Trade and Development Report 2018:
Power, Platforms and the Free Trade Delusion

Addendum

UNDERSTANDING THE GLOBAL ECONOMY WITH THE UN GLOBAL POLICY MODEL*

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1. Injections and leakages and financing

For understanding the growth of an economy, it is useful to start with an accounting identity that shows how final production (net of intermediate goods that are used up in production) of a region, or its Gross Domestic Product (GDP), is purchased by different sectors of the economy, that is,

$$Y = C + I + G + E - M,$$

where *Y* is total production, *C* is consumption, mostly purchased by households, *I* is investment, mostly purchases by firms, *G* is government expenditure on goods and services, *E* is exports and *M* imports. This *production* identity shows that goods and services produced must end up as consumption, investment (which is mostly for adding to the stock of productive capital), government expenditure and exports, with imports subtracted because part of the first three items may represent purchases of what is produced abroad. The value of what is produced is equal to the value of income, and income can be consumed, saved, or taxed. From this we get the *income* identity

$$Y = C + S + T,$$

where *S* is private saving and *T* is taxes (less transfers), we can use the production identity to get

$$(I - S) + (G - T) + (E - M) = 0,$$

which we will refer to as *the* identity. This identity, which must hold by definition for any region, shows the circular flow of production, income and spending: production implies income, from which spending takes place. The identity also distinguishes between different broad sectors, that is, the private, the government and the foreign or external sector. It may be used to understand the growth process by interpreting it in two related ways.

First, it can be interpreted as injections and leakages in the circular flow of income in terms of spending on final goods and services. Injections refer to expenditures that add to the circular flow, and leakages refer to receipts or income not spent on goods and services, that is, saved or withdrawn and therefore subtracted from the circular flow. In the private sector, for households, income comes from wages, returns on capital and land owned, net of taxes, and spending is mostly on consumption, while for firms, income is profits retained by them (from their revenues, after paying wages, interest, taxes, other costs and dividends), and spending is mostly on investment. Injections by the private sector consist of investment by firms, and leakages comprise of saving, that is, private disposable (or after-tax) income less private consumption. Injections by the government sector comprises of government current expenditure on goods and services), and government investment (on items such as transport and communications and electric power), while leakages consist of tax revenue (less transfer payments from the government to the private sector). Injections by the foreign sector come from exports, which is what foreign countries spend on goods and services produced in the region, while leakages consist of imports of goods produced abroad, which is reduces spending on domestic goods and services.

It is useful to distinguish between expenditures that depend on the level of income and production, and are endogenous in this sense, and those that do not, and are therefore exogenous or autonomous. Assume, for simplicity, that all injections – that is, investment, government spending and exports – are exogenous, and all leakages – private saving, taxes (net of transfers) and imports are endogenous and are fixed ratios of income which are called the saving rate, the tax rate and the import rate. The strength of aggregate demand, or the aggregate demand stance, of each sector can be measured by the (autonomous) injection from each sector divided by the leakage rate (which, rather than the level of the leakage, is exogenous). For the private sector, it is the level of private investment (I) divided by the (private) saving rate, *s*, for the government sector it is government current and investment expenditure (G) divided by the tax rate, *t*, and for the foreign sector it is exports (E) divided by the import rate, *m*.

Thus, for instance, the aggregate demand stance of the private sector is given by I/s.[1] It should be noted that these measures reflect stances, but not contributions to total aggregate demand, and must be weighted to find their contribution.[2] Given the autonomous levels of injections and the leakage rates, we can find the aggregate demand stances and the weights, which determine total output. This is not just an identity, but shows how aggregate demand *determines* output: if aggregate demand is high (or low), production increases (or decreases) to satisfy the equality. At any point in time an economy may, for instance, be said to have a strong private aggregate demand stance if I/s is high, that is, private investment is high and/or the private saving rate is low. All the three stances may be high or low; if they are all low, aggregate demand is low, and so is output. Since the level of output is a weighted average of the three stances, at least one must exceed the level of output, and can be called the relatively stronger stance. We can also write the growth rate of output as the weighted average of the growth rates of the three stances, although with weights that change over time.[3]

