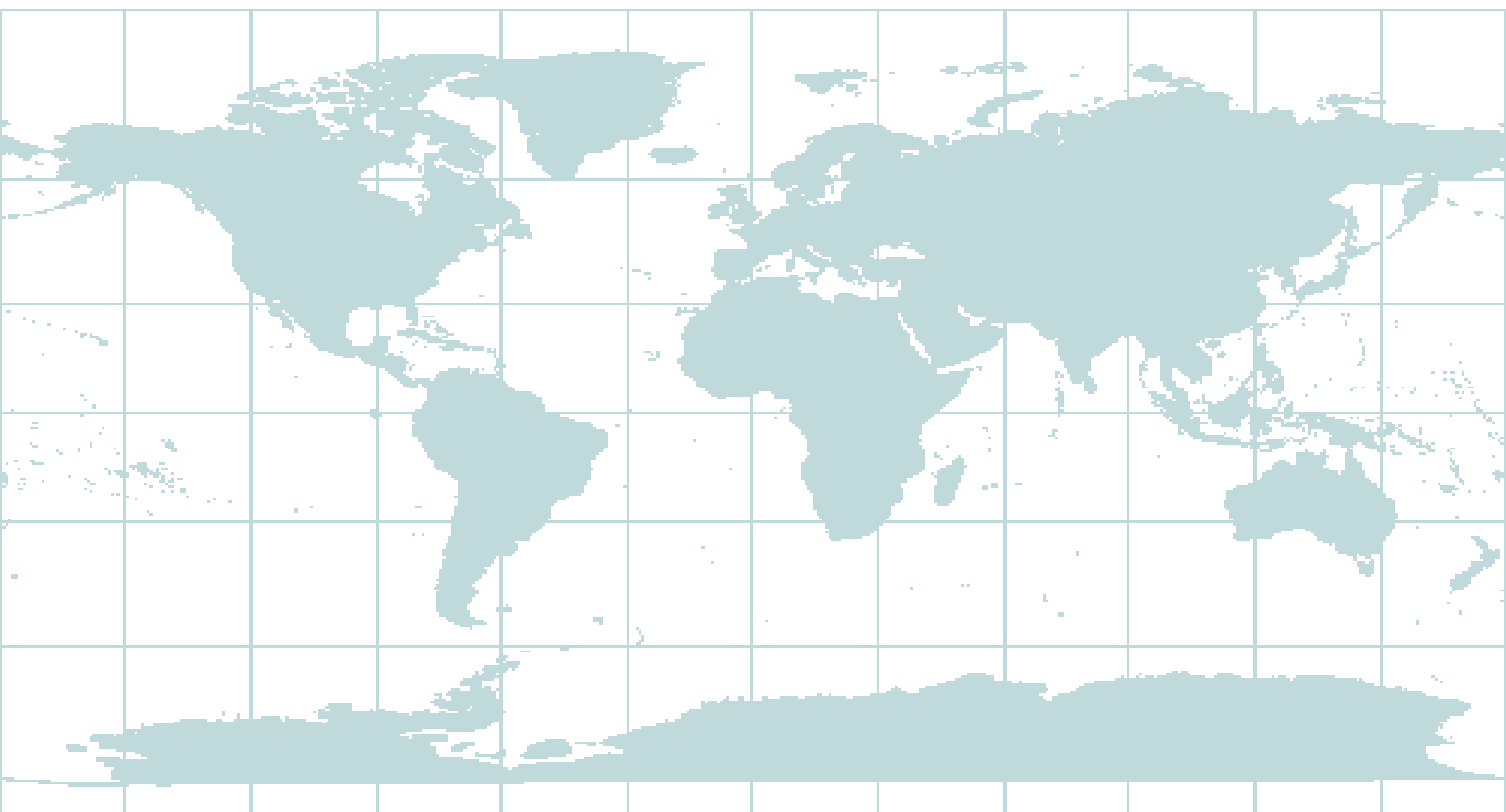


Development Policy and Analysis Division
Department of Economic and Social Affairs

Global Policy Model

Underlying concepts and empirical illustrations



United Nations
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The UN DESA Global Policy Model
Underlying concepts and empirical illustrations

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Abstract

A global policy model (GPM) has been developed by UN DESA for the study of medium-term policy coordination issues. The focus is on providing a clearly articulated structural explanation of developments in the world economy that have arisen or may arise in future from interactions between the main countries and country groupings.

The GPM represents the world economy as a historically-determined system that is open to alternative patterns of development depending on policy initiatives and responses in different regions. Yet there are many important constraints arising from the need to maintain financial stability and avoid excessive accumulation of debt. Likewise, there are institutions and behavioural rules that provide the framework for integration of the global system and define the terms for participation of individual countries and country groupings. Although the global system is variegated and complex in its detail, there is sufficient regularity of behaviour to give plausibility to propositions about requirements, objectives and constraints on policy.

This paper outlines main features of the model and its theoretical and empirical basis. The latter part illustrates how the model's historical data and simulation capabilities can be used to provide information relevant to contemporary policy debates and show, in a structured way, the full implications of economic policy choices.

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Introduction

This paper describes a Global Policy Model (GPM) that has been developed as a tool for investigation of policy scenarios for the world economy. The model is intended to trace historical developments and potential future impacts of trends, shocks, policy initiatives and responses over short, medium and long-term timescales. It is hoped that the model will provide new insights into problems of policy design and coordination in the quantitative macro-economic modelling tradition established by Jan Tinbergen, which undoubtedly permeated the formation process of the department of economic affairs of the United Nations.

Motivation

Globalisation has proceeded apace over the past two decades with nearly all countries in the world participating, albeit to varying degrees, in a common system of international trade and finance that provides major opportunities for economic development and at the same time exerts powerful constraints on national policies. As a first approximation it is plausible to say that in most countries key measures of economic performance such as GDP growth, inflation, the balance of payments and the exchange rate are largely determined, at least in the short run, by global market developments. Although this proposition may not be so evident in the case of very large economies such as those of the US, China or India the latter are certainly not immune to the influence of globalisation and their policies also are influenced by external as well as domestic considerations.

Globalisation has brought huge benefits through diffusion of technology and market opportunities in most parts of the world. These perceived benefits have encouraged governments in most countries to support institutions such as the WTO and IMF that encourage open markets and minimum intervention. But the process has not been without pitfalls. Among the principal concerns one may mention (i) instability of international trade and financial markets that has, if anything, propagated more rapidly as a result of the increasing influence of global markets on national economies, (ii) pressure on the environment arising from rapid growth of a market-driven pattern of energy supply and use, (iii) social pressures and increasing inequality of income and wealth within many countries, and (iv) a widening gap between developed and

developing countries on the one hand and a substantial group of low-income countries that have secured little benefit from global economic growth on the other.

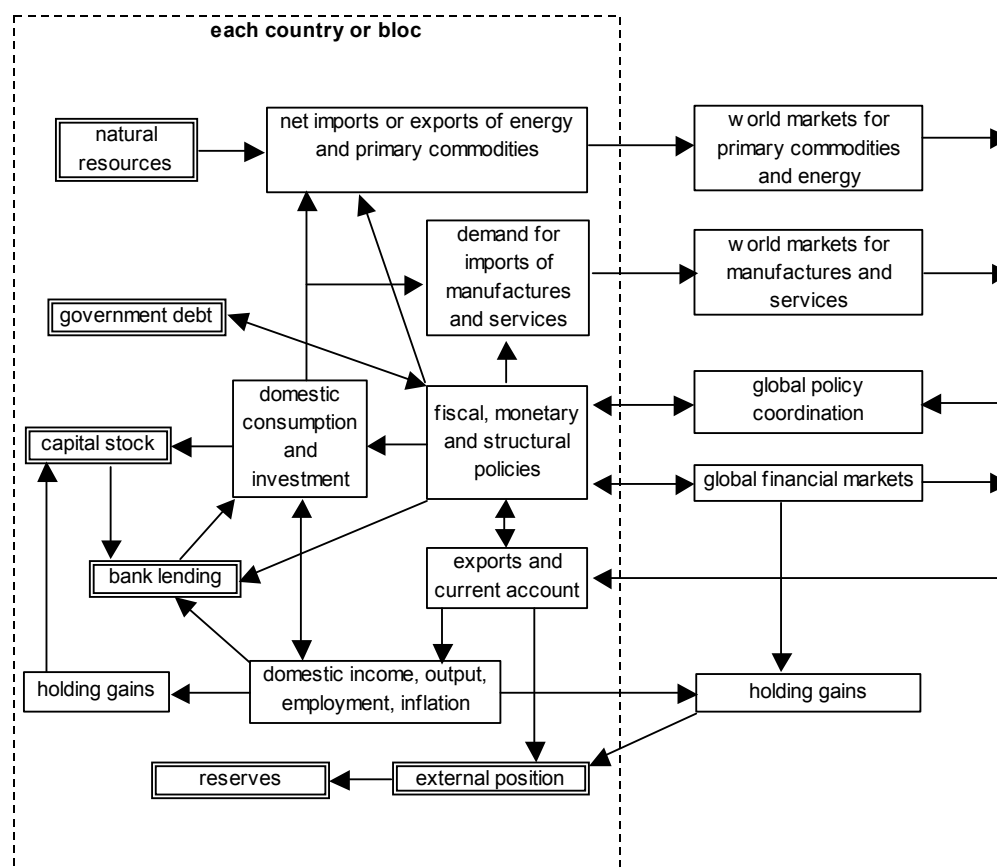
There have been ongoing attempts to mitigate the worst effects of shared problems through international meetings and declarations and new initiatives coordinated by regional and global institutions. However the longer-term benefits of such initiatives are weakened by the variety and complexity of issues that come up and the lack of a shared understanding of the way in which different problems relate to one another. On the one hand major international institutions such as UN DESA are able to provide useful information about the current situation and immediate prospects by publishing short-term forecasts validated by a network of national and regional institutions around the world and on the other hand specialist institutions provide long-term projections in fields such as demography, energy supply and industrial development. But there is also a need for sustained cooperation with regard to structural, financial and macro-economic policies which is scarcely assisted by existing systems and tools of analysis.

