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Emerging Asia's Growth and Policy Developments: Implications for Indonesia's Economy and Trade

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Abstract

This paper projects Indonesia's production and trade patterns to 2020 and 2030 in the course of global economic development under various growth and policy scenarios. We employ the GTAP model and Version 8.1 of the GTAP database, along with supplementary data from a range of sources to support projections of the global economy. The baseline projection assumes trade-related policies as of 2007 do not change in each region but that endowments and real GDP change at exogenously selected rates. Because of the long period over which we are projecting, we modify the standard income elasticities of demand for farm products in rapidly growing developing countries so as to more appropriately reflect their likely values over this time-frame. Effects are reported for three policy reforms: an expansion of rice exports associated with the opening of Myanmar; Indonesia's recently-imposed export taxes on unprocessed primary products; and implementation of Indonesia's new Food Law.

Keywords: Global economy-wide model projections; Indonesian economic growth and structural change; Food policy; Export taxes

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Emerging Asia's Growth and Policy Reforms: Implications for Indonesia's Economy and Trade

INTRODUCTION

Over the past five years, Indonesia's economy has grown at slightly more than 6% per year. That is not quite as high as in China and India, but it is very impressive by the standards of other developing countries – and sharply contrasts with recession-hit developed economies. The rapid growth in emerging economies is shifting the global industrial centre of gravity away from the north Atlantic to Asia. It has also raised the demand for primary products in the international marketplace, consistent with the fastest growth in emerging economies being concentrated in natural resource-poor countries such as China and India. That in turn is stimulating growth in exports from natural resource-rich economies. This is a continuation of a process begun in Japan in the 1950s and followed by Korea and Taiwan from the late 1960s and then by some Southeast Asian countries (Anderson and Smith 1981). However, because the earlier Northeast Asian group represents just 3% of the world's population, its rapid industrial growth was accommodated by the rest of the world without much difficulty, including in primary product markets. China and India, by contrast, account for more than two-fifths of humanity and so their rapid and persistent industrial and income growth has far greater significance for primary product markets and thus for such things as food and energy security and greenhouse gas emissions.

How might these on-going developments affect markets over the next two decades? This paper focuses on the potential consequences for Indonesia. It does so by first assuming no policy changes (the core scenario to 2020 and 2030), before then examining the market and welfare consequences of also implementing some recently announced policies. The estimated effects by 2020 of three policy shocks are reported. One is external to but of considerable policy interest in Indonesia, namely the re-entry of Myanmar into the international rice market associated with the opening up of its economy (which some believe could substantially depress the rice price); the others are Indonesia's recently-imposed export taxes on unprocessed primary products and the implementation of the new Food Law that was promulgated in November 2012 (both of which may dampen the country's agricultural exports and imports and also national economic welfare). Those recent trade policy changes in Indonesia may be in response to the latest 'Dutch disease' pressure on food production and manufacturing, which raises the question as to how appropriate they are, especially if the prices for the country's primary product exports were to soon fall.

Trade and development theory, and the historical experience to date with Asian industrialization, provide a guide as to what to expect both in and beyond the region over the next decade or two.[1] That theory and history is briefly summarized in the following section as a way of anticipating likely future trends in Indonesia and elsewhere. Those expectations are then tested in the third section, using the latest Version 8.1 of the GTAP global economy-wide model to project the world economy to 2020 and 2030. Results are presented for the core scenario before turning to scenarios for 2020 that incorporate the three recent policy changes mentioned above. Some caveats are then listed prior to the final section, which draws out implications for farmers, food consumers, and policymakers in Indonesia.

[1] That was the case too for a similar modeling exercise that was undertaken just prior to the Asian Financial Crisis (Anderson and Pangestu 1998). The focus of that earlier study, however, was on the effects of implementing the Uruguay Round's multilateral trade agreements by 2005, of China's accession to the WTO, and of prospective regional trade liberalization by APEC countries.

THEORY AND PAST EXPERIENCE

Like Northeast Asia's earlier rapidly industrializing economies, China and South Asia are relatively natural resource-poor and densely populated (Table 1(a)). They are therefore highly complementary with relatively lightly populated economies that are well endowed with agricultural land and/or mineral resources per worker, such as in Australasia, Latin America, the Middle East and parts of Africa. Their complementarity with ASEAN economies is less clear-cut, however. For example, Indonesia is relatively well endowed per worker with value added by minerals and energy raw materials compared with the rest of ASEAN and other Asia. Compared with non-Asian developing countries though, Indonesia is not as well endowed for mining – but it is twice as well endowed with agricultural land per worker, and this is projected to accentuate by 2030 (Table 1). These relative factor endowments are consistent with patterns of specialization in primary product trade as of 2005-09 (Table 2).

The workhorse theory of comparative cost advantage developed in the 20th century has been used to explain trade specialization patterns including trade between natural resource-rich and resource-poor economies. That theory blends the Heckscher-Ohlin-Samuelson model, which assumes all factors of production are mobile between sectors, with the Ricardo-Viner model which assumes some factors are sector-specific. Such a blend is provided by Krueger (1977) and explored further by Deardorff (1984). They consider two tradable sectors each using intersectorally mobile labour plus one sector-specific factor (natural-resource capital or produced capital). Assuming that labour exhibits diminishing marginal product in each sector, and that there are no services or nontradables and no policy distortions, then at a given set of international prices the real wage in each economy is determined by the aggregate per worker endowment of natural-resource and produced capital. The commodity composition of a country's trade – that is, the extent to which a country is a net exporter of primary or industrial products – is determined by its endowment of natural relative to industrial capital compared with that ratio for the rest of the world.

Leamer (1987) develops this model further and relates it to paths of economic development. If the stock of natural resources is unchanged, rapid growth by one or more economies relative to others in their availability of produced capital (physical plus human skills and technological knowledge) per unit of available labour time would tend to cause those economies to strengthen their comparative advantage in non-primary products. By contrast, a discovery of minerals or energy raw materials would strengthen that country's comparative advantage in mining and weaken its comparative advantage in agricultural and other tradable products, ceteris paribus. It would also boost national income and hence the demand for nontradables, which would cause mobile resources to move into the production of nontradable goods and services, further reducing farm and industrial production (Corden 1984).

Domestic or foreign savings can be invested to enhance the stock and/or improve the quality not only of a country's produced capital but also of its economically exploitable stock of natural resources. Any such increase in the stock of produced capital (net of depreciation) per worker will put upward pressure on real wages. That will encourage, in all sectors, the use of more labour-saving techniques and the development and/or importation of better technologies that are less labour intensive. Whether it boosts industrialization more than agriculture or other primary production will depend on the relative speed of sector-specific productivity growth that such R&D investments yield. Which types of investment would expand fastest in a free-market setting depends on their expected rates of return. The more densely populated, natural resource-poor an open economy is, the greater the likelihood that the highest payoff would be in expanding stocks of capital (including technological knowledge) for non-primary sectors. That gives rise to the Rybczynski effect, of pulling mobile resources (most notably labour) out of agriculture. If there is also relatively rapid productivity growth in primary sectors (as Martin and Mitra (2001) have found to be the case historically), and especially if that productivity growth is labour-saving, this also pushes labour into non-primary sectors (Martin and Warr 1993).

At early stages of development of a country with a relatively small stock of natural resources per worker, wages would be low and the country would have a comparative cost advantage in unskilled labour-intensive, standard-technology manufactures. Then as the stock of industrial capital grows, there would be a gradual move toward exporting manufactures that are relatively intensive in their use of physical capital, skills and knowledge. Natural resource-abundant economies, however, would invest more in capital specific to primary production and so would be less likely to develop a comparative advantage in manufacturing until a later stage of development, at which time their industrial exports would be relatively capital intensive.

The above theory of changing comparative advantages – which can also be used to explain shocks to that pattern from discovery-driven mining booms or major terms of trade changes imposed from the rest of the world – has been used successfully to explain the evolving trade patterns of Asia's resource-poor first- and second-generation industrializing economies and their resource-rich trading partners (early examples being Anderson and Garnaut 1980 and Anderson and Smith 1981). It has also explained the 20th century evolution, for early- and later-industrializing countries, of the flying geese pattern of comparative advantage, and then of comparative disadvantage, in unskilled labour-intensive manufactures as some rapidly growing economies expand their endowments of industrial capital per worker relative to the rest of the world – the classic example being clothing and textiles (Anderson 1992; Ozawa 2009; Lin 2012).

This theory also helps explain changes in the sectoral shares of Indonesia's GDP and exports. After the turmoil of the 1960s, Indonesia derived a below-average (above-average) share of GDP from agriculture (manufacturing), but that reversed with the sharp rise over the past decade in the price of primary products in which Indonesia still has a comparative advantage (Figure 1). The rise in the price of such export products as coal and palm oil led to the share of primary products in Indonesia's merchandise exports rising from 56 to 75% between 2005 and 2011 (WTO 2012). Its index of 'revealed' comparative advantage in agriculture[2] had fallen from 2.7 in 1965-69 to 1.0 in 2000-02, but by 2009-11 it was back to 2.4.

Another element that complicates the task of predicting trade outcomes has to do with domestic demand, the product pattern of which differs across the per-capita income spectrum (Markusen 2013). That, together with the fact that per capita incomes, endowments and productivities are expected to grow at different rates in different economies, makes it particularly difficult to predict from theory the future production and trade pattern of a country such as Indonesia that is not extreme in terms of expected output and income growth (Appendix Table A) or relative factor endowments (Table 1). For that reason an empirical modelling approach is called for. In particular, given the interdependence between sectors of growing economies described above, an economy-wide model of the world's national markets is needed to project future production, consumption and international trade developments. Such an approach has the additional advantage of being able to estimate the impacts of policy changes on projected developments.

[2] The index of 'revealed' comparative advantage in agriculture, following Balassa (1965), is the share of agriculture in Indonesia's exports divided by the share of agricultural products in global merchandise exports.

EMPIRICAL MODELING METHODOLOGY AND DATABASE

In this study we employ the GTAP model (Hertel 1997) of the global economy and the new Version 8.1 of the GTAP database which is calibrated to 2007 levels of production, consumption, trade and protection for 134 countries (Narayanan, Aguiar and McDougall 2012). The standard GTAP model is perhaps the most widely used CGE model for economy-wide global market analysis, in part due to its robust and explicit assumptions. The Version 8.1 base period of 2007 is ideal for projecting forward to 2030 because 2007 immediately precedes the recent period of temporary spikes in food and fuel prices and the global financial crisis and recession.