Second, it can be interpreted as showing the difference between the expenditures and receipts or the net spending of each sector, and therefore a change in the net asset position of that sector (see Godley, 1999, and Berg and Taylor, 2001). For instance, the net spending of the private sector, measured by the difference between investment and saving, is the same as the difference between private consumption and investment expenditure and private income. If the net spending is positive, the sector has higher current expenditures than current receipts, the excess needs to be financed by borrowing or by running down assets or net wealth; if net spending is negative, the sector will be accumulating wealth or reducing its debt. Specific private sector units or groups can spend amounts different from their receipts, which implies changes in their net assets; for instance, firms typically spend on investment more than they save (as retained profits), and hence increase their liabilities in the form of loans, bonds and stock issue. The net spending of the government sector is the difference between government spending on goods and services plus government transfers to the private sector, minus taxes. If government expenditures and transfers and interest payments on existing government debt exceed government revenues, so that the government budget is in deficit, it needs to finance its deficit either through government borrowing from the private sector or abroad, which has the effect of increasing government debt, or by issuing currency, which increases the liabilities of the government with the central bank. If net exports are negative, the region runs a trade deficit, which makes a negative contribution to the balance of payments of the region in relation to the rest of the world, that is, its payments abroad on the purchase of imports

[1] Here it is assumed that consumption is entirely endogenous to income and investment is autonomous This will have to be modified if there are both endogenous and autonomous components of consumption and investment. For instance, if consumption has both autonomous and endogenous parts but investment is autonomous, we may measure injections with the autonomous part of consumption and investment, and capture the role of leakages by the additional saving generated by a unit addition to income (that is, what is called the marginal saving rate).

[2] From the production identity and the income identities shown in the text, we get *the* identity, which we can write as

$$I - sY + G - tY + X - mY = 0.$$

For given values of the (autonomous injections) and the leakage rate we can solve for the level of output,

$$Y = \frac{I+G+X}{s+t+m},$$

which can be written, following Berg and Taylor (2001), as

$$Y = \frac{s}{s+m+t}\left(\frac{I}{s}\right) + \frac{t}{s+m+t}\left(\frac{G}{t}\right) + \frac{m}{s+m+t}\left(\frac{X}{m}\right).$$

The terms within parentheses on the right-hand side are the aggregate demand stances, and the contributions to aggregate demand are determined by the product of the stances and the weights of the sectors as measured by the ratio of the relevant leakage rate to the sum of the leakage rates.

[3] If we denote the growth rate of any variable *x* as *g*(*x*), we can write

$$g(Y) = \frac{I}{I+G+E}\,g\left(\frac{I}{s}\right) + \frac{G}{I+G+E}\,g\left(\frac{G}{t}\right) + \frac{E}{I+G+E}\,g\left(\frac{E}{m}\right),$$

where the weights multiplying the growth-rates may change over time as *I*, *G*, and *E* may grow at different rates. Since *s*, *t*, and *m* are constant, the growth rates on the right-hand side can be written equivalently as the growth rates of the numerators, that is, of the autonomous components of demand.

exceeds its receipts from abroad from the sale of exports. For given levels of other foreign payments and receipts such incomes and transfers to and from abroad and interest on foreign debt, this implies an increase in the liabilities of the region owed to foreign countries in the forms such as foreign loans.

It is important to note that the aggregate demand stances and financing and changes in net asset positions are related (see Godley, 1999). First, if units or sectors are currently constrained in the amount they can borrow, their current spending may be affected; thus, financing can affect the aggregate demand stance. Second, the changes in the asset and liabilities position of firms, households, and the government, as well as of the region as a whole in relation to rest of the world, have implications for their future spending and receipts, and their asset and liability positions, and may have major consequences on their aggregate demand stances and thereby affect the future growth process. It may well be that a region has a strong fiscal aggregate demand stance, that is a high $\frac{G}{t}$, with weak private sector $\frac{I}{s}$ and external sector $\frac{E}{m}$ stances, with implies, since the output is a weighted average of the three stances, that $\frac{G}{t} > Y$, or $G > T$, so that the government sector is in deficit; if this is large, and the government debt accumulates, it is possible that the government deficit may keep increasing because of interest payments on debt, making the fiscal stance unsustainable. Thus, the growth process of the economy may become unsustainable due to a weakening fiscal stance.

