2.028	-2.034
Forest products	6.435	6.434	6.435	6.433	6.436	3.605	3.605	3.606	3.605	3.606
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Authors' calculations.

Table 21 Subsidy to land use in forestry: Effects on land use – Java-Bali (per cent change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources					Simulation Set B: Additional 15% Emissions Reduction With International Assistance				
	Sim-A1	Sim-A2	Sim-A3	Sim-A4	Sim-A5	Sim-B1	Sim-B2	Sim-B3	Sim-B4	Sim-B5
Parametric assumptions										
Sigma-Crops	0.750	0.600	0.900	0.750	0.750	0.750	0.600	0.900	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.300	0.700	0.500	0.500	0.500	0.300	0.700
Land use change: Java-Bali (% change)										
Paddy	-0.401	-0.419	-0.387	-0.404	-0.400	-0.208	-0.221	-0.198	-0.207	-0.208
Maize	-0.369	-0.389	-0.354	-0.372	-0.368	-0.218	-0.232	-0.207	-0.217	-0.218
Root crops	-0.536	-0.547	-0.527	-0.539	-0.534	-0.334	-0.342	-0.329	-0.333	-0.335
Beans	-1.037	-1.022	-1.047	-1.038	-1.036	-0.832	-0.815	-0.844	-0.838	-0.829
Veg. & fruits	-1.043	-1.032	-1.051	-1.044	-1.042	-0.711	-0.702	-0.717	-0.708	-0.712
Rubber	-1.885	-1.841	-1.916	-1.891	-1.883	-1.129	-1.102	-1.147	-1.141	-1.123
Sugarcane	0.263	0.213	0.300	0.260	0.265	0.295	0.257	0.322	0.296	0.294
Coconut	-2.042	-1.981	-2.087	-2.043	-2.042	-1.333	-1.292	-1.363	-1.337	-1.332
Oil palm	-1.986	-1.938	-2.020	-1.984	-1.987	-1.210	-1.180	-1.231	-1.213	-1.209
Other estate crops	-1.056	-1.040	-1.068	-1.062	-1.053	-0.805	-0.789	-0.816	-0.819	-0.798
Tobacco	0.144	0.104	0.172	0.138	0.146	0.069	0.044	0.087	0.068	0.069
Coffee	-3.389	-3.202	-3.531	-3.393	-3.387	-2.291	-2.151	-2.399	-2.312	-2.282
Tea	1.028	0.894	1.130	1.026	1.029	0.784	0.690	0.855	0.758	0.795
Clove	-3.649	-3.435	-3.813	-3.651	-3.648	-2.613	-2.444	-2.744	-2.631	-2.605
Cacao	-1.811	-1.769	-1.842	-1.818	-1.808	-1.001	-0.980	-1.015	-1.013	-0.996
Other agriculture	-1.669	-1.634	-1.694	-1.673	-1.667	-0.927	-0.911	-0.939	-0.928	-0.927
Forest products	8.417	8.443	8.398	8.448	8.401	4.785	4.802	4.774	4.799	4.778
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Authors' calculations.

Table 22 Subsidy to land use in forestry: Effects on land use – Kalimantan (per cent change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources					Simulation Set B: Additional 15% Emissions Reduction With International Assistance				
	Sim-A1	Sim-A2	Sim-A3	Sim-A4	Sim-A5	Sim-B1	Sim-B2	Sim-B3	Sim-B4	Sim-B5
Parametric assumptions										
Sigma-Crops	0.750	0.600	0.900	0.750	0.750	0.750	0.600	0.900	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.300	0.700	0.500	0.500	0.500	0.300	0.700
Land use change: Kalimantan (% change)										
Paddy	-6.795	-6.844	-6.759	-6.791	-6.796	-4.010	-4.043	-3.986	-4.004	-4.013
Maize	-6.765	-6.816	-6.728	-6.762	-6.767	-4.020	-4.054	-3.995	-4.013	-4.023
Root crops	-6.921	-6.964	-6.890	-6.918	-6.922	-4.132	-4.160	-4.112	-4.125	-4.136
Beans	-7.390	-7.408	-7.377	-7.385	-7.392	-4.611	-4.614	-4.608	-4.611	-4.611
Veg. & fruits	-7.396	-7.417	-7.380	-7.391	-7.398	-4.494	-4.506	-4.485	-4.485	-4.498
Rubber	-8.184	-8.174	-8.190	-8.183	-8.185	-4.896	-4.891	-4.899	-4.902	-4.894
Sugarcane	-6.173	-6.252	-6.116	-6.171	-6.174	-3.527	-3.584	-3.486	-3.520	-3.530
Coconut	-8.331	-8.305	-8.349	-8.325	-8.333	-5.093	-5.073	-5.107	-5.090	-5.094
Oil palm	-8.278	-8.265	-8.287	-8.270	-8.282	-4.975	-4.966	-4.980	-4.971	-4.976
Other estate crops	-7.408	-7.424	-7.396	-7.407	-7.408	-4.585	-4.589	-4.581	-4.592	-4.581
Tobacco	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coffee	-9.591	-9.447	-9.701	-9.589	-9.591	-6.014	-5.899	-6.104	-6.028	-6.008
Tea	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Clove	-9.834	-9.665	-9.965	-9.830	-9.836	-6.324	-6.181	-6.436	-6.335	-6.319
Cacao	-8.115	-8.106	-8.120	-8.115	-8.115	-4.773	-4.773	-4.773	-4.779	-4.771
Other agriculture	-7.981	-7.981	-7.982	-7.979	-7.983	-4.703	-4.707	-4.699	-4.697	-4.705
Forest products	1.436	1.436	1.435	1.435	1.436	0.781	0.781	0.781	0.781	0.781
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Authors' calculations.

Table 23 Subsidy to land use in forestry: Effects on land use – Sulawesi (per cent change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources					Simulation Set B: Additional 15% Emissions Reduction With International Assistance				
	Sim-A1	Sim-A2	Sim-A3	Sim-A4	Sim-A5	Sim-B1	Sim-B2	Sim-B3	Sim-B4	Sim-B5
Parametric assumptions										
Sigma-Crops	0.750	0.600	0.900	0.750	0.750	0.750	0.600	0.900	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.300	0.700	0.500	0.500	0.500	0.300	0.700
Land use change: Sulawesi (% change)										
Paddy	-3.210	-3.257	-3.175	-3.212	-3.209	-1.913	-1.945	-1.889	-1.909	-1.915
Maize	-3.179	-3.228	-3.143	-3.181	-3.178	-1.923	-1.956	-1.899	-1.919	-1.925
Root crops	-3.341	-3.381	-3.311	-3.343	-3.340	-2.038	-2.064	-2.018	-2.033	-2.040
Beans	-3.828	-3.842	-3.817	-3.828	-3.827	-2.527	-2.529	-2.525	-2.529	-2.525
Veg. & fruits	-3.834	-3.852	-3.820	-3.834	-3.834	-2.408	-2.418	-2.400	-2.401	-2.411
Rubber	-4.652	-4.639	-4.661	-4.657	-4.650	-2.818	-2.812	-2.823	-2.827	-2.815
Sugarcane	-2.564	-2.643	-2.507	-2.567	-2.563	-1.419	-1.476	-1.378	-1.415	-1.421
Coconut	-4.805	-4.774	-4.827	-4.804	-4.805	-3.019	-2.997	-3.035	-3.019	-3.019
Oil palm	-4.750	-4.732	-4.763	-4.747	-4.752	-2.899	-2.888	-2.906	-2.897	-2.899
Other estate crops	-3.847	-3.860	-3.837	-3.852	-3.844	-2.500	-2.503	-2.498	-2.511	-2.495
Tobacco	-2.681	-2.749	-2.631	-2.685	-2.678	-1.642	-1.685	-1.610	-1.639	-1.643
Coffee	-6.113	-5.961	-6.231	-6.117	-6.112	-3.961	-3.842	-4.054	-3.978	-3.953
Tea	-1.821	-1.981	-1.700	-1.822	-1.821	-0.939	-1.050	-0.854	-0.960	-0.929
Clove	-6.367	-6.187	-6.505	-6.368	-6.366	-4.278	-4.130	-4.393	-4.292	-4.271
Cacao	-4.581	-4.568	-4.589	-4.586	-4.578	-2.693	-2.691	-2.693	-2.701	-2.689
Other agriculture	-4.442	-4.437	-4.445	-4.446	-4.441	-2.621	-2.623	-2.618	-2.617	-2.622
Forest products	5.343	5.345	5.341	5.345	5.341	2.985	2.986	2.984	2.986	2.984
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Authors' calculations.