In its simplest form, the model assumes perfect competition and constant returns to scale in production. The functional forms are nested constant elasticities of substitution (CES) production functions. Land and other natural resources, labour (skilled and unskilled), and produced physical capital substitute for one another in a value added aggregate, and composite intermediate inputs substitute for value-added at the next CES level in fixed proportions. Land is specific to agriculture in the GTAP database, and is mobile amongst alternative agricultural uses over this projection period, according to a Constant Elasticity of Transformation (CET) which, through a revenue function, transforms land from one use to another. In the modified version of the GTAP model we use, natural resources, including coal, oil, gas and other minerals, are specific to the sector in which they are extracted. Aggregate national employment of each productive factor is fixed in the standard macro-economic closure, although we use exogenous projections to model changes in factor availability over time. In the long-run model closure adopted here, labour and produced capital are assumed to be mobile across all uses within a country, but immobile internationally.

On the demand side there is a national representative household whose expenditure is governed by a Cobb-Douglas aggregate utility function which allocates net national expenditures across private, government, and saving activities. Government demand across composite goods is determined by a Cobb-Douglas assumption (fixed budget shares). Private household demand is represented by a Constant Difference of Elasticities (CDE) functional form, which has the virtue of capturing the non-homothetic nature of private household demands, calibrated to replicate a vector of own-price and income elasticities of demand (Hertel et al. 2008). In projecting to 2030 we follow Yu et al. (2004) in modifying these elasticities. We do so by econometrically estimating the relationship in 2007 between per capita incomes and income elasticities of demand for food crops, as reflected in the full GTAP database.[3] These estimates are then used to modify the elasticities for each region by 2020 and 2030, given projections of per capita income for each region.[4]

Bilateral international trade flows are handled through the Armington (1969) specification by which products are differentiated by country of origin. These Armington elasticities are the same across countries but are sector-specific, and the import-import elasticities have been estimated at the disaggregated GTAP commodity level (Hertel et al. 2007). For present purposes, where we are dealing with long-term changes, we follow the typical modelling practise of doubling the short-to-medium term Armington elasticities. The national balance of trade is determined by the relationship between national savings and investment, with investment allocated in response to rates of return with capital markets kept in equilibrium, for present purposes.

The GTAP Version 8.1 database divides each national economy into 57 sectors: 26 for primary goods, 16 for manufactures and 15 for services. In the present study we initially

[3] Thanks are also due to Papu Siameja for assistance with econometrically estimating projected income elasticities.
[4] On the prospective decline in per capita demand for rice globally as Asian incomes rise, see Timmer, Block and Dawe (2010).

aggregate the database to 35 countries/country groups and to 34 sector/product groups. We then further aggregate to 8 regions and just 4 sectors for reporting many results.

CORE PROJECTION OF THE DATABASE TO 2020 AND 2030

We project the GTAP database's 2007 baseline for the world economy to provide a new core baseline for 2020 and 2030 by assuming the 2007 trade-related policies of each country do not change. However, over that 23-year period we assume that national real GDP, population, unskilled and skilled labor, capital, agricultural land, and extractable mineral resources (oil, gas, coal and other minerals) grow at exogenously set rates. The exogenous growth rates for GDPs are based on estimates from the World Bank (2012), while capital stock and population growth rates are based on estimates from CEPII (Fouré et al. 2012).[5] For projections of skilled and unskilled labour growth rates, we draw on Chappuis and Walmsley (2011). Historical trends in agricultural land are estimated from FAOSTAT (summarized in Deininger and Byerlee 2011) and trends in mineral and energy raw material reserves are estimated from BP (2012) and the US Geological Survey (2012 and earlier editions). We assume that annual rates of change in fossil fuel reserves over the past two decades continue for each country for the next two decades.[6] For other minerals, in the absence of country-specific data, the unweighed average of the annual rate of growth of global reserves for iron ore, copper, lead, nickel and zinc between 1995 and 2009 for all countries is used (from the

[5] Making use of aggregation tools provided by Chappuis and Walmsley (2011).
[6] Past reserves data are from BP (2012). For coal, production data are used as a proxy, since projections of reserves are not available. Data were available for Vietnam's coal, oil and gas for only a decade of what was exceptionally high growth which would have led to implausibly high projections, so they were modified downward. Indonesia's coal reserves are assumed to grow at 3% per year during 2007-20 and then zero thereafter (since as of 2011 it had only 17 years of production in reserves, compared with twice that in China and six times that in both India and the rest of the world – see BP 2012).

US Geological Survey). These rates of change in natural resources are summarized in the last five columns of Appendix Table A.

Given those exogenous growth rates, the model is able to derive implied rates of total factor productivity and GDP per capita growth. For any one country the rate of total factor productivity growth is assumed to be the same in each of its manufacturing sectors, somewhat higher in most primary sectors and somewhat lower in services. Higher productivity growth rates for primary activities were characteristic of the latter half of the 20th century (Martin and Mitra 2001), and are necessary in this projection if the average of real international prices of primary products (relative to the aggregate change for all products) is to remain roughly unchanged.[7] The international price consequences for the core simulation are depicted in Figure 2.[8]

The assumed rate of China's GDP growth may seem rather high at 8.25% per year from 2007 to 2020. However, it needs to be remembered that China's GDP grew at 9.3% between 2007 and 2012, so our assumption implies a real growth rate for the remainder of this decade of 7.62%, which is marginally above the average annual rate we have assumed of 7.56% for the subsequent decade to 2030.

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[7] We chose that calibration because it is consistent with the World Bank projections over the next four decades (see van der Mensbrugghe and Roson 2010). An alternative in which agricultural prices fall, as projected in GTAP-based projection studies in the late 20th century (e.g., Anderson et al. 1997), is considered unlikely over the next two decades given the slowdown in agricultural R&D investment since 1990 and its consequent delayed slowing of farm productivity growth (Alston, Babcock and Pardey 2010) and the decline in the real price of manufactures as industrialization in China and other Asian countries booms – as occurred also with the original industrial revolution in the first half of the 19th century (Williamson 2012). It is even less likely for farm products if fossil fuel prices and biofuel mandates in the US, EU and elsewhere are maintained over the next decade. Timilsina et al. (2010) project that by 2020 international prices will be higher in the presence vs the absence of those biofuel mandates for sugar (10%), corn (4%), oilseeds (3%), and wheat and coarse grains (2.2%), while petroleum product prices will be 1.4% lower.

[8] The extent to which productivity growth rates is set higher in each primary sector than in other sectors is the same for high-income and developing countries, with the exception of agriculture in China and India, and is the same for all crop and livestock industries within each country's farm sector. Since overall TFP growth is higher for developing than high-income countries, this means we are assuming agricultural TFP growth is higher for developing than high-income countries on average. That is consistent with recent (if not earlier) experience: Ludena et al. (2007, Table 2) estimate that agricultural TFP annual growth during 1981-2000 averaged 1.3% globally and only 0.9% for high-income countries (but during 1961-80 those rates were 0.6% and 1.4%, respectively).

Impacts on Indonesia's sectoral and trade compositions

The differences across economies in rates of growth of factor endowments and sectoral factor productivities, and the fact that sectors differ in their relative factor intensities and their shares of GDP, ensure that the structures of production, consumption and trade across sectors within countries, and also between countries, are going to be very different in 2030 than in 2007 as incomes and comparative advantages change.

In particular, the faster-growing developing economies (especially those of Asia) will account for considerably larger shares of the projected global economy over the next two decades. The developing country aggregate share of world GDP (measured in 2007 US$, not PPP dollars in which developing country shares are much larger) is projected to rise from 27% in 2007 to 36% in 2020 and 45% in 2030, and for Indonesia from 0.8% to 1.2% and 1.4% in those same years. By 2030 China is projected to return to its supremacy as the world's top producing country not only of primary products but also of manufactures. This is a ranking China has not held since the mid-19th century when first the UK and then (from 1895) the US became the top-ranked country for industrial production (Allen 2011; Bairoch 1982; Crafts and Venables 2003). It is projected to become much more dominant in many other respects too, including imports of primary products (Figure 3).

Specifically, the Asian developing country share of global exports of all products nearly doubles, rising from 22% to 40% between 2007 and 2030. China's share alone grows from 8% to 21%. The growth of China's export share is entirely at the expense of high-income countries, as the export shares for the other developing-country regions also grow. In particular, Indonesia's share of global exports rises from 0.9% in 2007 to a projected 1.5% by 2030. The developing country share of primary products in world exports rises slightly, and its share of manufactures in world exports rises dramatically over the projection period, almost doubling (Table 3). Asia's import shares also rise, although not quite so dramatically: the increase for Developing Asia is from 19% to 32% for all products, but the rise is much sharper for China's primary product imports: from 1.3% to 6.5%.

The consequences of continuing Asian industrialization are also evident in the sectoral shares of national trade: primary products become less important in the aggregate of developing country exports and considerably more important in their imports, and conversely for non-primary products, with the changes being largest in Developing Asia (Tables 4 and 5).[9] In Indonesia, however, the share of farm products in its exports rises, from 12% to 20%. This implies an increase in Indonesia's comparative advantage in farm products at the expense of mineral and energy products declines (Figure 4). This development is partly because Indonesia's coal reserves are assumed not to grow after 2020 (see footnote 4 above), but it also reflects the fact that not only China but also India becomes a bigger importer of farm products by 2030 (Table 5).

Impacts on food self-sufficiency and real consumption of food products

These changes mean that agricultural and food self-sufficiency in developing countries as a group is projected in this core scenario to fall, from 100% to 96% between 2007 and 2030. The source of that change is mainly China and to a smaller extent India. However, Indonesia's self-sufficiency rises, from 104% to 119%, while that of other ASEAN and of other developing Asian countries falls slightly on average (Table 7).[10]

[9] It may seem surprising that high-income countries' comparative advantage in primary products strengthens, but recall that (a) what one part of the world imports the remaining part of the world must export to maintain global equilibrium, (b) the high-income country grouping includes Australia, Canada and New Zealand (and the US in terms of food exports) and (c) we have not allowed for possible agricultural protection growth in emerging Asia in this core scenario.