2. Aggregate demand, uncertainty and structure

The analysis presented so far has focused on aggregate demand and its growth as the major factor in determining output and the rate of growth of the economy. However, it has also emphasized the possibility of vulnerabilities due to financial factors that may – but need not necessarily – result in the unsustainability of the growth process. This raises two questions. First, what needs to be added to the approach to make it go beyond the idea that aggregate demand affects growth but that growth may possibly be unsustainable? Second, is the approach an appropriate and useful one for analyzing the development performance and prospects of the global economy?

On the first question, five major issues need to be addressed to allow the approach to provide a reasonably useful analysis of the complex global economy and its regions. First, so far, the approach has simplified by assuming that saving, taxes net of transfers and imports are fixed ratios of output and input, and private investment, government spending and exports are exogenously given and, although it has been suggested that financial constraints can have a role in affecting these injections and leakages, we have not explicitly taken such constraints, as well as other determinants, into account. We need to examine the determinants of different injections and leakages more carefully. Second, although the possibility of financial constraints on the behavior of different sectors has been mentioned, the nature of the financial sector, different assets, interest rates and the role of banks and the central bank have to be accounted for in more detail. Third, we have focused on economic growth, but economic development means much more than output and income and its growth, and relates also to human development in terms of things like education and health, income and wealth distribution, and the environment because of their intrinsic important, and which are affected by, and in turn affect, economic growth. For instance, the distribution of income – and intrinsically important feature of social life – can affect consumption and investment demand, and will be affected by the growth of output and employment. Fourth, while we have taken output and its rate of growth to be determined by aggregate demand, it is possible that in many regions output can be constrained and its growth limited by aggregate supply, that is, constraints due to the shortage of labor, especially skilled labor, capital and other resources, foreign exchange, and infrastructure, among others, and the level of technology. Finally, our approach has mentioned exports, imports and finance, but the analysis requires economies to be placed within a global economy, one in which each region interacts with other regions in highly globalized world. The next section will provide an outline of the UN Global Policy Model (GPM) which fills in these complications of the basic framework of the previous section in the form of an econometric model (that is, a model which uses actual data to econometrically estimate its equations and provides a complete model to compute what happens) of the global economy.

The rest of this section briefly addresses the second question raised above, that is, whether the approach is a useful and relevant one for understanding the performance and prospects of the global economy. This discussion is relevant not only for the GPM to be described below, but also for the general approach to which it may be said to belong, which can be called a post-Keynesian/structuralist (PKS) approach. The post-Keynesian approach follows John Maynard Keynes (1936) and incorporates major contributions from Michal Kalecki (1971) and Nicholas Kaldor, among others, who emphasized the roles of aggregate demand, uncertainty, financial markets, and income distribution, and the structuralist approach which takes a systemic perspective emphasizing the roles of structure and structural change in economies and the global economy, capital accumulation, and inequality within and between regions (see Blankenburg, et. al., 2008). Ideas from both these approaches have been incorporated into a large and growing literature (see, for instance. Taylor, 1983, 2004), and their basic features may be briefly mentioned, justified and contrasted to the better-known approaches and models of mainstream neoclassical economics based on mainstream macroeconomics and neoclassical (including new or endogenous) growth theory which are dominant in western academia and in some major international institutions.

It is useful to start with the notion of fundamental uncertainty emphasized by many post-Keynesians, because it is closely connected with several features of the PKS approach. Under uncertainty individuals, organizations such as firms, and policy makers do not know about much of what will happen in the future and what consequences their actions will have; the future cannot even be predicted with objectively knowable probability distributions, unlike what can be done in situations of risk; with uncertainty, we simply do not know (Keynes, 1936). Consequently, individuals and organizations make decisions following hunches, rules of thumb and social conventions that are context dependent and may change quickly; create institutions involving social arrangements that aim to reduce uncertainty and its effects, and without fully committing themselves to particular courses of action like investment in fixed capital, for instance, by holding liquid assets such as money.

First, as shown by the earlier discussion of injections and leakages, the PKS approach starts with accounting identities that hold for the system as a whole – for instance, how the components of aggregate demand add up to total production – and analyzes the behavior of groups, such as households, distinguishing between subgroups or classes such as wage recipients and profit recipients. The structuralist method focuses on the characteristics of the system as a whole rather than its elements, and on the behavioral and institutional characteristics of the system. Indeed, a method focusing on the optimizing behavior of individuals and firms – as in mainstream neoclassical economics – is not useful when the future in unknowable and when individuals and groups interact in complex ways based on social conventions.

