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# Absorptive Capacity and Achieving the MDGs

François Bourguignon and Mark Sundberg*

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**Abstract**

The ability of low-income countries to productively absorb large amounts of external assistance is a central issue for efforts to scale-up aid. This paper examines absorptive capacity in the context of MDG-based development programmes in low-income countries. It first defines absorptive capacity, and proposes a framework for measuring it. Applying a dynamic computable general equilibrium model to link the macro framework to sector results, the paper simulates MDG scenarios for Ethiopia and examines the role of infrastructure, skilled labour, macroeconomic, and other constraints on absorptive capacity. The main policy conclusions are that careful sequencing of public investment across sectors is key to minimizing the costs of reaching the MDGs; the macro impact of large aid flows on the tradeables sector can potentially be serious in the short run; large-scale frontloading of aid disbursements can be costly as it pushes against absorptive constraints; and that improvement of governance and institutional structures can significantly reduce the cost of achieving the MDGs.

Keywords: aid, absorptive capacity, Millennium Development Goals
JEL classification: O11, O15, O21



*Both authors the World Bank, Washington DC.

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UNU World Institute for Development Economics Research (UNU-WIDER)
Katajanokanlaituri 6 B, 00160 Helsinki, Finland

Camera-ready typescript prepared by Lorraine Telfer-Taivainen at UNU-WIDER

## 1 Introduction

The recent discussion about the need to scale-up Official Development Assistance in order to make significant progress towards the MDGs has highlighted the concept of 'absorptive capacity'. On one side are advocates of a general scaling up who rely on calculations of the amount of additional annual aid per capita needed in the next ten years to reach the MDGs. On the other side are advocates of 'aid effectiveness' cautioning against too much aid being delivered beyond the actual 'absorptive capacity' of a country. Absorptive capacity refers loosely to the ability to use additional aid without pronounced inefficiency of public spending and without induced adverse effects, for instance the 'Dutch disease', or the crowding out of domestic saving.[1]

In 2005 a decision was taken by the international development community to scale-up aid, the objective being to roughly double the volume of development assistance to Africa by 2010, and increase aid to other countries by around US$25 billion annually. This is an important and overdue decision, but it has not made the issue of 'absorptive capacity' less relevant. Should this aid materialize as promised, care will need to be taken to ensure that it is properly used by recipient countries in order to maximize its efficient use towards attaining the MDGs. This will require managing additional aid financed public spending and addressing absorptive capacity at a given point of time and, at the same time, ensuring that this absorptive capacity progressively strengthens to be commensurate with available aid flows in order to reach the MDGs. Absorptive capacity has indeed much to do with the timing and sequencing of ODA disbursements. Rapid scaling up of assistance in a country with very limited capacity to train and hire skilled labour, build new infrastructure, or manage large-scale public programmes may result in bottlenecks that result in rising unit costs, and falling quality of service delivery. In extreme cases it could conceivably lead to impaired growth potential with adverse medium-term consequences, for example if country competitiveness is undermined or public revenue efforts are adversely impacted.

To date, there has been very little systematic effort either to define the key drivers of absorptive capacity or to measure country ability to absorb scaled up foreign assistance. Empirical assessment must be country-specific since countries differ widely in their structural and institutional characteristics, and because absorptive capacity is essentially a dynamic concept that depends on the entire time path of an economy. Binding limitations today may be addressed over time through appropriate planning and investment strategies.

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[1] The major publications in 2005 on scaling up all have some discussion of absorptive capacity, including the Commission for Africa Report 'Our Common Interest'; the Global Monitoring Report 2005 'The Millennium Development Goals: From Consensus to Momentum'; the Millennium Project Report, 'Investing in Development', and the UN report 'In Larger Freedom: Towards Development, Security, and Human Rights For All'. The September 2005 edition of the IMF publication, Finance & Development, included several articles relevant to this debate on 'Making Aid Work'. de Renzio (2005) summarizes the issues surrounding scaling up and absorption.

In some instances the constraints to absorptive capacity may indeed be quite limiting, and indicate that a credible programme to fully reach the MDGs by 2015 is unlikely. This is particularly true in unstable or fragile stages, and indicates that alternative delivery tools may be needed, and that more modest targets are to be envisaged. In other countries, given an adequate strategic framework and sufficient external assistance, absorptive capacity may not be a barrier to rapid scaling up of assistance.

This paper addresses absorptive capacity in low-income countries from both a theoretical and empirical perspective. It first seeks to clarify what is meant in economic terms by 'aid effectiveness' and 'absorptive capacity', arguing that there are several potentially binding constraints to absorptive capacity that pose risks in any economy at any point of time for scaling assistance up too rapidly. The paper then briefly presents a framework for undertaking country specific analysis and taking explicitly into account absorptive capacity. This framework relates the macroeconomic environment and economic growth on the one hand, and sector-specific micro-constraints affecting implementation of the social MDGs on the other. It presents the rudimentary elements of the modelling framework used here to examine absorptive capacity and illustrates the framework with a simple application to the case of Ethiopia. The paper concludes with a brief discussion of the main findings and implications for designing MDG-based assistance strategies consistent with absorptive capacity and its dynamics.

## 2 Definition and role of absorptive capacity

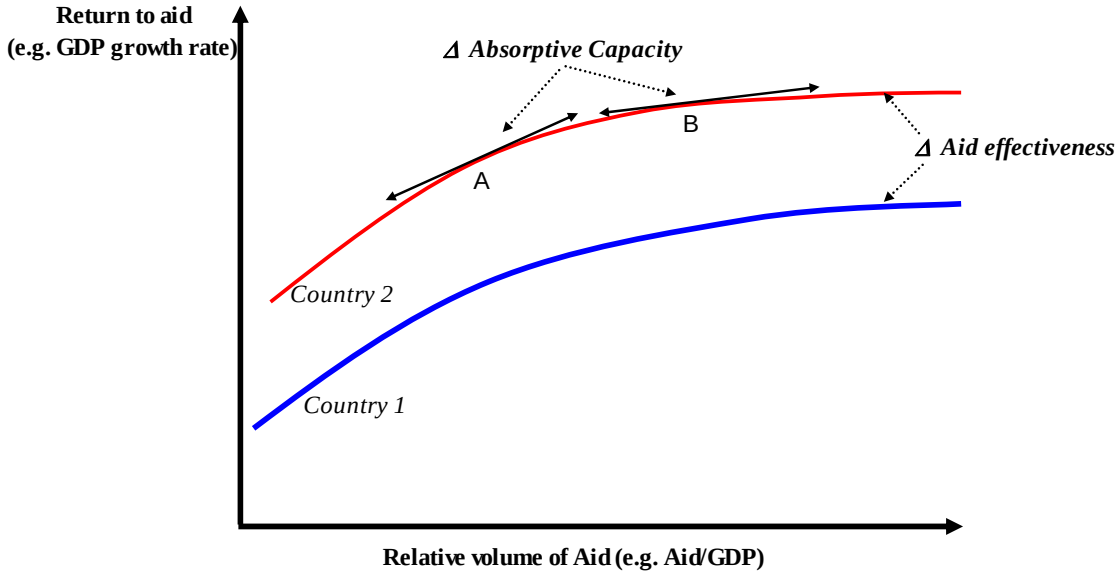
Concern is often raised about the ability of low-income countries to absorb large amounts of aid due to insufficient structural and institutional capacity. The literature on aid and growth usually considers that a country has reached its *absorptive capacity limit* for foreign aid when the rate of return on further increments of aid falls to some minimum acceptable level (for example, see Radelet 2003: 136).[2] There is ample evidence that many low-income countries suffer from capacity constraints and that the potential benefits from additional aid may often be constrained by weak capacity, frequently failing to meet intended objectives. Several empirical cross-country studies (Collier and Dollar 2002; Hansen and Tarp 2001; Radelet et al. 2004) show that after a certain level additional aid to GDP has little effect on growth. This 'saturation point' is a function of different proxies for absorptive capacity arising from macroeconomic, institutional, infrastructure, human capital, or sociocultural constraints (World Bank 2004). There has been an extensive literature in particular on the policy environment, which has emphasized that countries with 'good policies and institutions' can absorb larger amounts of aid before diminishing

[2] The literature on aid effectiveness discusses two types of complications that can arise if flows of foreign aid are large: macroeconomic and structural complications. Whereas in the case of macroeconomic problems, it is the quantity of aid and its allocation between the tradeable and non-tradeable sectors that matter, in the case of absorptive capacity, the issue is the quality of spending. See the detailed discussion in World Bank (2002).

returns set in.[3] In countries with low capacity the saturation point arrives much sooner, and additional amounts of aid are unlikely to be very productive.