[10] It is possible that these populous countries will seek to prevent such a growth in food import dependence in practice, by erecting protectionist barriers at least for food staples, but that is not modelled here. See, however, Anderson and Nelgen (2011).

Self sufficiency is a poor indicator of food security, however. A more meaningful indicator is real per capita consumption of agricultural and processed food products by households. Between 2007 and 2030, real per capita agricultural and food consumption is projected to increase by 80% for developing countries as a group and by 93% for Indonesia, and to more than double for China and South Asia. These are major improvements in food consumption per capita. Even if income distribution were to worsen in emerging economies over the next two decades, people in virtually all developing country regions could expect to be much better fed by 2030, according to this baseline scenario.

Turning to global consumption shares, the rise in grain consumption is especially great in China because of their expanding demand for livestock products, most of which continue to be produced domestically in this core scenario. So even though China's share of the world's direct grain consumption by households grows little, its share of grain consumed indirectly grows from 9% to 25% of the global total (the differences between China's total and household consumption in Table 8). That promises to provide on-going growth in the market for grain (and oilseed) exports to China. China's share of global consumption of fossil fuels is projected to rise by a similar proportion over this period (from 10% to 25%) and likewise for imports of other non-agricultural primary products (from 10% to 35% – see Figure 3).

Impacts on bilateral trade

In our core scenario it is the phenomenal growth in China's shares of global imports of primary products and exports of manufactures that dominate the bilateral trade picture. The share of Indonesia's exports going to China nearly trebles between 2007 and 2030, rising from 9% to 25%, while the share of its imports that come from China doubles (rising from

13% to 26%, see Figure 5). The same tendency is evident in the projected trade direction of many other natural resource-rich countries, some of which are well ahead of Indonesia in their intensity of trade with China. In 2007 one-sixth of Australia's exports went to China, for example, and by 2030 that Australian share is projected to be almost one-half. These projected bilateral trade outcomes will depend to some extent though on the evolving intensities of Chinese investment in natural resource sectors over the next two decades in various parts of the world, including resource-rich South America and Sub-Saharan Africa in addition to ASEAN and Australia.

EFFECTS OF POLICY CHANGES

The above projections assume no policy changes from 2007 to 2030. How would those projections change if we include some of the policy changes that have already taken place? This section examines the possible effects by 2020 of three policy shocks announced since 2007. One that is external to, but of considerable interest to Indonesia's rice policymakers, is the decision by Myanmar to begin opening up its economy, since that will involve its re-entry into the international rice market. The others are Indonesia's recently-imposed export taxes on unprocessed primary products and the implementation of the new Food Law that was promulgated in November 2012.

Myanmar's re-entry into the international rice market

Both Thailand (as the world's main rice exporter) and Indonesia (as prospectively a major rice importer) have a keen interest in what impact Myanmar's gradual opening up will have on international rice markets. In the interwar period, Burma (as it was then known) was the world's largest rice exporter, supplying about one-third of global exports (Wickizer and Bennett 1941); and its share was almost as high in the 1950s and early 1960s (Barker and Herdt 1985).

To examine the prospect of Myanmar re-emerging as a major rice exporter, we model an expansion in rice production and exports between 2007 and 2020 to the extent that the rice self-sufficiency of ASEAN countries other than Indonesia is 132% in 2020, instead of 125% as in the core 2020 projection for that year. Despite that major increase in rice exports in Southeast Asia, the impact on Indonesia is minor: its rice self-sufficiency falls by only one percentage point with the drop in the international rice price of two-thirds of a percentage point, and real food consumption in Indonesia by 2020 is only marginally higher.[11]

Indonesia's taxes on exports of unprocessed primary products

In 2012 Indonesia introduced taxes on exports of a wide range of unprocessed primary products, the aim of which are to encourage domestic processing of raw materials. The decrees went even further by foreshadowing a ban on unprocessed primary product exports from 2014 (Burke and Resosudarmo 2012).

There remains considerable uncertainty as to whether/when/how some of these measures might be implemented, but to examine their possible effects we ran an alternative scenario to 2020 in which we impose a 20% tax on raw oilseed and on the export of all unprocessed outputs of the non-agricultural mining/extractive sectors (except coal). Not surprisingly, those price-distorting policies shrink Indonesia's overall exports by 0.8%. While

[11] Modeling an emergence of Myanmar as a rice exporter is problematic with the GTAP Model, because that model is based on proportional changes and so does not lend itself to capturing the effect of a country moving from zero to positive trade. As a proxy, we generated those greater rice exports by assuming the supply expansion occurs in Vietnam. Since Vietnam has been the major source of Indonesia's rice imports in recent years, this is likely to have a similar impact on Indonesia as an expansion of rice exports from Myanmar.

agriculture and food exports only reduce by 0.7%, the impact of the export taxes on oil, gas and other minerals leads to other primary product exports being more than 17% lower than otherwise. Indonesian exports to China of other primary products reduce by 28% with the export taxes, driving an overall reduction in exports to China of 4.4% relative to the 2020 core baseline. This leads to China becoming 0.6% less important to Indonesia in overall export shares, but 2.6% less important for other primary exports (see Table 13). These policies also lower real GDP (by 0.1%). Yet they have almost no impact on overall agricultural self-sufficiency.[12]

Implementation of Indonesia's Food Law of November 2012

The new Food Law that was rushed through the parliament in late 2012 explicitly aims to boost food self-sufficiency in Indonesia, including though quotas and bans on imports, restrictions on exports of unprocessed farm products, and greater state involvement in food and feed procurement, distribution and processing. Numerous products are to be targeted, but the full product coverage – and the exact nature and extent of the interventions to be imposed – are yet to be made clear.

To get a sense of what impacts the implementation of just one component of such a food self-sufficiency policy may have, we model the consequences of simply restricting imports of a selection of farm products such that the self-sufficiency ratio for each of them rises to 99%.[13] The targeted products are rice, coarse grains, sugar, red meats and dairy products. Such a policy requires huge increases in tariffs on the targeted products to achieve near-self sufficiency, as reported in Table 9. These would divert mobile resources away from

[12] We note that impacts would be much more severe if exports from the large vegetable oils and fats sector are also taxed.

[13] The baseline from which this scenario is run is the updated 2020 database that includes the impacts of Indonesia imposing export taxes on selected primary products.

palm oil and other farm products in which Indonesia has a comparative advantage. The real exchange rate appreciation that such a rise in protectionism triggers means that, instead of Indonesia's share of global exports rising from 1.6% to 2.4% of global trade between 2007 and 2020, it shrinks to 1.2%. This eliminates much of the projected growth in the share of Indonesia's exports to China. Such protectionism reduces real GDP more than the previous export-tax scenario (by 0.45% instead of 0.11%). And, because it lowers national economic welfare, real domestic food consumption in Indonesia rises by 1.4 percentage points less between 2007 and 2020. That is, this critical food security indicator would be *reduced* by such measures.

SOME QUALIFICATIONS

As with the results from all other economy-wide projections modelling, it is necessary to keep in mind numerous qualifications. One is that we have aggregated the model into just 26 sectors/product groups. This leads to gross underestimation of the extent to which firms can take advantage of intra-industry trade through exploiting the increasing opportunities to lower costs through fragmenting the production process into ever-more pieces whose location is footloose (Feenstra 1998). Our underestimate is made even larger by not accommodating endogenous foreign direct investment flows, since they tend to reinforce trade flows in manufactures within Asia (Petri 2012). That linkage between investment and trade in manufactures has become more important in recent years as global value chains strengthen in ways that allow the innovating firms to retain ownership and control of their intellectual capital (Baldwin and Lopez-Gonzales 2013, Cattaneo et al. 2013).

Second, we have assumed constant returns to scale and perfect competition rather than allowing firms to enjoy increasing returns and some degree of monopoly power for their differentiated products. This too leads to underestimates of the changes associated with production and trade growth, particularly in manufactured goods and services (Krugman 2009).

Third, where consumers (including firms importing intermediate inputs) value a greater variety of goods, or a greater range of qualities, intra-industry trade can grow as a result of both economic growth and trade policy reform (Rutherford and Tarr 2002; Markusen 2013), but that too is not taken into account in the above analysis.

Fourth, our model has not included the new biofuel policies that have been put in place in many countries but have begun to bite severely since our 2007 base year. The new biofuel mandates and subsidies have had a non-trivial effect of increasing both the mean and the variance of international food prices, and are expected to become even more important over the next decade as the mandates in the United States and EU in particular increase to 2020-21 (see Hertel and Beckman 2011, Hertel and Diffenbaugh 2011, and the references therein). Whether these policies will still be in place in 2030 or even 2020 is a moot point. If the expected dramatic expansion in unconventional gas production materializes (see IEA 2012), and if the resulting fall in fossil fuel prices was enough to cause governments to abandon biofuel mandates, this omission from our modelling may be inconsequential.

Fifth, the effects of climate changes are not included in our projections. It is conceivable that they will affect agriculture in tropical countries more than those in temperate zones (Hertel and Lobell 2012). But they will also affect other sectors (Rosen and van der Mensbrugghe 2010), and the net effects at this stage are too uncertain to include in this analysis.

Sixth, our projection results depend on the underlying macroeconomic assumptions made, including those of relatively rapid growth in the large population bases of China and India. If these economies experienced a significant slowdown, this could have a substantial impact on our results. To test the sensitivity of our results to these kinds of assumptions, we projected the 2030 baseline with 25% slower growth in GDP, capital and skilled labour for China and India, along with a 1% global slowdown in primary total factor productivity growth. As expected, this somewhat moderates our results showing the expansion of the importance of these regions in global trade. For example, the share of Indonesia's total exports going to China and India is projected to rise from 13% in 2007 to 30% in our core 2030 baseline. However, under this slower growth scenario, the share only increases to 22%, reflecting a dampening of the import growth for China and India.

Finally, the standard GTAP model used here is comparative static. It therefore does not measure the additional dynamic consequences of trade reform. Dynamic effects arise in numerous ways. One of the more important is through encouragement of the more-efficient firms to take over from the less efficient in each country (Melitz 2003, Melitz and Ottaviano 2008; Bernard et al. 2012; Helpman 2013). Another way is through multinational firms sharing technologies and knowledge across countries within the firm (Markusen 2002). Offshoring is yet another mechanism through which heterogeneous firms are affected by trade liberalization, including via re-locating from small to larger nations (Baldwin and Okuba 2011). It may also alter the political economy of protection, providing stronger opposition from new exporters and thus leading to more opening up of economies (Baldwin and Lopez-Gonzales 2013).