In addition to emphasizing the structures of particular regions, the PKS approach focuses on structural asymmetries between different regions such as the high-income North and the low-income South, stemming from an international division of labor in which the North's technological advantage allows it to produce and export sophisticated manufactured goods, including capital goods, while the South exports mostly primary products and simple manufactured goods, and from different structural characteristics of the two regions, with the North having organized labor, usually tighter labor markets, and large firms, and the South having more unemployed and underemployed labor and small firms lacking the ability to set their prices (see Prebisch, 1950, and Singer, 1950). These asymmetries have resulted in a tendency to change the composition of spending over time towards Northern goods, and led to greater technical dynamism in the North, as well as to Southern terms of trade deterioration and global uneven development (see Dutt, 1990). These trends, however, are not inevitable: some Southern regions have experienced rapid growth over long periods and play a role in the global economy different from the rest of the South.

Second, as mentioned earlier, the PKS approach seeks to understand production and growth experience in terms of aggregate demand, rather than following the mainstream neoclassical approach which (even though sometimes incorporating aggregate demand for the shorter runs) focuses on the supply of resources and their productivity in analyzing long-run growth. The existence of uncertainty implies that

people and organizations usually hold liquid assets and do not spend all the resources available to them on goods and services, and are affected by their expectations of the future. This is likely to have long-run consequences,[4] both because the economy need not converge to a situation determined by the full employment of resources or at what is called the non-accelerating inflation rate of unemployment (see Storm and Naastepad, 2012) and because the determinants of aggregate supply are affected endogenously by aggregate demand forces, for instance, due to endogenous technical change.

This focus does not imply that factors affecting aggregate supply are ignored since the approach takes into account constraints such as a productive capacity that is given at a point in time, a limited supply of labor supply (especially skilled labor), and scarce financing, infrastructure and foreign exchange. However, it raises the possibility that aggregate demand may affect aggregate supply, for instance, because aggregate demand increases output growth, which makes more resources available for infrastructure and education for skill formation, and which induces productivity increases that increase international competitiveness and exports, thereby increasing foreign exchange availability.

Third, the approach emphasizes the importance of financial vulnerabilities, which can not only result in asset bubbles due to rising asset prices, but also lead to increases in debt that increases financial instability over longer periods (see Minsky, 1982). Some variants of the mainstream macroeconomic approach do take into account financial factors and how they interact with real factors, but this analysis often adopts the so-called efficient markets hypothesis, in which financial markets operate smoothly with financial actors using all relevant available information having full knowledge of all systematic factors in these markets, taking advantage of all profitmaking opportunities. Usually they take the view that in the longer term, finance is not a problem as long as financial markets are not distorted by policy-induced restrictions. In the PKS approach, financial instability and crises – both domestic and international – are closely related to uncertainty and eventually reduce aggregate demand adversely affecting longer term growth.

Finally, the PKS approach adopts a multi-dimensional perspective on development in terms of evaluating development experiences and policies, rather than focusing on single indicators such as the growth of per capita income and "social welfare" which depends on individual "utility" (sometimes supplemented with some notion of fairness), as in much of mainstream economics. While the approach emphasizes per capita income and its growth, it also takes into account income distribution, employment, human development and levels of financial indebtedness. This is partly because uncertainty implies that the relationships between different aspects of development (some of which are intrinsically valuable and others which may only be instrumentally important) are not stable and therefore better considered individually rather than being reduced to one, but also because there are different ethical perspectives worthy of attention. Economic growth, for instance, need not lead to increases of happiness or subjective well-being – based on surveys that ask people to rate their own wellbeing on a scale – and are unlikely to do so after a certain level of per capita income (see Helliwell, Layard and Sachs, 2018). Moreover, increases in per capita income are unlikely to result in human development in terms of health and education, without resources being used in particular ways, and subjective wellbeing is subject to adaptation in the absence of changes in objective conditions (Sen 1999).

