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Abstract

Even though Bangladesh has made progress towards reaching some of the Millennium Development Goals (MDGs), it is still a major challenge for the government to further reduce poverty and improve human developments, in particular achieving a 100 percent primary-school completion rate. As foreign aid is declining, resources need to be mobilized either by taxation or borrowing. Each funding option has drawbacks so it is important when government now chooses how to proceed to have an apprehension of the tradeoffs involved. Also issues arise in whether the composition of public spending should lean towards investment in human capital or infrastructural capital. In this paper, we apply the MAMS computable general equilibrium model developed by the World Bank to do a retrospective analysis study comparing a baseline scenario that mimics the actual development during the period 2005 - 2015 with four counterfactual scenarios in which the four most important MDG targets (education, child mortality, maternal mortality, water and sanitation) are achieved, based on either taxation, foreign borrowing, aid or domestic borrowing. Further, we compare the baseline with three public spending reallocation scenarios. We find that full achievement of these goals would have led to a GDP loss of 17 percent and 10 percent from domestic borrowing or taxation, respectively. For public spending composition we find that the marginal impact on achievement of the targets from reallocating public spending from infrastructure investment to human development sectors in Bangladesh is small.

Key words: MDGs, Infrastructure, Growth, CGE, MAMS

JEL classification: H52, H54, O11, O15

1. Introduction

Standing at the doorstep for the deadline of 2015, the general consensus is that the overall progress of Millennium Development Goals (MDGs)[1] achievement is limited and heterogeneous especially for the low income countries (The World Bank, 2012).World leaders are therefore working on formulating a new set of Sustainable Development Goals (SDGs) that include some of the MDGs and extend beyond including to end extreme poverty and put sustainable development at the core etc. The targets for the second phase are set to be achieved by the year 2030 (The United Nations, 2013). But low-income countries often lack enough resources to accelerate investments towards these targets. Countries face different tradeoffs. In this study, we explore the effects of alternative funding routes for Bangladesh and tradeoffs in composition of public spending.

The choice between debt and taxes is basically an issue of distribution across generations. However, borrowing raises concerns about the sustainability of growth and may harm growth through terms-of-trade effects. Increased taxation may hamper saving and investment and lead to lower GDP growth. Broad-based indirect taxes may offset the welfare gains of the poor received from enhanced MDG expenditure. On the other hand, they might benefit in the long run from the increase of public expenditure.

There is a trade-off between investment to improve the public infrastructure (roads and power irrigation) and investment allocated toward non-poverty MDGs such as education, health etc. It has been argued (see references below) that investment on infrastructural development would accelerate growth and thereby generate resources that can be allocated towards non-poverty MDGs. Moreover, infrastructure is an aggregate of resources in terms of facilities and mechanisms that support education, health care, employment and social welfare etc. (Kusharjanto & Kim, 2011). On the other hand, investment can also be allocated toward only to non-poverty MDGs that may not have an immediate effect on growth but through improved health and educational standards can increase productivity and accelerate growth in the long run (Ranis, 2004).

Comparing the different financing alternatives and analyzing the trade-off between infrastructure and MDGs are crucial to appraisal of the cost and benefit to reach the goals.

[1]Eight Millennium Development Goals (MDGs) were adopted in the United Nations Millennium summit declaration in year 2000 to be achieved by the year 2015. The purpose of the MDGs is to eradicate extreme poverty and hunger as well as improve the Human Development (HD) indicators in terms of education, gender equality, child mortality and maternal health among others.

Here, we therefore carry out an empirical assessment of the effect of alternative financing policies taken toward achieving growth and MDGs for Bangladesh. Bangladesh is a low income country with per capita GDP about US$752 aspiring to become a poverty free middle income country by the year 2021 (The World Bank, 2012). Even though it made progress in some of the MDGs, it is still a major challenge for the government to further reduce poverty and improve human developments specially achieving 100 percent primary school completion rate.

More precisely, we evaluate alternative policy measures to finance growth and MDG investment for Bangladesh by a counterfactual retrospective comparison of the economic development 2005-2015. We use the Maquette for Millennium Development Goals studies (MAMS) model, which we have calibrated to the Bangladesh economy. The MAMS framework developed by the World Bank is originally designed to deal in particular with low-income countries. It is a dynamic general equilibrium model that explicitly links progress on the MDGs front to the rest of the economy via markets for foreign exchange, factors (specially for labor) and goods and services[2]. We do comparisons of retrospective instead of prospective scenarios for two reasons. First, there is always a time lag in the provision of statistical data for a start year to which these types of models can be calibrated and in fact, 2005 is the latest year for which we have complete, consistent and reliable data (a Social Accounting Matrix). Since our focus is on comparison between policy alternatives and not on predicting the future, the start year is of second-order importance to our purpose. Second, in hindsight it is possible to evaluate the realism of the baseline, business-as-usual, scenario to which we contrast the alternative policy scenarios. In prospective analysis, comparison between alternative trajectories may seem less meaningful if the baseline is regarded as arbitrary.

We find that full achievement of these goals would have led to a GDP loss that is significantly larger in the domestic-financing scenario compared to the taxation scenario. The accumulated loss during the period is around 17.3 percent and 9.6 percent of 2005 GDP in the domestic-borrowing and taxation scenarios, respectively.[3] The tax-financing alternative is thus the better option in financing large development programs. For public spending composition we find that under some circumstances there arises a tradeoff between

[2] For example, the amount of real health or education services that a dollar can buy might change significantly due to changes in exchange rate, prices and wages.

[3] The reported figures are net present value with a discount rate of 5 percent as suggested by IMF (2013). In terms of 2015 GDP value the accumulated loss would have been 9.7 and 5.4, respectively.

overall MDG progress and poverty reduction. However, on the margin the impact of reallocating public spending in Bangladesh is low. This is explained by the significant progress Bangladesh has already achieved so far and therefore the unit costs of reaching the most remote parts of the population are high.

This study makes two main contributions to the literature. First, studying a country that is seen as one of the most successful in achieving most of the MDGs, we estimate that the cost of full achievement still is considerable.[4] Second, we demonstrate a tradeoff relation between poverty reduction and progress in achieving non-poverty MDGs for the case of Bangladesh, a finding that has been made previously for just a few other countries.

The outline of this study is as follows. Chapter two reviews some empirical literature on tradeoffs in pursuing MDGs. Chapter three gives an overview of macroeconomic and MDGs performance for Bangladesh during the last 25 years. Chapter four describes model and data. Chapter five analyses the simulation results and chapter six concludes.