POLICY IMPLICATIONS AND CONCLUSIONS

Should relatively rapid economic growth in Asia and to a lesser extent in other developing countries continue to characterize world economic development as suggested above, developing Asia's share of global GDP and trade will continue to rise steeply over the next two decades. By 2030, developing Asia is projected to consume around half of the world's grain and fossil fuels (or even more if carbon taxes are introduced in high-income countries but not emerging economies), and three-quarters of the world's other minerals. This is possible because their shares of the world's imports of primary products are projected to more than double between 2007 and 2030 in the core scenario – and paid for with their rapidly rising earnings from exports of manufactures. These changes in the global economy have significant implications for Indonesia, which is expected to increase its share of global exports by two thirds in the projected period from 2007 to 2030. It is likely to experience a particularly large increase in the share of global agriculture and food exports it contributes.

Our modelling results suggest that an expansion of rice exports associated with the opening of Myanmar will lower Indonesia's rice self-sufficiency slightly, however it has a small positive impact on on overall real output and consumption for Indonesia. However, our results suggest that Indonesia's recently-imposed export taxes on unprocessed primary products and implementation of Indonesia's new Food Law will have a negative overall impact on the Indonesian economy, particularly the new Food Law.

REFERENCES

Allen, B. (2011), *Global Economic History: A Very Short Introduction,* London: Oxford University Press.

Alston, J.M., B.A. Babcock and P.G. Pardey (eds.) (2010), *The Shifting Patterns of Agricultural Production and Productivity Worldwide*, Midwest Agribusiness Trade Research and Information Center, Iowa State University, Ames IA.

Anderson, K. (ed.) (1992), *New Silk Roads: East Asia and World Textile Markets*, Cambridge and New York: Cambridge University Press.

Anderson, K. (ed.) (2009), *Distortions to Agricultural Incentives: A Global Perspective, 1955–2007,* London: Palgrave Macmillan and Washington DC: World Bank.

Anderson, K., B. Dimaranan, T. Hertel and W. Martin (1997), 'Economic Growth and Policy Reforms in the APEC Region: Trade and Welfare Implications by 2005', *Asia-Pacific Economic Review* 3(1): 1-18, April.

Anderson, K. and R. Garnaut (1980), 'ASEAN Export Specialisation and the Evolution of Comparative Advantage in the Western Pacific Region', Ch.13 in *ASEAN in a Changing Pacific and World Economy,* edited by R. Garnaut, Canberra: ANU Press.

Anderson, K. and S. Nelgen (2011), 'What's the Appropriate Agricultural Protection Counterfactual for Trade Analysis?', Ch. 13 in *The Doha Development Agenda***,** edited by W. Martin and A. Mattoo, London: Centre for Economic Policy Research for the World Bank.

Anderson, K. and S. Nelgen (2013), *Updated National and Global Estimates of Distortions to Agricultural Incentives, 1955 to 2011*, World Bank, Washington DC, to be accessible from January at www.worldbank.org/agdistortions.

Anderson, K. and M. Pangestu (1998), 'Structural Changes in a Reforming World Economy: Implications for Indonesia', *Bulletin of Indonesian Economic Studies* 34(3): 85-113, December.

Anderson, K. and B. Smith (1981), 'Changing Economic Relations Between Asian ADCs and Resource-Exporting Developed Countries', in *Trade and Growth in the Advanced Developing Countries*, edited by W. Hong and L. Krause, Seoul: Korea Development Institute Press.

Armington, P. (1969), 'A Theory of Demand for Products Distinguished by Place of Production', *IMF Staff Papers* 16: 159-78.

Bairoch, P. (1982), 'International Industrialization Levels from 1750 to 1980', *Journal of European Economic History* 11: 269-331.

Balassa, B. (1965), 'Trade Liberalization and "Revealed" Comparative Advantage', *Manchester School of Economic and Social Studies* 33(2): 99-124.

Baldwin, R.E. and J. Lopez-Gonzales (2013), 'Supply-Chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses', CEPR Discussion Paper 9421, London, April.

Baldwin, R. and T. Okuba (2011), 'International Trade, Offshoring and Heterogeneous Firms', NBER Working Paper 16660, Cambridge MA, January.

Barker, R. and R.W. Herdt (with B. Rose) (1985), *The Rice Economy of Asia,* Washington DC: Resources for the Future.

Bernard, A.B., J.B. Jensen, S.J. Redding and P.K. Schott (2012), 'The Empirics of Firm Heterogeneity and International Trade', *Annual Review of Economics* 4(1): 283-313.

Burke, P.J. and B.P. Resosudarmo (2012), 'Survey of Recent Developments', *Bulletin of Indonesian Economic Studies* 48(3): 299-324, December.

BP (2012), *BP Statistical Review of World Energy,* London: British Petroleum.

Cattaneo, O., G. Gereffi, S. Miroudot and D. Taglioni (2013), ‘Joining, Upgrading and Being Competitive in Global Value Chains: A Strategic Framework’, Policy Research Working Paper 6406, World Bank, Washington DC, April.

Chappuis, T. and T.L. Walmsley (2011), ‘Projections for World CGE Model Baselines’, GTAP Research Memorandum No. 22, Center for Global Trade Analysis, Purdue University, West Lafayette IN, September.

Corden, W.M. (1984), “Booming Sector and Dutch Disease Economics: Survey and Consolidation”, *Oxford Economic Papers* 36(3): 359-80, November.

Crafts, N. and A.J. Venables (2003), ‘Globalization in Historical Perspective’, pp. 323-64 in Bordo, M., Taylor, A. and J. Williamson (eds.), *Globalization in Historical Perspective* Chicago: University of Chicago Press for the NBER.

Deardorff, A.V. (1984), “An Exposition and Exploration of Krueger's Trade Model”, *Canadian Journal of Economics* 5(4): 731-46.

Deininger, K. and D. Byerlee (2011), *Rising Global Interest in Farmland: Can it Yield Sustainable and Equitable Benefits?* Washington DC: World Bank.

Drysdale, P., K. Anderson, C. Findlay and B. Smith (1986), ‘Australia and the Pacific Economy’, *The Economic Record* 62(176): 66-70, March.

FAO/OECD (2012), *FAO/OECD Agricultural Outlook 2012-2021*, Paris and Rome: OECD and FAO.

Feenstra, R.C. (1998), ‘Integration of Trade and Disintegration of Production in the Global Economy’, *Journal of Economic Perspectives* 12(4): 31-50, Fall.

Fouré J., A. Benassy-Quéré and L. Fontagné (2012), ‘The Great Shift: Macroeconomic Projections for the World Economy at the 2050 Horizon’, Working Paper 2012-03, CEPII, Paris, February.

Fuglie, K.O. (2008), 'Is a Slowdown in Agricultural Productivity Growth Contributing to the Rise in Commodity Prices?' *Agricultural Economics* 39 supplement: 431-41.

Garnaut, R. (2011), *Global Emissions Trends*, Update Paper 3, Garnaut Climate Change Review Update 2011, Canberra: Commonwealth of Australia, February. www.garnautreview.org.au

Helpman, E. (2013), 'Foreign Trade and Investment: Firm Perspectives', NBER Working Paper 19057, Cambridge MA, May.

Hertel, T.W. (ed.) (1997), *Global Trade Analysis: Modeling and Applications*, Cambridge and New York: Cambridge University Press.

Hertel, T.W. and J. Beckman (2011), 'Commodity Price Volatility in the Biofuel Era: An Examination of the Linkage Between Energy and Agricultural Markets', Ch. 6 (pp. 189-221) in *The Intended and Unintended Effects of U.S. Agricultural and Biotechnology Policies*, edited by J. Graff Zivin and J. Perloff, Chicago: University of Chicago Press for NBER.

Hertel T.W. and N. Differbaugh (2011), 'Implications of Climate Volatility for Agricultural Commodity Markets in the Presence of Biofuel Mandates', Presented at the 14th Annual Conference on Global Economic Analysis, Venice, 16-18 June.

Hertel, T.W. and D.B. Lobell (2012), 'Agricultural Adaptation to Climate Change in Rich and Poor Countries: Current Modeling Practice and Potential for Empirical Contributions', GTAP Working Paper No. 72, Purdue University, West Lafayette.

Hertel T.W., D. Hummels, M. Ivanic and R. Keeney (2007), 'How Confident Can We Be in CGE-Based Assessments of Free Trade Agreements?' *Economic Modelling* 24(4): 611-635.

Hertel, T.W., B.G. Narayanan, and R.A. McDougall (2012), 'Behavioural Parameters', Ch. 14 in B.G. Narayanan, A. Aguiar and R.A. McDougall (eds.), *Global Trade, Assistance,* *and Production: The GTAP 8 Data Base*, West Lafayette: Centre for Global Trade Analysis, Purdue University.

IEA (2011), *World Energy Outlook 2011,* Paris: International Energy Agency, November.

Krueger, A.O. (1977), *Growth, Distortions and Patterns of Trade Among Many Countries*, Princeton, NJ: International Finance Section.

Krugman, P. (2009), 'The Increasing Returns Revolution in Trade and Geography', *American Economic Review,* 99(3): 561-71, June.

Lin, J. Y. (2012), "From Flying Geese To Leading Dragons: New Opportunities and Strategies for Structural Transformation in Developing Countries". *Global Policy, 3*(4), 397-409.

Leamer, E.E. (1987), "Paths of Development in the Three-Factor, n-Good General Equilibrium Model", *Journal of Political Economy* 95(5): 961-99.

Ludena, C.E., T.W. Hertel, P.V. Preckel, K. Foster and A. Nin (2007), 'Productivity Growth and Convergence in Crop, Ruminant and Nonruminant Production: Measurement and Forecasts', *Agricultural Economics* 37(1): 1-17, January.

Markusen, J.R. (2002), *Multinational Firms and the Theory of International Trade*, Cambridge: MIT Press.