This conclusion is intuitive and appealing, even though it is derived from cross-country analysis which is of little help when examining the case of a particular country. Moreover, the literature is not very clear on the causes of the complex phenomenon of declining returns. In effect, there is little insight in the literature provided from country-specific examples of capacity constraints and when or how they inhibit absorptive capacity and aid effectiveness. To clarify concepts, it is helpful to distinguish between these broad factors affecting aid effectiveness over time, and absorptive capacity at a given point in time. Figure 1 helps define formally the related concepts of aid effectiveness and that of absorptive capacity. 'Aid effectiveness' refers to the total economic and social return to aid at a given point in time.

Figure 1: Aid effectiveness and absorptive capacity




The return to aid has many dimensions. In Figure 1 it is associated with the rate of growth of GDP. But other dimensions, for instance poverty, the various other MDGs, or even summary measures of the welfare effects of aid, could have been used. This return will vary depending on several initial conditions—institutions, endowments, policy environment, etc.—working in isolation or together. It is an increasing function of the

[3] For discussions of this perspective on aid effectiveness, see World Bank (2004), Heller and Gupta (2002a) and Goldin et al. (2002). Recent papers that take issue with the result that effectiveness depends on policy and institutional quality include Hansen and Tarp (2001) and Easterly et al. (2003). The link between country conditions and aid effectiveness is borne out by case studies of individual countries, as well as evidence on project-level returns (for example, see the studies in Devarajan et al. 2001). The importance of institutional capacity has been emphasized, for example, in Kanbur et al. (1999), Heller and Gupta (2002b) and Bulir and Lane (2002).

amount of aid that is made available. Aid effectiveness is the height of this 'return to aid' curve. It represents 'what aid can buy' in the recipient economy at a given level of aid and given existing physical and institutional constraints. 'Absorptive capacity' refers to the *marginal rate of return* to aid, which is reasonably taken to decline as the amount of aid increases.[4] At a given point in time, the physical capacity of the economy to produce new infrastructure is limited. At some stage, providing more aid to expand infrastructure will result in less and less new infrastructure being installed and more and more distortions in the economy coming from the increase in aggregate demand. Absorptive capacity sets limits on the productive potential of aid, and as constraints become binding the returns to additional aid falls—or in other words, the unit cost of additional public goods and services, will rise. This distinction between aid effectiveness and absorption capacity is depicted in Figure 1. Aid effectiveness can be characterized as the difference between the top and bottom curves, representing the return to aid in two different countries. Country 2 is able to utilize aid more effectively than Country 1 at any given level of aid (relative to the size of its economy) due to a combination of endowments, institutions and policies.

'Capacity' on the other hand, refers to the declining return to aid in each country as the total amount of aid is increased, that is the slope of the return to aid curve. As constraints on capacity become binding—skilled labour costs rise, physical infrastructure cannot meet demands, administration is overwhelmed—the *incremental* returns to aid fall. The limit of absorptive capacity is reached when the marginal rate of return falls below some minimal acceptable level. This may be at point such as B, where a relatively low rate of return is still considered acceptable, or it may be at a point like A, representing a higher positive marginal rate of return relative to some opportunity cost of funds. In countries with lower overall aid effectiveness, such as Country 1, the total returns to aid will be lower. However, the absorptive capacity—the marginal return for a given aid/GDP ratio given by the slope of the curve—may be higher or lower than in the country with higher aid effectiveness. The two curves showing the total returns to aid can also be thought of as the same country at two points in time. This underscores the fact that aid effectiveness and absorptive capacity are dynamic processes linked to the underlying forces of economic development and change over time. Development targets which today are difficult to reach at any level of aid due to absorptive capacity constraints, may be possible to reach over time as capacity is built and the returns to aid increase.

The adoption of international development goals, the MDGs, affects the debate over intertemporal aid allocation in some basic ways. First, the MDGs are targets that have been adopted for all low-income countries, with differing levels of aid effectiveness. Allocating aid to only those countries with the highest level of aid effectiveness may help to meet

4 In other words, the aid effectiveness curve is taken to be concave. Note that it is not necessarily increasing everywhere, though. Some authors assume that increasing aid beyond some limit may be detrimental to the recipient economy at some stage. See for instance Hansen and Tarp (2001).

*global* targets, but would not advance the MDG cause in countries with lower aid effectiveness and deeper development challenges. Second, the MDG targets are clearly defined by their end-point in 2015. This concretely raises the question of how to optimally allocate resources to reach these targets over the coming decade.

Several potential constraints to expanding service delivery and accelerating growth help determine the shape of the returns to aid curve—both its position and its shape. There are three broad categories: quantitative, macroeconomic, and institutional:

- *Quantitative* constraints refer to key inputs to production of the MDGs, such as skilled workers (teachers, healthcare workers), required for delivery of core MDG-related services. Scarcity of physical capital and infrastructure (schools, roads, power, etc.) are also important factors in this category.
- *Macroeconomic* constraints refer to the effects of aid flows on the economy—when they are fully absorbed and spent. In particular, too much aid inflow is likely to distort domestic prices, in favour of non-tradable goods, assuming a limited capacity of that sector to respond to increased demand. This is turn reduces the purchasing power of aid in terms of domestic goods and crowds out domestic resources from their initial use. It may also lower the competitiveness of the economy on foreign markets. Of course, central banks may try to mitigate these effects. Also, public investment may be used to unlock productivity growth and may neutralize adverse effects of aid on competitiveness. But this can only be done progressively, and absorptive capacity will be increase only after some time.
- *Institutional* constraints refer to the governance environment broadly, both in terms of narrow resource management capacities (budget management, accounting, procurement, etc.), checks and balances institutions affecting the overall investment climate (regulatory, judicial, legislative), and the quality of service delivery to frontline users. The institutional and governance environment determines the extent to which resource leakage and corruption divert resources as aid is scaled up.

## 3 A general framework for measuring absorptive capacity

Identifying the constraints for scaling up aid with a view at reaching the MDGs is complex and requires an analytic framework that can capture the main macroeconomic and microeconomic aspects surrounding attainment of the MDGs. This framework must be dynamic so as to take into account possible changes in absorptive capacity, and in particular the effects of public investment and capacity building, the financial and non-financial requirements to reach the MDGs, and the whole path of public services and outcomes consistent with these goals. There presumably are many different time paths that lead to the MDGs at a given time horizon. Comparing them is crucial to determine the least cost in terms of both domestic and foreign resources to reach that goal. This requires in particular considering relevant opportunity costs of all domestic resources being used and policies being implemented. In standard project cost-benefit analysis this is relatively

straight forward, but in the case of economy-wide interventions with multiple objectives, there are several complications that make measurement difficult.

One such issue is the cross effects of investment in one MDG-related activity on the whole economy and other MDG outcomes. For instance, investment in water and sanitation (MDG8) can quickly improve health outcomes; investment in school and toilet facilities for girls and training female staff can improve gender balance and primary completion rates; improved roads and connectivity will reduce unit costs of supplying other public services, particularly to remote regions.[5] Identifying an optimal path will therefore depend on identifying these cross-effects and ensuring appropriate sequencing of investments. Another consideration is constraints from the demand side. If demand for public services is weak, due to poor quality services, uncertainty over returns, sociocultural factors (such as a gender bias against girls), or costly tradeoffs (such as the opportunity costs of education which arise from forgone child incomes), then there will be limits on public service uptake.