Table 24 Subsidy to land use in forestry: Effects on land use – Eastern Indonesia (per cent change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources					Simulation Set B: Additional 15% Emissions Reduction With International Assistance				
	Sim-A1	Sim-A2	Sim-A3	Sim-A4	Sim-A5	Sim-B1	Sim-B2	Sim-B3	Sim-B4	Sim-B5
Parametric assumptions										
Sigma-Crops	0.750	0.600	0.900	0.750	0.750	0.750	0.600	0.900	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.300	0.700	0.500	0.500	0.500	0.300	0.700
Land use change: Eastern Indonesia (% change)										
Paddy	-7.155	-7.200	-7.121	-7.162	-7.151	-4.207	-4.239	-4.184	-4.204	-4.208
Maize	-7.125	-7.173	-7.091	-7.133	-7.121	-4.217	-4.250	-4.193	-4.214	-4.218
Root crops	-7.280	-7.319	-7.252	-7.288	-7.277	-4.329	-4.356	-4.309	-4.325	-4.331
Beans	-7.747	-7.762	-7.737	-7.753	-7.744	-4.806	-4.809	-4.804	-4.810	-4.805
Veg. & fruits	-7.753	-7.771	-7.740	-7.759	-7.750	-4.690	-4.701	-4.682	-4.685	-4.693
Rubber	-8.539	-8.526	-8.547	-8.548	-8.534	-5.091	-5.085	-5.095	-5.100	-5.087
Sugarcane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coconut	-8.685	-8.656	-8.706	-8.690	-8.682	-5.288	-5.267	-5.302	-5.288	-5.287
Oil palm	-8.633	-8.615	-8.644	-8.635	-8.631	-5.170	-5.160	-5.176	-5.170	-5.170
Other estate crops	-7.766	-7.778	-7.756	-7.776	-7.761	-4.781	-4.784	-4.778	-4.792	-4.775
Tobacco	-6.647	-6.713	-6.600	-6.657	-6.642	-3.942	-3.985	-3.911	-3.940	-3.943
Coffee	-9.940	-9.794	-10.053	-9.949	-9.936	-6.207	-6.091	-6.297	-6.225	-6.199
Tea	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Clove	-10.183	-10.011	-10.316	-10.189	-10.179	-6.516	-6.373	-6.628	-6.531	-6.510
Cacao	-8.470	-8.458	-8.477	-8.481	-8.464	-4.969	-4.968	-4.969	-4.978	-4.965
Other agriculture	-8.337	-8.333	-8.339	-8.346	-8.333	-4.898	-4.901	-4.895	-4.896	-4.899
Forest products	1.052	1.052	1.051	1.053	1.051	0.576	0.577	0.576	0.576	0.576
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Authors' calculations.

Table 25 Subsidy to land use in forestry: Effects on land use – Indonesia (per cent change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources					Simulation Set B: Additional 15% Emissions Reduction With International Assistance				
	Sim-A1	Sim-A2	Sim-A3	Sim-A4	Sim-A5	Sim-B1	Sim-B2	Sim-B3	Sim-B4	Sim-B5
Parametric assumptions										
Sigma-Crops	0.750	0.600	0.900	0.750	0.750	0.750	0.600	0.900	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.300	0.700	0.500	0.500	0.500	0.300	0.700
Land use change: INDONESIA (% change)										
Paddy	-2.284	-2.321	-2.256	-2.285	-2.283	-1.582	-1.610	-1.562	-1.579	-1.583
Maize	-2.008	-2.043	-1.981	-2.010	-2.006	-1.442	-1.469	-1.423	-1.440	-1.443
Root crops	-2.491	-2.519	-2.470	-2.494	-2.489	-1.807	-1.828	-1.791	-1.803	-1.808
Beans	-2.958	-2.957	-2.959	-2.960	-2.957	-2.330	-2.325	-2.333	-2.335	-2.327
Veg. & fruits	-3.091	-3.099	-3.086	-3.092	-3.091	-2.233	-2.239	-2.228	-2.228	-2.235
Rubber	-4.966	-4.956	-4.973	-4.968	-4.966	-3.205	-3.199	-3.208	-3.211	-3.202
Sugarcane	-0.573	-0.637	-0.526	-0.575	-0.571	-0.274	-0.323	-0.239	-0.271	-0.275
Coconut	-4.860	-4.826	-4.885	-4.860	-4.860	-3.289	-3.266	-3.306	-3.289	-3.289
Oil palm	-4.868	-4.854	-4.878	-4.863	-4.871	-3.139	-3.130	-3.144	-3.136	-3.140
Other estate crops	-3.044	-3.042	-3.046	-3.051	-3.041	-2.328	-2.324	-2.330	-2.341	-2.322
Tobacco	-0.811	-0.856	-0.779	-0.817	-0.808	-0.756	-0.788	-0.733	-0.757	-0.756
Coffee	-5.696	-5.542	-5.815	-5.699	-5.695	-3.863	-3.744	-3.956	-3.880	-3.856
Tea	0.714	0.575	0.821	0.713	0.715	0.568	0.470	0.643	0.544	0.579
Clove	-6.188	-6.001	-6.331	-6.190	-6.186	-4.393	-4.243	-4.510	-4.409	-4.387
Cacao	-5.065	-5.052	-5.074	-5.071	-5.062	-3.121	-3.120	-3.121	-3.129	-3.117
Other agriculture	-4.943	-4.939	-4.946	-4.947	-4.941	-3.139	-3.142	-3.137	-3.136	-3.141
Forest products	2.188	2.189	2.188	2.189	2.188	1.076	1.076	1.075	1.075	1.076
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Authors' calculations.

Table 26 Results: Effects on the Subsidy Cost of Emission Abatement

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources		**Simulation Set B: Additional 15% Emissions Reduction With International Assistance**	
	Simulation A1-PT	Simulation A1-RF	Simulation B1-PT	Simulation B1-RF
	Oil palm production tax	Reforestation fund levy	Oil palm production tax	Reforestation fund levy
Parametric assumptions				
Sigma-Crops	0.750	0.600	0.750	0.600
Sigma-Forest-Crops	0.500	0.500	0.500	0.500
Changes in CO2 emissions resulting from land use change				
% change	-26.0	-26.0	-20.27	-20.27
Million tonnes CO2	-379.3	-379.3	-218.8	-218.8
Rate of production tax on oil palm (%)				
per cent	215.5	0	208.6	0
Revenue from the production tax on oil palm (Rp Billion)				
Rp Billion	16,873	0	2,432	0
Change in levy rate on forestry output (RF) (%)				
per cent	0	-61.5	0	-17.0
Revenue loss from change in levy on forestry output				
Rp. Billion	0	-22,364	0	-16,318

Source: Authors' calculations.