Markusen, J.R. (2013), 'Putting Per-Capita Income Back into Trade Theory', *Journal of International Economics* (forthcoming), doi: 10.1016/j.jinteco.2013.04.003

Martin**,** W. and D. Mitra (2001), 'Productivity Growth and Convergence in Agriculture and Manufacturing', *Economic Development and Cultural Change* 49(2): 403-22.

Martin, W. and P.G. Warr (1993), 'Explaining Agriculture's Relative Decline: A Supply Side Analysis for Indonesia', *World Bank Economic Review* 7(3): 381-401, September.

Melitz, M.J. (2003), 'The Impact of Trade on Intra-industry Reallocations and Aggregate Industry Productivity', *Econometrica* 71(6): 1692-1725.

Melitz, M.J. and G.I.P. Ottaviano (2008), 'Market Size, Trade and Productivity', *Review of Economic Studies* 75(1): 295-316, January.

Narayanan, B.G., A. Aguiar and R.A. McDougall (eds.) (2012), *Global Trade, Assistance, and Production: The GTAP 8 Data Base*, West Lafayette: Center for Global Trade Analysis, Purdue University. www.gtap.agecon.purdue.edu/databases/v8/v8_doco.asp

Nelson, G.C., M.W. Rosegrant, A. Palazzo, I. Gray, C. Ingersoll, R. Robertson, S. Tokgoz, T. Zhu, T.B. Sulser, C. Ringler, S. Msangi and L. You (2010), *Food Security, Farming, and Climate Change to 2050: Scenarios, Results, Policy Options*, IFPRI Research Report, Washington DC: International Food Policy Research Institute, December.

OECD (Organisation for Economic Co-operation and Development) (2012), *Producer and Consumer Support Estimates*, Online database accessed at www.oecd.org.

Ozawa, T. (2009), *The Rise of Asia: The 'Flying-Geese Theory of Tandem Growth and Regional Agglomeration*, London: Edward Elgar.

Petri, P. (2012), 'The Determinants of Bilateral FDI: Is Asia Different?', *Journal of Asian Economics* 23(3): 201-209, June.

Rosen, R. and D. van der Mensbrugghe (2010), "Climate Change and Economic Growth: Impacts and Interactions", Paper presented at the 13th Global Economic Analysis Conference, Penang, 9-11 June.

Rutherford, T.F. and D.G. Tarr (2002), 'Trade Liberalization, Product Variety and Growth in a Small Open Economy: A Quantitative Assessment', *Journal of International Economics* 56**(**2**):** 247-72.

Timilsina, G.R., J.C. Beghin, D. van der Mensbrugghe and S. Mevel (2010), 'The Impacts of Biofuel Targets on Land-use Change and Food Supply: A Global CGE Assessment', Policy Research Working Paper 5513, World Bank, Washington DC, December.

Timmer, C.P., S. Block and D. Dawe (2010), 'Long-run Dynamics of Rice Consumption, 1960-2050', Ch. 1.6 (pp.139-174) in *Rice in the Global Economy: Strategic Research and Policy Issues for Food Security*, edited by S. Pandey, D. Byerlee, D. Dawe, A. Dobermann, S. Mohanty, S. Rozelle, and B. Hardy, Los Banos: International Rice Research Institute.

US Geological Survey (2012), *Mineral Commodity Summaries*, accessed at http://minerals.usgs.gov/minerals/pubs/mcs/

van der Mensbrugghe, D. and R. Roson (2010), 'Climate, Trade and Development', Paper presented at the 13th Global Economic Analysis Conference, Penang, 9-11 June.

Williamson, J.G. (2012), 'Commodity Prices over Two Centuries: Trends, Volatility, and Impact, *Annual Review of Resource Economics* 4(6): 1-22 (forthcoming). DOI: 10.1146/annurev-resource-110811-114502.

Wickizer, V.D., and M.K. Bennett (1941), *The Rice Economy of Monsoon Asia*, Stanford CA: Stanford University Press.

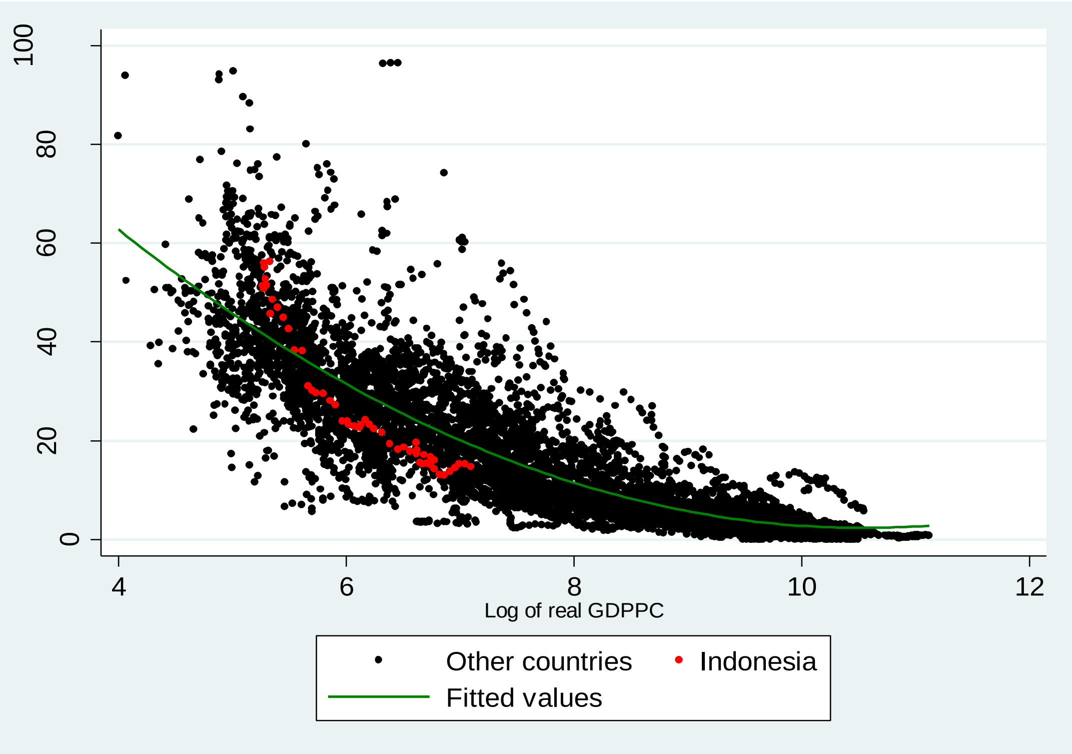
World Bank (2012), *World Development Indicators* at http://data.worldbank.org/indicator

World Bank (2012), *Pink Sheets*, http://econ.worldbank.org, accessed 15 March.

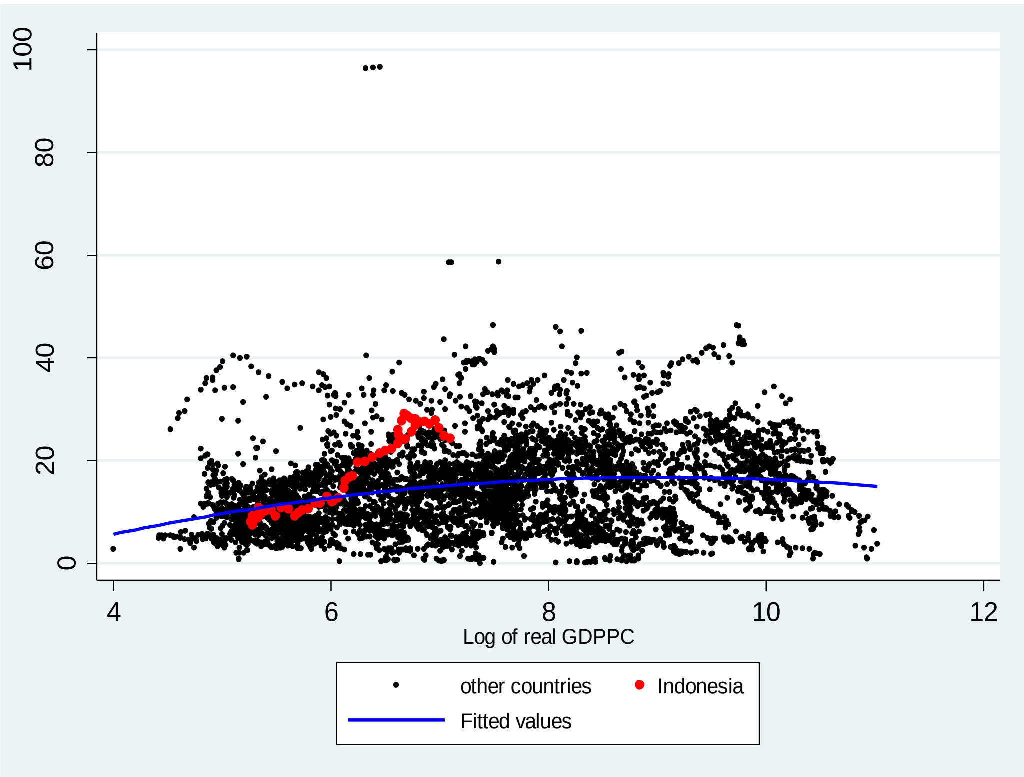
Yu, W., T.W. Hertel, P.V. Preckel and J.S. Eales (2004), 'Projecting World Food Demand Using Alternative Demand Systems', *Economic Modelling* 21(1): 99-129, January.