The global policy model (GPM) described in this paper represents a contribution towards filling this gap by providing an integrated framework for monitoring ongoing developments in different aspects of the global economy and different parts of the world and examining the potential effect of government responses (policy scenarios) whether undertaken independently or coordinated at a regional or global level.

The first part of the paper outlines the approach that has been taken in building the model. The second part presents some results from the exercise.

Overview of sectors and policy arenas

The GPM can be thought as a set of modules or sectors interacting with each other and where policies operate. The main sectors are private sector demand and income; government demand and income; international trade in manufactured goods (bilateral); international trade in primary commodities, energy and services (world pools); international factor payments and transfers, external positions, exchange rates and capital flows (world pools); government and domestic banking sector flows and balances; prices; output, capacity, inflation, employment and migration.



Policies are explicitly modelled for all sectors and may operate either as targeted functions or in a looser, reactive mode. The main policy arenas are ‘fiscal policy’, ‘monetary policy’ and ‘exchange rate, trade and industrial policy’.

Baseline projections on a ‘business as usual’ basis give an idea of the longer-run impact of ongoing trend changes in the economy and the potential impact of specific uncertainties such as energy trends or new financial shocks. They can also bring out contradictions. In other words simulations may suggest that policies or behavioural responses will have to change as the cumulative implication of business as usual assumptions for resource use, trade patterns, budgets, debt, relative prices and income distribution in some or many parts of the world becomes increasingly implausible.

Policy scenarios allow a researcher to examine the potential impact of different strategies or reactions by national and international authorities to such contradictions. The essential point for a global model is to highlight cross-border impacts and examine alternative packages and adjustment rules as means for achieving mutually beneficial outcomes.

The main objective is an improved understanding of the potential contribution of alternative packages and schemes of coordination to the resolution of critical problems in the global economy and it is essential to recognize that improved understanding is not achieved by use of the model as a ‘black box’. The benefit will come from the ability to describe mechanisms or reasons behind each significant outcome and assess their plausibility and magnitude. Therefore the policy model requires a schema of internationally standard and measurable variables with behavioural assumptions that are not overly complicated but can nevertheless provide an acceptable approximation of real-life developments in the world economy as a whole and individual countries and regions. Design features

This section reviews design features of the GPM that in combination, if not individually, differentiate it from other global models.

Flexible aggregation

Historical estimations and simulations of the future use a flexible bloc aggregation of countries that can readily be changed by model users depending on the purpose and focus of analysis. So far as the authors are aware, this feature is not common among global models.¹

The standard decomposition divides the world economy into 16 blocs. Developed countries are represented by the US, Europe, Japan, Other Developed² and East Asia High Income.³ Among the developing and emerging economies China and India are taken individually. There are two main energy-exporting blocs - the former USSR and West Asia. Other middle-income blocs include Central America and the Caribbean, South America, Africa Middle Income and East Asia Middle Income. The three remaining blocs are Africa Low Income, South Asia, and East Asia Low Income.

¹ The Global Trade Analysis Project, Purdue University, could be one of those few other cases, due mostly to the fact that it involves a network of hundreds of researchers who construct their own individual models. Professor Warwick McKibbin (Australian National University) has produced global models with different geographical aggregations, not in the sense understood here of a one model with flexible aggregation.

² Canada, Australia, Israel, New Zealand

³ Hong Kong, Korea, Singapore, Taiwan

Different decompositions have been used for a study focussed on least developed countries and for studies of specific world regions including Europe, South America and Africa.

One world...

The GPM views the world economy as an integrated system in which the behaviour of different countries and blocs differs because of their specific situations in terms of geography, level of development, financial position etc.

A common set of identities and behavioural equations is used for all blocs of countries to reflect the notion that they are part of the same world economy.⁴ The GPM is not the only global model to use a common schema of this kind although forecasting models typically adopt a more differentiated and pragmatic approach.

Use of a common schema is particularly relevant for analytical models that seek to develop a broader understanding of how the world economy functions as a system (see for example the GEM model developed for the IMF a few years back). Although the common schema is demanding in the sense that it is necessary to obtain or estimate data for the same variables in all countries,⁵ the benefit is that blocs are compared, so far as possible, on a like-for-like basis and that common methods of analysis can be used for all blocs, simplifying the understanding of assumptions and results. The imperative of this type of model is to “explain” differences within the model rather than treating the differences as exogenous and immutable. If some countries or blocs are more successful than others in any given period, we want to know why and endogenize the main causes of such differences.

Use of a common schema opens the door to panel estimation methods which are advantageous when, as in the case of global databanks, there is considerable variation in accuracy of observations for different groups of countries and in different time periods,

⁴ The one exception is the use of the US dollar as the numeraire for nominal exchange rates, entailing the assumption that the nominal exchange rate for the US as a country is always 1. This also means that the US must be distinguished separately in bloc disaggregations.

⁵ For example insistence on a common schema excludes series on the functional and sectoral distribution of employment and income that have long been available for most OECD member countries but are available for only a very small number of non-members.

especially if, as discussed in the next section, structural parameters exhibit uniformity across time and across countries or country groups.⁶

... yet, a “differentiated world”: structuralist parameterization

A considerable effort has been made to specify behavioural equations of the GPM using functional forms that make it possible for behaviour in countries in different parts of the world and at different levels of development to be represented by equations with the same features which yield as well the structural reasons that distinguish behaviour of one country or bloc from another.⁷ To put the matter more precisely, quantitatively different responses that are observed for many types of behaviour should themselves be endogenized; meaning that each difference should be attributed to structural characteristics such as demand composition, income level or financial constraints, etc; that can be incorporated explicitly in the relevant behavioural equation.

Thus, in the GPM a ‘structuralist’ character emerges through the introduction in econometric equations of state variables that ‘explain the difference’, or by normalization of variables that gives different weights to domestic and external factors in each bloc depending on the existing structure of the economy and the level of purchasing power. Equations enriched in this way can be estimated to yield common parameter values while remaining differences are captured in the equation intercept term⁸ and by the pattern and variance of residuals modelled by an autoregressive (AR) process. Equations estimated in this way allow the model to focus on economic causality, linkages and transitions and yet retain (very long term) differences between blocs that might be ascribed to history, geography, institutions, cultural factors, etc.

⁶ Additional information can be obtained using finer bloc disaggregations. Some work of this kind has been done for the GPM using 50-60 blocs to include countries with relatively complete historical data and up to 80 blocs to include all countries with substantial population or GDP.

⁷ For example, if the elasticity of responses to price and quantity changes differs significantly between blocs relevant behavioural equations should explain differences through scaling and inclusion of additive or multiplicative ‘state’ variables.

⁸ Specified as a fixed effect in each panel regression. As a matter of fact, in some panel regressions the introduction of differentiating variables and normalization of variables provides a sufficiently close explanation of structural differences to the extent that fixed effects per bloc turn out to be non-significant. In a few other cases, though, there remain variations that are not well explained. These may offer room for improvement and are the subject of continuous investigation. Yet in none of these cases is there a noticeable impact on simulated macroeconomic performance, due in part to the fact that the behaviour has been more uniform in the most recent period and in part also due to the introduction of intercept shifts to fix up the baseline projection.

The use of a common structure defined in this way is, so far as the authors are aware, an unusual feature of the GPM and the approach has some clear advantages for global modelling. It provides a well-defined basis for assessing historical developments in each country or bloc by monitoring them against a common model, enabling the researcher to determine whether or not patterns of events in each bloc represent significant departures from what may be termed globally normal behaviour. It also offers a robust method for modelling behaviour in blocs for which data are relatively unreliable.