[4] MAMS has been applied for 18 Latin American countries, many African and Arabic countries as well. As per our knowledge there has not been any such kind of economy wide study done concerning MDGs achievement in Bangladesh. The closest previous study is done by Khondker & Raihan (2011) who applied a macroeconomic framework to estimate the cost of MDG financing for Bangladesh. Their study lacks analysis of feedback effect from financing investment on MDG indicators, labor market and other macroeconomic indicators. Our study results are evaluated on MDG indicators, macro-economic performance, government expenditure, real exchange rate (RER), labour market and employment and consumer welfare.

2. Literature review

In this chapter we summarize briefly the pros and cons of different financing options in order to achieve a set of development targets. In the second part of the chapter we discuss some country-specific empirical findings.

2.1 Funding options

One of the alternatives to finance growth and MDGs investment is to mobilize domestic resources. The commonly applied instruments for the domestic resource mobilization strategies are to raise tax and/or domestically borrow. Taxation is central to any strategy for domestic resource mobilization (Vos et al., 2007). However, increased tax often reduces disposable income and investors may foresee lower net profits. As a result, saving and investment may decrease leading to lower GDP growth. The domestic demand effect will also depend on who is to carry the additional tax burden. If the indirect taxes have greater impact on low income groups, then reforms taken to increase the VAT and other indirect taxes may offset the welfare gains of the poor received from enhanced MDG expenditure. On the other hand, if increased tax efforts are distributionally neutral, even if the poor will lose in the short run, they might benefit in the long run from increased public expenditure (Vos et al., 2007).

Another tool for government is to borrow to mobilize resource towards MDG achievement. If the financing is made through borrowing (domestic or foreign) one cannot ignore the concern of debt sustainability apart from adverse effect on consumption growth. When government borrows money through selling bonds, a poorly developed bond market in conjunction with a relatively low level of savings in the economy may have strong upward effects on domestic interest rates (Vos et al., 2007). Financing through foreign borrowing would reduce the pressure on the domestic financial market but increased capital inflows would, besides increasing the external-debt ratio, also affect the real exchange rate.

Finally, accelerated investment financing can also be made through foreign aid. The effects of aid on human development indicators and growth remain controversial. According to Bourguignon & Sundberg (2006) some cross country study show poor performance of aid on growth. Other studies based on micro evidence from specific projects and applications show high rates of return from aid, though even the individual country case studies also give counteractive evidence of aid effectiveness. However, there is increasing evidence that aid

has a potentially important role to play for access to quality infrastructure which has significant role to growth. The quality infrastructure is also a key input in the production of MDGs (Bussolo & Medvedev, 2007). A recent study of the relationship between foreign aid and economic growth using a panel data set (1975-2002) for Bangladesh, Nepal, India, Sri Lanka and Pakistan showed a positive relationship (Asteriou, 2009).

Moreover, the commonly discussed problems associated with foreign borrowing or scaled up aid are real exchange rate (RER)[5] appreciation and fiscal sustainability. If the appreciation of RER prevails for longer period it can lead to the problem of "Dutch disease (DD)". One of the circumstances for DD to take place is that the large inflow of foreign aid increases government consumption, which leads to increased demand for non-tradable goods (Bourguignon & Sundberg, 2006). Prices on non-tradable goods increase relatively more compared to prices on tradable goods which leads to an appreciation of the RER. As a result, the export competitiveness of the country decreases. This translates into a "disease" if production factors move from dynamic export industries to non-tradable production activities. However, the Dutch disease effects may be muted or lessened if capital (aid) inflows are used to induce a rapid supply-side response in the economy that more than offsets the demand response (Li and Rowe, 2006). For example, if the recipient country government allocates the aid to infrastructural development it has a supply side impact that reduces the real exchange rate appreciation (Adam & Bevan, 2006, Magud & Sosa, 2010). Moreover, when aid is allocated for human development expenditure in the form of education, health and water and sanitation, it has a long term impact in terms of improved labor productivity.

2.2 Country studies

A large number of country studies have shown that which of these above mentioned financing strategies that is appropriate depends on the country-specific economic conditions. For most of the African countries such as Ghana, Rwanda, Ethiopia and a few Latin American countries scale up aid has been advocated by many authors (Bourguignon & Sundberg, 2006, Bogeti et al., 2008 and Lofgren et al., 2009). While for most of the Latin American countries (Argentina, Brazil, Colombia, Costa Rica, Ecuador, Paraguay and Peru) an expansion of the tax base and increase of tax rates have been recommended.

[5] Government expenditure regarding MDG related services are seen as non-tradable. Rising cost for non-tradable services will shift relative prices against tradable, thus leading to RER appreciation no matter how the increases expenditure is financed (Vos et al. 2007).

Löfgren & Diaz-Bonilla (2008) studied the impact of increase in aid flow on growth and MDGs for Ethiopia, using the MAMS model. Under a moderate increase in aid flow, this country showed significant progress in terms of growth, MDGs and other social indicators from a very disadvantaged position in 1990. The MAMS model simulation showed that a considerable expansion in government spending and foreign aid is required to achieve the different MDG targets. In another study, with the MAMS model, Kiringai & Levin (2008) studied allocation of public expenditure in as and the need for additional resources order to achieve all the MDG targets. Their simulation result shows that domestic resource mobilization by increase of taxation and domestic borrowing leads to lower growth in GDP compared to funding from foreign grants or foreign borrowing. The Dutch disease problem from foreign aid was not considered to be severe since the amount of foreign aid that is required to achieve MDG targets is not high.

Turning to Latin America, Sanchez (2009) applied the MAMS model to assess the impact of different financing option to reduce poverty and MDG achievement in Costa Rica. It is a middle income country that already achieved the MDG targets for access to water and sanitation and poverty before year 2000. Financing the required public spending through direct taxes or external borrowing was more viable for Costa Rica based on the simulation results. On the other hand, Ecuador faced higher challenges in reaching all the MDGs except for reducing child and maternal mortality under the current growth outlook and with existing policies. Extreme poverty stood at about 15 percent by 2000 and not even tripling the historical average per capita income growth rate (to 3 percent per annum) would be sufficient to achieve MDG1 by 2015. Increased public spending through raising direct taxes was recommended to achieve the MDGs for Ecuador (Leon et al., 2009).