Table 27 Palm oil tax and timber levy: Macroeconomic effects (per cent change from base unless otherwise stated)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources		Simulation Set B: Additional 15% Emissions Reduction With International Assistance	
	Simulation A1-PT	Simulation A1-RF	Simulation B1-PT	Simulation B1-RF
	Oil palm production tax	Reforestation fund levy	Oil palm production tax	Reforestation fund levy
Sigma-Crops	0.750	0.750	0.750	0.750
Sigma-Forest-Crops	0.500	0.700	0.500	0.700
Macroeconomic results (per cent change)				
Real GDP	-0.260	-0.083	-0.411	-0.047
Real consumption	-0.490	-0.125	-0.760	0.708
Export volume index	1.277	0.064	0.894	-0.550
Import volume index	1.468	0.089	0.829	1.583
GDP price index	-1.177	0.662	-1.020	1.177
Consumer price index	-0.935	0.887	-0.950	1.428
Real factor returns				
Wage: skilled	0.645	-1.802	-0.540	-0.195
Wage: unskilled	-2.409	0.201	-1.531	0.238
Capital	0.231	-0.615	-0.250	0.144
Land	-9.007	22.533	-3.545	17.008
Change in nominal GDP (Rp billion)				
Consumption	-19,870.2	10,634.8	-23,469.648	30,238.547
Investment	-6,759.3	851.5	-4,224.430	2,379.599
Stock	-1,085.6	77.7	-384.366	-428.747
Government	-2,560.9	655.2	-2,504.928	2,151.971
Net export	0.0	0.0	866.577	-10,345.297
Total	-30,275.9	12,219.1	-29,716.797	23,996.072

Source: Authors' calculations.

Table 28 Palm oil tax and timber levy: Effects on output by industry (per cent change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources		Simulation Set B: Additional 15% Emissions Reduction With International Assistance	
	Simulation A1-PT	Simulation A1-RF	Simulation B1-PT	Simulation B1-RF
	Oil palm production tax	Reforestation fund levy	Oil palm production tax	Reforestation fund levy
Paddy	0.045	-0.185	-0.088	0.027
Maize	-0.646	-0.533	-0.483	-0.158
Root crops	-0.151	-0.349	-0.241	-0.012
Beans	0.122	-1.176	0.101	-0.964
Veg. & fruits	0.756	-0.806	0.150	-0.287
Rubber	1.747	-0.819	0.998	-0.908
Sugar cane	-1.642	-0.482	-1.063	0.003
Coconut	1.074	-1.529	0.435	-1.126
Oil palm	-44.337	-1.449	-38.561	-1.022
Other estate crops	1.696	-1.419	1.088	-1.364
Tobacco	-1.600	-0.475	-1.056	0.031
Coffee	7.610	-4.395	3.322	-3.749
Tea	4.150	-1.240	2.442	-1.550
Cloves	2.551	-4.205	1.487	-3.629
Cacao	1.927	-1.194	1.135	-1.077
Other agriculture	0.201	-0.332	-0.065	-0.076
Livestock	-0.400	-0.429	-0.421	0.034
Forest products	1.379	6.892	0.798	2.917
Fisheries	0.205	-0.273	0.000	0.005
Agricultural service	-4.109	0.030	-2.077	-0.081
Coal mining	0.244	-0.105	0.159	-0.117
Oil & gas	0.028	-0.010	0.026	-0.020

Source: Authors' calculations.

Table 29 Palm oil tax and timber levy: Effects on output by industry - continued (per cent change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources		Simulation Set B: Additional 15% Emissions Reduction With International Assistance	
	Simulation A1-PT Oil palm production tax	Simulation A1-RF Reforestation fund levy	Simulation B1-PT Oil palm production tax	Simulation B1-RF Reforestation fund levy
Food, bev. tobacco	-1.694	-0.491	-1.094	0.004
Milled rice	0.099	-0.184	-0.063	0.032
Textile products	1.939	-0.381	1.135	-0.547
Wood products	2.120	7.226	1.278	1.888
Chemicals	0.401	-0.455	0.058	-0.704
Pulp paper	1.208	-0.126	0.698	-0.328
Oil refinery	0.214	-0.120	0.136	-0.082
Rubber products	2.603	-1.556	1.597	-1.403
Plastics	1.056	-0.193	0.553	-0.320
Ceramic products	0.834	-0.402	0.476	-0.267
Cement	0.298	-0.092	0.219	-0.146
Ferrous metals	1.725	-0.651	1.220	-0.852
Machinery	1.168	-0.640	0.666	-0.432
Other manuf.	5.334	0.198	3.441	-1.757
Utilities	0.166	-0.099	-0.068	0.145
Construction	-0.011	-0.005	-0.010	0.005
Trade	0.144	-0.047	0.093	-0.057
Other services	-0.089	-0.038	-0.153	0.177
Hotel & restaurant	-0.058	-0.182	-0.119	0.039
Transport	0.455	-0.439	0.131	-0.149
Banking & finance	0.111	0.032	0.116	-0.059

Source: Authors' calculations.

Table 30 Palm oil tax and timber levy: Effects on producer price by industry (per cent change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources		Simulation Set B: Additional 15% Emissions Reduction With International Assistance	
	Simulation A1-PT	Simulation A1-RF	Simulation B1-PT	Simulation B1-RF
	Oil palm production tax	Reforestation fund levy	Oil palm production tax	Reforestation fund levy
Paddy	-6.071	3.871	-3.610	3.726
Maize	-5.711	2.854	-3.534	3.083
Root crops	-5.684	4.055	-3.613	4.207
Beans	-3.543	2.533	-2.289	2.536
Veg. & fruits	-4.062	2.896	-2.706	3.114
Rubber	-4.878	2.974	-2.642	2.386
Sugar cane	-5.620	1.289	-3.287	1.628
Coconut	-4.791	3.912	-2.715	3.315
Oil palm	103.153	2.853	28.032	2.366
Other estate crops	-1.071	1.913	-0.637	1.596
Tobacco	-2.711	1.264	-1.750	1.479
Coffee	-7.758	1.420	-5.151	3.700
Tea	-1.401	-0.164	-1.083	0.538
Cloves	-4.048	2.401	-2.500	2.327
Cacao	-2.293	5.482	-1.272	4.050
Other agriculture	-4.931	4.343	-2.696	3.781
Livestock	-2.049	1.405	-1.512	1.676
Forest products	-0.880	-43.832	-0.248	-26.993
Fisheries	-3.714	0.812	-2.867	2.023
Agricultural service	-7.261	1.695	-4.041	1.770
Coal mining	0.026	0.066	0.044	-0.001
Oil & gas	-0.326	0.383	0.006	-0.009

Source: Authors' calculations.

Table 31 Palm oil tax and timber levy: Effects on producer price by Industry - continued (per cent change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources		Simulation Set B: Additional 15% Emissions Reduction With International Assistance	
	Simulation A1-PT Oil palm production tax	Simulation A1-RF Reforestation fund levy	Simulation B1-PT Oil palm production tax	Simulation B1-RF Reforestation fund levy
Food, bev. tobacco	3.244	1.371	1.266	1.657
Milled rice	-5.797	3.744	-3.342	3.337
Textile products	-1.586	0.490	-1.008	0.672
Wood products	-2.423	-6.919	-1.655	-1.498
Chemicals	-0.721	0.568	-0.168	0.529
Pulp paper	-1.781	0.343	-1.134	0.715
Oil refinery	-0.390	0.226	-0.291	0.273
Rubber products	-1.925	1.398	-1.136	1.077
Plastics	-1.231	0.358	-0.737	0.552
Ceramic products	-1.513	0.774	-1.067	0.839
Cement	-1.437	0.718	-1.047	0.779
Ferrous metals	-0.530	0.518	-0.181	0.166
Machinery	-1.099	0.682	-0.671	0.569
Other manufacturing	-1.099	0.376	-0.563	0.319
Utilities	-0.953	0.356	-1.292	1.265
Construction	-1.998	0.157	-1.271	0.663
Trade	-1.191	0.009	-1.548	1.268
Other services	-1.435	0.387	-1.405	1.181
Hotel & restaurant	-1.088	0.660	-1.211	1.402
Transport	-1.617	0.899	-1.127	0.963
Banking & finance	-0.810	0.031	-1.166	1.027

Source: Authors' calculations.