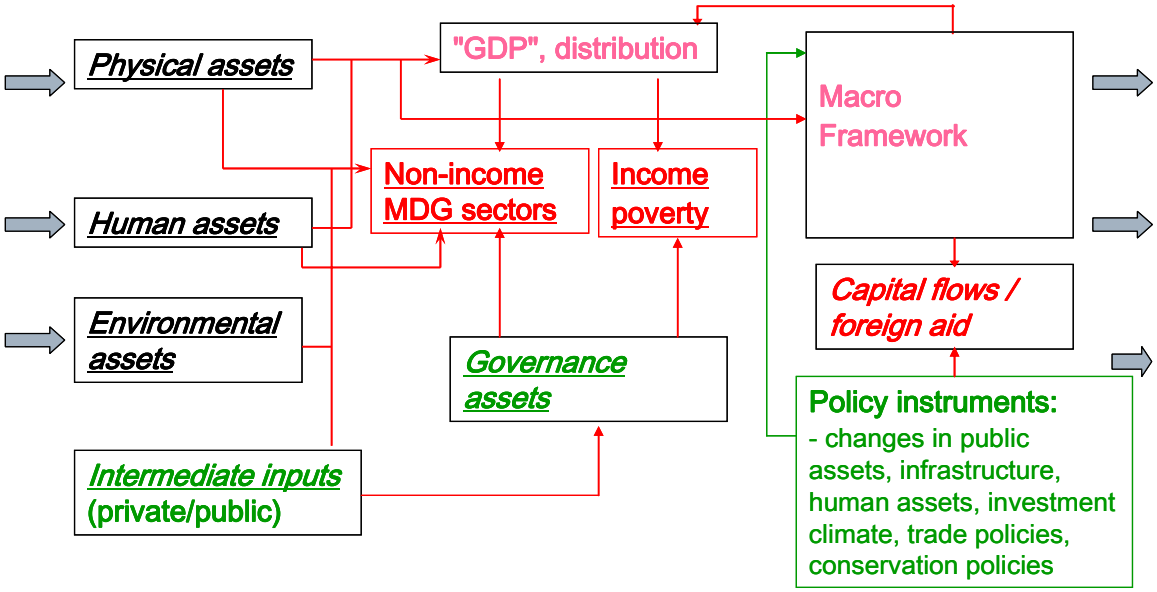
Comparing different paths leading to the MDGs over time requires some common measure of the benefits generated. There is no clear way to measure social welfare in the context of the MDGs. This would require aggregating across the different MDG targets (primary completion, maternal health, access to sanitation, poverty incidence, etc.) whereas an important feature of the MDGs is precisely the non-substitution view behind such a multi-dimensional objective. It is not clear how to compare one path with, for example, better education outcomes at the beginning of the period under analysis but worse sanitation outcomes with its converse, nor what appropriate discount rates should apply to social returns.

Approaching these complex issues requires a framework which incorporates the major productive assets in the economy, production processes both in the private and public sector, and policy instruments. Figure 2 illustrates the general architecture of such an integrated approach. The schema of interconnected boxes shows the core elements that need to be integrated conceptually and analytically. Starting from the left of Figure 2, the key factors that determine the state of the economy during a unit period and are inherited from the past are identified: (i). *physical* assets, not only plants and equipment, but MDG capital—schools, clinics, etc.; (ii) *human* assets, including labour by skills, possibly in specific occupations—nurses, doctors, etc.; (iii) *environmental* assets including clean water and sanitation (MDG7); (iv) *governance* assets, including institutions, and accountability mechanisms relevant to the efficiency of service delivery; and finally (v) intermediate inputs.

[5] Recent research in Nepal suggests that spending on agricultural research and extension, followed by rural roads, can have the greatest marginal impact on poverty reduction (Fan et al. 2004)

The middle boxes in Figure 2 represent the general equilibrium of the economy during the current period. The outcome of economic activity is represented by levels of output (GDP) including in the public sector, and the distribution of income within the population. These outcomes jointly determine results on the MDG front, both for income MDG (i.e. poverty) and non-income goals. Of course the equilibrium of the economy is also governed by the macroeconomic framework and by public policies, which are shown on the right side, and represent the key policy space that influences outcomes on the MDG and non-MDG fronts. At the same time policies and the equilibrium of the economy determine the changes taking place in the various assets, appearing on the left-hand side of the diagram. This framework not only informs on the current sate of the economy but also on its dynamics through these changes; this is the meaning of the arrows at both the right and left end of the chart.

Figure 2: The general architecture of an integrative approach




Having such an analytic tool that integrates the key elements of assets, production, and policy can help guide policy and prioritize across alternative interventions. Consider some simple examples. If as a result of additional aid inflows a country reallocates spending towards providing public services to achieve the MDGs, this will clearly have implications for other public services and for the rest of the economy. Shifting domestic resources toward the social sectors will impact on available resources in the private sector or in the public sector for infrastructure investment, administration, or for operations and maintenance of public assets. Likewise, public hiring of skilled labour to fill critical vacancies in social sectors, leads to reducing labour from other activities, including the private sector, and will raise real wages and possibly lower private growth and income poverty reduction.

Some of these issues are very difficult to address in empirical work, while others can be approximated to generate insights into the main policy challenges. To understand these issues more concretely and clarify their relevance, the previous general framework must be made capable of taking country-specific context and constraints into account. The next section briefly sets out a modelling framework to examine MDG country targets.

## 4 A model for simulating MDG-oriented policies and measuring absorptive capacity

MAMS (for 'Maquette for MDG Simulation') is a model built along the preceding lines with a focus on the capacity constraints and tradeoffs to achieve the MDGs. MAMS is a dynamic computable general equilibrium (CGE) model, the main originality of which is to incorporate a module that covers those MDGs most amenable to economic modelling: poverty, health, education, and water-sanitation. Unlike many other CGE models, MAMS thus relies on a thorough representation of the allocation and the outcome of public spending. As noted in the Introduction, the rationale for the use of a model of this type is that the pursuit of MDG strategies has strong interactions with the whole economy via markets for foreign exchange, factors (especially labour), goods and services, with feedback effects that may significantly alter the findings of more narrow sectoral analyses. For example, the amount of real health or education services that a dollar in aid can purchase may change significantly in light of changes in exchange rates, prices and wages whereas the latter may significantly affect the rate of growth of the economy and the rate of poverty reduction. In addition, existing relationships between different MDGs (for example, health and education) may influence the expansion in real services that is required—improvements in water and sanitation may reduce the expansion in health services that is required to reach health MDGs.

In the application described in the following section, the model is applied to an Ethiopian database and solved for the period 2002-15.[6] More specifically, building on the recent literature and sector studies on health and education outcomes, MAMS considers the following MDGs: (MDG1) halving, between 1990 and 2015, the headcount poverty rate; (MDG2) achieve universal primary education (100 per cent completion rate by 2015); (MDG4) reducing by two-thirds the under-5 mortality rate (U5MR) by 2015; (MDG5) reducing by three-fourths the maternal mortality rate; and (MDG7) reduce by half the number of people without access to safe water and basic sanitation. The model has relatively detailed treatment of government activities related to these MDGs. Government consumption, investment and capital stocks are disaggregated by function into three education sectors (primary, secondary, tertiary), three health sectors, one sector for water

6 The model is presented in detail in Bourguignon et al. (2004) and Lofgren (2004). Preliminary applications to Ethiopia are discussed in Lofgren and Diaz-Bonilla (2005), Bourguinon and Sundberg (2006) and Sundberg and Lofgren (2006). More work is presently done in the case of Ethiopia and MAMS is now being applied to a variety of countries in Africa and Latin America.

and sanitation, public infrastructure, and other government activities. The major government revenue sources are taxes (direct and indirect), foreign borrowing, and foreign grants. The non-government economy is represented by a single activity. The primary factors of production are divided into public capital, private capital, and three types of labour (unskilled, skilled, and highly skilled). GDP growth is a function of growth in the stocks of labour and capital and productivity growth. The composition and overall growth of the labour force depends on the evolution of the education sector whereas capital stock growth depends on investments. Productivity growth is also endogenous and is represented by the effects of changes in the stock of public capital in infrastructure on private production.

The core MDG module specifies how changes in the different MDG indicators are determined. It is parameterized on the basis of detailed sector studies on Ethiopia. In the module the government has an annual primary education budget covering teacher salaries, recurrent operations and maintenance costs, and capital investment (for example, in new classrooms). Recurrent expenditures and the capital stock in primary education together determine the supply side.[7] Demand for primary schooling and student behaviour—the population share that enrols in the first grade, graduation shares among the enrolled, and the shares of the graduates that choose to continue to the next grade—depend on the quality of education (student-teacher and student-capital ratios), income incentives (using current wages as a proxy, the expected relative income gain from climbing one step on the salary ladder), the U5MR (a proxy for the health status of the school population), household consumption per capita, and the level of public infrastructure services—proxying for roads and ease of access to schools. Supply and demand equilibrate through the number of pupils in the educational systems and the quality of education. With fixed supply capacity, more demand means more children enrolled in primary and a decline in quality, which in turn reduces the excess demand. This specification of sector demand and supply also captures lags between educational investment and outcomes, which is one strength of the approach. Based on sector studies, the lags between increased enrolments and outcomes at different education levels are related to the number of years required for completion, and actual completion rates.

