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Infrastructure for Growth and Human Development in Pakistan

A Simulation Analysis of Fiscal Policy Options

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Abstract

This paper explores the use of fiscal policy to accelerate development in Pakistan during the period 2013–2022, with a focus on the creation of fiscal space for increased investment in infrastructure, as well as on indicators related to macro and sectoral developments, Millennium Development Goals (MDGs), and education. In terms of method, the analysis relies on simulations with a Pakistani version of MAMS (Maquette for MDG Simulations), a Computable General Equilibrium model developed at the World Bank for country strategy analysis. The different policy scenarios point to the importance of selecting infrastructure projects with high productivity effects and the crucial role of financing in determining the net effects of expanded government infrastructure spending. Transfer programs can generate immediate welfare gains but are less effective over time unless they are designed to raise productivity, perhaps via improvements in health, nutrition, and education outcomes. A final high-growth scenario explores requirements and consequences for Pakistan's economy if, during the period 2013–2022, it managed to raise its rate of annual GDP growth from the 4-5 percent range to 7 percent. The results for the final scenario indicate that rapid growth acceleration may be achieved via a combination of strong increases in savings, investment and total factor productivity. By 2022, 10 years of growth at a rate of 7 percent would spread across the macro demand indicators as well as the major production sectors. Its effects would include significant, broader gains in terms of poverty reduction and better outcomes for indicators.

This paper is a product of the Development Economics Prospects Group; and the Poverty Reduction and Economic Management Unit, South Asia Region. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at hlofgren@worldbank.org.

INFRASTRUCTURE FOR GROWTH AND HUMAN DEVELOPMENT IN PAKISTAN: A SIMULATION ANALYSIS OF FISCAL POLICY OPTIONS

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Sector board: Economic Policy

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1. SUMMARY AND INTRODUCTION[1]

This paper explores the use of fiscal policy to accelerate growth and human development in Pakistan during the period 2013-2022, with a focus on the creation of fiscal space for increased investment in infrastructure, as well as on the impact that this may have on indicators related to macro and sectoral developments, millennium development goals (MDGs), and education. In terms of method, we rely on simulations with a Pakistani version of MAMS (Maquette for MDG Simulations), a CGE model developed at the World Bank for analysis of medium- to long-run country strategies. The model is linked to a 2008 database for Pakistan, including a social accounting matrix (SAM) that is disaggregated into 30 sectors out of which 21 are private and 9 governmental, the latter representing different categories of government services. The simulated scenarios consist of a *base* scenario, a set of fiscal policy scenarios, and a scenario that explores features and effects of a switch to a high growth trajectory starting from 2013.

The *base* scenario is designed to represent a business-as-usual projection for Pakistan's economy up to 2022. It also serves as a benchmark to which other scenarios are compared. Drawing on the current trend and projections, the *base* annual GDP growth rate averages 4.3 percent, with growth rates between 4 and 5 percent for all aggregate sectors (agriculture, industry, private services and government services). Among the final demand categories (private and government consumption and investment), growth rates range between 4 and 6 percent. The resulting employment growth is sufficient to bring about a moderate decline in the unemployment rate. Government receipts increase by around 1 percent of GDP as the net result of a tax increase and a decline in government borrowing, which is constrained sufficiently to keep current domestic and foreign debt-to-GDP ratios unchanged. As the result of private consumption growth without major distributional changes, the national headcount poverty rate declines from 15 percent to less than 9 percent. Other MDG and education indicators also improve as the result of increased human development services complemented by growth in real household consumption and improvements in government infrastructure.

The main focus of the fiscal policy scenarios is to test the impact of raising government spending on infrastructure with alternative means of creating the needed fiscal space and alternative assumptions regarding the strength of the productivity gains from the infrastructure that is created. Across the sources of fiscal space, the most positive welfare and growth effects from infrastructure expansion are realized if the government manages to curb growth in wasteful spending (i.e., spending without identified positive impacts on productivity, welfare, or human development). If fiscal space alternatively is created via increased taxation or reduced energy subsidies, the effects are more ambiguous (improvement according to some indicators accompanied by deterioration according to others) since the increase in the space for

[1] The authors would like to thank Jose López-Cálix for valuable comments on earlier versions of this paper and an IFPRI team – Dario Debowicz, Paul Dorosh, Hamza Haider, and Sherman Robinson – for kindly sharing a Pakistan SAM for 2008 that they also adjusted to better meet the needs of our analysis. The authors are indebted to the Knowledge for Change Program (KCP) Trust Fund for funding the basic research that has permitted the development of MAMS.

government infrastructure spending is accompanied by a decline (at least initially) in the space for private consumption and investment.