On ethical grounds, a concern for fairness and social justice leads the PKS approach to emphasize income distribution and inequality, for instance, between the rich and the poor, wage earners and profit recipients, between men and women, and between countries and regions of the world. It is fair to say that mainstream macroeconomics and growth theory mostly ignores inequality, focusing on efficiency and economic growth instead. However, especially with recent increases in inequality in many regions,

[4] Solow (2005, p. 5), the father of neoclassical growth theory, writes that that theory "is about the evolution of potential output. In other words, the model takes it for granted that aggregate output is limited on the supply side, not by shortages (or excesses) of effective demand." He continues that "some sort of endogenous knitting-together of the fluctuations and growth contexts is needed, and not only for the sake of neatness: the short run and its uncertainties.

the concern with it has grown, even among a few eminent mainstream economists (see Stiglitz, 2012, Atkinson, 2015, and Piketty, 2015). The PKS approach has also long emphasized the interactions between income distribution and growth, stressing how a reduction inequality can increase aggregate demand by shifting income to wage recipients who consume a higher proportion of their income than profit recipients (see Rowthorn, 1982 and Dutt, 1984) although a decline in the profit share can reduce investment demand and have an opposite effect (Bhaduri and Marglin (1990).

3. The Global Policy Model

A brief, simple and non-technical account of the main features of the GPM model (which is described in more detail and formally in Cripps and Izurieta, 2014) follows the discussion in section 2 of the five features required to go beyond the basic injections-leakages approach.[5]

3.1 Determinants of injections and leakages

The actual determinants of different injections and leakages in the GPM are described using equations for changes in the private saving-income ratio, the private investment-output ratio, the tax-income ratio, and net exports. Rather than discussing the details of all equations and all determinants and time lags and strong path dependencies (according to which higher levels of a variable tend to make its subsequent levels higher) it suffices here to review the main determinants of the major injections and leakages.

In the GPM private saving as a ratio of private income depends positively on the growth of private income, and negatively on the growth on private wealth, which increases consumption. It also depends negatively on the labor share in income and in its change, since a shift in income distribution towards labor increases consumption and reduces saving. It also depends positively on per capita income as a ratio of the world average, capturing the idea that regions with lower relative income tend to consume at a higher rate,[6] and positively on the inflation rate, due to the inflation tax, which induces asset holders try to maintain the real value of their financial assets when is reduced by inflation. Private investment as a ratio of GDP depends on the growth rate of output to capture the positive effects of faster growth of sales through the accelerator effect, on the profit share in GDP to capture the positive effects of expected profits and internal savings by firms, and on changes in financial conditions, including the rate of interest on bonds and in domestic and foreign credit availability. Increases in the firm debt also have a negative effect on investment as firms try to get less indebted.

For the government sector, indirect taxes (for instance, sales taxes) less subsidies depend on the level and change in the value of energy exports (for instance, due to higher oil prices), while direct taxes (for instance, income and profits taxes) net of transfers and interest payments as a ratio of income depend positively on income, positively on the level of the public debt since the government tries to reduce it, and negatively on unemployment, since greater unemployment benefits increase transfers and reduce net taxes. Government spending depends positively on tax revenue which allows the government to spend more, negatively on public debt in order to reduce indebtedness, and negatively on the current account external deficit because of a tighter balance of payments constraints which reduces the government's ability to borrow and also in order to reduce aggregate demand and imports. In primary product-exporting countries government spending increases with the current account surplus, for instance due to increases in the world price of primary products.

[5] The model has evolved from the Cambridge-Alphametrics model which in turn drew on the global models developed at the Department of Applied Economics at the University of Cambridge in the 1970s and 1980s, in all of which Francis Cripps had a major role (Cripps and Izurieta, 2014).

[6] This may be because an increase in world income implies that the average quality of goods increases, which cost more, and therefore increase consumption spending, or because of international demonstration effects according to which consumers in low-income countries keep up with others in a globalized, interconnected world.

Regarding the foreign sector, the model distinguishes between international trade in manufactured goods, primary goods, energy and services. Exports and imports of manufactured goods depend on prices (discussed below) of exports and imports (higher prices of exports making them less competitive and reducing them, and higher prices of imports making domestic goods more competitive and reducing them), on the exchange rate (which affects exports positively by making them more competitive and reducing imports by making them more expensive in terms of domestic currency), and on income and production in the region (although different expenditures have different effects on imports), and on foreign income and production, which increases exports. Trade in services rises with other kinds of imports and exports, being complementarity to them, but also depends on the real exchange rate. Trade in primary products depends on world prices that are determined in global markets (see below) and on exchange rates. Net exports of these products as a ratio of GDP depends on changes in GDP and world prices. Trade in energy products in related to supply and demand in each country, and the model distinguishes between fuels such as oil and gas and other sources. For each country energy demand depends on GDP per capita.