The specification of health services draws on a World Bank health sector strategy report for Ethiopia. It also relies on a supply-demand framework. Improvement in U5MR and maternal mortality rates (MDG4 and MDG5) are determined by the level of health services per capita (public and private services), per capita consumption, the population shares with access to improved water and sanitation services (MDG7), and infrastructure in general—for example, the role of rural roads in improving health outcomes with given healthcare supply. The package of health services that achieves MDG4 and MDG5 also includes

[7] Private supply of education services has not been separately included since this is relatively small in Ethiopia, but this could be elaborated for countries where it is important.

HIV/AIDS prevention services sufficient to halt its spread (part of MDG6). For water and sanitation, the population shares with access to improved services are modelled as functions of per capita household consumption and provision of government water and sanitation services.

The provision of the additional government services needed to reach the MDGs clearly requires additional resources—capital, labour, and intermediate inputs—that become unavailable to the rest of the economy. The effects of a programme depend on how it is financed—from foreign sources, domestic taxes (which reduce consumption), or domestic borrowing (which crowds out private investment). Even with 100 per cent foreign grant financing for additional services, which minimizes domestic resource costs, the rest of the economy is affected through two main channels—labour markets and relative prices. At one point of time, expanding provision of health or education services increases demand for teachers and doctors, reducing the number of skilled workers available in other sectors and therefore the output in those sectors. Increased school enrolment also reduces the size of the overall labour force (since it removes a larger part of the school-age population from the labour force), though in the medium run it adds to the share of skilled labour in the labour force.

Two forces drive changes in relative commodity prices. First, domestic demands switch toward MDG-related government services with impacts on production costs and prices throughout the economy. Secondly, increased aid flows lead to an appreciation of the real exchange rate, manifested in increased prices of non-traded relative to traded outputs. These manifestations of the Dutch disease can bring about long-lasting changes in the structure of production, which is diverted from exports and competition with imports.

The limitations on absorptive capacity are captured through three main channels: The two channels just mentioned, through labour market and through changes in the real exchange rate (relative price of the domestic good and international prices); a third channel through potential infrastructure bottlenecks, particularly in transport and energy. Large investments in education services, for example, will tend to reduce further absorptive capacity as skilled labour is diverted to education, as the relative price of non-tradeables rises (for example, real wages are bid up reflecting the Dutch disease effect), and as infrastructure bottlenecks reduce the efficiency of public service delivery. Moreover, the impact will not be limited to the education sector but affects costs throughout the economy, including other public services and the private sector. Policymakers thus face important tradeoffs: increased investment in public service delivery is essential for improved MDG outcomes, but beyond some point the unit costs begin to rise, along with indirect costs to other sectors. The challenge is to keep costs down while also targeting social outcomes over time. Building absorptive capacity is clearly a central element to this process.

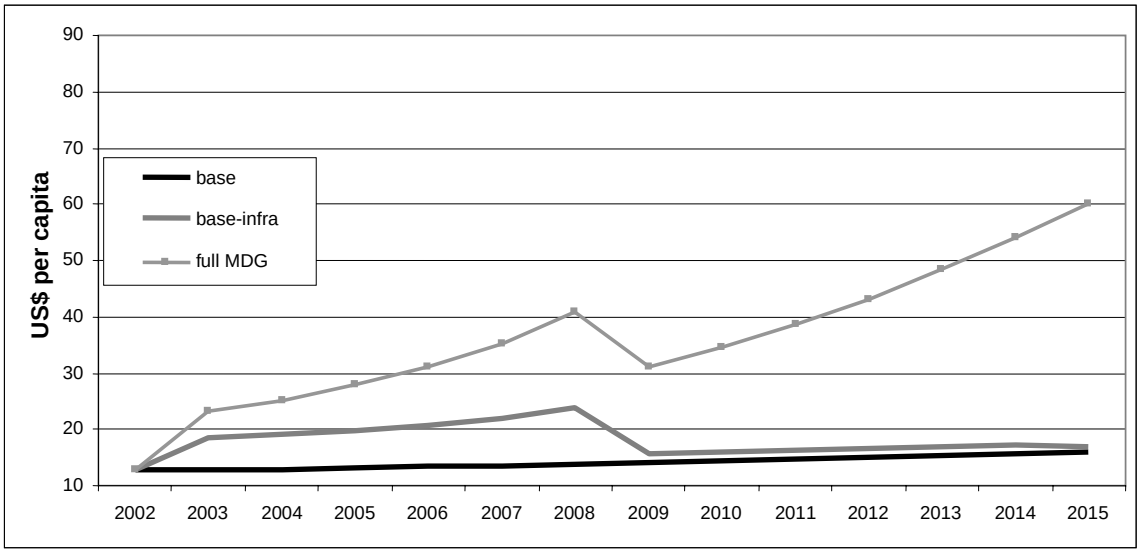
There are also important complementarities across spending on different MDGs, in our modelling framework represented by cross-elasticities, where progress for one MDG may

contribute to progress for other MDGs. For example, progress in the provision of improved water and sanitation services has a positive impact on heath outcomes. In addition, in education the provision of education services (primary, secondary, and higher) helps to expand the skilled workforce needed to both increase productivity of the private sector, and work in publicly funded schools and clinics.

## 5 Building absorptive capacity to reach the MDGs: an illustration

The discussion in this section is based on scenarios that have been roughly calibrated to the country case of Ethiopia.[8] However the results are also of broad relevance to other poor countries with limited weak absorptive capacity. The scenarios serve to illustrate some of the key aspects of absorptive capacity, and the tradeoffs facing policymakers. The starting point for considering capacity constraints to reach the MDGs is to consider a business-as-usual ('base') case, under which Ethiopia continues to receive external assistance at the current level and to perform along current trends.[9] For most of the MDGs, including income poverty, primary school completion, and water and sanitation, Ethiopia is expected to fall far short of the MDG targets in this scenario. In contrast, two other cases are shown which correspond to first, accelerated investment in core infrastructure considered key to improving economic growth (denoted as 'base-infra' in the figures that follow), and second, additional expenditures to reach each of the five education, health and sanitary MDGs being modelled (denoted 'full MDG'). In each of these cases the additional financing is assumed to come from external grants, requirements for which are shown in Figure 3.

Figure 3: Foreign grant financing (US$ per capita)




8 Presented in Bourguignon et al. (2004).

9 External grants expand at an annual rate of 1.5 per cent from their 2002 level, while foreign loans remain at their 2002 level. Government services and GDP all grow at around a 4 per cent annual rate, similar to the long-run growth trend.

Ethiopia's basic infrastructure requirements are separately shown from investments needed to reach the five social MDG targets since these investment streams are quite distinct, and increasing core infrastructure spending is considered critical to accelerating growth a necessary input into the first MDG (income poverty). These investments include the basic transport system, expanding power generation and distribution, to link the urban, peri-urban and rural economies, and investing in large-scale water management and irrigation systems to improve agricultural productivity.[10] It is assumed that a gestation lag of five years is necessary for this expanded infrastructure to generate an increase in the productivity of the private sector. This is the reason why the need for external financing appearing in Figure 3 for this scenario falls to a level close to the base case after this initial period, after adding more than US$10 per capita of external financing.[11]

The third scenario combines external financing requirements for infrastructure with the amounts needed to fulfil the five MDG social services. This is the main scenario that illustrates the impact of full external grant financing to achieve both the income poverty and reach the social MDGs. The combined external financing requirements, rise to around US$60 per capita by the end of the period, or approximately 33 per cent of GDP as compared with current aid levels of 16 per cent. This undoubtedly represents a huge absolute and relative increase in the development assistance received by Ethiopia.