Several studies have focused tradeoffs that can be made between investment in human and non-human capital. Resources can be shifted towards MDG indicators by reduction of infrastructural development or vice verse, infrastructural development can be used as a means for reaching MDGs. Support has been found both for and against the popular hypothesis that infrastructural investment will accelerate growth and thereby have a positive impact on MDG achievement. Qureshi (2008) argued from the Pakistan's evidence that high economic growth might not result into better MDG indicators. This evidence was contradictory to the trickle down approach that assumes that the economically disadvantaged segments of the society may ultimately reap the long-term benefits of economic growth. He

suggested that instead high spending on education and health would yield better result even if the economy grew at a relatively lower rate. Pradhan & Abraham (2002) studied the role of human development policy on the economic growth of Indian states in a panel-data analysis for the period 1980-97. They concluded that the claim that modern economic growth is accompanied by a much faster rate of "investment in man" than investment in non-human capital. Their findings suggested that economic growth of the states significantly depends upon their human development policy. In particular, government investment in education seems critical for economic development while per capita health expenditure did not show any significant growth impact.

A few MAMS-case studies have explored the trade-offs between investment in infrastructure and human development. Bussolo and Medvedev (2007) compare Ghana and Bolivia and run a number of simulations where allocation of government resources varies from infrastructure-intensive to human development intensive. The results of each simulation in terms of consumption growth and the average level of achievement of the non-poverty MDGs are then represented as points of a trade-off curve. For both Ghana and Bolivia they found a concave pattern of the trade-off curve, which implies that additional investment in either human development or infrastructure services results in progressively smaller improvements in the relevant indicators. Dessus et al. (2014) undertake a similar analysis for Tanzania but from an aid-allocation perspective. The analysis compare progress made in terms of poverty reduction with the progress made in terms of reducing the distance remaining vis-à-vis education and health related MDGs. With additional foreign grants invested in infrastructure, poverty is reduced by 1.7 percentage point in 2015 compared with the baseline scenario, while 10 percent of the remaining distance to reach MDG2 and MDG4 is covered. However, if the additional foreign grants are invested in education and health, poverty is reduced by 0.4 percentage point in 2015 compared with the baseline scenario, while 50-60 percent of the remaining distance to reach MDG2 and MDG4 is covered. In other words, in Tanzania the results suggest a significant impact of reallocating public spending across sectors.

The overall conclusion from the empirical literature on tradeoffs is that there is a concave trade-off curve, which implies that composition of public spending matters. The magnitude of these effects on MDG achievement is likely to differ between countries. Bourguignon and Sundberg (2006) suggest that the trade-off between human development

and growth becomes flatter as a country comes closer to achieving its HD targets. This is because the unit costs of reaching the most remote parts of the population are likely to rise as a country comes closer to the MDG targets. Previous case-studies that have analyzed trade-offs are countries that are still far away to achieve the HD targets. In this study we look at the case of Bangladesh which we would expect have a rather flat trade-off curve. If that is the case the argument for reallocating public spending in order to achieve the "human" MDGs become less compelling. If the impact of reallocating public spending is limited the question of resource mobilization and its cost becomes important. In the next section we will investigate these issues with a MAMS model for Bangladesh.

3. **Human development, growth and macroeconomic overview of Bangladesh**

According to a recent progress report on MDGs, Bangladesh has made significant progress in the areas of poverty reduction, reducing the prevalence of underweight children, increasing enrolment at primary level of education, lowering the infant mortality rate and maternal mortality ratio (Planning Commission, 2013). The poverty target of halving the population living below the poverty line was achieved in 2012.

Table 3.1: Selected MDG indicators and Growth performance

MDG Indicator	1990	2005	2010	Target 2015
MDG 1: Prop of pop below 2122kcal%(HIES)	59.0	40.0	31.5	29.5
MDG 2: First-cycle primary net completion rate (%)	43.0	54.0	79.5*	100.0
MDG 4: under 5 mortality rate(per 1,000 live births)	146.0	120.0	44.0*	48.7
MDG 5 : Maternal mortality rate (per 100,000 live births)	574.0	250.0	194.0	143.0
MDG 7a: access to safe drinking water	79.0	61.0	98.2	100
MDG 7b: access to improved sanitation	39.0	43.0	63.6	69.5
Macroeconomic Indicators (period average)	1996-2000	2001-2005	2006-2012	
GDP Growth (%)	5.2	5.4	6.3	
Sectoral contribution in GDP growth				
Agriculture	25.7	21.9	18.7	
Industry	25.3	26.5	28.4	
Service	49.0	51.6	52.9	
Population, annual change (%)	1.6	1.5	1.4	
Per capita GDP growth (%)	3.6	4.0	4.8	

Source: Planning Commission (2013) and Asian Development Bank (2014), */2011.

Progress in under-five mortality and maternal mortality rate showed impressive performance during the period 1990-2012 and have been ascribed to progress in expanding child immunization and successful family planning program (Table 3.1). Credit is also given to roles played by different Non-Governmental Organizations (NGOs) and stipend to female education. Births attended by health personnel were only 5 percent in 1990 which increased to 31.7 percent in 2011. However, to reduce the maternal mortality even more it is needed to accelerate the rate of births attended by skilled health personnel to 50 percent (MDG report, 2012). The proportion of the population with access to safe drinking water was 98.2 percent in the year 2010 which is very close to the target of 100.[6] Access to sanitary latrines has increased both for the urban and rural areas and may be achieved in 2015. The only target that is not likely to be achieved is the education target of 100 percent completion rate. Compared to other developing countries performance in Bangladesh has been impressive considering the declining aid-GDP ratios and the relative low public-spending ratio. Even though the country made significant success in the net enrolment ratio in primary education including gender parity the net completion rate performance does not show a satisfactory trend. As per the Bangladesh Planning Commission (2013), the primary completion rate was 80 percent by the year 2012 and emphasizes on the challenge to attain primary completion rate of 100 percent, adult literacy and quality of education.

Bangladesh has experienced accelerated growth since 1990 and onward. In the 1980s GDP per capita grew on average by 1.6 percent and accelerated further during the decade of 2000 and reached to 4.8 percent during 2006-12 (Table 3.1). These achievements were followed by a comprehensive program of macroeconomic reforms. The aim of these reforms were to move toward open market economy which included adopting flexible exchange rate system, reducing import duties and removing controls on movement of foreign private capital among others (Mahmud et al, 2008). Apart from growth in GDP, the population growth control has also been working as a contributing factor for the upward trend in per capita GDP growth.

The government's tax revenue increased from an average of 6.7 percentage of GDP in 1990-1995 to 9.2 percent of GDP in 2006-2012 as a consequence of reforms taken in tax system. The public revenue structure was burdened by taxes from indirect sources for long time and was characterized by heavy imports and excise duties (Sarker, 2006). One of the

[6] This is not considering the issue of arsenic contamination. This is also our assumptions in the various scenarios presented in the report.

vital reforms taken was the introduction of Value Added Tax (VAT) in 1991 by replacing the sales tax. In spite of these reforms and increase in the tax-GDP ratio is still low even compared to poorer developing countries.

