AfDB

Development Research Brief

Number 6 | August 2009

EDRE Development Research Department

Office of the Chief Economist, ECON

Computations of Development Financing Gaps: Some Conceptual and Empirical Issues

Abebe Shimeles, Nooman Rebei, and Léonce Ndikumana*

Introduction

Multilateral institutions such as the World Bank, the IMF, and regional banks routinely use simpler, but practical financing gap models to guide policy discussions and resource mobilisation. Frequently used by these institutions is the Two-Gap model, which is rooted in the works of Domar (1939), Harrod (1946, 1947), and Chenery and Strout (1966). The Two-Gap model is the precursor and foundation of more elaborated growth models (starting from Solow-Swan, leading to modern endogenous growth models). The intuition behind the Two-Gap model can be easily explained by considering the well-known national income identity from the demand and supply sides:

$$Y = C + I + G + X - M = C + S + T \qquad (1)$$

Y is total output produced in a given year (GDP). C is private consumption. I stands for total investment and G the government consumption. X denotes exports, while M represents imports. S is savings and T stands for total government tax revenue. Rearranging, we get an equation explaining total resource gap of an economy into internal balance (government budget) and external gap (balance of trade), such that:

$$S - I = (X - M) + (G - T) \qquad (2)$$

It is clear from equation (2) that the most binding constraints are either the savings gap (left hand side) or the foreign exchange gap (external finance gap). The government budget deficit is mainly driven by one of these gaps. According to the Two-Gap model, the required external finance is the larger of these gaps. In the absence of any external or internal financing sources, such as borrowing or aid, supply and demand side of the economy should be in equilibrium. Thus, if countries are left to their own devices, particularly poor ones, attaining equilibrium is certainly a simple matter of necessity, but with a huge price. Economic stagnation, or even economic regression, may arise. This is where Chenery and Strout (1966) brought in foreign aid as a vehicle to support a certain target growth rate.

To do that, the Two-Gap model borrowed from the Harrod-Domar (HD) model the simple theory of economic growth, where GDP (Y) grows proportionately with investment, the factor of proportionality being the Incremental Capital Output Ratio (ICOR) or marginal product of capital, which is assumed to be constant. The higher ICOR is, the lower a country needs to invest to reach a certain growth rate and vice versa[1]. The rest of the computation is a matter of details in how imports, exports, savings, and investment feature in the analysis.[2] The hallmark of the Two-Gap model is that economic growth is driven by capital accumulation or investment, particularly in the short-run. Secondly, there is a one-to-one relation between foreign aid and investment.

The application of the HD model and its extension in the Two-Gap model in a developing country context dates back to the early 1950s, where development planning was still fashionable. Most notable was India, which extended the HD into a multi-sector growth model with a number of innovations to capture several deficiencies for practical use. The World Bank still uses this model with relevant adaptation, taking into account other features of a developing economy. Currently, the model is called Revised Minimum Standard Model, where debt or government deficit enters explicitly in the analysis so that instead of two gaps, there are three.

Critiques of the Two-Gap Model

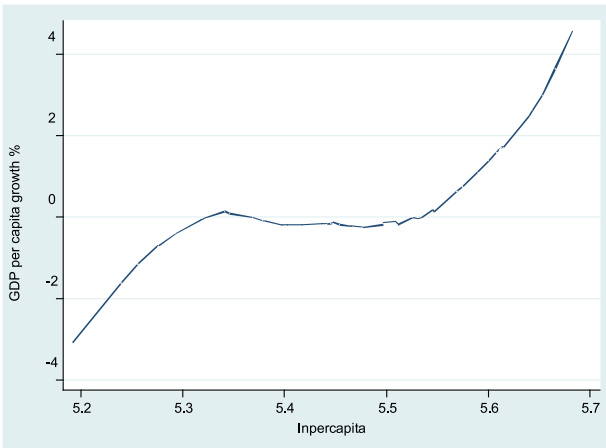
The HD growth model was eventually overtaken by its extended version — the Two-Gap model — which thrived among planners in the developing world and among multinational lending institutions, particularly the World Bank. Solow and others (Swan, Ramsey, Diamond) formulated a growth model in the neo-classical spirit, where the production function (supply side) drove economic growth with emphasis on labour and total factor productivity, and attendant assumptions, such as diminishing returns to factors of production. These were absent in the HD model. Easterly (1999) summarises the key shortfalls of the model at both theoretical and empirical levels. Why then, does a model that has been out of favour in the theoretical growth literature continue to dominate policy making in the real world?

There are a number of considerations that still make the HD framework attractive for policy making. First, it deals with short-run planning problems, while most growth models that have theoretical appeal and some degree of sophistication deal with long-run growth. The distinction is very important in application. The issue of long-run or short-run is not about timeframe. It is about an economy reaching its equilibrium or steady state over a certain period of time, or to be specific, zero per capita growth or GDP growing at the rate of population growth. Here, ICOR can be conveniently assumed to be constant. One can also easily obtain the growth rate required to support a constant per capita income level. From a policy perspective, this is not attractive. Secondly, most developing economies, particularly those in Africa, are far from reaching a stable equilibrium, even over an extended period (see for example, Berthlemy 2005). For instance, one of the star performers of SSA, which is Ghana, never managed to reach a steady state over 47 years (Figure 1). Thus, the transitional dynamics become complicated for policy makers to handle, even as they try to use a much refined growth model.

The other factor that sustains the usefulness of HD is the lack of alternative models that can fit the needs of policy-makers and practitioners like development banks, especially in dealing with short to medium-term financing needs. As the saying goes, "it takes a model to beat a model"[3]. Countries continue to use Leontief type input-output models and Social Accounting Matrices (SAMs), which in spirit, are close to the HD specification in terms of proportionality between input (investment) and output. Most macro-econometric models require estimates of ICOR to compute financing gaps, whether they are formulated in the structural approach or neo-classical framework.