Table 32 Palm oil tax and timber levy: Effects on consumer price by commodity (per cent change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources		Simulation Set B: Additional 15% Emissions Reduction With International Assistance	
	Simulation A1-PT	Simulation A1-RF	Simulation B1-PT	Simulation B1-RF
	Oil palm production tax	Reforestation fund levy	Oil palm production tax	Reforestation fund levy
Paddy	0.000	0.000	0.000	0.000
Maize	-5.495	2.749	-3.394	2.952
Root crops	-5.683	4.054	-3.613	4.206
Beans	-2.502	1.813	-1.555	1.646
Veg. & fruits	-4.272	3.039	-2.864	3.294
Rubber	0.000	0.000	0.000	0.000
Sugar cane	0.000	0.000	0.000	0.000
Coconut	-4.918	4.022	-2.790	3.426
Oil palm	0.000	0.000	0.000	0.000
Other estate crops	-1.443	2.712	-0.999	2.452
Tobacco	-2.710	1.263	-1.750	1.479
Coffee	-7.756	1.417	-5.151	3.700
Tea	-1.396	-0.170	-1.083	0.538
Cloves	-4.471	2.649	-2.771	2.645
Cacao	0.000	0.000	0.000	0.000
Other agriculture	-4.933	4.345	-2.698	3.785
Livestock	-2.114	1.444	-1.570	1.743
Forest products	-0.875	-43.889	-0.249	-27.016
Fisheries	-3.711	0.811	-2.865	2.022
Agricultural service	0.000	0.000	0.000	0.000
Coal mining	0.514	-0.475	0.052	-0.001
Oil & gas	0.000	0.000	0.000	0.000

Source: Authors' calculations.

Table 33 Palm oil tax and timber levy: Effects on consumer price by commodity - continued (per cent change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources		Simulation Set B: Additional 15% Emissions Reduction With International Assistance	
	Simulation A1-PT	Simulation A1-RF	Simulation B1-PT	Simulation B1-RF
	Oil palm production tax	Reforestation fund levy	Oil palm production tax	Reforestation fund levy
Food, bev. tobacco	3.294	1.369	1.281	1.676
Milled rice	-5.797	3.744	-3.342	3.337
Textile products	-1.679	0.491	-1.087	0.727
Wood products	-2.442	-6.999	-1.672	-1.513
Chemicals	-0.769	0.584	-0.194	0.609
Pulp paper	-2.010	0.318	-1.326	0.838
Oil refinery	-0.097	-0.141	-0.329	0.308
Rubber products	-0.930	0.768	-0.416	0.369
Plastics	-1.132	0.364	-0.655	0.489
Ceramic products	-1.611	0.797	-1.164	0.920
Cement	-1.436	0.693	-1.071	0.798
Ferrous metals	0.000	0.000	0.000	0.000
Machinery	-1.068	0.665	-0.650	0.548
Other manufacturing	-1.117	0.372	-0.580	0.326
Utilities	-0.956	0.360	-1.292	1.265
Construction	0.000	0.000	0.000	0.000
Trade	-1.180	-0.004	-1.548	1.268
Other services	-1.478	0.380	-1.468	1.235
Hotel & restaurant	-1.106	0.663	-1.247	1.444
Transport	-1.580	0.884	-1.094	0.934
Banking & finance	-0.824	0.008	-1.216	1.071

Source: Authors' calculations.

Table 34 Palm oil tax and timber levy: Effects on land use - Sumatra ('000 Ha.)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources		Simulation Set B: Additional 15% Emissions Reduction With International Assistance	
	Simulation A1-PT	Simulation A1-RF	Simulation B1-PT	Simulation B1-RF
	Oil palm production tax	Reforestation fund levy	Oil palm production tax	Reforestation fund levy
Parametric assumptions				
Sigma-Crops	0.750	0.750	0.750	0.750
Sigma-Forest-Crops	0.500	0.700	0.500	0.700
Land use change: Java-Bali (000 Ha)				
Paddy	190.3	-57.9	104.2	-28.6
Maize	34.0	-13.8	18.5	-6.8
Root crops	27.8	-10.3	15.0	-5.0
Beans	3.8	-2.0	2.3	-1.4
Veg. & fruits	28.5	-11.1	15.1	-5.8
Rubber	257.3	-87.0	149.4	-57.3
Sugarcane	5.6	-1.7	3.0	-0.6
Coconut	102.0	-51.0	55.3	-31.0
Oil palm	-1,344.8	-157.2	-769.9	-92.2
Other estate crops	0.7	-0.3	0.5	-0.2
Tobacco	0.2	-0.1	0.1	0.0
Coffee	125.8	-48.8	69.4	-34.2
Tea	1.9	-0.4	1.2	-0.3
Clove	5.2	-3.9	3.1	-2.7
Cacao	10.5	-5.2	6.2	-3.2
Other agriculture	32.7	-13.9	17.2	-7.2
Forest products	518.4	464.5	309.4	276.7
TOTAL	0.0	0.0	0.0	0.0

Source: Authors' calculations.

Table 35 Palm oil tax and timber levy: Effects on land use – Java-Bali ('000 Ha.)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources		Simulation Set B: Additional 15% Emissions Reduction With International Assistance	
	Simulation A1-PT	Simulation A1-RF	Simulation B1-PT	Simulation B1-RF
	Oil palm production tax	Reforestation fund levy	Oil palm production tax	Reforestation fund levy
Parametric assumptions				
Sigma-Crops	0.750	0.750	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.500
Land use change: Java-Bali (000 Ha)				
Paddy	-6.0	-12.5	-5.2	-2.6
Maize	-22.3	-7.9	-12.2	-2.7
Root crops	-7.8	-5.1	-4.8	-1.6
Beans	-4.8	-7.3	-1.3	-6.5
Veg. & fruits	4.3	-8.8	0.9	-4.4
Rubber	5.9	-2.8	3.3	-2.2
Sugarcane	-2.4	0.4	-1.5	0.8
Coconut	10.7	-20.5	4.6	-14.0
Oil palm	-9.4	-0.6	-4.9	-0.4
Other estate crops	1.5	-4.2	2.0	-4.2
Tobacco	-5.2	0.1	-2.5	0.3
Coffee	16.7	-8.5	8.4	-6.7
Tea	4.0	-0.2	2.8	-1.0
Clove	2.6	-6.8	1.8	-5.4
Cacao	0.8	-1.4	0.5	-1.0
Other agriculture	0.9	-1.2	0.3	-0.6
Forest products	10.5	87.4	7.8	52.2
TOTAL	0.0	0.0	0.0	0.0

Source: Authors' calculations.