To exemplify the effects that may be involved, if additional infrastructure is financed via a gradual increase in domestic taxes that reaches 2.2 percent of GDP by 2022, for the central case in terms of government infrastructure productivity, the impact on growth in GDP is very marginally positive while private consumption growth and poverty reduction slows down – the 2022 poverty rate increases from 8.6 percent for the *base* to 9.0 percent. However, thanks to the improvements in infrastructure (facilitating access to and production of health and education services), other MDG and education indicators improve albeit marginally. These limited effects reflect the opportunity costs of tax-based financing. On the other hand, if the productivity gains from additional infrastructure are strong (the elasticity of TFP with respect to infrastructure services is doubled), growth in GDP increases by 0.5 percentage points while the 2022 poverty rate falls to 7.6 percent and other MDG and education indicators also improve. Alternatively, if the same addition to infrastructure is financed by reduced growth for wasteful government activities, the GDP growth gains are at 0.2 and 0.7 percentage points for the central and high productivity cases, respectively, while the poverty rate falls to 7.9 or 6.7 percent. For the latter financing mode – reliance on waste cuts – infrastructure expansion was contrasted with expansion of a program with equal per-capita transfer for the total population. The simulation results suggests that transfers have the advantage of rapidly raising private consumption and reducing poverty but that, unless they generate productivity gains, infrastructure expansion generates stronger long-run gains in private consumption and poverty reduction.

In sum, the different policy scenarios point to the importance of selecting infrastructure projects with high productivity effects and the crucial role of financing in determining the net effects of expanded government infrastructure spending. Transfer programs can generate immediate welfare gains but are less effective over time unless they can be designed to raise productivity, perhaps via improvements in health, nutrition, and education outcomes.

The changes in economic growth and other indicators under the above scenarios are moderate, reflecting the fact that the fiscal changes that are considered also are moderate (but given this, relatively feasible). In a final high-growth scenario, which should be contrasted with the *base* scenario, we depart from analyzing consequences of marginal policy changes. Instead, we explore requirements and consequences for Pakistan's economy if it, during the period 2013-2022, managed to swiftly raise its rate of annual GDP growth from the 4-5 percent range to 7 percent. A qualitative change of this nature would require broader reforms that lead to improvements in the investment climate and in the quality of government institutions, as well as increases in private savings and investments in both physical and human capital.

Our analysis is focused on the implications of this high growth scenario for (a) key macroeconomic variables – TFP, factor accumulation, savings, investment, consumption, and unemployment; (b) the government budget and debt; and (c) MDG indicators. The results indicate that, in the context of an increase in investment from 14 to 18 percent of GDP (with a

70 to 30 percent split between private and government investment) supported by higher private and government savings, the rate of annual TFP growth would have to increase from 1-2 percent to 3-4 percent. Compared to the base, the consequences of more rapid GDP growth and higher levels of private and government investment (with a focus on infrastructure), include increases in annual growth by 2-3 percentage points for private consumption, absorption (the sum of private and government consumption and investment), and GDP for aggregate sectors (agriculture, industry, and services). In the labor market, unemployment in 2030 would fall from 12.6 percent for the *base* to 5.0 percent (the minimum unemployment rate) for the high growth scenario. Assuming that the government does not increase its borrowing, the total government debt in 2030 would decline by 10 percent of GDP, from 62 percent to 52 percent. Also measured relative to GDP, the major changes in the government budget are shifts to infrastructure from other areas and to investment from consumption, reflecting a strong growth acceleration for government investment compared to government consumption. Among the MDG indicators, improvements would be strong across the board; to exemplify, the 2030 poverty and under-five mortality rates would decline to 3.1 percent and 68.6 per thousand (compared to 8.6 percent and 74.8 per thousand for the *base*).