The results suggest that under a set of specific conditions it is possible to achieve the MDGs by 2015. Several key conditions pertain however: a *predictable* flow of external grant financing increasing at a rather fast speed; flexible financing that can be used for current or capital expenditure needs; grant financing received is actually 'absorbed and spent',[12] actual delivery of the services for which expenditures have been provided; and so forth. The progress towards select MDGs is shown in Figures 3-5, and reveals the different contributions made by these investments in basic infrastructure and direct investment in the MDGs. The contribution of investment in basic infrastructure, which helps accelerate the growth rate relative to the base case by around 1.5 per cent annually, is very important for achieving MDG1—halving the incidence of poverty from its 1990 level of 36 per cent of the population (using the national poverty line). Spending on MDG-related sectors also helps to increase growth and household consumption levels, mainly by raising the supply

10 Discussed in World Bank (2005). Three priorities identified for growth are: (1) public investment to support urban rural linkages; (2) reduce risks to agricultural producers through investing in improved water management, social safety nets, and security of land tenure; and (3) improve the investment climate and reduce risk facing private agents.

11 This five-year lag in the effect of infrastructure investment also explains the change in the slopes of most curves shown below around 2008-09.

12 See Aiyar et al. (2006) for a discussion of aid surges and absorption versus switching. Such an immediate and complete use of aid flows would not necessarily occur if exogenous macroeconomic shocks were introduced in the initial framework.

of skilled labour and through employment generated by higher public investment.[13] In the full MDG scenario (full-MDG), where both sets of investments are taken together, the incidence of extreme poverty is roughly halved from 1990 levels to around 19 per cent.

Figure 4: MDG1: population living on $1 (PPP) per day or less (%)

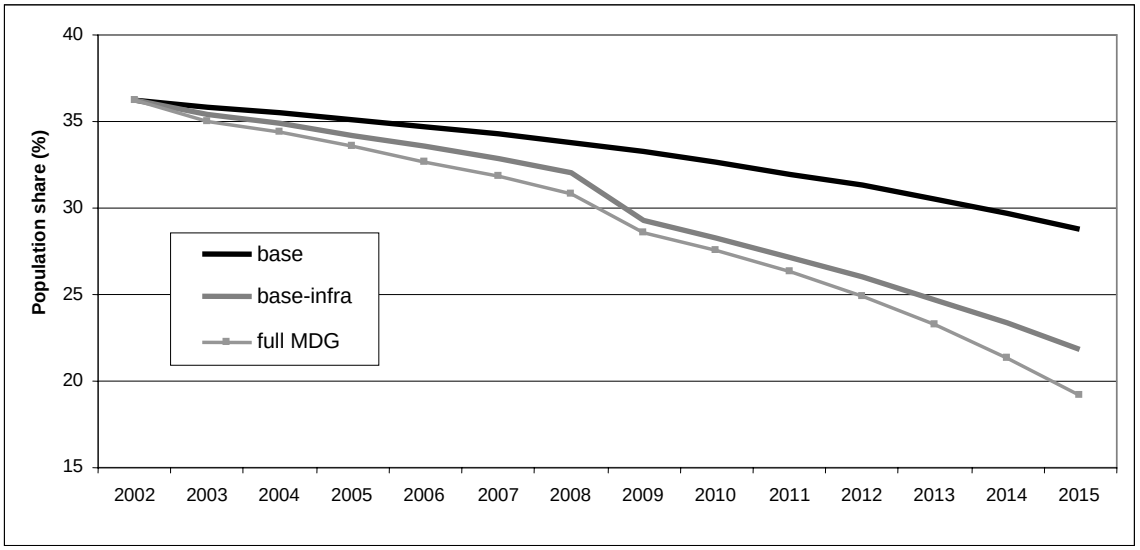
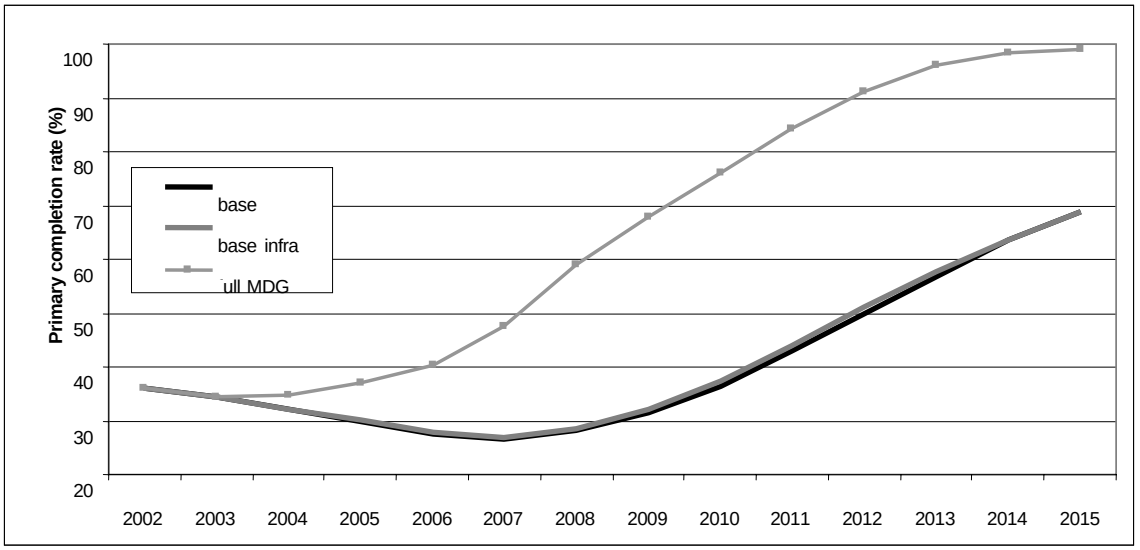



Figure 5: MDG2: net primary school completion rate (%)




Completion rates for primary education rise increase from 35 per cent in 2002 to 100 per cent by 2015. Likewise, the U5MR and maternal mortality rate also fall to levels that just reach the MDG targets. The path along which these targets are achieved is not always smooth. The dip seen in the first five years for primary school completion with the base and base-infra scenarios reflects the rapid expansion of demand for schooling and

13 An additional factor is through the exchange rate effect of appreciation of the currency helping to increase average real purchasing power.

enrolment. Without a corresponding increase in the supply of educational services, this increase in enrolment contributes to a drop in the quality of schooling and therefore in completion rates. This process stops when public expenditures in education catch up with demand. Three types of capacity constraints particularly affect aid absorption: infrastructure constraints, skilled labour constraints, and macroeconomic constraints. These help illustrate the importance of sequentially addressing absorptive capacity over time to reach the MDGs.

### 5.1 Infrastructure constraints

As infrastructure networks are developed (roads, energy, and irrigation, telecoms), producers and consumers are better integrated into national and international markets, expanding opportunities and capturing network effects that can serve to accelerate growth. Investment in infrastructure also reduces the indirect costs of doing business (through improving, for example, the reliability of power, transport logistics, or reliable product-to-market timing) and associated losses that depress firm productivity.[14] Capturing these gains requires a sufficient level of, and sequencing of, public or private investment in infrastructure to reach the threshold where economy-wide network effects can begin to support higher productivity. Without such productivity gains, additional aid aimed at reaching the MDGs would be less effective since it would buy much less of those domestic services needed for the MDGs. This is an argument to give some priority to these productivity-enhancing investments even though they may not be directly related to the achievement of the MDGs.

Other infrastructure investments are associated with service delivery to reach the MDGs rather than enhancing the productivity of the private sector. Investment in schools, clinics and training facilities, and water and sanitation facilities is clearly required to meet the primary education, health, water, and sanitation MDG targets. Physical facilities need to expand in parallel with outlays on personnel and other recurrent expenditures to avoid deterioration in the quality of services, declining demand, and failure to reach targeted outcomes.

### 5.2 Skilled labour constraints

The requirements for accelerating primary school completion rates help to illustrate the importance of skilled labour constraints. Between 2002 and 2015 over 100,000 trained teachers will need to be brought into Ethiopia's educational system to achieve the target of 100 per cent primary school completion and to maintain education quality standards necessary to ensure there is demand for education services.[15] This requires investment in

[14] Recent work by Eiffert et al. (2005) on African economies highlights productivity costs associated with the quality of infrastructure services.

[15] This is based on Education for All: Fast Track Initiative standards, which implies moving from the current 75:1 student-teacher ratio to a targeted level of 40:1.

teacher training facilities and expanding the number of higher education graduates to meet the requirements for skilled teachers. In the short run skilled labour can be hired from other sectors, in particular the private sector, but at the cost of both higher wages, and some loss in output as labour exits the private sector. Accelerating this process serves to push up unit costs, which is reflected in rising costs in the model as capacity limits are reached.