Table 3.2: Macroeconomic Indicators of Bangladesh (% of GDP)

	1990-95	1996-2000	2001-2005	2006-2012
National Account				
Gross investment	17.8	21.5	23.6	24.8
Gross national saving	17.8	21.0	24.3	29.2
Gross domestic saving	13.3	16.8	18.9	19.9
Remittances	2.6	3.3	4.8	8.6
Government Account	1.9	0.9	0.7	0.8
Tax Revenue	6.7	7.4	8.2	9.2
Non-tax Revenue	1.7	1.8	2.1	2.1
Grant	2.4	1.5	0.9	0.6
Current expenditure	6.7	7.2	8.5	10.2
Capital expenditure	6.5	6.4	6.3	5.0
Budget deficit	3.2	3.0	3.7	3.6
Domestic borrowing	1.3	2.0	2.1	2.7
Foreign borrowing	1.7	1.1	1.5	1.6
Foreign debt	38.7	38.7	32.7	25.7
Domestic debt	12.3	12.3	18.0	17.2

Source: Asian Development Bank (2014)

The current expenditure share of GDP showed an increased trend and capital expenditure share of GDP showed a downward trend during the period of 1990-95 to 2006-2012. The government's effort of not letting the current expenditure grow out of control and maintaining the downward trend for the capital expenditure resulted in a budget deficit of around 3 percent of GDP during the period 1990-2012. The budget deficit was mostly met by domestic borrowing which implies that the domestic debt has been increasing over time. Foreign borrowing has seen the reversed trend decreasing over time to a relatively low debt-ratio of 26 percent.

Remittances have become an important source of foreign transfers and have contributed to the good growth performance (The World Bank, 2012). Remittance inflows have increased from 2.6 percent of GDP in 1990-95 to 8.6 percent of GDP in 2006-12 (Table 3.2). On the other hand Bangladesh has seen a declining trend in aid during the same time period. The current net ODA inflow to Bangladesh is significantly low even compared to the heavily indebted poor countries (HIPC) and other Asian Low Income Countries (IMF, 2007). IMF (2007) emphasized that this reduction in aid dependence is premature. As the

country needs enormous development challenges to acquire the status of middle income country, more external aid could be helpful under the right domestic conditions. But lack of good governance, infra-structural system and lower productivity in the government sectors are also considered to be important problems to make aid effective (IMF, 2011).

4. Model and Data Description[7]

The issues of financing alternatives to improve MDGs, the links between growth and service delivery and the trade-offs with other economic policy goals need to be studied in an economy-wide framework. Most MDGs tend to be jointly produced and future income growth rates and progress on the MDGs are both endogenous. There are synergies between the services provided to achieve the MDGs. This means that interventions taken to achieve one MDG are often likely to positively accelerate other MDGs and therefore the problem of double counting of cost can arise (Bussolo & Medvedev, 2007). Moreover, the choice of financing mechanisms towards MDGs achievement matter a lot in determining the cost of each MDG.

All of these above issues give the rational for use of a Computable General Equilibrium (CGE) Model. The CGE approach has advantages and disadvantages. First, given that it is country-specific, it provides a tool for policymakers in a specific country to deepen the debate on the impact of various policy interventions. Second, it requires less data compared to cross-country studies. Third, our approach is a "prediction-by-theory" which means that the impact of an intervention can be traced in a consistent way from the macro to the micro-unit included in the analysis. Some of the drawbacks of this approach are that the model is dependent on a number of parameters and elasticities that, in many developing countries, may require extensive data analysis and even data collection. A second set of concerns are related to the validity of the model structure and the assumptions that it embodies.

MAMS framework has been built from a standard CGE framework with dynamic recursive features which incorporates a special module specifying the main determinants of MDGs achievement. The general equilibrium model has the relevance since the achievement of the MDG has dynamic effects on the economy as a whole. MAMS has flexibility in terms of capability to accommodate a wide variety of datasets and adaptability to the country-

[7]The model description section draws on Löfgren and Diaz-Bonilla (2010) and Bourguignon et al. (2008)

specific circumstances. The core module of the MAMS model has its origin to the IFPRI standard CGE model consisting of producers, consumers, the government sector and the rest of the world.

The MDG module of the MAMS focuses on the production of education, health, water and sanitation. It explicitly incorporates achieving universal primary education, reducing under five and maternal mortality, increasing access to safe water and basic sanitation. In addition, reduction in head count poverty rate is also monitored. The model does not contain mechanisms for specifically poverty reduction related interventions. The above mentioned MDG indicators are included in the MAMS model as these selected MDGs have the greatest cost and the greatest interaction with the rest of the economy (Löfgren & Diaz-Bonilla, 2008). These MDGs are modeled in an additional set of functions that link the level of MDG achievements, relating service delivery and other determinants to MDG indicators. Table 3.1 specifies how the changes in different MDG indicators are determined in MAMS.

Table 3.1: Determinants of MDGs achievement in MAMS

		Other determinants			
Poverty and MDGs	Per-capita service delivery	Per-capita Consumption	Wage incentives	Public Infrastructure	Other MDGs
1. Poverty		X			
2. Education	X	X	X	X	4.5
4. Infant Mortality	X	X		X	7a.7b
5. Maternal Mortality	X	X		X	7a.7b
7a. Access to water	X	X		X	
7b. Access to sanitation	X	X		X	

Source: Bussolo and Medvedev (2007).

The determinants include the delivery of relevant services (in education, health and water-sanitation) and other indicators, also allowing for the presence of synergies between MDGs. i.e. the fact that achievements in terms of one MDG can have an impact on other MDGs. For example, achieving the target of hundred percent primary education requires additional schooling services, but is also facilitated by improvements in health conditions, by better infrastructure (e.g., by better roads to school), by higher income levels (better-off parents may not need their children to work) and by good returns to education (proxied by the wage premium paid to skilled workers). In education, the model tracks base-year stocks of students and new entrants through the three cycles. In each year, students will successfully complete their grade, repeat it, or drop out of their cycle. Student performance

depends on educational quality (quantity of services per student), household welfare (measured by per-capita household consumption), and the level of public infrastructure, wage incentives and health status. As mentioned before, the MAMS model does not include explicit policy instruments for head count poverty. Rather the model is capable of tracking the achievement on poverty reduction by using several alternative methods. In our case, we used an estimated elasticity of poverty reduction with respect to growth in household's per capita consumption.