To sum up, the results for the final scenario indicate that rapid growth acceleration may be achieved via a combination of strong increases in savings, investment and TFP. By 2022, 10 years of growth at a rate of 7 percent would spread across the macro demand indicators as well as the major production sectors. Its effects would include significant broader gains in terms of poverty reduction, and better outcomes for MDG indicators.

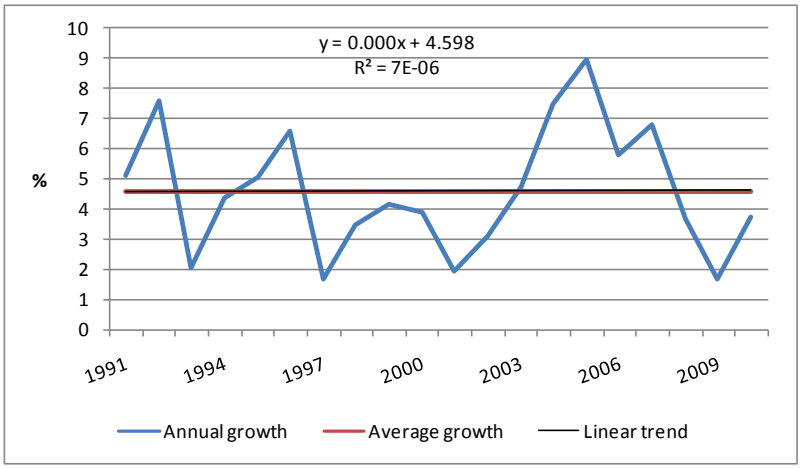
In outline, the rest of this paper is organized as follows. Section 2 summarizes Pakistan's economic and social development 1990-2010 from an aggregate perspective while Section 3 describes the model structure and the database. Section 4 presents the simulations and analyzes their results. Appendices 1 and 2 provide additional details on the database and the simulation results, respectively.

2. ECONOMIC AND SOCIAL DEVELOPMENT 1990-2010: AN AGGREGATE PERSPECTIVE

To provide context for the simulation analysis of this paper, we here summarize, from an aggregate perspective, economic and social developments for Pakistan during the period 1990-2010, organizing the discussion around a set of figures.[2]

As shown in Figure 2.1, during the period 1991-2010, real annual growth in GDP at factor cost followed a flat trend, averaging at 4.6 percent but with large year-to-year variations. However, the Pakistani economy experienced a particularly slow growth spell 2006-2010 with declining or below average growth rates, something that does not bode well for the future. Over time, the contribution of total factor productivity (TFP) growth to GDP growth has been declining (López-Cálix et al. 2012, pp. 6-7).

Figure 2.1. Growth in real GDP at factor cost 1991-2010



Among the GDP expenditure components, growth was strongest for exports and imports followed by private and government consumption, while fixed investment growth was slowest (Figure 2.2). Real household consumption per capita grew at annual rate of 2.1 percent, like GDP without any significant change over time with a similarly high degree of variability (Figure 2.3). The evolution of nominal GDP shares, which depends not only on real growth but also on changes in relative prices, is shown in Figure 2.4: private consumption increased while other parts were either fairly constant (exports, imports and private investment) or declining (government consumption). The somewhat contrasting stories in terms of real growth and nominal GDP shares suggest that relatively prices changed, inter alia increasing for government services.

Investment was primarily financed by national savings with a minor role played by foreign savings (which corresponds to the gap between gross investment and gross national savings; Figure 2.5). Foreign direct investment (part of foreign savings) remained moderate, although registering a slight increase during the period 2006-2009.

[2] The underlying data is available from the authors on request.

Figure 2.2 Real macro aggregates (index)