Another important point is that the common structural model provides a convenient basis for assessing the potential for catch-up or long-run convergence of economic performance in different blocs based on current state and a relatively small number of bloc-specific parameters. Apart from differences in the starting point and values of some equation intercepts, all blocs potentially exhibit similar behavioural responses to the chosen explanatory variables. It is the task of the model to clarify reasons for differences in current positions and development paths rather than treating such differences as innate.

Given the focus on seeking an improved explanation of structural differences, development of the GPM calls for ongoing research aimed at refining the schema for each aspect of behaviour in order to improve historical explanation.⁹

Econometric methods

Behavioural equations are estimated using panel regressions on annual observations for blocs distinguished in the model.¹⁰ As with any structural time-series model, care has to be taken with equation specifications in order to deal with issues such as non-stationarity, bounded behaviour, heteroskedasticity and simultaneity.

Non-stationarity

To reduce the risk of spurious correlation, equations are typically specified in an error-correction form

⁹ In particular the model builders disparage use of dummy variables to neutralise the impact of unusual historical episodes or poorly understood patterns. Such episodes and patterns may rather be considered as providing important evidence about how behaviour is modified when economies are under stress or face structural constraints, which should be considered essential for the analysis of policy.

¹⁰ The GPM is implemented in EViews 6 and panel regressions are performed using the EViews 'pool' object with bloc-specific covariances.

$$d(y) = c_0 - c_1 y(-1) + c_2 x(-1) + e$$

where the coefficient c_1 measures the speed of adjustment of the dependent variable y and c_2/c_1 measures the long-run response of y to explanatory variables x . The intercept c_0 is usually estimated with ‘fixed effects’ that allow permanent differences in the long-run relationship between y and x in each bloc. The coefficient c_1 is often not very large, implying a slow adjustment, and dynamic terms $d(x)$ are often added to speed up responses and reduce serial correlation of residuals.

If the estimated error-correction is very weak the model degenerates and typically converts to a less deterministic long-run relationship of the form

$$d(y) = c_0 + c_1 d(x) + e$$

which implies a drifting (non-stationary) long-run relationship between the dependent variable and explanatory variables. This path-dependent type of behaviour is not common but is found, notably, for government expenditure on goods and services.

Bounded behaviour

A common problem that arises in the specification of macro-economic variables is boundedness from below. Many series such as incomes, expenditures and prices must be positive and this is often ensured in empirical models by using a log transform in equations. A variant of this case arises with inflation and real interest rates that may occasionally be negative but may still be assumed to have lower bounds.¹¹ There are also cases where it is plausible to assume upper bounds as well as lower bounds. Upper bounds will typically apply to ratios, for example balance sheet items relative to income. For example many financial variables have shown very rapid growth in the past relative to GDP but we are not be ready to assume that such trends can continue indefinitely. Upper bounds of this kind are implemented using inverse log transforms that ensure the variables remain positive.¹²

Heteroskedasticity

Another issue that arises in panel regressions on series spanning several decades is the large difference in magnitude and sensitivity of many variables between the beginning

¹¹ In this case a transform of the form $\log(y - y_{\min})$ is used to enforce a lower bound.

¹² For example, the transform $\log(1/(r_{\max} * z/y - 1))$ ensures that the value of y is positive and less than a multiple r_{\max} of a reference variable z .

and end of the period. In the case of variables represented by log transforms this is not significant since although the variables may exhibit trends there is usually no presumption that the volatility and sensitivity of log variables will increase or decrease through time. Yet some variables cannot be modelled by log transforms because they have varying sign - for example trade balances and financial balances. Since we require these variables to exert a broadly linear influence in behavioural equations the GPM often represents balances as ratios to GDP with some precautions to avoid introducing unwanted short-run dynamics.

Simultaneity

Another important point is that as is very well known, variables in macro-models are influenced by simultaneous feedbacks that generate close correlations between many key variables, a problem that is particularly acute in models using annual as opposed to quarterly data. Such feedbacks may easily result in overestimation of coefficients when structural equations are estimated individually as in the case of the GPM. Although econometric techniques have been devised to reduce or eliminate such bias, these methods rely on the availability of sufficiently powerful independent drivers of the variables concerned exhibiting sufficient historical variation to clarify underlying structural relationships. Independent variables are hard to come by in practice and if they are insufficiently powerful estimated values of coefficients are not well determined. For example principal components analysis of GPM panel data over the past 4 decades reveals only a small number of significant degrees of freedom for each related group of variables such as domestic demand, trade, financial flows, inflation etc.

Given the lack of independent instrumental variables and the presence of strong same-period feedbacks in annual data, econometric estimates of several critical structural coefficients are inevitably subject to bias arising from simultaneity, a fact that is confirmed when the model as a whole is simulated since over-estimation of the strength of structural feedbacks eventually results in unstable feedbacks when the model is used to simulate developments over longer-term future timescales.

The solutions adopted are (i) to avoid specification of simultaneous feedbacks unless there is a clear case for so doing and (ii) to impose a priori values for a small number of

structural feedbacks that are known to be critical¹³ and re-estimate other coefficients conditional on the imposed values.

Path dependency, dynamics and stability

As indicated at the outset, the GPM does not have any single, well-defined backbone or equilibrium path to which the world economy tends to return in the medium or long term. Being an open disequilibrium system, a wide variety of outcomes may be simulated with different growth rates and end points. Since aggregate demand and technical progress remain the principal drivers unless major behavioural innovations are introduced into the model, the long-run growth rate is best understood as reflecting growth of aggregate investment and government spending on services in the world as a whole. These variables in turn reflect confidence and expectations on the one hand (private investment) and government policy on the other. But behind the behaviour of investors and ministries of finance lie a wide range of inhibiting or encouraging factors and it is not particularly illuminating to enumerate all the elements that contribute to any given outcome.

It follows that baseline or business-as-usual simulations of the GPM do not provide well-defined forecasts of longer-term developments. Considerable variation may readily be introduced by modifying assumptions that impact growth of demand in individual blocs or the world as a whole. In other words, the model is geared towards ‘what if’ scenarios rather than forecasts and their probability distribution.

The main purpose of the GPM is consideration of policy packages and policy coordination. Unlike the baseline, policy simulations are driven by specific objectives of countries, blocs or groups of blocs and the objectives give a specific character and pattern to each exercise. The question that the model is intended to illuminate is the scale and plausibility of policy intervention that may be needed to achieve the stated objectives and the significance of spill-overs and side-effects in the world economy as a whole and other countries or blocs. The main lessons learned concern the relative importance of different mechanisms that contribute to the results and their implication for policy design.

¹³ The identification of critical coefficients relies partly on familiar analytical models such as multiplier-accelerator systems and partly on examination of implausible simulation properties revealed by dynamic multiplier tests or policy simulations.

Productive capacity

The GPM recognizes specific supply constraints of various kinds but does not rely on a natural growth rate for each country or bloc defined by an aggregate production function depending on availability of inputs such as labour force, capital, technology, land and other natural resources.¹⁴

Global constraints on supply of energy and primary commodities give rise to price increases in times of shortage. The energy market in particular is resolved by movements of the price of oil which is very sensitive to the ex ante supply/demand balance and has significant effects on inflation and current accounts.

Limits on aggregate domestic productive capacity are not rigid but the model assumes an increasing inflationary impetus as capacity utilization rises to peak levels. The measure of aggregate productive capacity responds to demand but with a considerable lag, hence capacity constraints could become binding. But ultimately, growth of capacity is endogenous and can be pushed up if demand expands at a higher rate for any length of time. The underlying assumption is that output per person employed in the economy as a whole can increase through investment and restructuring to almost any historically plausible extent in order to sustain growth of output. The capacity for technical progress is a singular feature of the modern world economy. This does not mean that individual national economies can achieve arbitrary target growth rates. Specific physical and financial constraints come into play, expectations change, prices move and investment, trade and output adjust. Such situations are reasonably well captured in the GPM.

As in most macro-models, the immediate determinant of growth of output in each country or bloc is demand represented by domestic spending plus exports less imports, the former being affected in the familiar manner by income, growth expectations and other factors that influence consumer and business confidence including inflation, fiscal and monetary policies, external deficits and accumulation of government debt.

What differentiates the GPM from many other models is that there is no built-in tendency for demand to adjust towards a given level of capacity utilisation (e.g. a level

¹⁴ Or combination of disaggregated production functions with constant or diminishing returns.

defined by a well-defined non-inflation-accelerating rate of unemployment), or to a notion of potential output which effectively determines realized output.