Figure 1: Relationships between sectoral share of GDP and log of real GDP per capita, Indonesia and all countries, 1960 to 2011

(a) agriculture



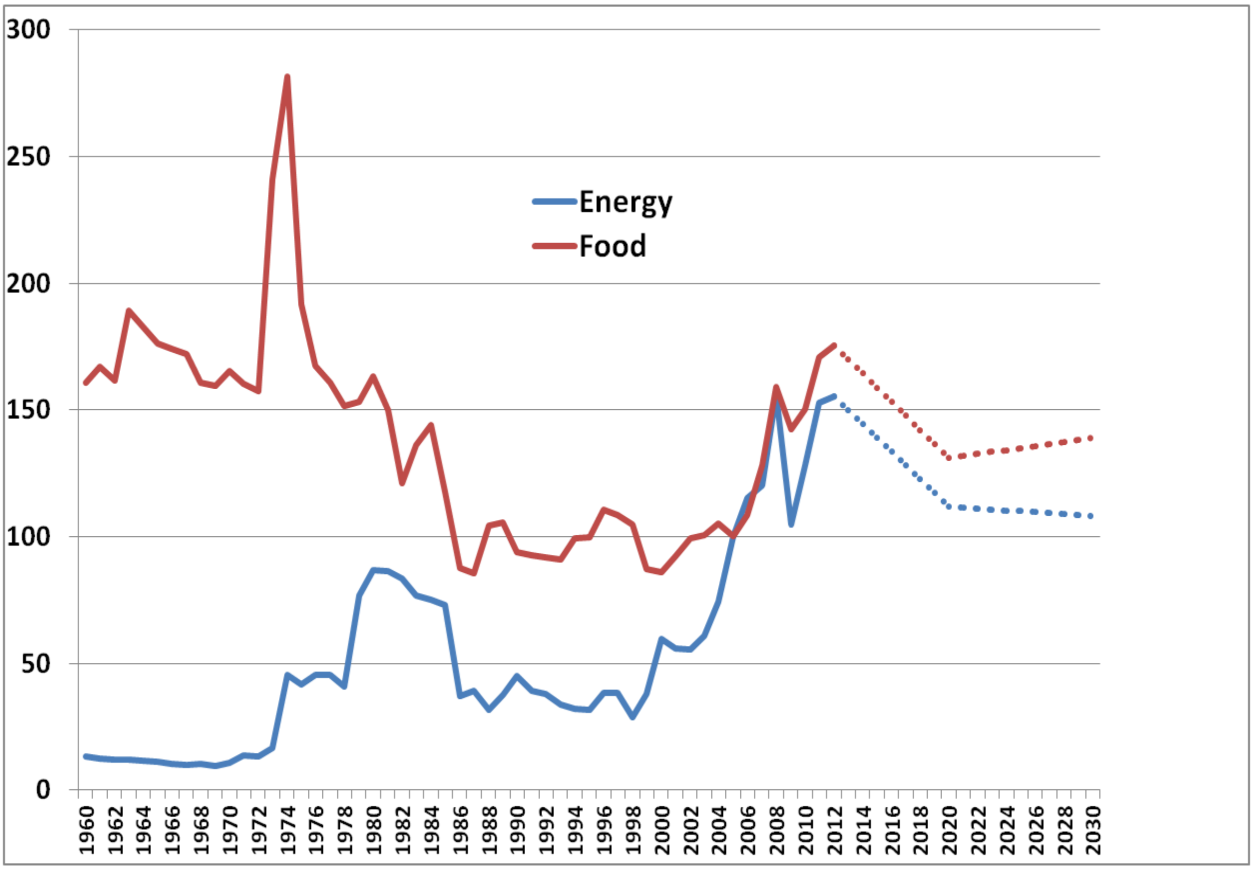
(b) manufacturing



Source: Authors' compilation based on World bank (2013)

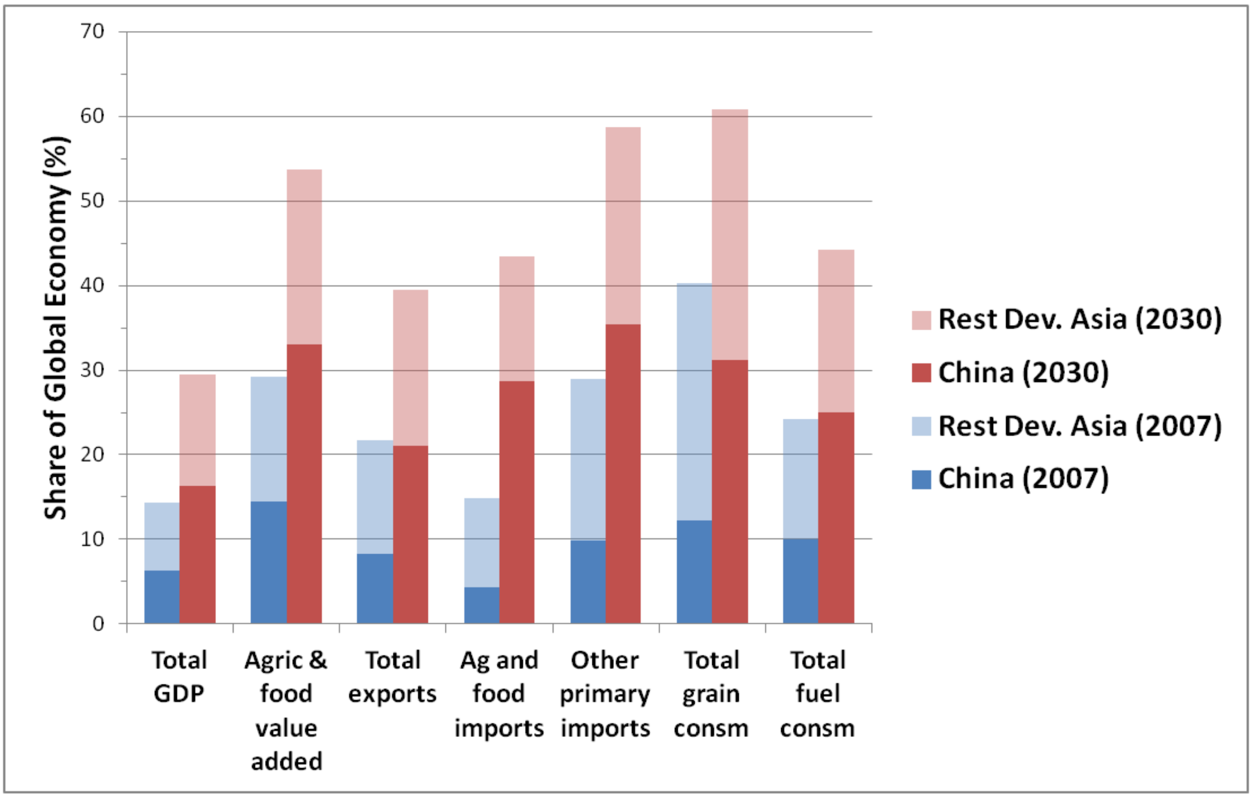
Figure 2: Real international prices of food and energy raw materials, 1960 to 2012 and projected to 2020 and 2030

(2005 = 100)



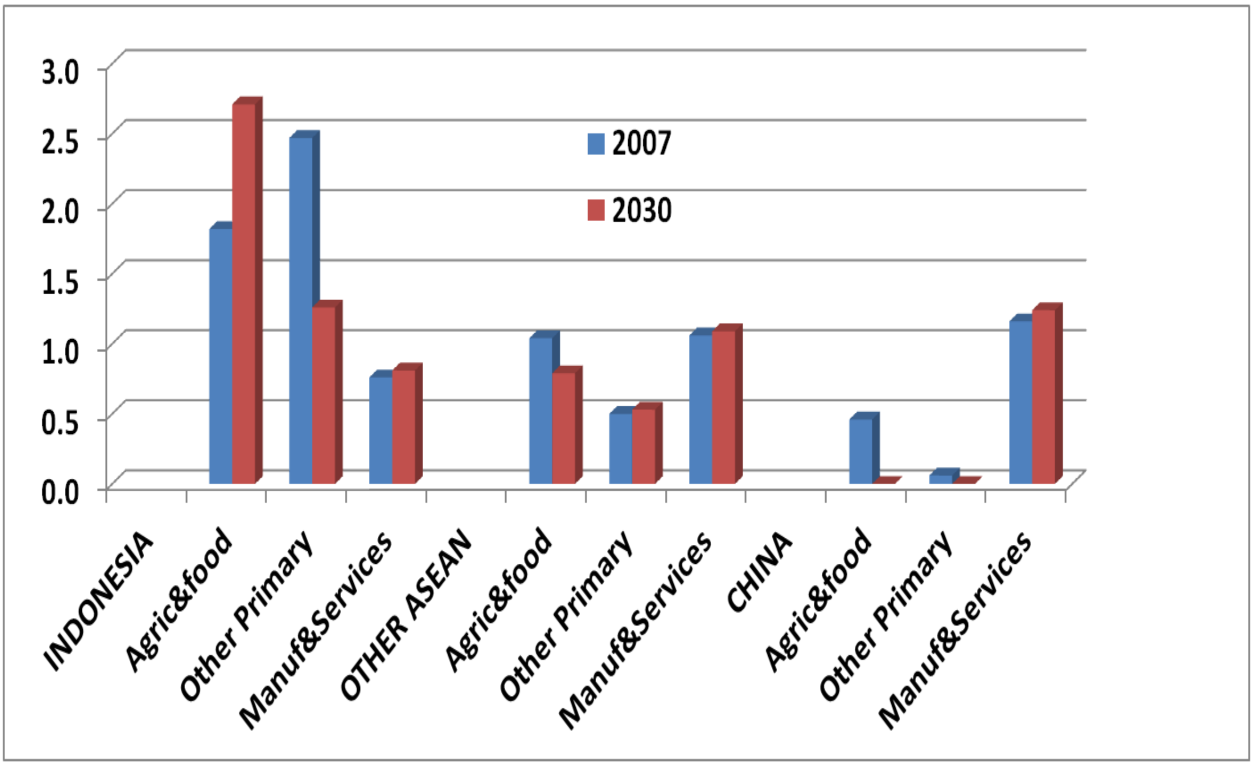
Source: World Bank (2013) and authors' GTAP Model projections

Figure 3: Shares of China and other Developing Asia in the global economy, 2007 and 2030 (%)



Source: Derived from the authors' GTAP Model results

Figure 4: ‘Revealed’ comparative advantage indexes, Indonesia, Other ASEAN and China, 2007 and 2030[a]



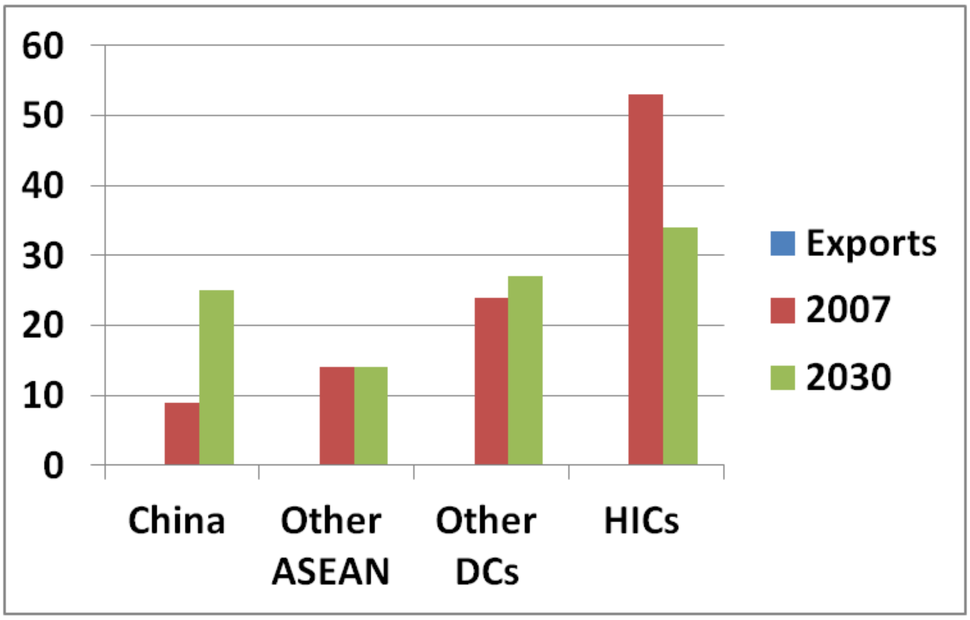
[a] The index of ‘revealed’ comparative advantage is the share of a product in an economy’s exports divided by the share of that products in global exports, following Balassa (1965).