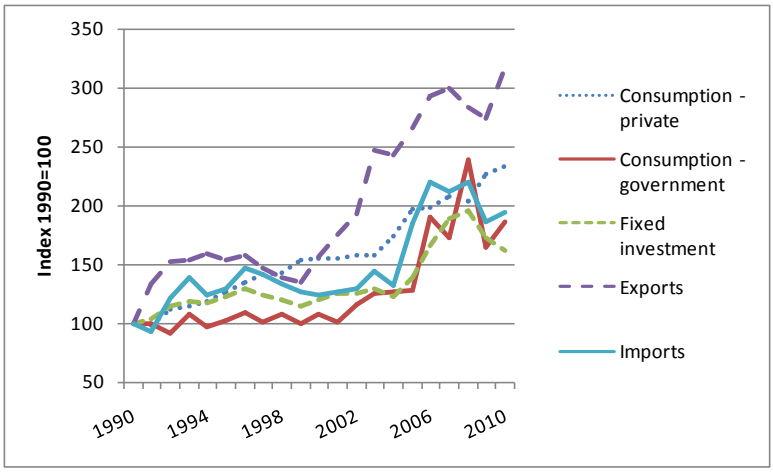


Figure 2.3. Growth in real household consumption per capita 1991-2010

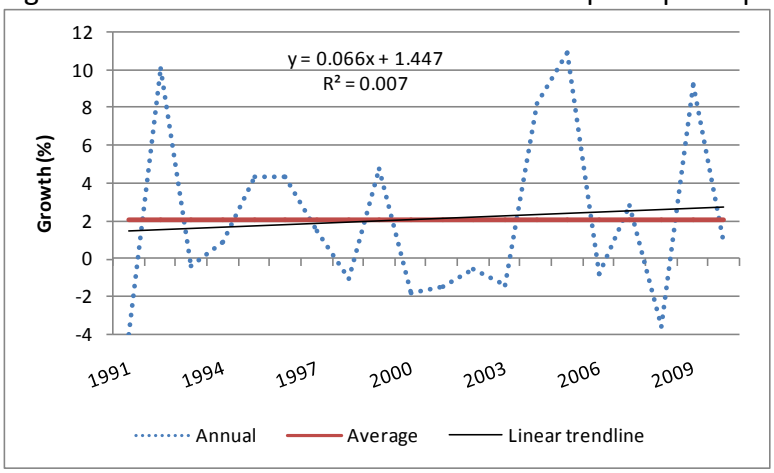


Figure 2.4. GDP components by expenditure (shares)

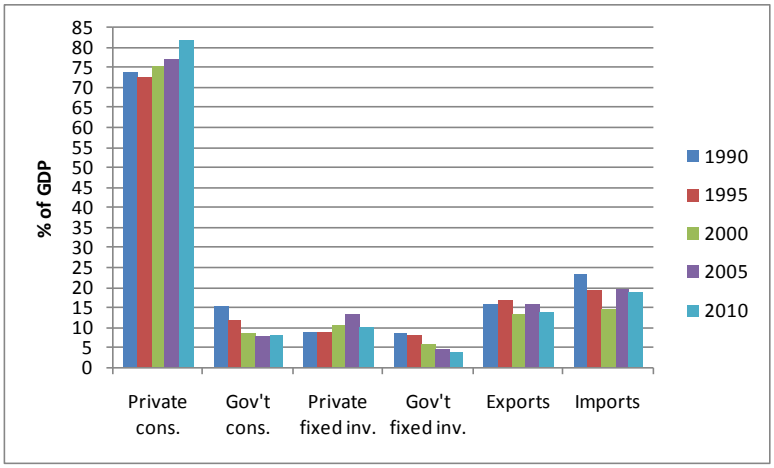
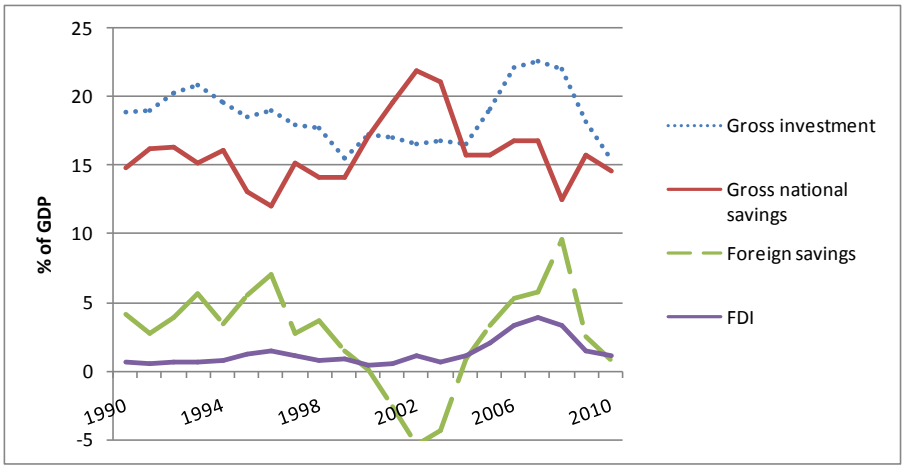
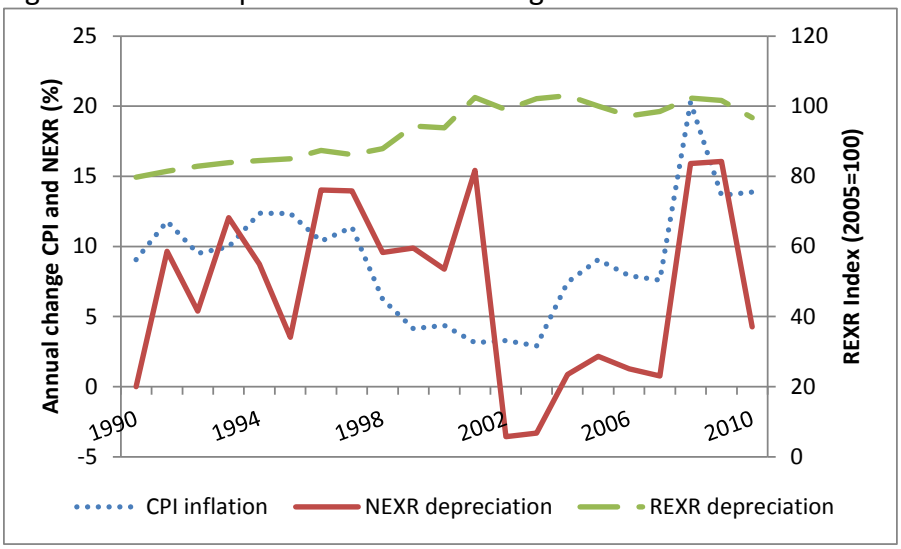