Figure 6 shows the path of real wages, and hence the pressure on skilled labour, under three scenarios: the base case; the full-MDG case examined earlier; and the case with aid frontloaded to allow increased hiring of teachers and accelerate achievement of the enrolment rates to meet the primary completion target. As more funds are spent on hiring skilled labour for education, real wages increase significantly, and unit costs consequently rise as available skilled labour is limited, and must be bid away from other sectors. In the full-MDG scenario, the private sector loses labour to the public sector and wages for skilled labour rise across all sectors initially, before levelling off when the expanded schooling system starts producing an increasing number of skilled workers. The loss of labour and higher real wages also causes private growth to contract. In the frontloading scenario, total grants and MDG-related expenditures are sharply elevated for two years and then subside to rates required to reach the MDGs. Real wages spike to almost 25 per cent above their initial value in the first two years, sharply raising unit costs of achieving the MDGs, and slowing the rate of growth. Investment in teacher training, and other secondary and higher education programmes helps expand the supply of skilled labour with a lag, and wage pressures hence begin to moderate. By the middle of the projection period the real wage path moderates and begins to decline.

The comparison of these two real wage paths shows the importance of the timing of investments in teacher training capacity. In Figure 6, it would seem that the front-loading scenario leads to a cost of skilled labour larger than with the investment profile implicit in the full-MDG scenario when looking at the algebraic sum of the areas between the two curves. However, things are different when the gap between the two curves is weighed by the number of skilled workers.

Figure 6: Real wages of workers with secondary school education (Birr)

There are plausible conditions under which the market clearing wage for skilled labour suggested by the model may underestimate what would be necessary to generate sufficient supply. Skilled labour may be attracted abroad by higher wages, a chronic problem for many developing countries, new graduates may not be of sufficient quality, or there may not be adequate incentives for skilled workers to relocate to remote areas of the country. Under these circumstances skilled wages would have to rise more sharply in order to recruit and retain adequate teachers, generating higher unit costs.

### 5.3 Macroeconomic constraints

A major concern across the scenarios for meeting the MDGs is the impact of scaled-up aid flows on domestic demand, relative prices, and the real exchange rate. Aid flows permit a much larger trade deficit, but to the extent that they are not spent exclusively on imports they place upward pressure on prices in the non-traded sector and on the real exchange rate, reducing competitiveness and resources flowing to traded goods and services. These issues are well recognized.[16] As stressed in Bevan (2005), the extent to which aid flows are associated with the problem of real exchange rate appreciation depends largely on the relative impact on demand and supply in the non-tradeables sector.[17] The supply response, depending on the effects of aid on productivity across sectors, largely determines the depth and duration of adverse effects following the surge in aid.

In the case of Ethiopia, all scenarios show exchange rate appreciation, rising real wage rates, and a deterioration in the trade balance as imports surge and export performance deteriorates. Differences in the level of external financing and the way in which aid is used determine the impact on the exchange rate, real wages, and trade performance. Figure 7 shows the path of real exports through 2015. Dutch disease effects are clearly a serious concern in the medium-term with the full-MDG scenario and the surge that it generates in aid flows. The aid induced appreciation of the exchange rate and the drop in net exports are severe. Exports fall from around 14 per cent of GDP to 8 per cent by 2015, and the real exchange rate appreciates by close to 20 per cent. However, the impact on real GDP growth, which is essentially driven by factor supplies and infrastructure led productivity gains, is quite limited.[18] This result is to be contrasted with what happens in the 'base-infra' scenario where the GDP export share is slightly above that observed in the base scenario at the end of the period.

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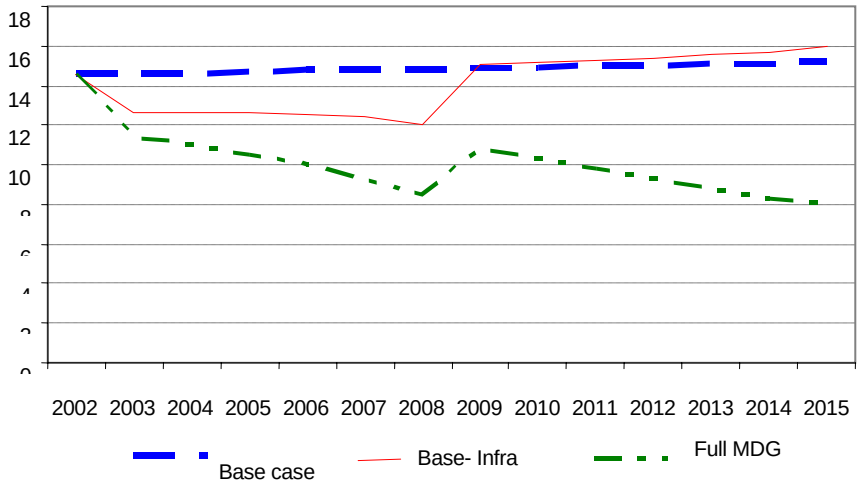
16 Heller and Gupta (2002a) provide a clear overview of the issues and cite several country studies.

17 How aid is initially used, whether it is used to finance public investment (is spent) and whether it increases net imports (is absorbed), will also have a major short-term impact. It is assumed here that all aid is spent and has an impact on net imports, and we ignore these short-term issues.

18 Things would be different if growth were somewhat related to the share of exports in GDP, as is sometimes argued in the literature on growth and trade-openness.

Figure 7: Real exports as a share of GDP, 2002-2015




Public spending on infrastructure and MDG services differ in their effects on the supply side and in their import intensities. Infrastructure spending has a positive but lagged impact on productivity, whereas spending on MDG services has only a very modest impact on productivity in the short run, but affects supply through adding to the stock of skilled labour. Infrastructure spending initially causes some exchange rate appreciation, until productivity improvements raise growth GDP, incomes, and demand. The import intensity of basic infrastructure in Ethiopia, a country with limited domestic capacity for manufacturing inputs, is also high. This helps reduce the impact of infrastructure spending on relative prices, and hence reduces the adverse impact on competitiveness.

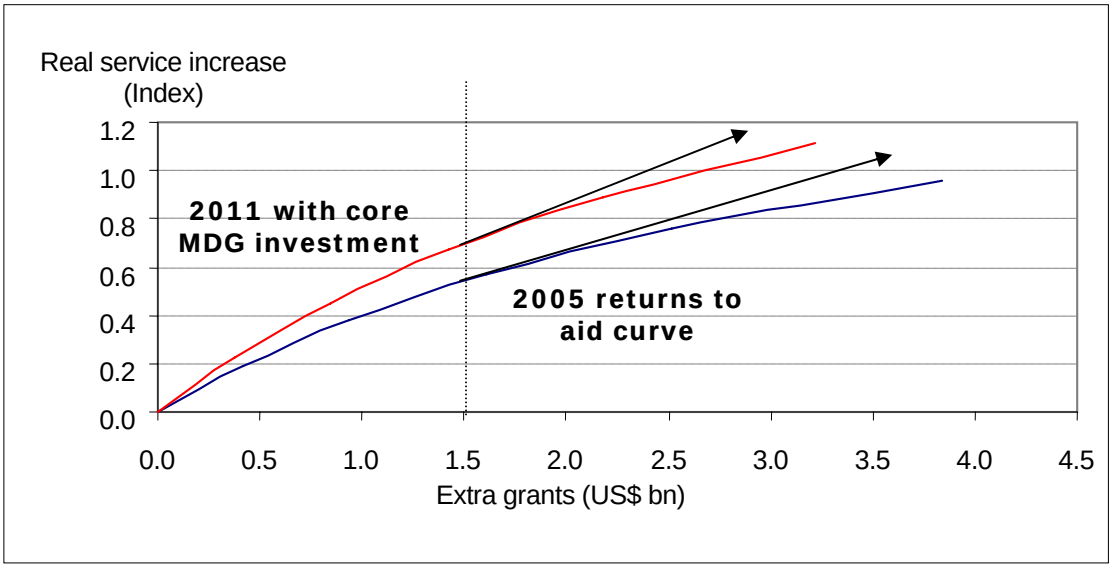
By contrast, investment in provision of MDG-related social services takes much longer to impact on productivity (through a healthier, better educated workforce), and in the near term places greater pressure on the real exchange rate. In the case of aid spent on MDG-related services, and in the absence of higher investment in basic infrastructure, the real exchange rate appreciates by about 30 per cent and exports decline to less than half their initial share of GDP by 2015. Note that appreciation of the real exchange rate also reduces the purchasing power of foreign grants—unit costs rise and it requires larger aid flows to reach the MDG targets. This comparison confirms the importance of the sequencing of public spending in scenarios of aid scaling up. Reaching the MDGs requires increasing the absorptive capacity of the economy, which in turn requires increases in productivity and eliminating bottlenecks in factor markets, most notably in the skilled labour market.