3.2 The financial system

The financial system distinguishes between four sectors for each region: the private sector comprising of households, firms (excluding banks), a consolidated banking sector which consists of the central bank and commercial banks, the government and the rest of the world. The model enumerates the liabilities and assets of each sector: for instance, the private sector holds physical capital and stocks of inventories, bank deposits, loans to the government and net loans made abroad; banks hold assets representing loans made to the private sector, the government, and the rest of the world (on a net basis). The assets and liabilities change due to investment, private saving, borrowing by firms from banks and from abroad, and borrowing and lending by the government from and to all of the three other sectors, and due to capital gains and losses. There are two interest rates for each region, a short-term 'policy' rate and a long-term 'bond' rate. The former is determined by policy adjustment by the central bank using what is called the Taylor rule, rising with the inflation rate in an effort to reduce inflation by reducing spending, and rising with the rate of capacity utilization, that is, the ratio of output to potential output (which is calculated using a statistical trend estimation method) to increase aggregate demand when capacity utilization is low in an effort to increase output and employment. The bond rate is determined positively by the policy rate and inflation, and negatively by the level of per capita income, reflecting the fact that high-income countries have lower long-term rates presumably because of a less uncertain future.

3.3 Employment, inflation and income distribution

The growth of production is related to the growth in employment, captured in the model using Okun's law, the negative relation between the rate of growth of output and the change rate of unemployment, because growth in output, other things constant, increases growth in employment. The supply of labor, or the labor force, depends on among other things, urbanization, the participation rate or the proportion of people in working age who work or are looking for work, and immigration from abroad (all of which respond positively to income). Employment is found from the labor force and the unemployment rate, and labor productivity, or output per worker, is then calculated from the levels of output and employment.

The distribution of income between labor income and profit income is determined mainly by what is called by the profit markup on the labor cost of producing one unit of output (see Kalecki, 1971).[7] The price is determined by the profit markup and by unit costs of production, which depend mainly on unit labor costs, which in turn depends on the money wage and the number of workers required per unit of

[7] National accounts include a third source of primary income: "income from unincorporated enterprises", or "mixed income". In the GPM this is summed to compensation of employees to determine the labor share. The choice reflects the reality that in developing countries mixed income is largely an estimate of income from informal employment.

production, the inverse of labor productivity. An increase in the markup increases the price given the money wage and labor productivity, reducing the real wage (the ratio of the money wage and the general price level), thereby reducing the labor share. Given the real wage, an increase in labor productivity increases the markup and profits, also reducing the labor share. The labor share in the GPM is therefore determined by the factors that determine the real wage, unit labor requirements, and other factors that affect unit costs.

The changes in the wage depends positively on labor productivity as workers are more likely to desire and receive wage increases when their productivity rises, positively on inflation as the money wage is adjusted upwards when prices and the cost of living rises, and negatively on the unemployment rate which slows down wage increases. The price level of the domestic good depends on the money wage (positively), labor productivity (negatively), indirect taxes, the exchange rate (which, for instance, increases the domestic price of intermediate inputs), intermediate prices including energy prices, and the markup which, additionally, depends on credit conditions since an increase in the interest rate increasing the unit costs of production that need to be financed.

The discussion of the goods market and distribution suggests a complex relation between economic growth and income distribution. As discussed earlier, an increase in the labor share increases consumption demand, but may reduce investment by squeezing profits and reduce net exports by eroding competitiveness; the overall effect on growth is therefore ambiguous. An increase in output and growth, in turn, affects wages, prices, productivity, and therefore income distribution.