Source: Derived from the authors’ GTAP Model results

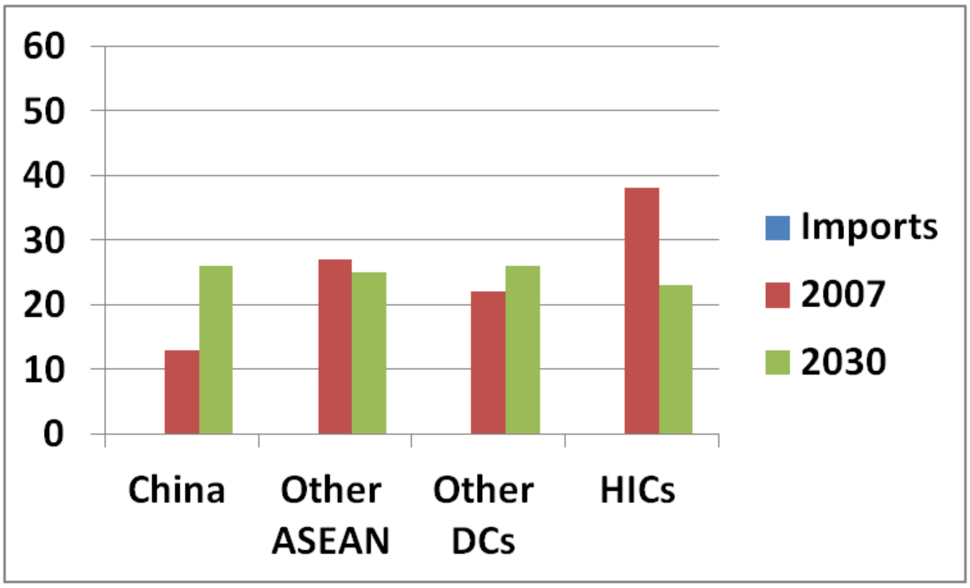
Figure 5: The re-direction of Indonesia's external trade between 2007 and 2030

(% of all goods and services trade with different trading partners)

(a) Exports



(b) Imports



Source: Derived from the authors' GTAP Model results

Table 1: Relative natural resource endowments per worker,[a] 2007 and 2030

(world = 100)

a) 2007

	Agricultural land	Fossil fuels (coal, oil, gas)	Other minerals	Forestry and fishing	All primary
Indonesia	107	59	87	102	84
China	115	27	83	110	74
India	94	8	19	38	49
Rest ASEAN	89	48	28	158	72
RDev Asia	102	6	80	83	56
Rdeveloping	57	235	129	66	142
Australia	209	384	1836	244	347
Other High Income	130	157	144	158	144
World	100	100	100	100	100

b) 2030

	Agricultural land	Fossil fuels (coal, oil, gas)	Other minerals	Forestry and fishing	All primary
Indonesia	113	38	81	95	68
China	138	48	103	138	85
India	84	7	17	33	35
Rest ASEAN	89	59	27	148	72
RDev Asia	86	3	70	73	38
Rdeveloping	49	185	103	53	129
Australia	196	619	1894	252	513
Other High Income	161	182	184	202	176
World	100	100	100	100	100

[a] Based on real output value of sector-specific endowments of natural resources per active worker in each region relative to the world, 2007 US dollar domestic prices. The workforce is assumed to grow between 2007 and 2030 by only 2% in China compared with 36% in Indonesia, 35% in other ASEAN countries, 47% in India, 44% in other developing Asia, and 59% in other developing country regions. Natural resource endowment growth rates are shown in Appendix Table A.

Source: Calculated from GTAP database and authors' core projection to 2030, using CEPII data for economically active population (Fouré, Benassy-Quéré and Fontagné 2012).

Table 2: Indexes of trade specialization in primary products (PPs),[a] Indonesia and other countries, 2005-09

	Ag. & food (light proc.)	Fossil fuels (coal, oil, gas)	Other minerals (+ NF metals)	Forestry & fishing products	ALL PRIMARY
Net PP importers:					
Japan	-0.96	-0.99	-0.43	-0.83	-0.85
South Korea	-0.89	-0.99	-0.50	-0.61	-0.84
Taiwan	-0.70	-0.94	-0.46	-0.17	-0.82
China	-0.43	-0.84	-0.66	-0.65	-0.69
India	0.23	-0.99	-0.37	-0.67	-0.54
Pakistan	-0.29	-1.00	-0.37	0.08	-0.53
Thailand	0.43	-0.87	-0.46	0.08	-0.42
Philippines	-0.26	-0.84	0.07	0.52	-0.33
Net PP exporters:					
Malaysia	0.29	0.51	-0.37	0.69	0.28
Vietnam	0.20	0.98	-0.60	-0.26	0.38
Indonesia	**0.28**	**0.56**	**0.62**	**0.84**	**0.50**
Brazil	0.84	-0.18	0.70	-0.15	0.55
Australia	0.75	0.58	0.79	0.72	0.71
Russia	-0.57	0.98	0.71	0.82	0.77
Argentina	0.94	0.66	0.34	0.10	0.84

[a] The trade specialization index for commodity group j for each region is defined as the 5-year average of $(X_j-M_j)/(X_j+M_j)$, where X and M are gross values of exports and imports

Source: Authors' calculations from the GTAP Version 8 database.

Table 3: Regional sectoral shares of global exports, 2007 and 2030 (%)

(a) 2007 Base

	Agric. & Food	Other Primary	Manufactures	Services	Total
Indonesia	0.10	0.22	0.50	0.05	0.87
China	0.24	0.05	7.43	0.56	8.27
India	0.11	0.07	0.87	0.45	1.50
Rest ASEAN	0.32	0.25	3.51	0.81	4.89
Rest Dev. Asia	0.09	0.04	4.69	1.31	6.14
Rest Developing	1.27	6.11	5.56	1.80	14.75
Australia	0.14	0.34	0.42	0.23	1.13
Rest High Income	3.85	2.74	42.86	13.00	62.44
HICs	**4.00**	**3.08**	**43.27**	**13.22**	**63.58**
Developing	**2.13**	**6.75**	**22.56**	**4.98**	**36.42**
of which Asia	0.86	0.63	17.00	3.18	21.68
World	**6.13**	**9.83**	**65.84**	**18.21**	**100.00**

(b) 2030 core

	Agric. & Food	Other Primary	Manufactures	Services	Total
Indonesia	0.28	0.23	0.86	0.08	1.45
China	0.03	0.06	19.01	1.97	21.06
India	0.05	0.23	2.11	0.99	3.37
Rest ASEAN	0.36	0.42	4.67	0.83	6.28
Rest Dev. Asia	0.14	0.08	5.78	1.37	7.37
Rest Developing	1.79	6.71	6.56	2.13	17.19
Australia	0.14	0.59	0.21	0.16	1.10
Rest High Income	4.17	3.68	24.15	10.18	42.17
HICs	**4.31**	**4.27**	**24.36**	**10.34**	**43.28**
Developing	**2.64**	**7.74**	**38.98**	**7.37**	**56.72**
of which Asia	0.85	1.02	32.42	5.23	39.53
World	**6.95**	**12.01**	**63.34**	**17.71**	**100.00**

Source: Derived from the authors' GTAP Model results

Table 4: Sectoral shares of national exports, 2007 and 2030 (%)

(a) 2007 Base

	Agric. & Food	Other Primary	Manufactures	Services	Total
Indonesia	11.6	24.7	57.4	6.2	100.0
China	2.9	0.6	89.8	6.7	100.0
India	7.2	4.8	58.2	29.8	100.0
Rest ASEAN	6.6	5.1	71.8	16.5	100.0
Rest Dev. Asia	1.5	0.7	76.4	21.4	100.0
Rest Developing	8.6	41.5	37.7	12.2	100.0
Australia	12.5	30.4	37.0	20.1	100.0
Rest High Income	6.2	4.4	68.6	20.8	100.0
HICs	**6.3**	**4.8**	**68.1**	**20.8**	**100.0**
Developing	**5.9**	**18.5**	**61.9**	**13.7**	**100.0**
of which Asia	4.0	2.9	78.4	14.7	100.0
World	**6.1**	**9.8**	**65.8**	**18.2**	**100.0**

(b) 2030 core

	Agric. & Food	Other Primary	Manufactures	Services	Total
Indonesia	19.5	15.9	59.2	5.5	100.0
China	0.1	0.3	90.2	9.3	100.0
India	1.4	6.8	62.5	29.3	100.0
Rest ASEAN	5.7	6.7	74.3	13.3	100.0
Rest Dev. Asia	1.9	1.1	78.4	18.6	100.0
Rest Developing	10.4	39.1	38.1	12.4	100.0
Australia	12.7	53.6	19.4	14.3	100.0
Rest High Income	9.9	8.7	57.3	24.1	100.0
HICs	**10.0**	**9.9**	**56.3**	**23.9**	**100.0**
Developing	**4.7**	**13.6**	**68.7**	**13.0**	**100.0**
of which Asia	2.2	2.6	82.0	13.2	100.0
World	**6.9**	**12.0**	**63.3**	**17.7**	**100.0**