It is a matter of historical record that many developing countries in Asia, large and small, have been able to sustain GDP growth of the order of 8-10% per year continuously for one or more decades and in such cases output has increased dramatically through restructuring of existing industries and implementation of technologies, marketing techniques and forms of organisation that are already well-established in other countries. There has often been little increase in the employed labour force as a whole but there have been huge movements of people into cities and large reductions in numbers working in agriculture. The ability of so many countries to sustain rapid growth for long periods of time makes it difficult to justify the assumption of a rigid supply-side limit on growth of productive potential in low or middle income countries in any part of the world as a principle.

It is plausible to assume that there are long-run limits to growth of output in high income countries but it is hard to put a number on the maximum growth of output per person or potential participation of people in different age groups in the labour force. The GPM is currently being extended to include demographic and employment variables that make it possible to consider such constraints explicitly and examine possible consequences for growth of productive capacity.

Policy simulation

Finally, how does the GPM portray policy within this structure of assumed behaviour and constraints and how are alternative policy packages and coordination schemes represented?

The first point to note is that policies are largely endogenous as, for example, fiscal policies are in most countries constrained by non-discretionary commitments on the one hand and financial exigencies on the other. Meanwhile, monetary policies have to take account of inflationary pressures, the level of capacity utilization, exchange rate and balance of payments issues. In the GPM equations for policy variables are parameterized based on past experience. Unusual policy behaviour and innovations appear as residuals. New rules and regime changes can be introduced by defining targets and instruments (see Appendix E) which generate new patterns of residuals representing the divergence between the new rule and historical behaviour.

More generally, and considering that the scope and degree of influence of government differs between blocs and changes through time, we may take the view that, in some instances at least, any or all behavioural variables in the model are potentially influenced by government policy. Private sector behaviour also follows typical historical patterns much of the time while exhibiting residual differences that reflect a myriad of specific causes as well as generalised swings in expectations or confidence.

A baseline or business-as-usual scenario generally assumes that future behaviour will converge to normal behavioural patterns with historical residuals vanishing or fading out. Exceptions are modelled by the introduction of intercept shifts that represent widely-expected changes in trend or consequences of current policy such as counter-recession stimuli or post-recession consolidation which were not captured by normal responses in the model. Baseline variants are set up to explore critical areas of uncertainty such as the rate of development of new energy sources, buoyancy of savings or crises of confidence that might bring about future recessions.

The GPM provides several methods for specification of alternative policy packages and coordination schemes.

The simplest is to introduce specific innovations in behaviour by specifying values for residual terms in equations for policy variables. While this approach is useful for sensitivity analysis it has limited value when it comes to the search for improved solutions that require sustained policy implementation and coordination as in this case the number of residuals to be modified is large. The impact of new policies could be hard to analyse unless the policies themselves are defined in a reasonably simple way.

Thus a more effective approach to modelling policy packages and coordination schemes is to specify new rules that modify behaviour. Such rules embody context-dependent responses and can link multiple instruments and targets through time and across countries.

Policy innovations in GPM scenarios are usually specified by explicit rules, each with an objective function and list of instrument variables. The adjustment process implied by such rules may be more or less effective, rapid and complete.¹⁵

¹⁵ The objective may take the form of a target, floor or ceiling and parameters include the desired value or trajectory of the objective, the weight of each instrument and limits on its use, whether the response is contemporaneous or delayed, the degree of convergence to be achieved in each period, etc.

Rules may operate separately in individual blocs or may be coordinated, for example when blocs adopt similar rules or participate in a shared rule, spreading the burden of adjustment to achieve a common objective. There are evidently pro's and con's of each type of rule. Following the principle of subsidiarity, it is often preferable to rely on local policy innovations since these are easier to agree and more realistic in relation to local circumstances. On the other hand it may be very difficult to find local rules that resolve global problems and a certain amount of international consensus is necessary to provide a stable framework for government and business when national economies are highly interdependent.

When behavioural assumptions are modified in the model, it does not follow that it is realistic or even possible that such modifications can be implemented in the real world. The GPM provides some indication of realism by calculating the size of residuals representing departures from historical behaviour required to give effect to each new policy. The calculated residuals are compared with the historical standard deviation of shocks for the same variable and bloc and the probability of new shocks of this or larger size is calculated on the assumption that shocks come from an independent normal distribution. The effect of policy rules in a GPM scenario may be constrained by attaching probability bounds that prevent residual adjustments going too far outside the historical range.¹⁶

¹⁶ Typically the search for innovations is restricted to those that lie within a 90% or 95% range of probability.

Assumptions and data sources

Before empirical examples are presented in the final section of the paper, this section describes the background and data sources in a bit more detail to give a concrete idea of the way the model has been implemented.

Policy perspectives and macro theory

The core structure of the GPM is derived from a model originally developed at the Cambridge Department of Applied Economics in the late 1970s, which was strongly influenced by extensions of the Keynesian analysis of the short run and was used to examine problems of economic development in Europe and Japan as well as developing countries. In this context it was assumed that balance of payments constraints bear heavily on demand-management policies in most countries other than those that have strong tendencies to surplus. The GPM retains a somewhat demand-driven perspective on macro-economic behaviour underpinned by a structuralist perspective on production and trade without strong equilibrium assumptions.

As in any demand-driven model of the world economy, growth appears to be somewhat unstable with investment, inventory and trade cycles being damped in the short run by fiscal stabilisers and in the longer-run by the need for deficit countries to restrain demand in order to stabilise exchange rates, reserves and external debt. Constraints and bottlenecks are identified in the GPM in similar ways as in other models, with perhaps more emphasis on time-dependency.

Productive potential is assumed to be flexible, though not unlimited, in most countries, considering the prevalence of under-employment in agriculture and services, as explained by Kaldor and others following W.A. Lewis. The export-led growth perspective that is a common property of demand-led models acquires force if trends of competitive advantage exhibit persistence of the kind demonstrated through quite long periods in the 19th and 20th century. Although leading positions may eventually be passed on it has been common for a few countries to maintain the momentum of market

acquisition and technical progress over one or several decades, allowing their economies to reduce or eliminate under-employment.¹⁷

It has been important to understand why cumulative advantages have not accrued to exporters of commodities, despite limitations on land and natural resources of the world as a whole, and despite occasional periods of high prices that have brought considerable wealth to commodity exporters. The long-term weakness of earnings from commodity exports may be attributed to the competitive nature of commodity markets and 'land-saving' technical progress facilitated by innovation and the use of industrial inputs.

Since the early 1970s oil revenues or more generally, energy balances, have periodically come to the forefront as a significant element in global financial flows. Thus the GPM retains a decomposition of merchandise trade between three sectors - manufactures, energy and commodities - with an evolving, oligopolistic pattern of bilateral market shares for manufactures and competitive market-clearing prices for oil and commodities. This structure serves to demonstrate, for example, how the rising cost of imports of oil to Europe can be offset in balance of payments terms, albeit with some delay, by rising exports of manufactures to oil-exporters in the Middle East where European companies had a high market share. On the other hand non-oil developing countries that do not gain any such compensation have in the past financed costly oil imports by accumulating external debt.

The evident importance of oil has prompted the inclusion in the GPM of variables measuring supply and absorption of energy, taking into consideration gas, coal and non-carbon sources¹⁸ as well as oil, a feature that requires further development about carbon emissions and prospective exhaustion of low cost oil reserves.

Another area that has been developed in the GPM, taking advantage of modern UN data sources, is the analysis of financial variables and their impact on the real economy including in particular exchange rates and government and private sector financial flows reflecting fiscal policy in the case of the former and savings and investment behaviour in the case of the latter. Moreover in common with some other contemporary models, the GPM provides an explicit if somewhat preliminary treatment of financial assets and liabilities including government debt, bank deposits and lending, exchange reserves and

¹⁷ A perspective strongly argued by Kaldor with acknowledgements to Young and Myrdal

¹⁸ Hydro and nuclear electricity and a range of other sources

other external assets and liabilities, making it possible to track cumulative effects of financial imbalances and holding gains in a stock/flow framework of the kind that has been advocated by macro-economic theorists since the 1980s. This provides a check on longer-run consequences of assumptions about financial flows, interest rates and inflation.

In addition, the availability of longer and more robust time series, together with developments in statistics and in econometric methods, have facilitated a richer data exploratory analysis and a better understanding of long run patterns and short term fluctuations. This allows the model to assign a very dynamic role to markets and private sector behaviour as well as a considerable potential for government intervention and leaves the verdict open on a wide range of possible future outcomes for individual countries and the world as a whole.