The model includes several links between the MDGs module and the rest of the economy. An important link is that the provision of the additional government services needed to reach the MDGs requires additional resources – capital and investment, labor and intermediate inputs – that become unavailable to the rest of the economy. At the same time, the production of the MDGs generates additional resources as it influences the educational composition of the labor force, raising its average level of education.

The core data source for MAMS model calibration is the Social Accounting Matrix (SAM) 2005 for Bangladesh. The SAM specifies key production sectors along with disaggregated accounts for social services. Since our primary focus is on government policies to growth and human development, the SAM is restructured in a way where we aggregate the rest of the economy into four activities (Table A1). These are agriculture, industry, service and other government. The MDG relevant sectors are water and sanitation, health and education. The activities for education sector are again divided into primary, secondary and tertiary education provided by both the government and private sectors[8]. Each of these sectors/services has a direct link to the labor market where labor is divided according to primary, secondary and tertiary skill levels. The growth in the labor force will partly depend on the success of the education sectors of the economy. The total factor employment of labor by skill and sector level was estimated from the Bangladesh Household Income and expenditure Survey (HIES) 2005. 83 percent of labor force aged between15-64 was employed at different sectors. Unskilled worker has the majority share in the labor force comprising 61.4 percent of total labor force. Also 55.8 percent and 29.2 percent of total unskilled worker are employed at agricultural and service sector respectively. Labor defined as high skilled are mostly employed at the service sector. Data on student's enrollment was

[8]Detail description of how the education and health expenditures are divided between government and private provider is given in appendix B.

obtained from Bangladesh Bureau of Educational Information and Statistics (BANBEIS, 2010).

Data on population by household and selected age groups and by year was taken from Bangladesh Bureau of Statistics (BBS) and United Nation's population data. The households are broadly divided according to rural and urban groups. Out of the total population, 25.7 percent lived in the urban areas. Data on foreign grant and government debt were borrowed from the Bangladesh Ministry of Finance. One major effort for the MAMS model to work is to build the MAMS SAM which is the disaggregation of original SAM into public current expenditures and investments into the different MDGS activities. A detailed description of how the MAMS SAM is constructed is given in appendices A and B.

Some of elasticity values for the core and MDG version are taken from the MAMS demo version. This introduces a certain degree of imprecision in the model results but this can be justified for two reasons: firstly, the elasticity values are within a reasonable range as established in the existing CGE literature. Secondly, the results are not considered as absolute rather a direction changes due to the policy measures.

5. Simulation Scenarios: Financing scenarios and trade-offs

What is the cost to achieve all the MDGs in Bangladesh by 2015? Do the overall costs differ between financing scenarios? The first set of scenarios present a baseline-scenario and four financing scenarios (Table 5.1). The financing options available to the government are either to increase taxes, borrow domestically, foreign borrowing or grant aid. We compare the results from the baseline scenario to the alternative scenarios and as such make it possible to say something about the economy-wide impact of alternative financing scenarios. Apart from these four financing scenarios, we further experiment by reallocating public spending. We reallocate spending on other government services, which do not contribute to MDG achievement, by reducing the annual growth rate from four to two percent. In the sixth scenario we expand investment to infrastructural development (infra). In the seventh scenario (human) we instead expand spending on human development (education, health and water/sanitation). The final scenario is a mixed scenario (mixed) in which both infrastructure and human development increase.

Table 5.1: Simulation Scenarios

Name	Description
Base	Baseline scenario 2005-2015
Mdg-ftr	scenario achieving all MDGs (foreign transfer financing)
Mdg-tax	scenario achieving all MDGs (domestic tax financing)
Mdg-fb	scenario achieving all MDGs (foreign borrowing financing)
Mdg-db	scenario achieving all MDGs (domestic financing)
Infra	50% cut of growth in other government services + expansion of infrastructure
Human	50% cut of growth in other government services+ expansion of human development sectors
Mixed	50% reduction in growth for other government services + expansion of infrastructure and human development sectors

The baseline scenario developed for the period 2005-2015 can be characterized as a fiscal-prudent scenario and a series of assumptions were retained to simulate this scenario:

- An annual growth rate of 6.0 percent for real GDP between 2005 and 2015.
- An annual population growth rate of close to 1 percent between 2005 and 2015.

- The small country assumption holds: world prices of exports and imports are exogenous and assumed constant with respect to the model's numeraire, the consumer price index in 2005.

- Foreign direct investments are held constant as a share of GDP.

- Foreign grants to the government are assumed to decline over time from 1 percent of GDP in 2005 to 0.6 percent in 2015 reflecting actual trends in (grant) aid disbursements. External debt is declining as a share of GDP from 27 percent in 2005 towards 24 percent in 2015. The domestic debt-ratio is declining as well from 16 percent of GDP in 2005 to 14 percent in 2015.

- Public primary spending (consumption, investment, transfers to households and interest payments) is in nominal terms averaging around 15 percent of GDP over the period. Public investment is on average 5 percent of GDP over the period. Tax revenue increase from 9 percent of GDP in 2005 to around 10 percent of GDP in 2015.

In a broad sense, our baseline scenario replicates recent macro-trends and our model-predicted targets are not that far from actual MDG performance (Table 5.2). In our baseline scenario the poverty-target is likely to be achieved before 2015. With regard to primary education we predict that the net primary completion rate could go up from 45.8 percent in 2005 to 82.0 percent in 2015 in the baseline scenario, yet short of the universal 100 percent targeted. It should be noted that we are using primary completion rate as the target which is the more ambitious target compared to enrolment rates. Regarding the health-related MDGs, both MDG4 and MDG 5 will move closer to the target in 2015. The proportion of the population with access to water and sanitation will be increasing but still below the target in 2015. To summarize, in our baseline scenario it is only the poverty target that is on track but significant progress have been made in the health and water related targets.

Table 5.2: MDG performance in the baseline scenario

	2005	2010	2015	Target
	Base scenario			
National Poverty headcount (%)	40.0	33.5	27.8	29.5
Primary education completion rate (%)	39.9	51.0	82.0	100.0
Under-5 mortality (per 1000 children)	120.0	83.4	60.1	48.7
Maternal mortality (per 100.000 births)	250.0	199.6	163.0	143.0
Access to water (%)	61.0	69.3	78.6	100
Access to sanitation (%)	43.0	49.2	56.7	69.5

In our first set of scenarios we ask the question how much resources are needed to achieve the MDGs and what is the economy-wide effects of the different financing alternatives. Table 5.3 shows the development of some important macroeconomic variables. A key distinction is between scenarios that mobilize resources domestically and those that rely on resources from abroad.