### 5.4 Overall absorptive capacity constraints

Linking this back to the earlier discussion about aid effectiveness and absorptive capacity (Figure 1), constraints posed by skilled labour supply, macro balances, and infrastructure capacity determine the returns to aid as the levels of total aid increase. Figure 8 shows the 'returns to aid', as the amount of aid used towards the MDGs is increased. Returns are measured here in 2005 and 2011 for the education sector based on the percentage of primary school completion achieved (MDG2). The bottom curve illustrates the return to

investment in education that faces the economy initially (in 2005). As grants are used to bring more teachers into the school system and expand education services, primary completion rates rise but at a declining rate. The declining rate of return is due to both rising costs (higher wage payments to attract skilled labour) and to declining quality levels which reduce demand. Schools cannot be built rapidly enough, and teacher-classroom ratios decline.

Figure 8: Aid effectiveness and capacity constraints




The top curve in Figure 8 shows the same return to aid profile five years later, when public investment in higher education and teacher training is already helping to moderate wages, school construction has expanded, and improvements in infrastructure are serving to raise productivity and reduce unit costs of services. The returns to aid are higher, meaning that aid effectiveness has increased. Also, for any level of aid, it is the case that the slope of the return to aid curve has increased, meaning that *absorptive capacity has increased*.[19] Greater increases in primary school completion rates per additional dollar invested, for example, can be attained in 2011 than is the case in 2005.

### 5.5 Sequencing investments

The preceding has shown the importance of correctly sequencing investments to address capacity constraints over time to reduce total costs. The simulation with core infrastructure investment underscores this point: a threshold level of core infrastructure must be in place before productivity gains can be fully realized. Frontloading investment in infrastructure is required to capture these gains early on. Delaying core infrastructure investment and

19 Although this requires further verification and improvement in the precision of the calculations, it would seem that this property still holds when the comparison is made for aid/GDP rather than aid maintained constant.

focusing on social services will delay gains in productivity, with implications for the rate of overall growth, household incomes and public revenues, as well as for the productivity of public service delivery and the effectiveness of aid.

Investment prioritization across MDG service sectors depends on lags in the production process and cross-sector externalities. Since skilled labour is developed with a lag, and since skilled labour is a critical input to expanding the supply of all the MDG services, this argues for early investment in education. Placing priority on the sectoral sequencing of public services that *generate positive externalities* also helps to lower the investment cost of other MDGs. Both the access to improved water and education levels are important elements of reducing under-five mortality. Hence, investment in developing and maintaining potable water supplies, as well as maternal education, should precede or move in parallel with other child health related investments. If this sequencing is reversed (that is, placing initial priority on non-education related MDGs, followed by investment in water, education, and finally basic infrastructure services), it would result in higher total costs of meeting the MDGs, or, if resources are constrained, it would lead to a shortfall in meeting the MDG targets.

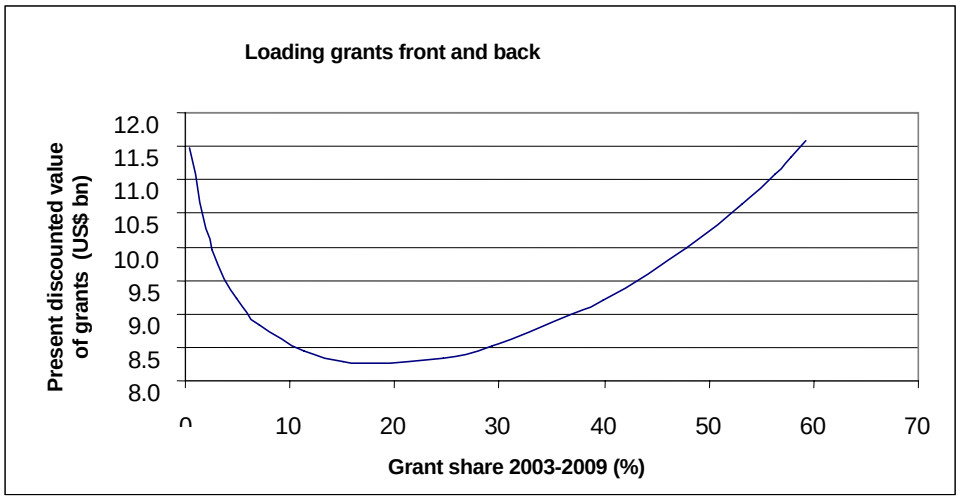
### 5.6 Frontloading

Excessive frontloading of aid, it was argued above, places pressure on real wages, slows growth, and raises the overall cost of achieving the MDGs. The discussion of sequencing also suggests that *inadequate* frontloading of some investments, such as infrastructure, can impose costs through delaying the potential productivity gains and exploiting externalities. At the limit, investing too late in training or infrastructure make reaching the MDGs impossible. Taken together this suggests that there is an optimal level of frontloading that minimizes costs over time. An intuitive argument suggests that absorptive capacity is the main criterion in minimizing this cost. Clearly, if the absorptive capacity of aid is not constant over time, the total cost of reaching the MDGs could be lowered by reallocation aid from the periods where the absorptive capacity is low to periods where it is high. The problem is that such a simple argument, borrowed from elementary optimization theory, would work if the returns from aid could be measured by a scalar. In the context of the MDGs, where no substitution is allowed across goals, this is clearly not the case. Yet, a simple experiment shows that the preceding intuition is correct and that there is something like an optimal sequencing of public spending on the MDGs and therefore optimal sequencing of aid flows.

To explore the question of optimal frontloading further, Figure 9 shows the present discounted value of grants required to reach the MDGs as the share of expenditures ‘frontloaded’ is varied—with the relative composition of these expenditures across MDGs maintained constant. Two five-year periods are considered, varying the share of total

outlays between the two periods.[20] The resulting 'U-curve' shows how the present value of total costs falls as the share frontloaded increases from very low levels, costs are minimized at around 20 per cent, and thereafter rise at an accelerating rate as capacity constraints become binding—labour costs rise, exchange rate appreciation reduces the purchasing value of aid, and congestion costs rise from infrastructure bottlenecks. In the extreme, at some point around 70 per cent frontloading, costs become effectively infinite and reaching the MDGs is not possible.

Figure 9: Total costs and frontloading of expenditure shares




It is important to be cautious in interpreting this result, however. First, while it suggests that total costs are minimized at around 20 per cent of outlays taking place in the first half of the period, it is important to stress that the calculation has not taken into account the welfare outcomes along the different paths towards reaching the MDGs. As more resources are frontloaded, social service outcomes improve *earlier*, and social welfare consequently improves. The MDG focus leads to ignoring variations in social welfare along the path towards the MDGs. Second, the underlying exchange rate and wage dynamics differ along the curve, with consequences for competitiveness of traded goods and for wage differentials, the effects of which may appear after the MDG horizon. Consideration of scaling up and frontloading aid clearly needs to consider the impact on welfare and the consequences for growth and MDG outcomes post-2015.