Data sources

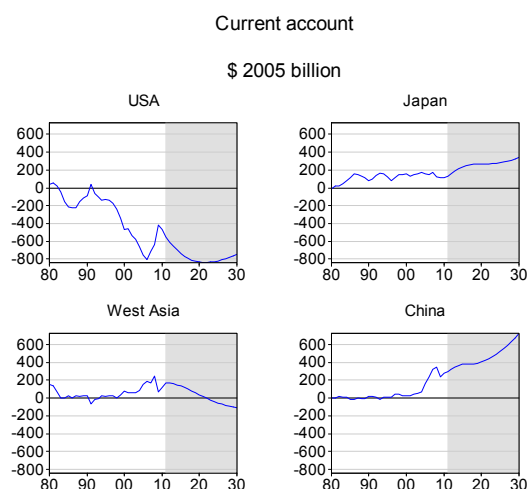
To give effect to the theoretical perspectives outlined above the GPM relies mainly on UN and IMF databanks that provide annual series for individual countries, in principle covering the whole world. Inevitably the availability and consistency of data varies depending on the topic covered, the most comprehensive and complete source being the COMTRADE database providing statistics on trade by commodity, source and destination. Other datasets that are reasonably complete and up-to-date include population and national accounts aggregates (expenditure and production in dollars and national currency units at current and constant prices) published by the UN Statistical Department and balance of payments flows published by the IMF. Balance-sheet and monetary data, also published by the IMF, are less complete and in the case of many countries, available for shorter past time spans. Government accounts are assembled with considerable difficulty and greater reliance on other sources such as OECD and Eurostat.

Estimates of the value of capital and private wealth are currently constructed on somewhat arbitrary assumptions about holding gains, government lending to the private sector and investment in state enterprises etc. Data on the sectoral and functional distribution of income and real estate prices are, for the time being at least, lacking.

Empirical illustrations

This final section reviews specific aspects of recent history that have an important bearing on growth of the world economy and the distribution of growth between regions and use the model to present some ideas about the potential effect of different policy responses to these developments.

Global financial imbalances



The current account deficit of the US that emerged in the late 1990's and continued to increase up to 2006 is seen by some as a precursor of the recession that started in 2008. In any case the US deficit was many times larger in monetary terms than any previously-recorded deficit. It was accommodated and ultimately financed by surpluses in Japan, oil-exporting regions and China.¹⁹

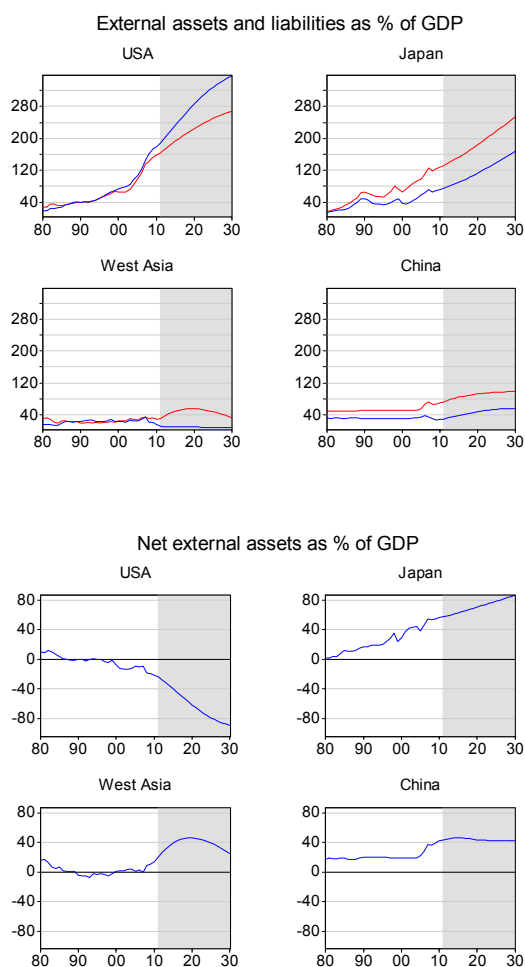
Three conditions coincided to permit continued expansion of these current account imbalances: (i) deficit spending by the US government and private sector, (ii) high savings in the surplus countries exceeding investment and government deficits in the same countries, and (iii) the ability of central banks and global capital markets to recycle funds from surplus to deficit regions across currency zones without generating too much financial instability. Policies in the key countries were all supportive or at least complicit with regard to these developments and it can be argued that the imbalances could have continued without interruption so long as this combination of circumstances was seen to be beneficial to the participating countries.

The recession brought an interruption with smaller imbalances and diminished recycling. Yet as illustrated in the charts, a plausible baseline projection of the GPM could contain the implication of continuing imbalances following the recession.

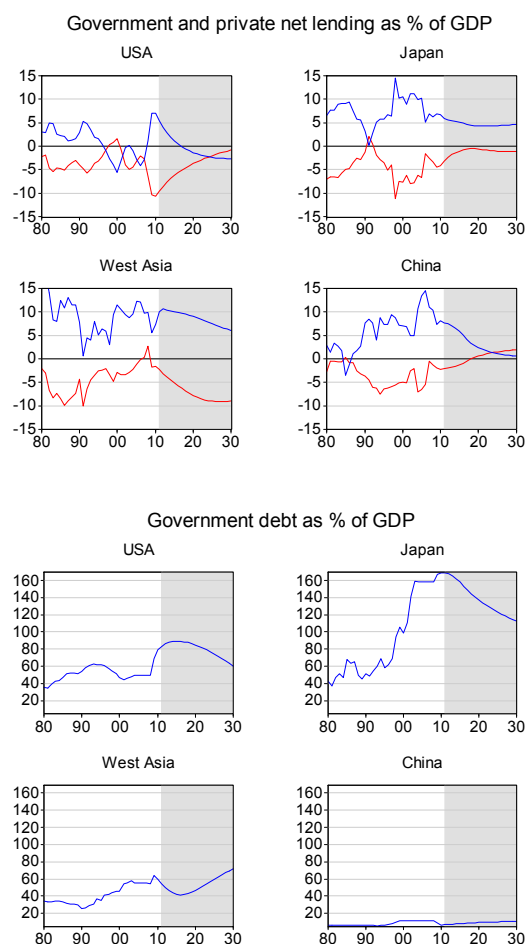
¹⁹ Surpluses in Germany and other European countries were largely offset by deficits in the same region, notably those of the UK, Spain and several lower-income countries.

One important caveat is the cumulative impact on external positions. Up to now the net external position of the US has not deteriorated too much as holding gains on US investments around the world have helped to offset current account deficits. The outcome has been a very rapid increase in the value of external liabilities and assets. But in any country including the US there is some issue about the level of external ownership of domestic assets that is acceptable and it may be questioned whether external liabilities could exceed 200% and eventually approach 300% of GDP as implied in the baseline projection without provoking major changes in US policy which in this context would inevitably take a less open direction.

Apart from the recycling issue and acceptability of very high levels of gross or net



indebtedness, another aspect of considerable interest is the source of domestic savings/investment imbalances that have given rise to external surpluses and deficits on an unprecedented scale. The main driver has been private (non-government) behaviour with government balances offsetting a large part of the variation in private balances. Thus in the 1990s when the US private sector moved from surplus to deficit, government budgets moved in the opposite direction achieving a surplus for the first time in the year 2000. Since that time swings in the private balance have been mirrored quite closely by government budgets with the combined figure showing an increasing net deficit until a large and sudden reduction in private spending initiated the recession.



A similar but opposite process took place in Japan as the private surplus climbed during the 1990s and government moved into heavy deficit generating a huge government debt with additional domestic liabilities arising from accumulation of exchange reserves in pursuit of a lower exchange rate for the Yen. There were also spectacular increases in savings in China and high net savings in the other long-term surplus region, West Asia. In the 1980s and 1990s government deficits did something to offset private surpluses in these regions but since 2000 government deficits have been small making for large surpluses on current account and rapid accumulation of exchange reserves and other external assets.

Thus, a plausible baseline projection shows the US private sector moving back into deficit as the recession fades. With much less certainty, such baseline assumes the private sector surplus in China will reduce progressively while surpluses in Japan and West Asia will be not much different from the past. In this context the US budget deficit should reduce steadily and government debt will eventually decline as a percentage of GDP. Japanese government debt is projected to fall relative to GDP as a result of reductions in the budget deficit and other non-budget outlays. Since there is no particular reason for the Chinese government to incur large deficits, the overall result is that external imbalances will tend to reassert themselves with the possible exception of West Asia where surplus could eventually move into deficit as oil-driven growth slows down.

Other imbalances that may become more pronounced in coming years include those of Europe (surplus), high income resource-rich countries such as Australia and Canada (deficit), Central and South America (deficit) and middle-income Africa (deficit). These

are unlikely to be on the same scale as imbalances of the US, Japan and China. South Asia and low-income Africa are vulnerable to large and sustained deficits but deficits in these regions will not make much impact on the global pattern because their GDP remains so low.

Potential for policy innovation

The potential for policy innovation depends on the timescale and pattern of response to locally in the country or group of countries where the change takes place and spill-over effects in other regions.