Table 5.3: Macro-indicators by simulation (% average growth from first to final report year)

	base	mdg-ftr	mdg-tax	mdg-fb	mdg-db
Absorption	6.4	6.9	6.2	6.9	5.8
Consumption - private	5.9	6.0	5.2	6.0	5.8
Consumption - government	4.0	7.5	7.9	7.5	7.5
Fixed investment - private	9.9	9.9	8.8	9.9	4.0
Fixed investment - government	4.7	8.6	9.6	8.6	9.0
Exports	5.0	3.2	4.2	3.2	4.2
Imports	7.1	8.1	6.6	8.1	6.6
GDP at factor cost	6.0	5.9	5.8	5.9	5.3
Total factor employment (index)	3.5	3.6	3.5	3.6	3.2
Total factor productivity (index)	2.5	2.4	2.2	2.4	2.1
Real exchange rate (index)	-1.0	-1.8	-1.0	-1.8	-1.1
Unemployment rate (%)*	4.3	4.3	4.3	4.3	4.3
Headcount poverty rate (%)*	27.8	27.6	28.9	27.6	27.8

*/Final simulation year

Table 5.4: Macro-indicators (% of nominal GDP)

		Final year				
Indicator	2005	base	mdg-ftr	mdg-tax	mdg-fb	mdg-db
Absorption	106.8	109.7	113.1	109.6	113.1	110.2
Consumption - private	80.3	77.1	76.3	73.4	76.3	80.9
Consumption - government	5.1	5.0	7.1	7.4	7.1	7.4
Investment - private	15.8	22.7	22.6	20.8	22.6	13.9
Investment - government	5.6	5.0	7.1	8.0	7.1	8.0
Exports	16.8	13.8	10.5	12.6	10.5	13.4
Imports	23.7	23.5	23.6	22.3	23.6	23.6
Net indirect taxes	6.7	7.3	7.3	10.4	7.3	7.4
GDP at factor cost	93.3	92.7	92.7	89.6	92.7	92.6
Foreign savings	1.0	1.5	1.4	1.5	6.0	1.6
Gross national savings	20.4	26.2	28.3	27.4	23.7	20.3
Gross domestic savings	14.6	18.0	16.6	19.2	16.6	11.7
Foreign government debt	27.0	24.2	22.1	24.0	49.6	25.5
Domestic government debt	16.0	14.3	14.2	14.5	14.2	66.6

Domestic resource mobilization scenarios, in the form of either taxation or domestic borrowing, both lead to lower growth and less poverty reduction compared to the base scenario. The tax scenario involves adjustments of both income taxes and indirect taxes and leads to lower growth in private consumption. The domestic borrowing scenario leads to lower average growth compared to the tax scenario as private investment is crowded out by government borrowing. Household consumption is on the other hand higher as interest payments on domestic debt accrue to urban households. This explains why poverty reduction is slightly higher in the borrowing scenario.[9]

Table 5.5: Government revenue and spending (% of nominal GDP)

		Base	Final year				
Indicator		2005	base	mdg-ftr	mdg-tax	mdg-fb	mdg-db
Receipts	Direct taxes	2.4	2.9	2.9	5.1	2.9	3.0
	Import tariffs	4.1	4.1	4.1	4.1	4.1	4.1
	Other indirect taxes	2.6	3.2	3.2	6.3	3.2	3.2
	Foreign transfers	1.0	0.6	4.8	0.6	0.5	0.6
	Factor income	1.1	1.2	1.3	1.3	1.3	1.3
	Domestic borrowing	3.5	1.3	1.3	1.3	1.3	11.2
	Foreign borrowing	0.9	1.4	1.2	1.4	5.9	1.4
	Total	15.6	14.7	18.9	20.1	19.3	24.9
Spending	Consumption	5.1	5.0	7.1	7.4	7.1	7.4
	Fixed investment	5.6	5.0	7.1	8.0	7.1	8.0
	Private transfers	3.0	3.0	3.0	3.0	3.0	3.0
	Domestic interest payments	1.5	1.3	1.3	1.4	1.3	6.2
	Foreign interest payments	0.4	0.3	0.3	0.3	0.7	0.3
	Total	15.6	14.7	18.9	20.1	19.3	24.9

The drawback from a foreign borrowing scenario, besides increasing the external debt, is that this scenario would lead to a stronger appreciation of the real exchange rate compared to the tax and base scenarios. This would negatively affect export growth (see Table 5.4), which would be reduced from an annual average of 5.0 percent in the base-scenario to around 3.2 percent in the external borrowing scenario. An aid-financed scenario would require that aid is scaled up significantly reaching 4.8 percent of GDP in 2015 (period average is around 4 percent of GDP). This would also as in the case of external borrowing negatively affect export performance.

[9] There are only two household groups in the model, one urban group and one rural group.