3.4 Aggregate demand and aggregate supply

The GPM includes some of what may be referred to as supply-side features which constrain the expansionary effects of aggregate demand on growth. One, growth can be constrained by the growth of potential output which, as noted earlier, is determined as a statistical trend, and can be seen as depending on the availability of capital and labor and on technology. Increases in output due to aggregate demand expansion that approach potential output puts upward pressure on inflation by increasing wages and prices. These inflationary tendencies can reduce aggregate demand by reducing consumption demand because of its positive effects on saving through the inflation tax, by reducing investment by increasing the long-term interest rate, and by reducing net exports by making domestic goods less internationally competitive, and also through contractionary effects on government spending and on the policy interest rate. However, in the GPM potential output increases when there is an increase in output, which tends to somewhat mitigate these negative effects on aggregate demand. This response of potential output to actual output reflects increases in productivity growth due to the shortages of capital and labor as well as growth in the labor force. Inflation is also moderated when aggregate demand increases due to increases in labor productivity and increases in labor supply due to, for instance, immigration, internal migration and higher participation rates. Two, as noted earlier, financial factors constrain the growth of output by restricting aggregate demand. An expansion of output that is financed by an increase in private sector or government borrowing, which exerts downward pressures on both private and net government spending, as well as downward pressure on investment through financial markets as the long-term interest rate both because the short-term rate is increased by the central bank due to inflationary pressures, and because inflation increases the spread between short- and long-term rates. These financial pressures, however, are not inevitable, since an expansion in aggregate demand leads to an expansion of output and income, which increases private saving and government tax revenue, both of which increase the availability of finance through the banking system and reduce the need for government borrowing. Three foreign exchange shortages due to balance of payments constraints also have a role. An expansion in output due to an expansion of aggregate demand increases imports, and this reduces net exports and increases the current account deficit. Other things constant, this results in a reduction in government expenditure which depends on the current account and in investment, which reacts negatively to a reduction in external financing. The result is that the aggregate demand expansion is curtailed by the worsening foreign exchange position. Here again, however, an expansion of aggregate demand and output increases the growth rate of the economy, which brings in external capital flows, which relaxes the balance of payments constraint. Moreover, increases in production, especially in the

manufacturing sector, are likely to result in labor productivity increases over time due to learning by doing, or what have been called Kaldor-Verdoorn effects, which increase external competitiveness that, in turn, can increase exports along the lines emphasized by Kaldor (1966), thereby reducing the pressure on the balance of payments.

3.5 Global interactions

The GPM divides the global economy into 30 regions and examines the interaction between them.[8] The global interactions that are emphasized in the GPM are through international trade and international capital flows, although other international factors for instance, those affecting saving rates, as captured by the influence of per capita income compared to the world average, and the role of international migration affecting labor supply, are also considered.

Regarding global trade, of the four types of traded goods and services considered, trade in manufactures is examined in bilateral terms for regional pairs, where the value of exports and imports depends on price competitiveness, which is affected by real exchange rates, and on income levels. Trade in services is complementary to other trade, but is also affected by the real exchange rate. The price of primary products, affected positively by the rate of growth of world imports, determines the imports and exports of these commodities for each region. The world price of carbon energy is determined by market-clearing in the global carbon energy market. The real exchange rate for each region rises in the long run with GDP growth and with increases in relative per capita income, capturing the idea that sustained growth and relative development makes regions more internationally competitive. However, in the short run the real exchange rate depends on nominal exchange and inflation rates, and there are also parameters that capture expectations of future exchange rate changes. The current account balance depends on trade flows and net external income and transfers. The latter changes due to changes in the net external position of countries and US interest bond rate (as a proxy for international interest rates) and due to exogenous factors.

International capital flows and international financial markets are modeled by making external net asset positions of regions respond to the accumulation of current account surpluses and deficits, capital gains and losses on external assets (with the value of assets depleted by world inflation, and increased by increases in the price of capital which in turn depends on capacity utilization, and per capita income relative to the world), changes in the foreign currency reserves of monetary authorities (which, as a ratio of national income depend on the current external account and on the central bank's policy of intervening in foreign exchange markets), the level and change of national income (the direction of the effects depending on the regions), and on exogenous parameters that represent expectational factors and policies such as capital controls.