Considering the problem of imbalances, contemporary discussion concentrates on fiscal and monetary policies considered broadly to include influence on exchange rates with mercantilist trade policies lurking in the background. On the one hand imbalances in the form of private spending and government deficits are potentially favourable to expansion of global demand and recovery from recession. On the other hand deficits and accumulating debt present problems of acceptability and sustainability. From the perspective of deficit regions, there is a risk that accumulating debt will damage the debtor's credit status making borrowing increasingly expensive and difficult to secure. Eventual recurrence of exchange crises such as those that occurred in the 1990s could not be ruled out.

In principle if deficit countries eschew fiscal consolidation and maintain long-term growth of government spending with stable tax rates, the level of government debt may rise substantially relative to GDP. In these cases the current account may remain in deficit for some time. But then the exchange rate would weaken and if an inflationary spiral is avoided, improved competitiveness should feed into improved GDP growth, higher investment, rising tax revenues and a declining debt-to-GDP ratio. This optimistic picture of the potential benefits of growth-orientated fiscal and monetary policy is not without risks, in particular the risk of a confidence crisis leading to capital outflow, exchange rate collapse, credit contraction and high interest rates. The risk is less if such policies are followed simultaneously and coherently by groups of countries since spillovers from deficit regions are generally positive for trading partners. On the whole, the larger the country or group of countries involved, the lower the risk. Thus if the US and Europe could make a pact to sustain expansionary policies as long as necessary to restore growth and employment, then, according to GPM simulations,

government deficits would reduce after 2-3 years and debt to GDP levels would come down rapidly in the second half of the coming decade. But if fiscal policies are decided on a national basis or favour consolidation rather than expansion such benefits cannot be achieved. Additionally it should be noted that spill-over effects from consolidation are negative for trading partners.

A different path to recovery that appears to be favoured by many commentators include action by surplus countries to reduce their surpluses and revalue their exchange rates which in principle may allow the US and other high-income deficit countries to recover from recession while undertaking fiscal consolidation and reducing the level of government debt. But it is not clear why deficit countries could be expected to respond in the desired manner since if they experience large real exchange rate appreciation they may find it very difficult to maintain the momentum of catch-up which has done much to change the distribution of world income in their favour over the past few decades. The point is that providing they do not lose competitiveness emerging economies are now large enough collectively to be able to maintain their own growth momentum while the US and some other high income countries continue to suffer high unemployment and insufficient growth. To reverse or balance out this trend, the US and Europe would have to embark on their own expansionary policies in a coordinated fashion.

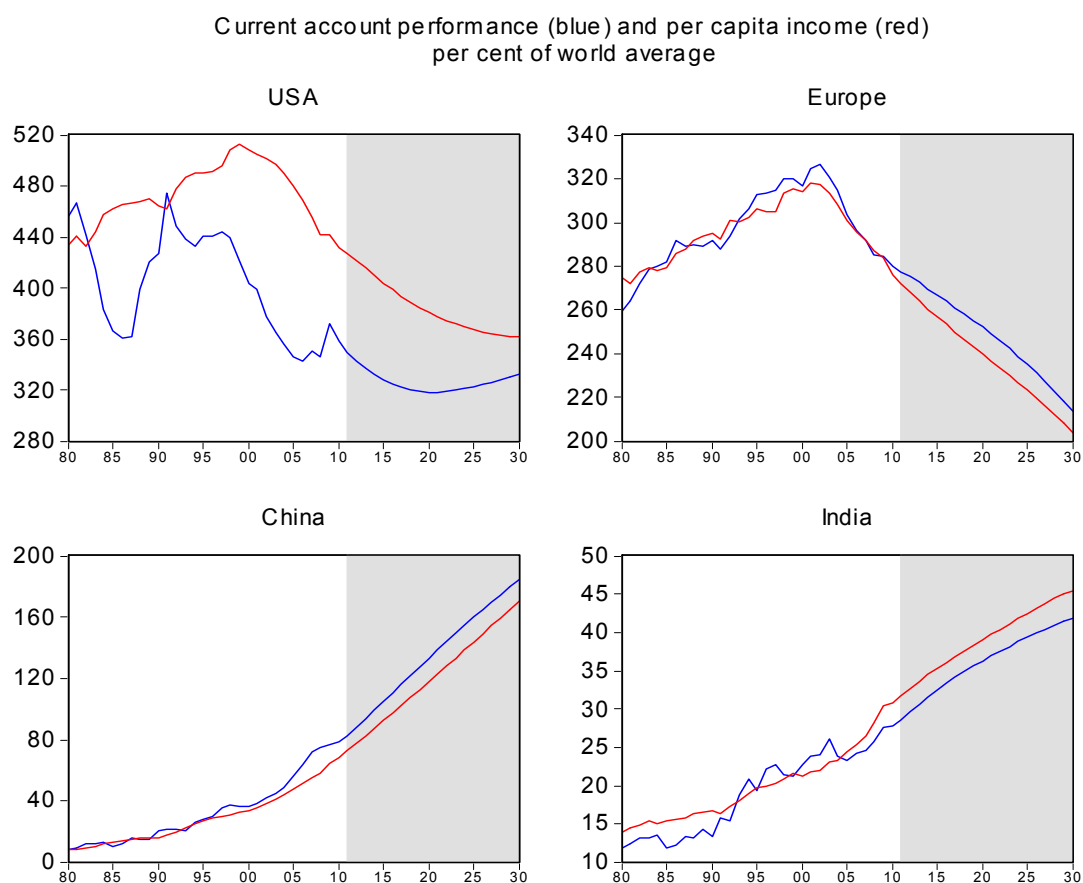
Winners and losers

Although it is commonplace to assert that all countries benefit from globalisation, there can be no doubt that from a national perspective the global economy and financial system is a competitive arena in which some countries perform much better than others and the playing field is not at all level.

The term ‘comparative advantage’ is possibly apt to describe the variegated pattern of international trade and finance but the most important comparison is not between different branches of production in one country but between different countries attempting to earn income in the same market where the success of one tends to mean the failure of others.

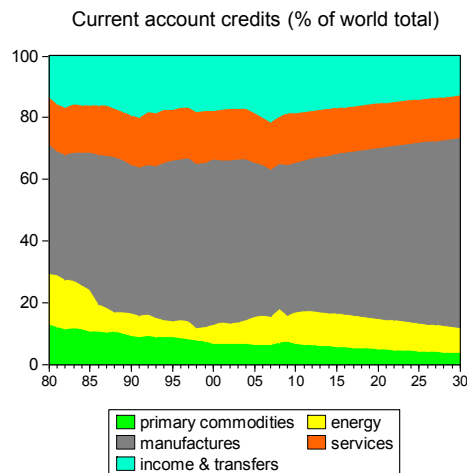
A reasonably good overview of the competitive position of different countries or country groups can be obtained by comparing per capita exports and other current account credits on the one hand and the ratio of imports and other current account debits to GDP on the other.

If the current account is balanced the ratio of these two indicators, which we will term the *c/a* performance index, determines GDP per capita. Out of balance, if per capita GDP exceeds the performance index there has to be a net capital inflow (*c/a* deficit) and if it falls short there will be a *c/a* surplus and net capital outflow. To put all this another way, domestic borrowing and financial deficits raise GDP per capita above the performance index but have to be financed by capital inflow while high domestic saving and financial surpluses reduce GDP per capita below the performance index and result in capital outflow.



The chart compares the *c/a* performance indicator and relative per capita income since 1980 for the US, Europe, China and India with projections to 2030. It will be seen that the GPM baseline used here implies some eventual recovery of the competitive position of the US while that of Europe deteriorates significantly. China continues its long-term catch up and India moves up from a still very low current level in 2010 reaching somewhere near China's current position in 2030. By then China's per capita income is not far below that of Europe.

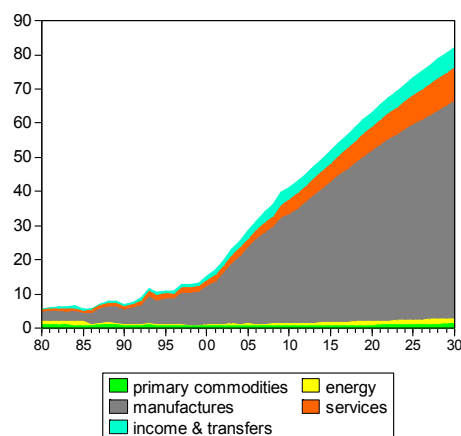
To understand the historical or projected division of world income in more detail it is useful to examine values of the two component indexes, those for exports and imports, for each country or bloc.