Figure 2.5. Investment and savings (shares of GDP)



As shown in Figure 2.6, the real effective exchange rate depreciated during the 1990s and stayed fairly stable since 2000. [3] The average CPI and nominal depreciation rates for the period 1991-2010 were at 9.0 and 7.1 percent, respectively, roughly consistent with real exchange rate stability given inflation among Pakistan's trading partners. As expected, nominal exchange rate depreciation is positively correlated with CPI inflation. However, the depreciation rates show stronger year-to-year variability than CPI inflation.

Figure 2.6. Macro prices: CPI and exchange rates

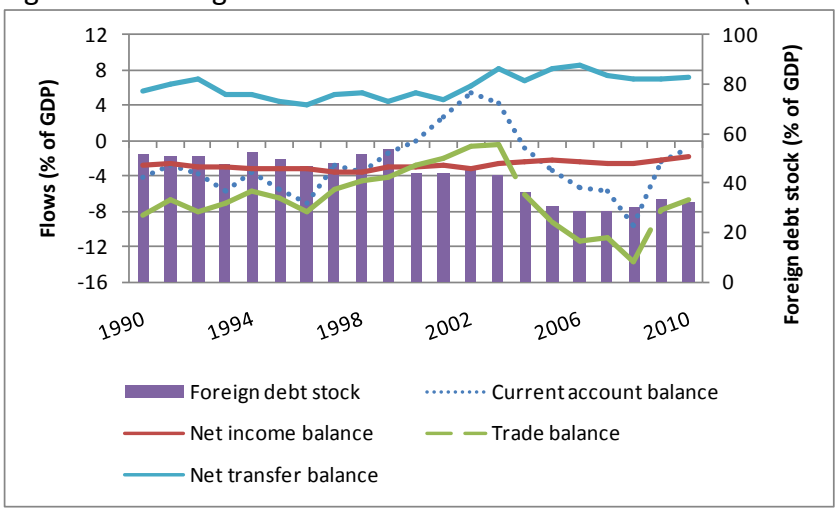


Since 1990, Pakistan has typically had a current account deficit (Figure 2.7; corresponding to positive foreign savings in Figure 2.5), on average amounting to close to 3 percent of GDP, reflecting the combined contributions of trade deficits and current transfer surpluses at 6-7 percent and a net income deficit of close to 3 percent. The total foreign debt stock was close to

[3] In this paper, the different exchange rate measures refer to rupees per unit of foreign currency; i.e. an increase (decrease) signifies depreciation (appreciation).