4. Concluding comment

It should be remembered that the model is not meant to provide a definitive depiction of the global economy or of any of its parts. The global economy is too complex to be portrayed by a single model, and is subject to far too many uncertainties about the nature of causal mechanisms operating in the past and present, and especially its future. The relations that have been estimated from past data cannot be

[8] This includes three from Africa (that is, North Africa, low-income Africa, South Africa); four from developing South and East Asia (China, India, Indonesia, Other South Asia); Saudi Arabia, Turkey, and an aggregate for Other West Asia; five from Latin America and the Caribbean (Argentina, Brazil, Mexico, Central America and the Caribbean, Other South America); two from high-income North America (Canada, USA); six from Europe (France, Germany, Italy, UK, Other Euro-Area and Other Europe), four from High-income Asia and Pacific (Australia Japan, South-Korea, Other East Asia High Income), two from Transition Economies (Russia, Central Asia and Other CIS), and Other Developed (including Israel and New Zealand). The model can also be adapted to add and modify regions, for instance, to examine policy issues relevant for single countries that are not included in the 25 regions to take into account their external linkages.

interpreted as definitive laws in the future and the model cannot be interpreted as one that produces precise forecasts for the future. Nevertheless, it is hoped that the model can capture some of the key characteristics of the different regions in the global economy especially because the model allows a great deal of flexibility in terms of exogenous factors which can be changed to take into account various kinds of contingencies and unforeseen factors as well as policy changes.

References

Atkinson, Anthony (2015). *Inequality: What can be done?* Cambridge, MA: Harvard University Press.

Berg, Janine and Taylor, Lance (2001) "External liberalization, economic performance and social policy", in L. Taylor, ed., *External liberalization, economic performance and social policy*, Oxford and New York: Oxford University Press.

Blankenburg, Stephanie; Palma, Jose Gabriel and Tregenna, Fiona (2008). "Structuralism" in Steven N. Durlauf and Lawrence E . Blum, eds., *The new Palgrava dictionary of economics*, 2nd edition, vol. 8, Houndmills, UL and New York, USA: Palgrave Macmillan.

Cripps, Francis and Izurieta, Alex (2014). "The UN Global Policy Model (GPM): Technical description", http://unctad.org/en/PublicationsLibrary/tdr2014_GPM_TechnicalDescription.pdf, Geneva: UNCTAD.

Dutt, Amitava K. (1984). "Stagnation, income distribution and monopoly power", *Cambridge Journal of Economics*, 8(1), pp. 25-40.

Dutt, Amitava K. (1990). *Growth, distribution and uneven development*, Cambridge, UK: Cambridge University Press.

Godley, Wynne (1999). "Seven unsustainable processes: Medium term prospects for the US world economies", Annondale-on-Hudson, New York: Levy Institute of Bard College.

Helliwell, John; Layard, Richard; and Sachs, Jeffrey, eds. (2018). *World Happiness Report, 2018*, Center for Sustainable Development, Columbia University et al.

Kaldor, Nicholas (1966). *Causes of the Slow Rate of Economic Growth in UK*. Cambridge, UK: Cambridge University Press.

Kalecki, Michal (1971). *Selected essays on the dynamics of the capitalist economy*, Cambridge, UK: Cambridge University Press.

Keynes, John Maynard (1936). The general theory of employment, interest and money, London: Macmillan.

Minsky, Hyman (1982). *Can "it" happen again*, Armonk, NJ: M. E. Sharpe.

Piketty, Thomas (2015). *The economics of inequality*, Cambridge, MA: Harvard University Press.

Prebisch, Raul (1950). The economic development of Latin America and its principal problems, New York: United Nations.

Rowthorn, Robert (1982), "Demand, real wages and growth", *Studi Economici*, 18, pp. 3-54.

Sen, Amartya K. (1999). *Development as freedom*, New York: Anchor Books.

Singer, Hans (1950). "The distribution of gains between borrowing and investing countries", *American Economic Review*, 40(2), May, 473-85.

Solow, Robert M. (2005) Reflections on growth theory. In P. Aghion and S. Durlauf (eds.), *Handbook of Economic Growth*, Vol. 1 (pp. 3–10). Amsterdam: North Holland-Elsevier.

Stiglitz, Joseph (2012). *The price of inequality*. New York: W. W. Norton.

Storm, Servaas and C. W. M. Naastepad (2012). *Macroeconomics beyond the NAIRU*, Cambridge, MA: Harvard University Press.

Taylor, Lance (1983). Structuralist macroeconomics. Applicable models for the Third World, New York: Basic Books.

Taylor, Lance (2004). Reconstructing macroeconomics. Structuralist proposals and critiques of the mainstream, Cambridge, MA: Harvard University Press.