Finally, the HD approach provides a useful benchmark – a first-order approximation to the complicated task of estimating financing needs for development. It allows a check on consistency across the macroeconomic balances as well as sectoral investment programmes.

Figure 1: Growth dynamics in Ghana: 1960-2007



[1] In neo-classical models, the ICOR is commonly interpreted as a measure of the quality of investment.
[2] See for instance http://www.google.com/search?hl=en&source=hp&q=the+two-gap+model&aq=f&oq=&aqi= for a nice guide on the model.
[3] "The other-worldly philosophers", The Economist July 18, 2009, p. 68.

The way forward

For AfDB, comparing financing requirements based on alternative models and approaches could be an exercise worth the effort. However, HD may continue to be relevant when time and resources are limited. Usually, the resource requirements generated by HD are the lowest possible, given its assumptions, which are: (1) Investment is proportional to growth of output. This leaves out issues of investment allocative and productive inefficiencies; and (2) Foreign aid is proportional to investment. This ignores issues of inefficiencies and leakages of aid.

In a typical developing country, inefficiencies in both the aid-investment and investment-growth linkages imply that the actual resource requirements are larger than the amounts generated from the straightforward HD model. Indeed, while consistent broadly with other estimates, ECON's estimates of resource requirements for Africa are generally on the low end (Table 1).

In analysing the empirical validity of HD in the African context, Easterly (1999)[4] found no empirical basis to support the predictions of the HD in over 138 countries for the 1950-1992 period. The key predictions of the HD model are that aid promotes investment. It assumes that a one-to-one relationship exists between the two. It also assumes that investment (one period lagged) leads to high growth in the next period.

Setting aside issues of model specification and others, we attempted to re-examine these relationships for a sample of 12 African countries. We were unable to replicate Easterly's findings. Our results actually suggest strong support for both predictions. Except for two countries, we found significant relationships between growth and investment for the 10 countries when a constant is added in the OLS regression. This is because the HD model assumes no constant term in the relationship between growth and investment (proportionality). In all cases, zero constant was accepted. Once we impose a zero constant on the regressions, it turns out that all countries exhibit a strong and positive short-term relationship between investment and growth. The relationship between aid and investment is also found to be positive, and in most cases, significant. Extending this analysis to all African countries would be interesting.

Finally, it is argued that HD ignores diminishing returns to aid. This is true so long as diminishing returns to investment exist, since both are proportionately related. But the existence of diminishing returns implies that the straightforward HD projections will underestimate the actual resource requirements.

To summarise, the AfDB, as well as other institutions, continue to use various methodologies to estimate resource requirements for developing countries. Any of these methodologies has its own limitations in relation to empirical application to country-specific and context-specific circumstances. Nonetheless, estimates generated from simple models like the HD turn out to be very consistent with estimates generated by more sophisticated methodologies. As can be seen in Table 1, ECON's estimates of financing gaps using the HD model are indeed similar to those from other institutions and authors. If anything, the ECON estimates are on the low end.

Table 1: Various estimates of financing gaps for African countries

Institution	Source (Report/paper)	Africa	Date	Main results	Methodology
World Bank	Global Economic Prospects (GEP)	71.8bn (overall FG); $60.7 (just covering government deficit)	30-Mar-09	External financing requirements for all developing countries as a group are anticipated to increase to $1.3 trillion in 2009. Africa represents 5.52% of total developing countries GDP, implying an FG for Africa of $71.82 billion. In addition, based on the 4% of GDP deficit in 2009, Africa would need an external financing of $60.76 billion.	ICOR or Fiscal Deficit forecasts
IMF	The Implications of the Global Financial Crisis for Low-Income Countries	$51.40bn Net external financing (an estimate in the BoP framework)	3-Mar-09	The total balance of payment shock will cost Low-Income Countries (LICs) in Africa about $150 billion in 2009. Adding the impact on Africa's 14 middle-income countries, this figure could easily rise to above $200-250 billion.	The total balance of payment deficits
Thirlwall - Hussain Model	Exorcism of the Ghost. An Alternative Growth Model for Measuring the Financing Gap	$152bn/year	2000	For an objective of reaching a 7% growth, the FG would be around 10% of GDP, which corresponds to $152 billion in the most conservative case (other assumptions imply larger FG).	Measuring the capital inflows necessary to fill the export-import gap as a dominant constraint on output growth
ECON	G20 Paper	$50bn - $117bn (2009)	2009	$50bn to reach pre-crisis growth; $117 to reach 7% growth	ICOR; assume 7% MDG-required growth for all countries
ECON	GCI input	$52bn	2009	Required growth to reach MDGs, net of current aid	ICOR; consider country-specific MDG-required growth
ADB/GCI	GCI paper	$90bn (2009)	2009	Infrastructure gap	Assume 15% GDP investment target; use AEO growth projections for 2009/2010; use baseline of average 2000-2008 growth rate for 2010-2020

[4] Easterly, W., 1999. "The ghost of financing gap: Testing the growth model used in the international financial institutions." Journal of Development Economics, 60 (2) 423-438.

Comments and suggestions can be sent to:

Leonce Ndikumana
Abdul B. Kamara

Development Research Department
African Development Bank

BP 323, 1002 Tunis Belvedere, Tunisia – Tel.: +216 71 102 876 – Fax: +216 71 103 779 – E-mail: economic-research@afdb.org – Web: www.afdb.org

*Abebe Shimeles, Nooman Rebei and Leonce Ndikumana are respectively Principal Research Economist, Research Economist and Director in the Development Research Department AfDB.