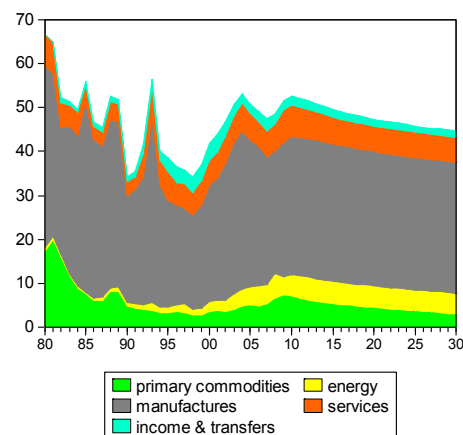
It is worth noting that for the world as a whole there have not been huge changes in the composition of credits and debits since the 1970s. The GPM baseline does not anticipate large changes either. In the baseline shown here the importance of manufactures reasserts itself and despite projected increases in the price of oil, energy trade is expected to decline slowly in value terms as a share of the world total.

The most dramatic change in the baseline projection is continued growth of China's exports of manufactures accounting for an ever-increasing share of the world total as shown by the grey area in the left-hand chart.

China current account credits per capita (% of world average)

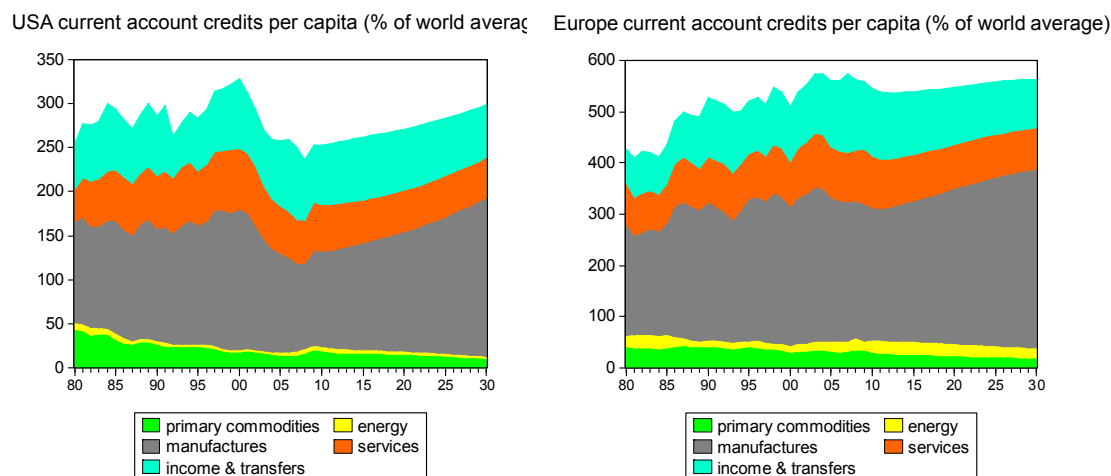


China current account debits / GDP (% of world average)



On the other hand China's imports of primary commodities and energy are not projected to increase more relative to GDP than in other blocs. This underwrites the sustained long-term improvements in China's overall competitive position and relative per capita income shown earlier. Coming from some distance behind the projection for India is similar although India would remain a much less open economy with relatively low imports of manufactures and greater dependence on growing exports of services and income and transfer credits.

The main explanation of different outcomes projected for the US and Europe in this baseline is an improvement in export performance of the US. This in turn is a function of different projected movements of the real exchange rate as continuing US deficits and rising external indebtedness provoke sustained dollar depreciation while Europe's stronger financial position implies less export growth and greater exposure to increases in imports ultimately implying slower per capita GDP growth.



Sustained catch-up by China and India does not imply similar trends of convergence in other low income regions in Africa or Asia. Thus there is an issue whether the division between winners and losers imparts a deflationary bias to the world economy as a whole. Although middle-income countries that improve their global position may expand their trade relatively fast, high-income countries may adopt conservative, deflationary policies that result in current account surpluses and at the same time constrain countries with weak trade performance that at the end of the day must accept growth rates determined by stronger countries. A pattern of growth that is in line with the needs and aspirations of most or all regions of the world is only achievable if most or all low- and middle-income regions can steadily improve their competitive position vis-a-vis slow-growing rich countries.

Rebalancing the global growth pattern

Although exchange rate adjustments can help middle- and high- income countries to adjust their trade performance there is a limit to the degree to which countries can adjust the real exchange rate in a downward direction without confronting severe distortions in relative prices and income distribution as external goods and services, incomes and

assets become extremely expensive relative to the internal price level. Governments come under pressure to subsidize imported products, increase pay of urban employees, and allow prices of essential commodities to rise in order to secure supplies leading ultimately to severe inflation. Such limitations of exchange rate or monetary adjustment have led governments throughout history to seek other means to promote exports and import substitution through all kinds of commercial, industrial, regional and sectoral policies. But if every country pursues such policies simultaneously the weaker get little benefit and the balance of advantage will not shift in their favour. In the worst case competitive export promotion can result in a 'race to the bottom' with respect to taxation, environmental protection and social responsibility.

Slow-growing high-income countries have little to lose *collectively* by transferring competitive advantages to lower-income countries and regions that need to grow faster but so long as they vie for competitive advantage and maintain overvalued currencies it is difficult for their electorates to recognize potential benefits of positive discrimination in favour of low-income trading partners.

Historically the best environment for positive discrimination has been a context of regionalization in which member countries accord privileges to each other, cooperate in the development of common infrastructure and institute rules of co-existence that make it easier for them to improve their region's competitive position while sharing benefits through high levels of internal trade. Global agreements on positive discrimination in favour of low income countries have show so far limited scope and do not seem to have been effective in the past despite 50 or 60 years of effort by UN organisations and high income countries.

Assessing the growth challenge

Starting from average annual income of around \$1,000 per person as is currently the situation for countries with a combined population of nearly 1 billion, the time required to reach middle- or upper-middle income status, depending on the GDP growth rate, is illustrated in the following table.

Income level (\$2005 ppp per capita)	Blocs with 2010 income around the given level	Annual growth of per capita income 2000-2010	Assumed future annual growth of per capita income	Time to reach next income level starting now (years)	Income level in 2030
40,000	USA	0.6%	2%		59,000
30,000	Europe, Japan, Other developed, East Asia high income	0.4 - 2.5%	2.5%	12	49,000
10,000	CIS, West Asia, East Asia middle income, Central America, South America	1.1 - 5.3%	4.5%	25	24,000
5,000	China, Africa middle income	3.4 - 9.4%	7%	10	19,000
2,500	India, South Asia, East Asia low income	3.5 - 5.9%	6%	12	10,000
1,250	Africa low income	3.8%	5%	14	3,000
	Total gap (Africa low income to USA)			73	

The gap from the bottom to the top of the table is over 70 years and might be taken to represent three generations. In the past the problem for very low income countries has been one of take-off as many countries experienced periods of economic stagnation with declining per capita income in the 1980s and 1990s. For regions that have managed to reach an income level of around \$10,000 per person there is a large and apparently difficult gap to cross before reaching upper-middle or high income status. Many such countries have remained around their present relative position for several decades past.