Table 36 Palm oil tax and timber levy: Effects on land use - Kalimantan ('000 Ha.)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources		Simulation Set B: Additional 15% Emissions Reduction With International Assistance	
	Simulation A1-PT	Simulation A1-RF	Simulation B1-PT	Simulation B1-RF
	Oil palm production tax	Reforestation fund levy	Oil palm production tax	Reforestation fund levy
Parametric assumptions				
Sigma-Crops	0.750	0.750	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.500
Land use change: Kalimantan ('000 Ha)				
Paddy	6.6	-57.3	1.0	-30.1
Maize	-0.1	-3.2	-0.2	-1.7
Root crops	0.1	-4.0	-0.1	-2.1
Beans	0.0	-0.7	0.0	-0.4
Veg. & fruits	1.1	-6.1	0.3	-3.2
Rubber	44.3	-68.0	22.9	-39.3
Sugarcane	0.0	-0.1	0.0	-0.1
Coconut	5.6	-23.5	2.0	-13.1
Oil palm	-364.9	-84.0	-193.1	-46.0
Other estate crops	0.0	-0.3	0.0	-0.2
Tobacco	0.0	0.0	0.0	0.0
Coffee	4.6	-4.9	2.2	-3.0
Tea	0.0	0.0	0.0	0.0
Clove	0.1	-0.5	0.1	-0.3
Cacao	0.9	-3.8	0.5	-2.1
Other agriculture	0.9	-3.7	0.3	-1.9
Forest products	300.8	260.1	164.2	143.5
TOTAL	0.0	0.0	0.0	0.0

Source: Authors' calculations.

Table 37 Palm oil tax and timber levy: Effects on land use - Sulawesi ('000 Ha.)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources		Simulation Set B: Additional 15% Emissions Reduction With International Assistance	
	Simulation A1-PT	Simulation A1-RF	Simulation B1-PT	Simulation B1-RF
	Oil palm production tax	Reforestation fund levy	Oil palm production tax	Reforestation fund levy
Parametric assumptions				
Sigma-Crops	0.750	0.750	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.500
Land use change: Sulawesi (000 Ha)				
Paddy	-3.6	-36.5	-3.7	-19.0
Maize	-5.3	-12.4	-3.3	-6.4
Root crops	-1.2	-4.5	-0.9	-2.3
Beans	-0.6	-2.4	-0.3	-1.6
Veg. & fruits	0.5	-5.2	-0.1	-2.8
Rubber	1.0	-1.2	0.6	-0.7
Sugarcane	-0.2	-0.4	-0.2	-0.2
Coconut	7.1	-36.5	2.1	-21.7
Oil palm	-47.0	-6.2	-24.4	-3.6
Other estate crops	0.9	-10.5	1.2	-7.3
Tobacco	0.0	0.0	0.0	0.0
Coffee	12.9	-10.6	6.2	-7.2
Tea	0.1	-0.1	0.0	0.0
Clove	2.4	-11.1	1.6	-7.6
Cacao	5.7	-27.9	3.7	-17.0
Other agriculture	1.3	-6.3	0.2	-3.4
Forest products	26.2	172.0	17.2	100.7
TOTAL	0.0	0.0	0.0	0.0

Source: Authors' calculations.

Table 38 Palm oil tax and timber levy: Effects on land use – Eastern Indonesia ('000 Ha.)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources		Simulation Set B: Additional 15% Emissions Reduction With International Assistance	
	Simulation A1-PT	Simulation A1-RF	Simulation B1-PT	Simulation B1-RF
	Oil palm production tax	Reforestation fund levy	Oil palm production tax	Reforestation fund levy
Parametric assumptions				
Sigma-Crops	0.750	0.750	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.500
Land use change: Eastern Indonesia ('000 Ha.)				
Paddy	-5.2	-37.2	-3.9	-19.4
Maize	-6.0	-21.1	-3.7	-11.0
Root crops	-3.4	-16.2	-2.3	-8.4
Beans	-2.4	-11.5	-1.2	-6.6
Veg. & fruits	-0.6	-11.9	-0.8	-6.2
Rubber	0.2	-0.6	0.1	-0.3
Sugarcane	0.0	0.0	0.0	0.0
Coconut	1.3	-46.8	-0.9	-25.9
Oil palm	-18.7	-4.4	-9.6	-2.4
Other estate crops	-0.8	-20.5	0.1	-12.3
Tobacco	-0.8	-1.6	-0.4	-0.9
Coffee	7.8	-10.8	3.6	-6.5
Tea	0.0	0.0	0.0	0.0
Clove	0.6	-7.3	0.4	-4.5
Cacao	0.3	-10.2	0.2	-5.7
Other agriculture	0.3	-14.6	-0.6	-7.6
Forest products	27.3	214.7	19.1	117.8
TOTAL	0.0	0.0	0.0	0.0

Source: Authors' calculations.

Table 39 Palm oil tax and timber levy: Effects on land use - Indonesia ('000 Ha.)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources		Simulation Set B: Additional 15% Emissions Reduction With International Assistance	
	Simulation A1-PT	Simulation A1-RF	Simulation B1-PT	Simulation B1-RF
	Oil palm production tax	Reforestation fund levy	Oil palm production tax	Reforestation fund levy
Parametric assumptions				
Sigma-Crops	0.750	0.750	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.500
Land use change: Indonesia ('000 Ha.)				
Paddy	182.1	-201.4	92.5	-99.8
Maize	0.3	-58.4	-0.9	-28.6
Root crops	15.5	-40.1	6.9	-19.5
Beans	-4.1	-23.9	-0.6	-16.4
Veg. & fruits	33.9	-43.1	15.3	-22.4
Rubber	308.7	-159.5	176.3	-99.8
Sugarcane	2.9	-1.9	1.4	0.0
Coconut	126.7	-178.3	63.1	-105.8
Oil palm	-1,784.8	-252.3	-1,001.9	-144.5
Other estate crops	2.3	-35.9	3.9	-24.1
Tobacco	-5.8	-1.7	-2.9	-0.7
Coffee	167.7	-83.7	89.8	-57.6
Tea	6.1	-0.6	4.0	-1.3
Clove	10.9	-29.6	6.9	-20.4
Cacao	18.2	-48.5	11.2	-29.0
Other agriculture	36.1	-39.8	17.3	-20.8
Forest products	883.1	1,198.6	517.7	690.8
TOTAL	0.0	0.0	0.0	0.0

Source: Authors' calculations.

Table 40 Palm oil tax and timber levy: Effects on land use – Sumatra (% change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources		Simulation Set B: Additional 15% Emissions Reduction With International Assistance	
	Simulation A1-PT	Simulation A1-RF	Simulation B1-PT	Simulation B1-RF
	Oil palm production tax	Reforestation fund levy	Oil palm production tax	Reforestation fund levy
Parametric assumptions				
Sigma-Crops	0.750	0.750	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.500
Land use change: Sumatra (% change)				
Paddy	6.227	-1.894	3.210	-0.954
Maize	5.120	-2.073	2.648	-1.047
Root crops	5.649	-2.093	2.886	-1.044
Beans	5.461	-2.907	3.066	-2.026
Veg. & fruits	6.880	-2.682	3.414	-1.426
Rubber	11.137	-3.768	5.822	-2.576
Sugarcane	5.099	-1.501	2.576	-0.532
Coconut	7.519	-3.759	3.795	-2.376
Oil palm	-32.964	-3.853	-28.153	-2.351
Other estate crops	6.903	-3.096	4.020	-2.351
Tobacco	3.904	-1.641	2.118	-0.794
Coffee	15.704	-6.099	7.487	-4.552
Tea	9.869	-1.801	5.588	-1.687
Clove	8.183	-6.108	4.530	-4.606
Cacao	7.562	-3.722	4.158	-2.411
Other agriculture	7.443	-3.160	3.635	-1.697
Forest products	7.196	6.448	4.007	3.608

Source: Authors' calculations.