### 5.7 Governance and institutional reforms

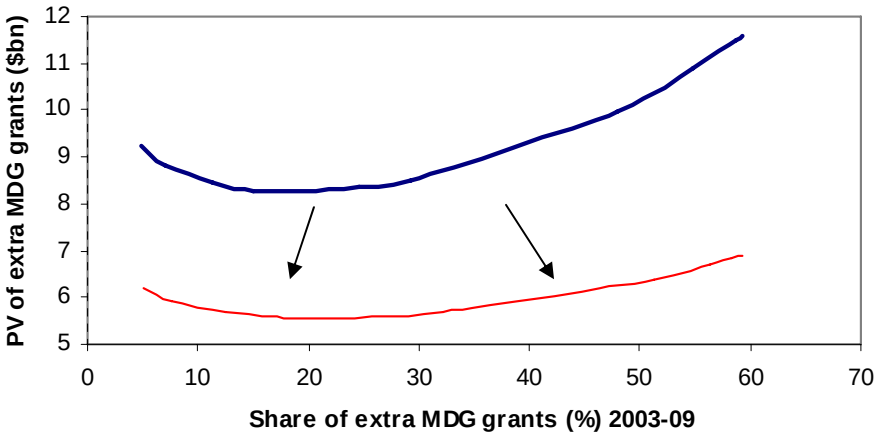
The model does not address the critical question of how underlying institutional capacity and governance can be improved. The broad range of issues that this encompasses are frequently part of Poverty Reduction Strategies and tackled in policy-based lending by institutions like the World Bank—improving public expenditure management,

20 Because the model has been parameterized around 2002, the actual simulation periods correspond to 2003-09, and 2009-15.

strengthening oversight mechanisms, strengthening the business climate, and so on. Taken together, governance and institutional reforms can be thought of as measures to improve the efficiency of public resource utilization. In terms of the model, they affect the underlying productivity of public activities and reduce unit costs of achieving the MDGs—falling teacher absenteeism, reduced waiting times for processing legal cases, licensing, and regulatory issues, less leakage in the use of central government resources for delivery of services to end-users. Simple reforms can sometimes have major consequences.[21]

Consider the effect of introducing governance and institutional reforms in the form of improvement in the underlying efficiency of public services at the rate of two per cent compounded annually**,** and independent of the rate of public investment (this assumption is used in the World Bank, for example, to guide annual budget parameters). Introducing this to the model and recalculating the U-curve in Figure 10 suggests several effects that emerge from this. First, the productivity gain in public services significantly reduces the cost of achieving the MDGs along all points of the curve and 'flattens' the curve, reducing the total variation in costs. The total cost of achieving the MDGs by 2015 in present value terms falls by around one-third.

Figure 10: Frontloading with enhanced governance and institutions




Second, the new point of cost minimization leans slightly towards greater frontloading contrary to the expectation that it would shift towards the left (less frontloading as productivity levels are higher and unit costs are lower during the second period). The ambiguity in this outcome arises from two underlying effects that push in opposite directions. Increasing future productivity of public spending pushes toward more frontloading in order to benefit from productivity gains longer. On the other hand, there is

[21] For an in depth discussion of governance, institutional capacity, and service delivery, see World Bank (2003). One example often cited is the Ugandan newspaper campaign to boost schools' and parents' ability to monitor local officials' handling of school grants. Through greater public awareness, 'capture' or leakage of budget resources fell from 80 to 20 per cent between 1995 and 2001 (Reinikka and Svensson 2004).

a change in relative prices between periods. The decline in the cost of investment over time pushes towards delaying public investment. In the present case, the first effect seems to be stronger than the second. One important implication of this analysis is that anticipated incremental gains in underlying governance or productivity should not be a reason to delay public expenditures towards capacity building and service delivery. Even if there are underlying efficiency gains that reduce costs over time, this does not constitute a reason to delay investment in the MDGs, but rather suggests that future gains in absorptive capacity due to increasing productivity in public services must be capitalized on by investing early.

## 6 Conclusions

The capacity of low-income counties to absorb and effectively use large aid flows in support of the MDGs is a central concern in the debate over international financing of MDG efforts. Direct estimates of the financing necessary to achieve the MDGs imply very large increases in aid flows at the level of the individual recipient countries. A basic question being asked is over the absorptive capacity of low-income countries as higher levels of aid will become available to advance the MDG agenda.

We have shown in this paper that absorptive capacity should not be seen as a rigid characteristic of recipient countries that would depend only on the quality of its governance institutions. In a strict economic sense, absorptive capacity, defined as the marginal return to aid, is a dynamic concept that depends on the timing and sequencing of public spending. Rapid scaling up of aid in a country with very limited capacity to train and hire skilled labour, build new infrastructure, manage new and large-scale public programmes, or maintain macro stability may lead to bottlenecks, rising unit costs, and falling quality of service delivery. Taken to extremes it could also lead to impaired growth potential with adverse medium-term consequences. In such a country, mobilizing international aid in support of the MDGs should therefore move in tandem with efforts to identify a suitable time profile of aid flows in recipient countries which balances the need to quickly accelerate progress towards achieving the MDG outcomes through expanded and improved public service delivery, with constraints on absorptive capacity and the way to progressively weaken these constraints.

This has implications for the sectoral composition and sequencing of public spending and aid disbursements for meeting the MDGs. Country specific plans are required to identify key constraints, identify bottlenecks to growth, clarify potential externalities, and formulate strategic plans to build capacity. This requires in-depth and country-specific analysis to determine the appropriate sequencing of public investment for each country. To provide some empirical basis to address these questions the paper employs a modelling approach (MAMS) that combines a relatively standard and highly aggregated CGE model with an MDG module that links MDG performance to the functioning of social sectors and the way different public services (in health, education, water, sanitation and public infrastructure) are provided. The model has been applied to Ethiopia to help illustrate the

main messages. It focuses on three main constraints to aid absorption—skilled labour, infrastructure, and macroeconomic constraints.

Four main conclusions can be drawn from the simulations undertaken with this model:

- First, careful sequencing of public investment is important for minimizing the total cost of reaching the MDGs. From the outset priority investment is needed in basic infrastructure to generate the basis for higher productivity growth and network effects improving linkages across and within regions and sectors. Among the MDG services, accelerating education spending is a priority since skilled labour can only be produced with a lag and is restricting absorptive capacity.
- Second, the macroeconomic impact of large aid flows on the tradeables sector (the Dutch disease) can be serious, resulting in a significant decline in the share of exports in the economy, at least in the short run. The threat to future growth will depend in large measure on the supply response in the economy, and the impact of aid and development strategies in spurring accelerated productivity growth in both the traded and non-traded sectors.
- Third, large-scale frontloading of aid disbursements (other than infrastructure) is costly as it pushes against absorptive capacity constraints, intensifies the premium on skilled wages, bids labour away from the private sector (depressing growth), and augments short-term Dutch disease effects. In the case of Ethiopia the model suggests that the cost minimizing MDG strategy involves a steep upward profile of public spending and aid disbursements. It is not clear however how much this result is country specific.
- Fourth, improvements in the underlying governance and institutional structures help to secure broad productivity improvements in public service delivery, and should underpin development strategies. Their cumulative effect can significantly reduce overall costs of achieving the MDGs and secure long-term productivity gains. However, it is not necessarily because very much progress is anticipated in the future that aid should be delayed. It might be optimal to increase early public investment precisely to take full advantage of the ongoing and future gains in public sector productivity.

Two last remarks should help draw some lessons from the preceding exercise for the allocation and the management of aid. First, the paper focused on the allocation of the aid directed towards a specific country across sectors and over time. It did not tackle the issue of the allocation of aid across countries. Of course, this is where the notion of comparative aid effectiveness introduced in Figure 1 should play a role. After taking into account country specificity in aggregating returns from aid across countries, an optimal allocation clearly tends to equalize marginal returns, or ‘absorptive capacities’ across countries. If not enough aid is available, absorptive capacities will not be equalized and some countries will not receive adequate aid. The argument in this paper suggests that such reasoning might be incorrect if applied in a static way. Absorptive capacity is a dynamic concept and the

optimal allocation of aid should be based on both perceived absorptive capacity today but also anticipated capacities in the future as defined by an explicit MDG strategy. Poverty Reduction Strategy Papers could be playing this role nowadays.

Second, the argument in this paper is based on framework with no uncertainty, where donors have perfect knowledge of the MDG strategy of recipient countries and recipient countries reveal their true strategy based on the anticipation of fully certain future aid flows. Clearly, the optimal strategy of recipient countries depends very much on the confidence they have that donors will hold on their commitments. Likewise, the commitment of the donors depends on the confidence they have that recipient countries will hold on the strategy they have announced. Such a situation may lead to some low-equilibrium of the type found in the well-known Prisoner's Dilemma, with none of the players trusting their partner. The argument in this paper corresponds to the high equilibrium but leaves aside the issue of how donors and recipients can coordinate on that equilibrium, which is today the core of the international debate on aid effectiveness.

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