Global convergence

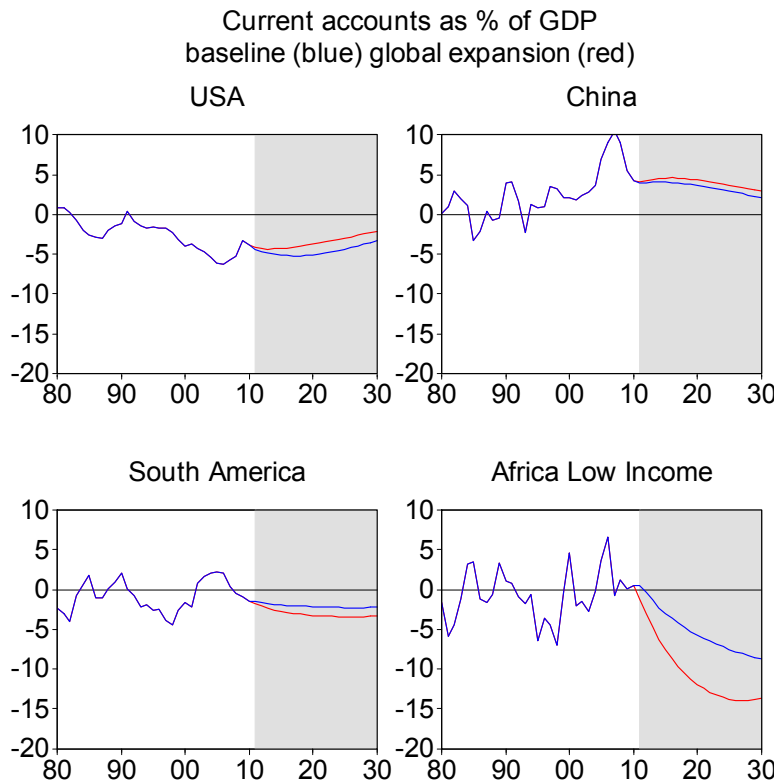
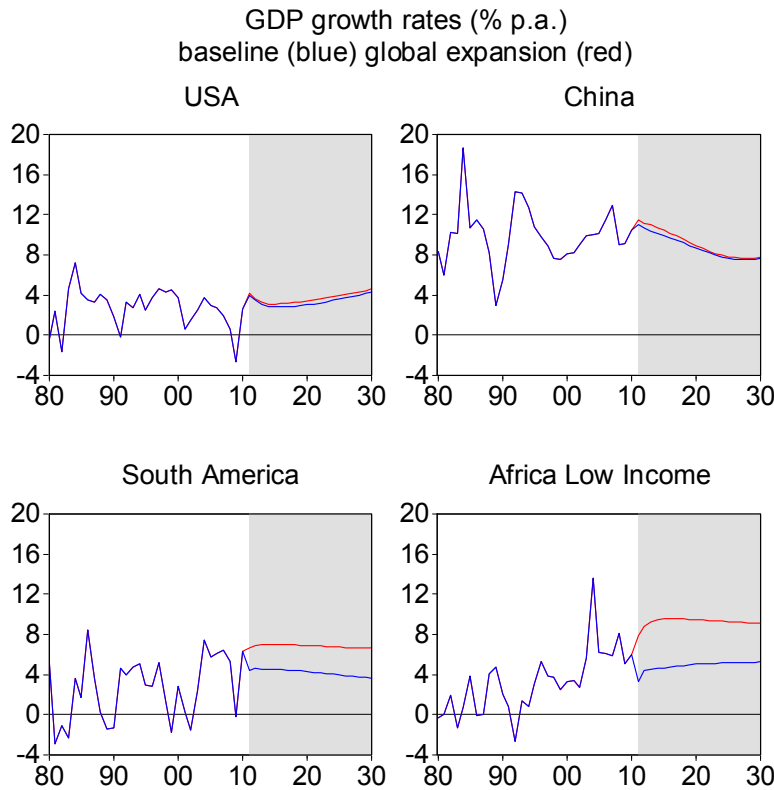
The main and probably inescapable ingredients of a globally-coordinated growth perspective that is in principle capable of supporting sustained catch-up by low and middle income regions in coming decades include the following:

- i) sustained growth of government spending on services and investment at a rate equal to or slightly higher than the target growth of GDP

- ii) incentives and support for private investment to keep pace with government spending
- iii) energy saving in all countries on a scale that will keep global absorption down to 1% per year, accompanied by expansion of supply capacity sufficient to keep the real price of oil at around the present level
- iv) targeted systems of regional preference and coordinated sectoral and industrial development linking low and middle income countries in each major geographical region (Central and South America, Africa, South Asia and East Asia), accepted and supported by higher-income trading partners
- v) long-term, low-cost financing for low-income blocs experiencing substantial current account deficits and accumulating debt positions.

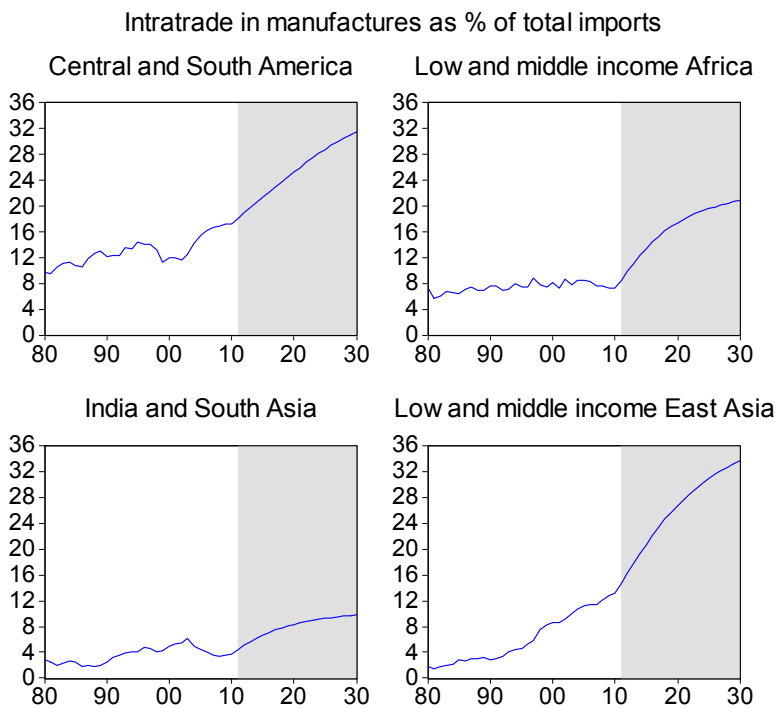
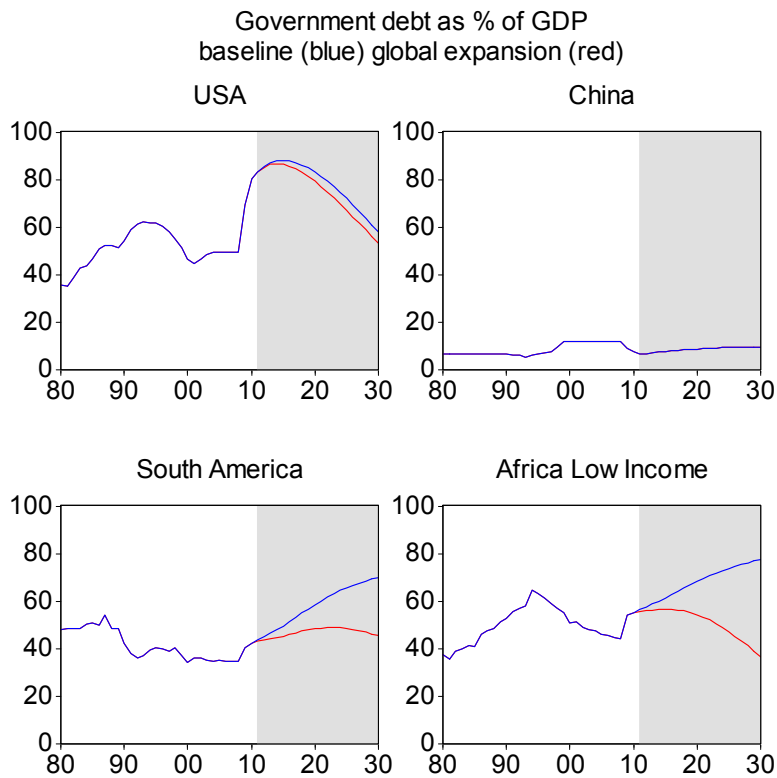
The first two objectives, if satisfied, would generate a high rate of growth of global demand as well as in low and middle income countries. This in turn would make concerted energy policies more vital and it would be important to make sure energy supplies are available to low and middle income countries at manageable prices even if they have not yet been able to develop sufficient local sources of supply. The last two objectives are crucial to support industrial development and mitigate or compensate increasing current account deficits and avoid highly inflationary currency devaluation in low and middle income countries with weak trading positions.

The following charts illustrate a global development scenario for the period to 2030 constructed according to the above principles. Results are shown for four blocs - the USA, China, South America and low income Africa - to illustrate the range of outcomes generated. Red lines on the charts indicate results of the global development scenario, blue lines show baseline results for comparison.



Unsurprisingly, expansion of demand through government spending and private investment is effective for low and middle income blocs, generating rapid growth of per capita income without prejudicing growth in high income blocs and already fast-growing regions such as China that are not assumed to undertake any special new policies apart from those relating to energy and provision of financial support for developing low-income countries.

Moreover, despite strong regional preferences in favour of the low and middle income countries in America, Africa, South Asia and East Asia (but excluding China), current accounts of high income regions and China are if anything stronger than in the baseline projection. This reflects a tendency to increased current account deficits in the developing blocs that have accelerated domestic spending. The African low income group in



particular has large current account deficits relative to GDP that would certainly require financial support under objective (v) listed above. Alternatively, trade and investment agreements could be enforced that ensure a relatively rapid diversification that would finance the growth push with export revenues.

Accelerated income growth has uniformly beneficial effects on government debt, reducing the debt burden significantly despite rapid growth of government spending. By implication, current account deficits in high-growth developing regions reflect increased private deficits due to higher investment - objective (ii).

The final chart presented here shows the assumed effect of preferences and coordinated industrial development on trade in manufactures in each global region. The least plausible picture is probably that for Africa since intra-regional trade has not been growing significantly as a

share of the total in recent years and it would inevitably take quite a long time to build the momentum of a new pattern in this respect. Further refinement of the policy assumptions is evidently necessary in this case. It might be the case, for example, that promotion of agriculture and services could help to bridge the gap during the transition to industrialisation. The GPM does offer an infrastructure to support the specification and quantitative evaluation of alternative solutions proposed by a policy analyst.