Table 41 Palm oil tax and timber levy: Effects on land use – Java-Bali (% change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources		Simulation Set B: Additional 15% Emissions Reduction With International Assistance	
	Simulation A1-PT	Simulation A1-RF	Simulation B1-PT	Simulation B1-RF
	Oil palm production tax	Reforestation fund levy	Oil palm production tax	Reforestation fund levy
Parametric assumptions				
Sigma-Crops	0.750	0.750	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.500
Land use change: Java-Bali (% change)				
Paddy	-0.109	-0.226	-0.094	-0.048
Maize	-1.150	-0.408	-0.638	-0.141
Root crops	-0.652	-0.428	-0.407	-0.138
Beans	-0.829	-1.256	-0.233	-1.129
Veg. & fruits	0.505	-1.028	0.104	-0.524
Rubber	4.509	-2.132	2.435	-1.685
Sugarcane	-1.169	0.174	-0.707	0.378
Coconut	1.106	-2.122	0.473	-1.483
Oil palm	-36.962	-2.218	-30.453	-1.457
Other estate crops	0.527	-1.448	0.691	-1.457
Tobacco	-2.293	0.031	-1.150	0.114
Coffee	8.803	-4.502	4.046	-3.679
Tea	3.316	-0.131	2.209	-0.787
Clove	1.730	-4.512	1.184	-3.733
Cacao	1.147	-2.085	0.825	-1.518
Other agriculture	1.034	-1.514	0.318	-0.798
Forest products	0.993	8.282	0.729	4.572

Source: Authors' calculations.

Table 42 Palm oil tax and timber levy: Effects on land use - Kalimantan (% change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources		Simulation Set B: Additional 15% Emissions Reduction With International Assistance	
	Simulation A1-PT	Simulation A1-RF	Simulation B1-PT	Simulation B1-RF
	Oil palm production tax	Reforestation fund levy	Oil palm production tax	Reforestation fund levy
Parametric assumptions				
Sigma-Crops	0.750	0.750	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.500
Land use change: Kalimantan (% change)				
Paddy	0.749	-6.516	0.118	-3.657
Maize	-0.302	-6.686	-0.428	-3.747
Root crops	0.201	-6.705	-0.196	-3.744
Beans	0.022	-7.481	-0.022	-4.700
Veg. & fruits	1.368	-7.267	0.315	-4.116
Rubber	5.406	-8.301	2.651	-5.235
Sugarcane	-0.321	-6.141	-0.497	-3.246
Coconut	1.974	-8.292	0.686	-5.040
Oil palm	-36.421	-8.382	-30.306	-5.015
Other estate crops	1.390	-7.660	0.903	-5.016
Tobacco	0.000	0.000	0.000	0.000
Coffee	9.737	-10.522	4.266	-7.157
Tea	0.000	0.000	0.000	0.000
Clove	2.604	-10.531	1.398	-7.209
Cacao	2.015	-8.257	1.038	-5.074
Other agriculture	1.902	-7.722	0.530	-4.380
Forest products	1.658	1.433	0.890	0.780

Source: Authors' calculations.

Table 43 Palm oil tax and timber levy: Effects on land use - Sulawesi (% change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources		Simulation Set B: Additional 15% Emissions Reduction With International Assistance	
	Simulation A1-PT	Simulation A1-RF	Simulation B1-PT	Simulation B1-RF
	Oil palm production tax	Reforestation fund levy	Oil palm production tax	Reforestation fund levy
Parametric assumptions				
Sigma-Crops	0.750	0.750	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.500
Land use change: Sulawesi (% change)				
Paddy	-0.289	-2.929	-0.296	-1.572
Maize	-1.328	-3.106	-0.839	-1.664
Root crops	-0.831	-3.126	-0.609	-1.661
Beans	-1.008	-3.931	-0.435	-2.637
Veg. & fruits	0.324	-3.709	-0.099	-2.040
Rubber	4.320	-4.783	2.227	-3.184
Sugarcane	-1.347	-2.540	-0.908	-1.152
Coconut	0.924	-4.774	0.270	-2.985
Oil palm	-37.076	-4.867	-30.594	-2.959
Other estate crops	0.345	-4.118	0.486	-2.960
Tobacco	-2.469	-2.679	-1.350	-1.412
Coffee	8.607	-7.089	3.835	-5.147
Tea	3.130	-2.837	2.002	-2.300
Clove	1.547	-7.099	0.979	-5.201
Cacao	0.964	-4.737	0.620	-3.019
Other agriculture	0.852	-4.182	0.115	-2.310
Forest products	0.811	5.329	0.530	2.963

Source: Authors' calculations.

Table 44 Palm oil tax and timber levy: Effects on land use – Eastern Indonesia (% change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources		Simulation Set B: Additional 15% Emissions Reduction With International Assistance	
	Simulation A1-PT	Simulation A1-RF	Simulation B1-PT	Simulation B1-RF
	Oil palm production tax	Reforestation fund levy	Oil palm production tax	Reforestation fund levy
Parametric assumptions				
Sigma-Crops	0.750	0.750	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.500
Land use change: Eastern Indonesia (% change)				
Paddy	-0.961	-6.877	-0.727	-3.862
Maize	-1.994	-7.047	-1.268	-3.952
Root crops	-1.500	-7.066	-1.039	-3.950
Beans	-1.675	-7.839	-0.865	-4.903
Veg. & fruits	-0.352	-7.625	-0.531	-4.320
Rubber	3.617	-8.656	1.785	-5.437
Sugarcane	0.000	0.000	0.000	0.000
Coconut	0.244	-8.647	-0.164	-5.243
Oil palm	-37.500	-8.736	-30.894	-5.218
Other estate crops	-0.331	-8.018	0.052	-5.218
Tobacco	-3.127	-6.637	-1.777	-3.707
Coffee	7.874	-10.868	3.387	-7.355
Tea	0.000	0.000	0.000	0.000
Clove	0.862	-10.877	0.542	-7.407
Cacao	0.284	-8.612	0.185	-5.276
Other agriculture	0.172	-8.079	-0.318	-4.584
Forest products	0.133	1.048	0.093	0.569

Source: Authors' calculations.

Table 45 Palm oil tax and timber levy: Effects on land use - Indonesia (% change)

	Simulation Set A: 26% Emissions Reduction Using Domestic Resources		Simulation Set B: Additional 15% Emissions Reduction With International Assistance	
	Simulation A1-PT	Simulation A1-RF	Simulation B1-PT	Simulation B1-RF
	Oil palm production tax	Reforestation fund levy	Oil palm production tax	Reforestation fund levy
Parametric assumptions				
Sigma-Crops	0.750	0.750	0.750	0.750
Sigma-Forest-Crops	0.500	0.500	0.500	0.500
Land use change: Indonesia (% change)				
Paddy	1.264	-2.038	0.367	-1.292
Maize	-0.274	-1.983	-0.380	-1.252
Root crops	0.248	-2.319	-0.154	-1.490
Beans	-0.603	-3.120	-0.234	-2.516
Veg. & fruits	1.649	-3.005	0.453	-1.918
Rubber	9.023	-5.082	4.381	-3.553
Sugarcane	0.477	-0.604	-0.090	-0.094
Coconut	2.793	-4.840	0.997	-3.269
Oil palm	-33.971	-4.966	-28.956	-3.180
Other estate crops	0.426	-3.375	0.566	-2.862
Tobacco	-2.287	-0.899	-1.187	-0.655
Coffee	12.492	-6.674	5.454	-5.053
Tea	4.005	-0.418	2.450	-0.959
Clove	2.232	-6.945	1.239	-5.346
Cacao	1.669	-5.222	0.856	-3.446
Other agriculture	3.459	-4.678	1.124	-2.826
Forest products	1.531	2.185	0.716	1.069

Source: Authors' calculations.