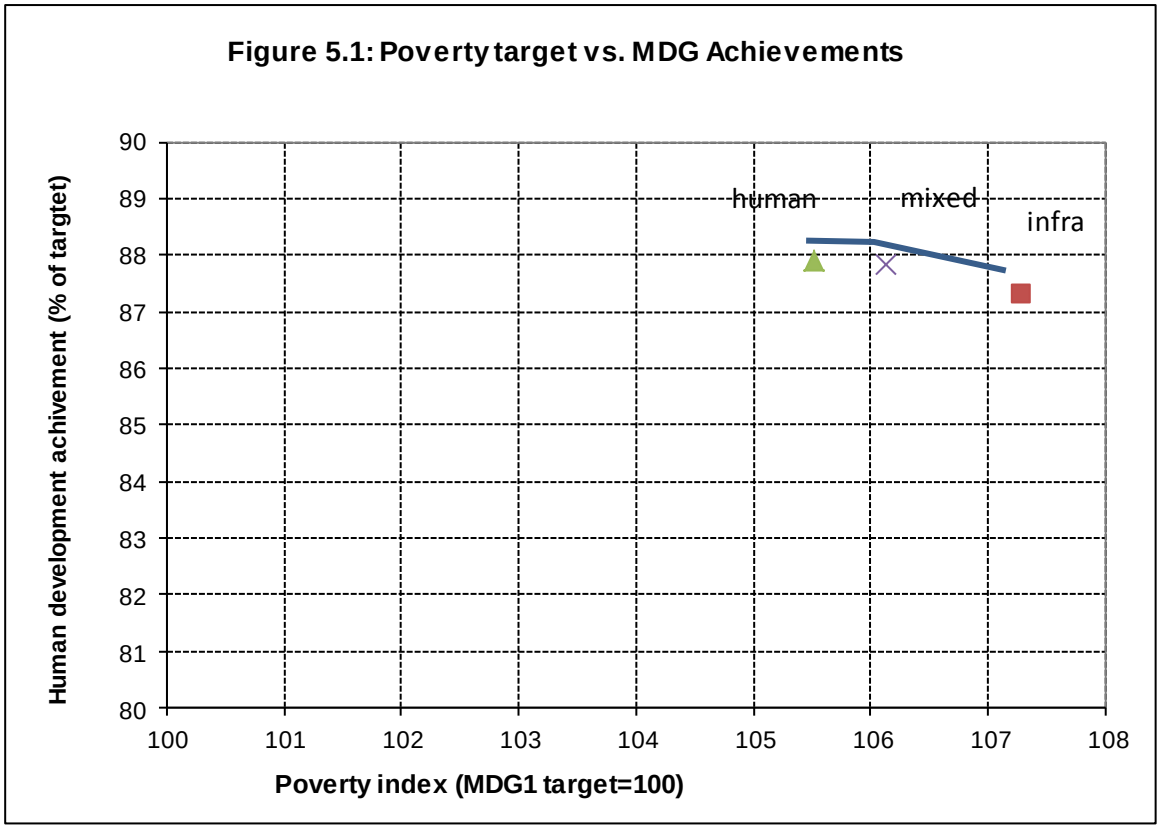
To summarise, the major differences in the financing scenarios we note that debt financing leads to a significant increase in the debt ratios. The external debt almost double while domestic debt financing would quadruple the domestic debt ratio. Domestic debt financing also has the drawback of slowing down GDP growth. Accumulated over time this GDP loss is around two times higher (in net present value) than a tax-financed scenario.[10] In the longer term and assuming reduced aid-dependency mobilising, more tax revenue seems to be the key to finance future development programmes. A tax-financed scenario implies that the tax-GDP ratio needs to be increased from 9.1 percent of GDP to around 15.5 percent of GDP (Table 5.5).

Another option to achieve the MDGs would be to reallocate public expenditures towards sectors that influence the MDGs. In this section, we analyze trade-offs in MDG achievement as a result of a compositional change in public expenditures. All scenarios assume that annual growth of other public expenditures is reduced by half, from 4 percent to 2 percent during 2006-2015. In our first scenario we assume that infrastructure spending increase relative to the other sectors, which retain their baseline growth rate. In the second human development scenario, we instead assume that spending to primary education, health and water sectors increase relative to infrastructure. The final scenario is a mixed scenario where public spending targeted to primary education, health and infrastructure is growing while the other sectors (secondary and tertiary education) have the same growth rate as in the baseline scenario.

In the absence of monetary values attached to progress made on the various MDGs, it is very difficult to identify an optimal public expenditure composition.[11] In addition, the time horizon selected for the evaluation of public expenditure strategies adds another complexity, as the effects of investment in education and health on growth take longer lags to manifest than does investment in infrastructure. Here we visually summarize trade-offs, following the approach in Bussolo and Medvedev (2007). Figure 5.1 illustrates progress made in terms of poverty reduction with the progress made in terms of human development following the three public spending scenarios outlined above.

[10] We sum up for each year the GDP loss for each scenario compared to the baseline scenario and calculate Net Present Value.

[11] We compute for MDG2, MDG4, MDG5 and MDG7 the share of remaining distance in 2015 in the baseline scenario and in the alternative scenarios. We treat the MDGs equal in the sense that we report an arithmetic average gap across the MDGs.



The key message from the above scenarios is that we can improve achievement in the human development MDGs by reallocating public spending but at the cost of slightly lower poverty reduction. If we reallocate spending on other government services towards infrastructure we would further see improvement in poverty reduction but less progress in human development achievement. The mixed scenario implies progress in between the infrastructure and human development scenarios. Compared to previous country cases we also get a concave pattern but a rather flat curve that is explained by the high cost when we are close to the targets. On the margin we do not get any significant impact on human development achievement by reallocating public spending.

What are the policy lessons that can be drawn from our empirical analysis? Regarding the alternative financing options Bangladesh could have come even closer in achieving the MDG targets through additional public investments financed by either borrowing or taxation. Increased aid-flows could also be considered to be an option but it seems unlikely, given the recent trend in aid-flows to Bangladesh, that donors are willing to scale up the requirement to achieve the MDGs. Besides in the longer term Bangladesh should reduce its aid dependency and focus more on domestic resource mobilization. The least costly scenario among domestic borrowing and taxation in terms of GDP loss is the

taxation scenario. Our results suggest that increasing the tax-GDP ratio from 9.1 to 15.5 percent of GDP is not overwhelmingly difficult. In the short to medium term the best way for developing countries to respond to the tax challenges are essentially to broaden tax bases, reduce rates and improve tax administration (Bird et al., 2008).

Compared to other developing countries, performance in Bangladesh has been impressive considering the declining aid-GDP ratios and the relative low public-spending ratio. In our scenarios scaling up public spending to human development and infrastructure would improve the outcome of MDG achievement further. However, reallocating public spending in between various public spending categories would not change the achievement dramatically.

6. Conclusion

This study is an empirical assessment of the effect of alternative financing policies taken toward achieving growth and MDGs for Bangladesh. Even though Bangladesh has made significant progress in some of the MDGs, it is still a major challenge for the government to further reduce poverty and improve human developments specially achieving 100 percent primary school completion rate.

In this study we evaluate alternative policy measure to finance growth and MDG investment for Bangladesh by a counterfactual retrospective comparison of the economic development 2005-2015. We use a dynamic general equilibrium model that explicitly links progress on the MDGs front to the rest of the economy via markets for foreign exchange, factors (specially for labor) and goods and services.

We find that full achievement of these goals would have led to a GDP loss which is significant larger in the domestic financing scenario compared to the tax scenario. The tax-financing alternative is thus the better option in financing large development programs. For public spending composition we find that under some circumstances there arises a tradeoff between overall MDG progress and poverty reduction. However, on the margin the impact of reallocating public spending in Bangladesh is low. This is explained by the significant progress Bangladesh has already achieved so far and as such the unit costs of reaching the most remote parts of the population are high.