50 percent of GDP in the 1990s, after which it declined strongly during the period 2000-2006, reaching the current share of around 30 percent of GDP. The years of debt decline were characterized by relatively strong performance in terms of the current account balance (surpluses or small deficits), low nominal exchange rate depreciation (Figure 2.6), and strong GDP growth (Figure 2.1).

Figure 2.7. Foreign debt stock and current account flows (shares of GDP)



Among the aggregate sectors, real growth 1991-2010 was relatively strong for manufacturing and, to a lesser extent services, and weaker for agriculture and other industry (made up of mining, construction, electricity, water, and gas; Figure 2.8). The evolution of nominal GDP shares (Figure 2.9), which is influenced not only by real growth but also by relative price changes, shows matching changes for agriculture and services whereas manufacturing and other industry both stayed flat, suggesting that manufacturing suffered from a relative price decline (possibly related to links to international prices) whereas the relative prices for other industry (which for the most part is non-traded) increased. Nevertheless, at this aggregate level, the transformation of sector structure (with maximum changes in nominal GDP shares of 4.5-5 percent) seems modest. The changes in sectoral employment shares (Figure 2.10) match the relative real sector growth rates (Figure 2.8): the employment share of services, with relatively rapid real GDP growth, increases whereas the employment share of the relatively slow-growing agricultural sector declines. For industry, which is made up fast-growing manufacturing and slow-growing other industry, the employment share change stays relatively stable.

Infrastructure can play an important role by promoting growth, with certain types of infrastructure being more strongly linked to some subsectors (e.g. roads have a disproportionate impact on transportation services and sectors that make heavy use of such services). Figure 2.11 summarizes the evolution selected types of infrastructure since 1990. Adjusted for population growth, the number of fixed phone lines doubled but is still low (at 2 per 100 in population) while the number of mobile phone subscriptions increased astronomically (to close to 60 subscriptions per 100 inhabitants). In terms of length, the railroad

network fell by around 10 percent whereas the road network increased by some 50 percent, accompanied with an increase in the paved road share.

Figure 2.8. Real aggregate sector value added (index)

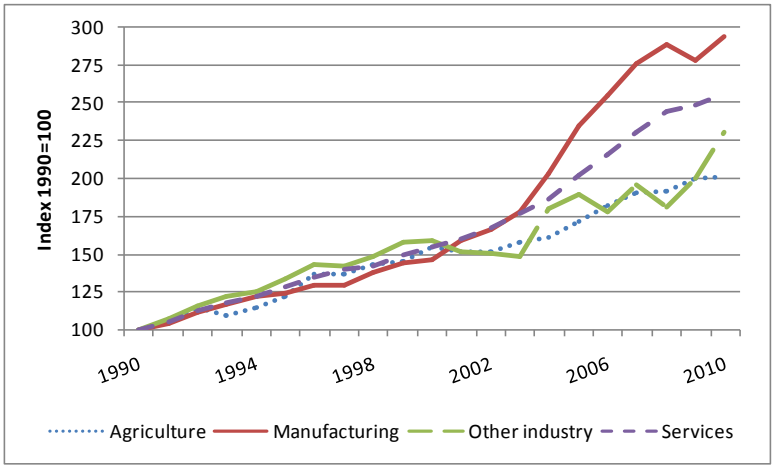


Figure 2.9. Aggregate sector value added (shares of nominal GDP)