Figure 1 Effects on Emissions of a Subsidy to Production Forest

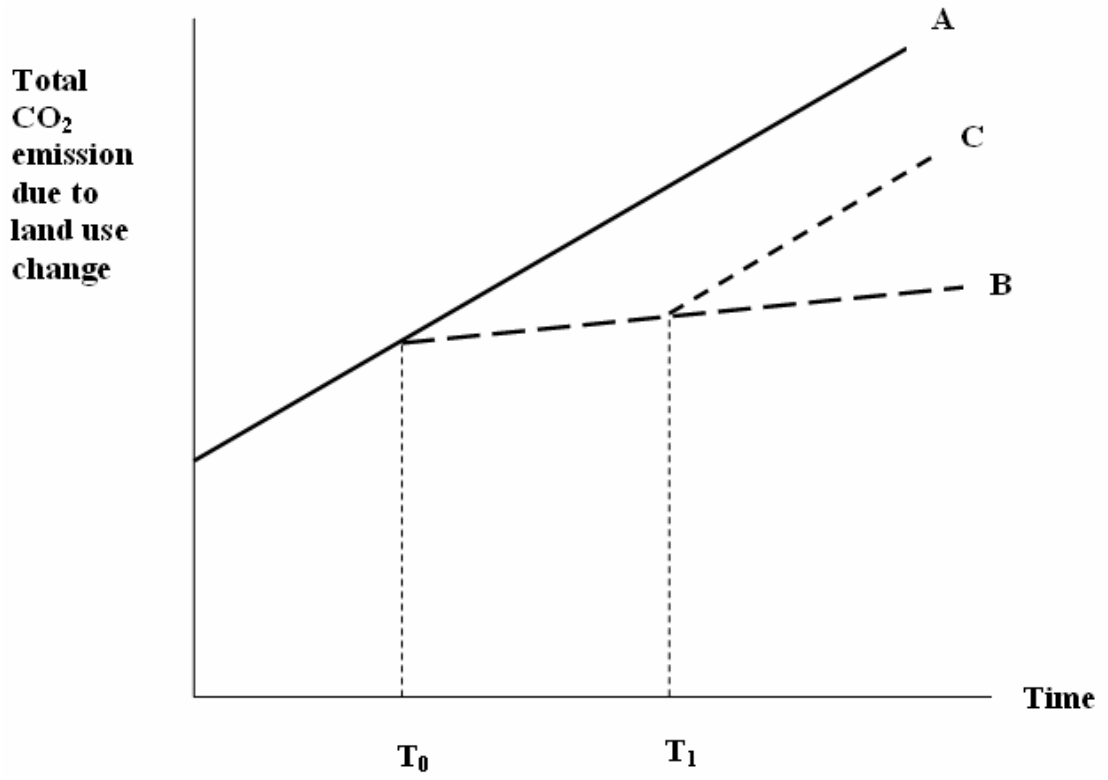


Figure 2 Analytical Structure of the Model

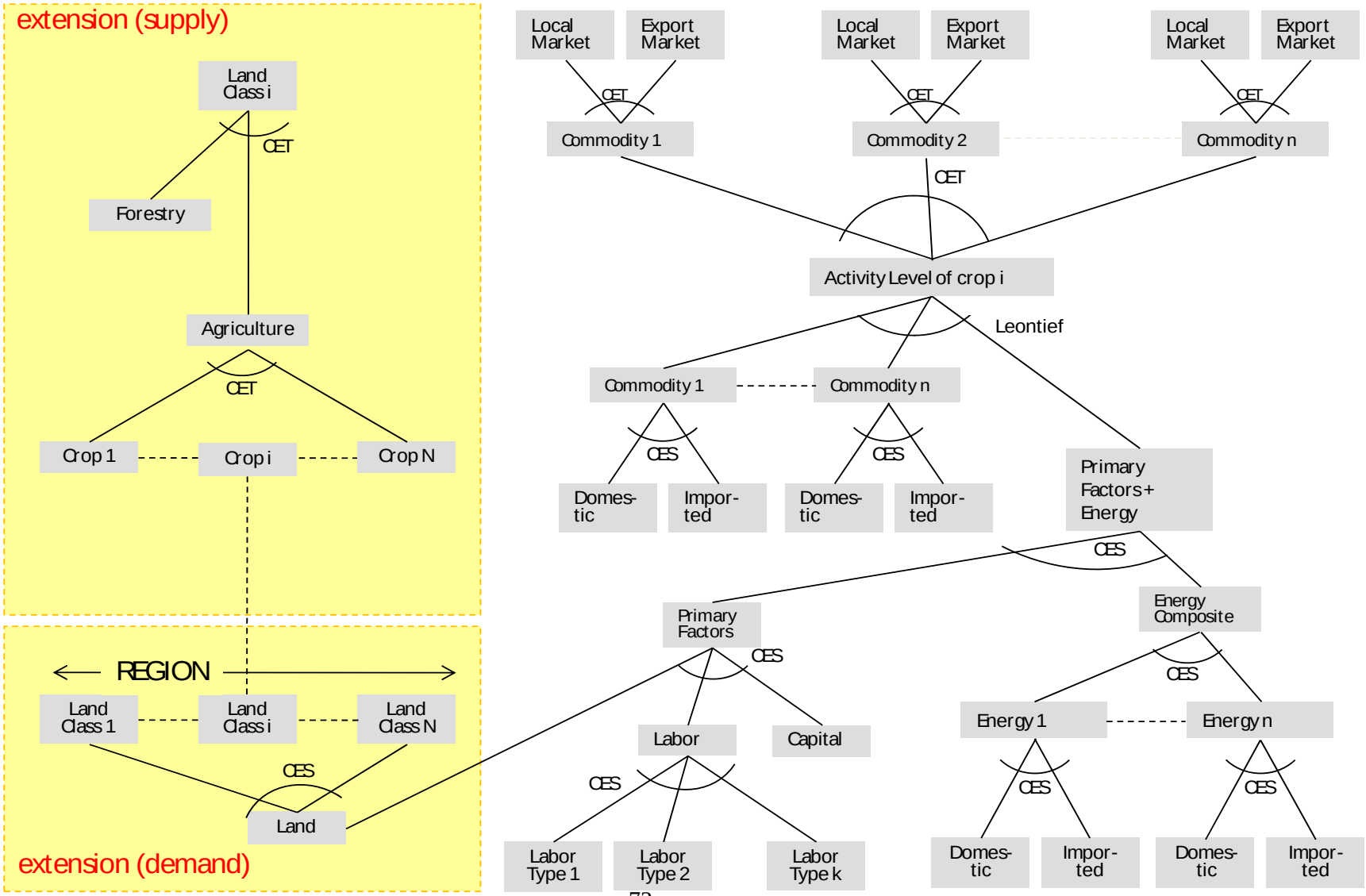


Figure 3 Modeling Land Mobility Between Forestry and Crops