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Appendices: Building a MAMS SAM for Bangladesh

Appendix A:

Table A1: Sectoral contribution and share of public spending based on SAM 2005

	output	intermediate use	labor earnings	capital earning	GDP at factor cost	public spending
agriculture	19.8	18.3	8.2	16.8	21.4	
industry	29.9	43.3	15.3	20.4	15.8	
service	44.1	33.6	65.6	56.8	55.1	
water & sanitation	0.1	0.0	0.0	0.2	0.1	2.7
education	1.9	1.2	4.8	0.7	2.6	26.9
Health	2.3	2.3	2.1	2.9	2.2	18.2
infrastructure	0.1	0.1	0.4	0.0	0.2	3.1
other government	1.9	1.2	3.7	2.2	2.7	49.0
total	100.0	100.0	100.0	100.0	100.0	100.0

Source: All the shares are own calculation based on the Bangladesh SAM 2005

Table A1 reveals the contribution of different sectors where the original 63 activities SAM was aggregated into 8 sector activities. For the Bangladesh economy the service sector contributes most in terms of output, labor earnings, capital share and GDP at factor cost. The industrial sector has highest contribution for intermediate use. Education, health, water and sanitation, other infrastructure and other government activities of original SAM needed to disaggregate into public current expenditures and investments. This disaggregation is based on public expenditure figures from Asian development Bank (2010), Bangladesh Development policy review (2003) and Bangladesh Bureau of Statistics (2005). From the table A2, we see that government current expenditures are very low around 5.5% of GDP. Public investment is around 6% of GDP. On the other hand, table A3 states that, total revenue collection in Bangladesh is also very low around 10.6% of which tax revenue is around 8.5% and non-tax revenue is 2.1% of GDP. Overall public deficit is around 3.3% of GDP, which is financed by domestic (1.9% of GDP) and external financing (1.4% of GDP). Domestic financing is either through borrowing from banks or non-banks.

Table A2: National Income and Product Accounts (% of GDP)

	2000	2001	2002	2003	2004	2005
Consumption	**82.1**	**81.9**	**81.6**	**81.0**	**80.3**	**79.9**
Private	77.5	77.2	76.4	75.5	74.7	74.3
General government	4.6	4.8	5.2	5.4	5.5	5.5
Investment	**23.1**	**23.1**	**23.3**	**23.7**	**24.3**	**24.6**
Private	15.8	16.4	17.0	17.5	18.1	18.5
Public	7.4	6.9	6.3	6.2	6.2	6.1
Domestic demand	**105.1**	**105.1**	**104.9**	**104.7**	**104.5**	**104.5**
Net exports	-5.7	-5.5	-5.3	-5.6	-5.9	-6.4
Exports of goods and services	14.7	14.9	14.3	14.9	16.1	17.8
Imports of goods and services	20.4	20.3	19.5	20.4	21.9	24.1
Statistical discrepancy	0.6	0.4	0.5	1.0	1.5	2.0
GDP at current market prices	100.0	100.0	100.0	100.0	100.0	100.0
Memorandum						
Gross national saving	22.8	22.9	24.2	25.2	25.6	26.8
Gross domestic saving 3/	17.4	17.7	18.0	18.2	18.4	18.3
Gross domestic saving /4	18.0	18.1	18.4	19.1	19.8	20.1

Source: ADB. 2010

Table A3: Revenue and financing (% of GDP)

	2001	2002	2003	2004	2005
Total revenue	9.6	10.2	10.3	10.4	10.6
Tax revenues	7.7	8.0	8.3	8.4	8.5
NBR taxes	7.3	7.6	7.9	8.0	8.1
Non-NBR taxes	0.4	0.4	0.4	0.4	0.4
Nontax revenue	1.9	2.2	2.0	2.0	2.1
Total expenditures	14.6	14.0	13.5	13.6	13.9
Current expenditures	7.9	8.1	8.0	8.1	8.4
Pay and allowances	2.4	2.5	2.4	2.3	2.4
Goods and services	1.2	1.3	1.4	1.5	1.5
Interest	1.7	1.9	1.8	1.7	1.8
Subsidies and transfers	2.2	2.2	2.4	2.6	2.7
Block allocation	0.4	0.2	0.1	0.2	0.2
Annual development program	6.1	5.5	5.2	5.0	4.9
Non-ADP capital and lending	0.6	0.4	0.4	0.6	0.9
Other expenditures	0.0	0.2	0.3	0.2	0.1
Check float plus discrepancy	-0.1	0.1	-0.4	-0.4	-0.3
Overall balance (excluding grants	-4.9	-4.1	-3.3	-3.2	-3.3
Primary balance (excluding grants)	-3.2	-2.2	-1.5	-1.6	-1.6
Net financing	4.9	4.1	3.3	3.2	3.3
External financing (net)	2.1	2.1	1.7	1.5	1.4
Domestic financing	2.8	1.9	1.5	1.8	1.9
Banks	1.2	0.2	0.0	0.7	1.2
Nonbank	1.7	1.7	1.5	1.1	0.8
Memorandum item					
Public	51.9	52.0	49.9	48.1	47.2
External	33.9	33.5	31.6	29.9	29.0
Domestic	18.0	18.5	18.3	18.2	18.2

Appendix B: Split of public and private MDG sectors

Total value added in health sector is 90.874 (output is 156.894) million taka in SAM2005. This was far above of what is reported at Bangladesh Bureau of Statistics for the public sector (16583 million taka). Therefore, we assumed that the health sector in the SAM consists of both private and public. Private spending on health is close to 60% of total spending and public spending makes up the rest. 40%. We split the health sector into two sectors where 60% of the sector is assumed to be private and 40% is public.

Total output in the education sector in the SAM is 130.997 million taka. Total output of education service from the private sector is 78.887 million of Tk. which is 60% of the

total. This is also close to the consumption shares of private and public spending in the sector. We assumed that 62% of total education output and expenses is private and the rest is public. We also needed to split private and public education sectors into three levels of primary, secondary and tertiary. Public education is split according to budget shares in Table B2. Private education is split according to the same shares.

Table: B1 Production of health services

	2005	
Value added of private health sector (million Tk.)		
Private health establishment	18077	
Individual health worker	56214	
Total	74291	
Value added of public health sector (million Tk.)		
Compensation of employees	15300	
Consumption of fixed capital	1283	
Total	16583	
Value added of health sector at current price (million Tk.)		
Public	16583	0.223217
Private Sector	74291	0.776783
Total	90874	
Consumption	152223.4	
Public sector	61926.6	0.41
Private sector	90296.76	0.59

Table B2 Public spending education

Basic Education	current	capital	% curr	% cap
Primary (1-5)	21172.50	15223.00	0.41	0.56
Secondary (6-10)	17354.00	6627.00	0.33	0.25
Higher secondary and Above	13697.00	5145.50	0.26	0.19
Administration	2902.00	1193.50		
Maintenance	1192.50	132.50		
Other	391.00	28320.50		
Total	56709.00	56642.00		
total excl adm	52223.50	26995.50	1.00	1.00