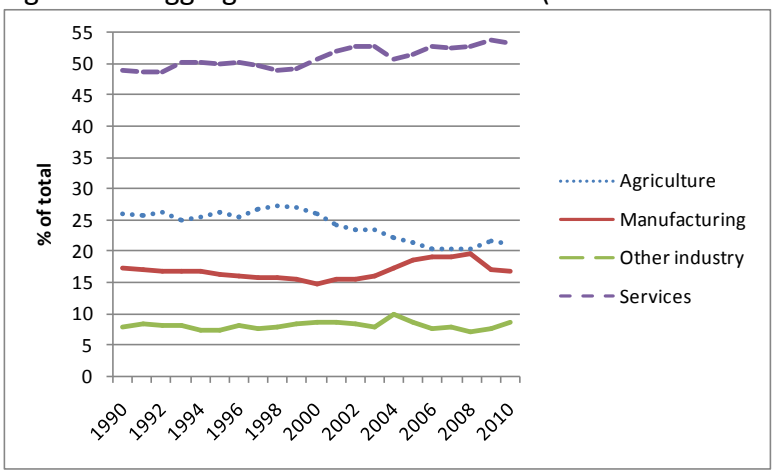


Figure 2.10. Share in total employment by aggregate sector

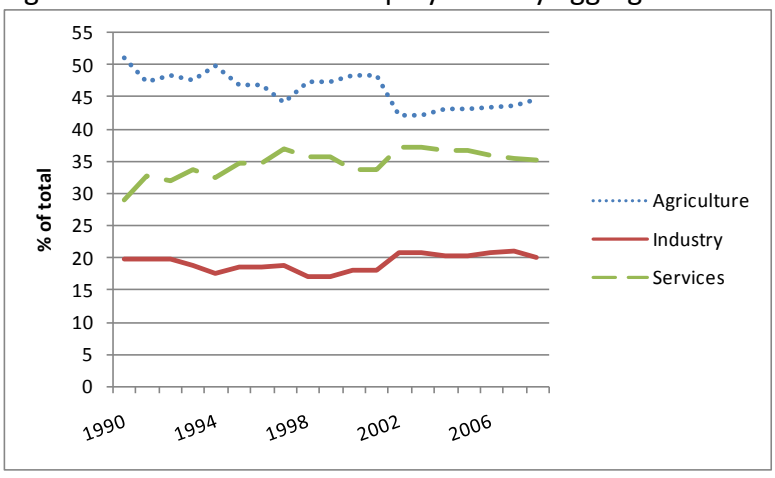
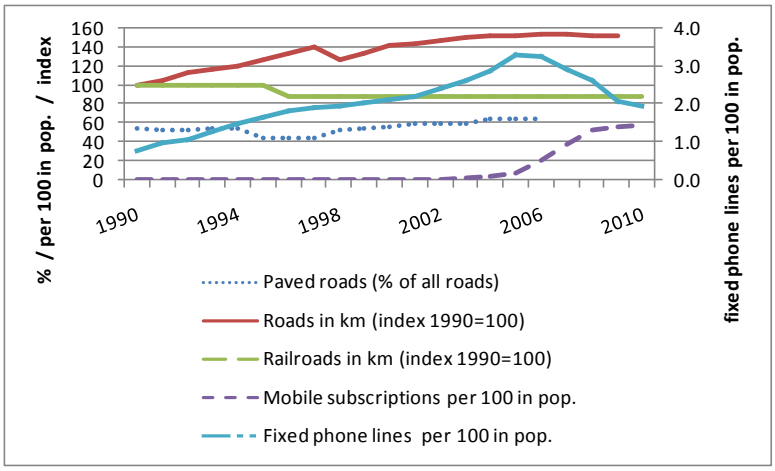


Figure 2.11. Infrastructure provision



Between 1990 and 2010, as Pakistan's population increased from 112 to 174 million, the annual population growth rate gradually declined (from 2.9 to 1.8 percent), aided by a decline in the total fertility rate (number of births per woman) from 6.0 to 3.4 (Figure 2.12). The population became more urbanized and older: the shares increased for those 15-64 (labor force age) and, by a much smaller number of percentage points, for those aged 65 or above while the shares declined significantly for the 0-14 age group. As a result, the dependency rate (the ratio between the population shares outside and inside labor force age) declined dramatically, from 90 percent in 1990 to 66 percent in 2010 (Figure 2.13), signaling that Pakistan enjoyed a demographic dividend.