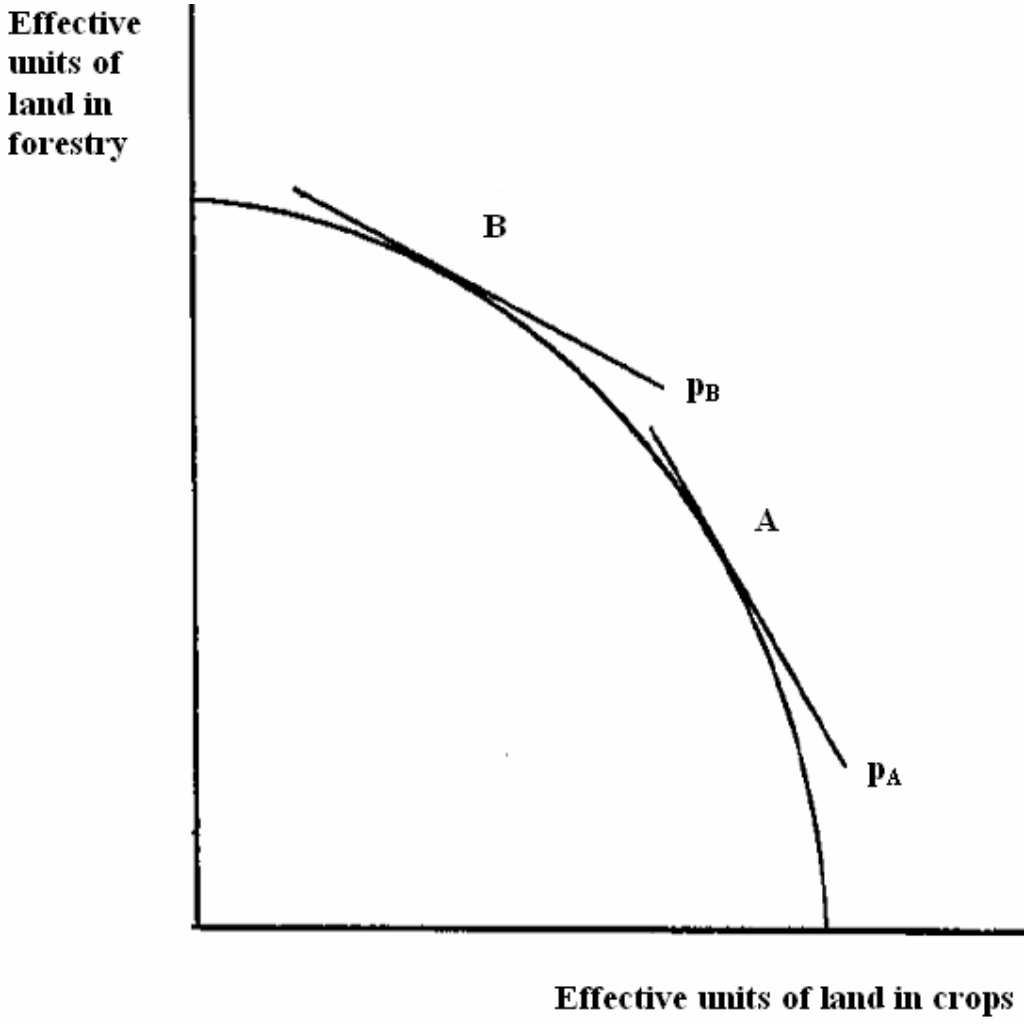
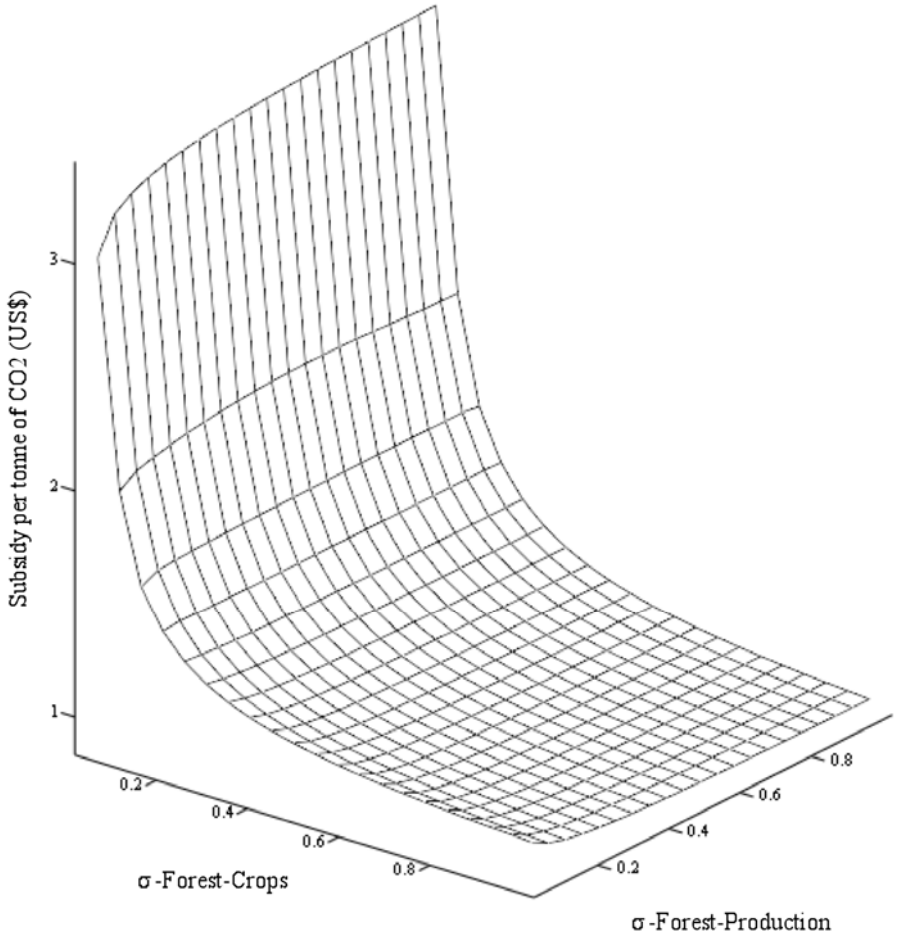
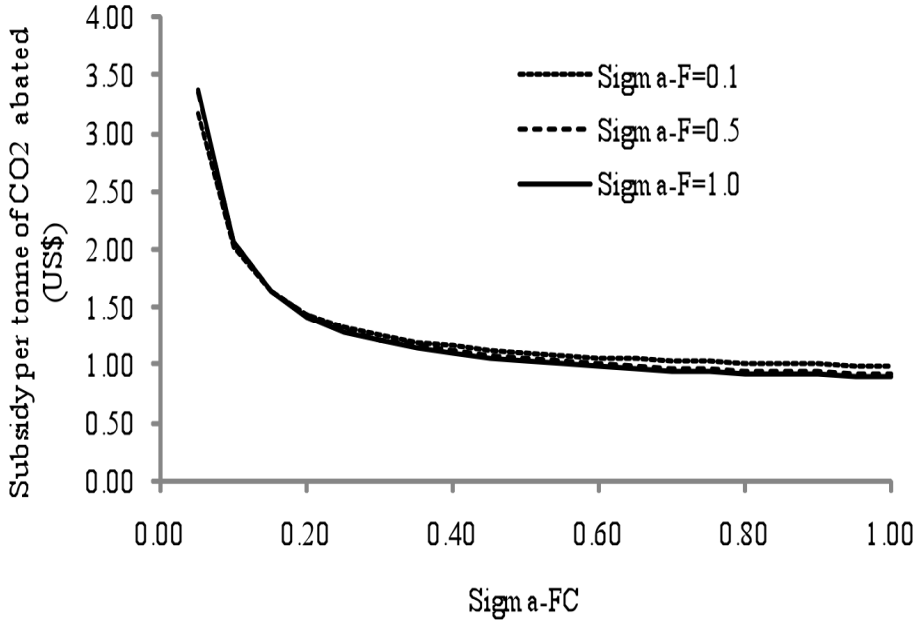


Figure 4 Sensitivity Analysis I



Source: Authors' calculations.

Figure 5 Sensitivity Analysis II



Source: Authors' calculations.