Source: Derived from the authors' GTAP Model results

Table 5: Sectoral shares of national imports, 2007 and 2030 (%)

(a) 2007 Base

	Agric. & Food	Other Primary	Manufactures	Services	Total
Indonesia	9.5	6.5	68.5	15.5	100.0
China	4.3	15.6	69.9	10.2	100.0
India	3.0	30.6	49.0	17.4	100.0
Rest ASEAN	5.3	10.5	67.6	16.6	100.0
Rest Dev. Asia	5.8	15.5	62.2	16.5	100.0
Rest Developing	8.8	4.8	68.6	17.8	100.0
Australia	4.6	4.7	72.6	18.1	100.0
Rest High Income	6.3	9.8	65.5	18.4	100.0
HICs	**6.3**	**9.7**	**65.6**	**18.4**	**100.0**
Developing	**6.5**	**11.4**	**66.4**	**15.7**	**100.0**
of which Asia	5.0	15.6	64.9	14.4	100.0
World	**6.4**	**10.2**	**65.9**	**17.6**	**100.0**

(b) 2030 core

	Agric. & Food	Other Primary	Manufactures	Services	Total
Indonesia	9.0	11.3	64.4	15.3	100.0
China	13.7	29.6	50.0	6.7	100.0
India	6.2	34.9	42.9	16.0	100.0
Rest ASEAN	5.6	10.1	67.8	16.5	100.0
Rest Dev. Asia	6.3	14.0	62.6	17.1	100.0
Rest Developing	7.7	4.8	68.5	19.0	100.0
Australia	4.7	4.3	71.4	19.6	100.0
Rest High Income	5.5	8.5	66.7	19.3	100.0
HICs	**5.5**	**8.4**	**66.8**	**19.3**	**100.0**
Developing	**9.1**	**17.3**	**59.4**	**14.1**	**100.0**
of which Asia	9.7	23.1	55.3	11.9	100.0
World	**7.2**	**12.6**	**63.3**	**16.9**	**100.0**

Source: Derived from the authors' GTAP Model results

Table 6: Trade specialization index,[a] Indonesia and other countries, 2007 and 2030

a) 2007

	Ag. & food (light proc.)	Fossil fuels (coal, oil, gas)	Other minerals	Forestry and fishing	All primary
Indonesia	0.14	0.59	0.82	0.77	0.47
China	-0.44	-0.91	-0.92	-0.70	-0.80
India	0.21	-1.00	-0.33	-0.62	-0.61
Rest ASEAN	0.12	-0.31	-0.37	0.46	-0.15
Rest Dev. Asia	-0.71	-0.98	-0.65	-0.32	-0.86
Rest Developing	0.08	0.85	0.59	0.46	0.67
Australia	0.69	0.54	0.94	0.65	0.71
Rest High Income	-0.07	-0.46	-0.33	-0.05	-0.31

b) 2030

	Ag. & food (light proc.)	Fossil fuels (coal, oil, gas)	Other minerals	Forestry and fishing	All primary
Indonesia	0.46	-0.03	0.87	0.87	0.36
China	-1.00	-0.96	-0.99	-1.00	-0.98
India	-0.76	-1.00	-0.18	-0.91	-0.72
Rest ASEAN	0.07	-0.21	-0.16	0.60	-0.07
Rest Dev. Asia	-0.68	-0.99	-0.41	0.03	-0.80
Rest Developing	0.26	0.84	0.68	-0.07	0.68
Australia	0.65	0.64	0.98	0.88	0.81
Rest High Income	0.26	-0.24	0.10	0.63	0.01

[a] Trade specialization index for commodity j for each region is defined as $(X_j-M_j)/(X_j+M_j)$. Ag. & food excludes the highly processed other foods sector.

Source: Derived from the authors' GTAP Model results

Table 7: Agricultural self-sufficiency ratio,[a] 2007, 2020 and 2030 (%)

	2007	2020 core	2030 core	2030 with slower Ch&Ind growth and slower primary TFP
Indonesia	104	111	119	108
China	98	92	87	88
India	102	99	96	95
Rest ASEAN	106	105	104	98
Rest Dev. Asia	89	88	88	87
Rest Developing	103	106	109	106
Australia	124	126	130	123
Rest High Income	99	103	110	109
HICs	**100**	**103**	**111**	**109**
Developing	**100**	**98**	**96**	**96**
of which Asia	98	95	91	91
World	**100**	**100**	**100**	**100**

[a] Agricultural self-sufficiency ratio excludes ‘other (highly processed) food products’

Source: Derived from the authors’ GTAP Model results

Table 8: Regional shares of global consumption of grains and fossil fuels, 2007 and 2030 (%)

	2007				2030			
	Grains	**Grains HH consm[a]**	**Fuel**	**Other minerals**	**Grains**	**Grains HH consm[a]**	**Fuel**	**Other minerals**
Indonesia	4.2	5.1	1.2	1.9	4.0	5.3	1.8	1.7
China	12.3	3.5	10.0	27.4	31.2	5.8	25.0	60.5
India	10.5	16.3	4.2	4.2	13.3	23.1	8.1	6.2
Rest ASEAN	5.2	5.5	3.5	1.6	4.8	6.3	3.9	1.3
Rest Dev. Asia	8.1	9.3	5.4	6.8	7.6	10.0	5.5	4.1
Rest Developing	25.1	40.6	17.8	16.6	19.7	39.2	18.5	11.0
Australia	0.9	0.1	1.0	4.1	0.6	0.1	0.7	1.8
Rest High Income	33.7	19.6	57.0	37.4	18.8	10.1	36.5	13.3
HICs	**34.6**	**19.7**	**58.0**	**41.5**	**19.4**	**10.2**	**37.2**	**15.1**
Developing	**65.4**	**80.3**	**42.0**	**58.5**	**80.6**	**89.8**	**62.8**	**84.9**
of which Asia	40.3	39.7	24.2	41.9	60.8	50.6	44.3	73.9
World	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

[a] Private household and government consumption (excluding use by firms)

Source: Derived from the authors' GTAP Model results

Table 9: Indonesian food and agricultural import shares and tariff rates, without and with the target of 99% self-sufficiency for products marked *, 2020 (%)

	2020 share of agric and food imports	**2020 tariff without new Indonesian Food Law**	**2020 tariff with new Indonesian Food Law**
***Rice, processed**	*4*	9	190
Wheat	*16*	3	3
***Coarse grains**	*1*	3	599
Fruit & veg	*3*	4	4
***Oilseeds**	*3*	5	186
***Vegetable oils**	*4*	9	114
***Sugar**	*11*	20	401
Cotton	*16*	0	0
Other crops	*5*	4	4
***Cattle & sheep**	*3*	3	487
***Beef & mutton**	*2*	5	121
Other meats	*2*	2	2
***Dairy products**	*10*	4	125
Other processed foods	*20*	10	10
TOTAL	***100***		

Source: Derived from the authors' GTAP Model results

Table 11: Indonesia's self sufficiency in farm products, 2007, 2020 core, and 2020 after policy changes

	2007 baseline	2020 core baseline	Myanmar rice expansion	Indonesia export taxes	Indonesia Food Law (to achieve 99% self-sufficiency)
Rice	0.96	0.97	0.96	0.97	1.00
Coarse grains	0.97	0.98	0.98	0.98	1.01
Fruit & Veg	0.98	1.06	1.06	1.06	1.03
Oilseeds	0.94	0.93	0.93	0.93	1.00
Veg oils	1.95	2.53	2.54	2.52	2.16
Cattle & sheep	0.94	0.94	0.94	0.94	1.00
Sugar	0.64	0.66	0.66	0.65	1.00
Beef & mutton	0.92	0.92	0.92	0.92	1.00
Poultry meats	0.97	1.00	1.00	1.00	0.99
Dairy products	0.71	0.72	0.72	0.72	1.00
Highly processed food	1.06	1.05	1.05	1.05	1.03

Source: Derived from the authors' GTAP Model results

Table 13: Share of Indonesia's exports going to China, 2007, 2020 core and alternative scenarios (%)

	2007	**2020 core**	**Indonesia export taxes**	**Indonesia Food Law (to achieve 99% self-sufficiency)**
Agric and food	10.9	32.3	32.2	29.9
Other primary	10.0	19.7	17.1	17.2
ALL PRODUCTS	8.7	16.1	15.5	14.5

Source: Derived from the authors' GTAP Model results

Appendix Table A: Exogenous projected average annual GDP and endowment growth rates, 2007 to 2030 (% per year)

	GDP growth	**Population growth**	**Unskilled labour**	**Skilled labour**	**Capital**	**Oil reserves**	**Gas reserves**	**Coal reserves**	**C mi rese**
Indonesia	5.75	0.83	0.87	4.12	3.88	-1.08	0.56	1.68	
China	7.95	0.42	-0.06	3.41	7.32	-0.40	4.85	5.62	
India	7.25	1.06	1.28	4.24	5.56	0.24	0.00	4.93	
Rest ASEAN	4.21	1.00	0.00	3.98	4.34	2.93	2.33	6.75	
Rest Dev Asia	3.72	1.20	-0.18	2.97	4.01	0.37	-1.64	-1.41	
Rest Developing	3.79	1.45	0.76	3.76	3.40	1.69	2.86	2.42	
Australia	2.35	1.11	0.29	1.91	2.28	1.54	6.52	3.56	
Rest High-income	1.60	0.24	-0.66	1.56	1.28	2.13	-0.06	-1.06	
HICs	**1.61**	**0.26**	**-0.64**	**1.57**	**1.30**	**2.12**	**0.25**	**-0.28**	
Developing	**5.13**	**1.03**	**0.42**	**3.60**	**4.57**	**1.52**	**2.53**	**4.33**	
of which Asia	6.27	0.82	0.18	3.47	5.68	0.34	1.29	4.62	
World	**2.55**	**0.88**	**-0.37**	**1.89**	**2.35**	**1.70**	**1.44**	**2.10**	

Source: Authors' assumptions (see text for details)