Figure 2.12. Population: total, growth, and fertility rate

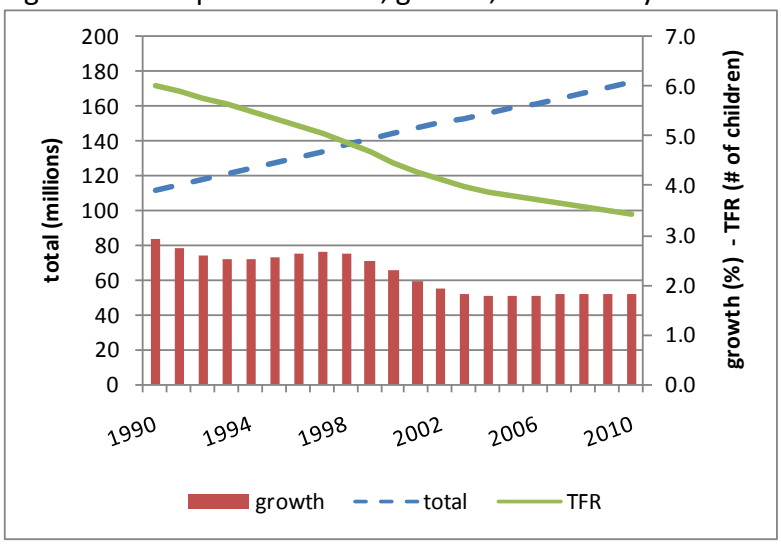
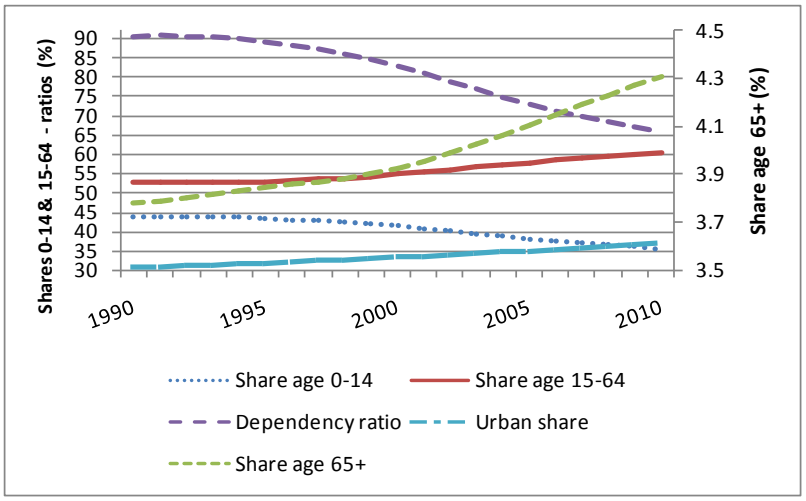
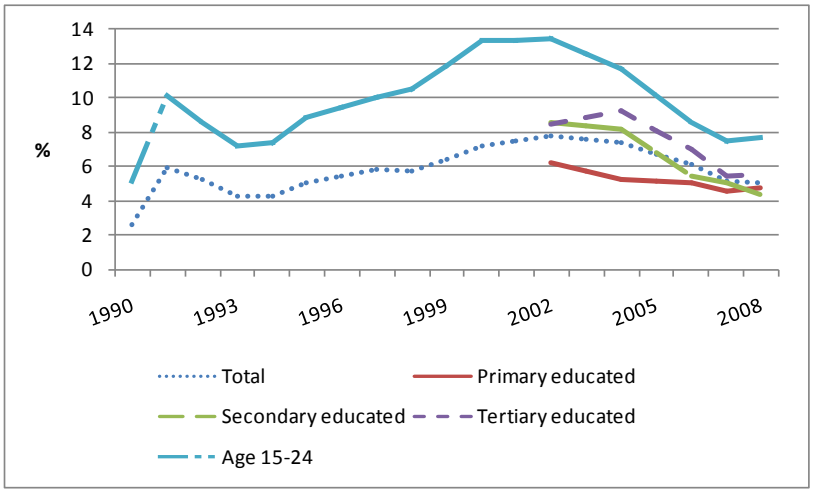


Figure 2.13. Population shares (age, location, dependency)



Unemployment data are of dubious quality in countries like Pakistan with substantial employment in subsistence agriculture and other informal sectors. Nevertheless, available data, summarized in Figure 2.14, suggest that the total unemployment rate increased in most years during the period 1990-2005, after which it declined up to 2008, ending up with a net increase for the full period. Throughout the full period, the youth (15-24) unemployment rate was considerably higher than the total rate. A more limited time series for unemployment rates by level of education suggests that, between 2005 and 2008, these rates converged after initially having been higher for the more educated.

Figure 2.14 Unemployment (total, by education, youth)

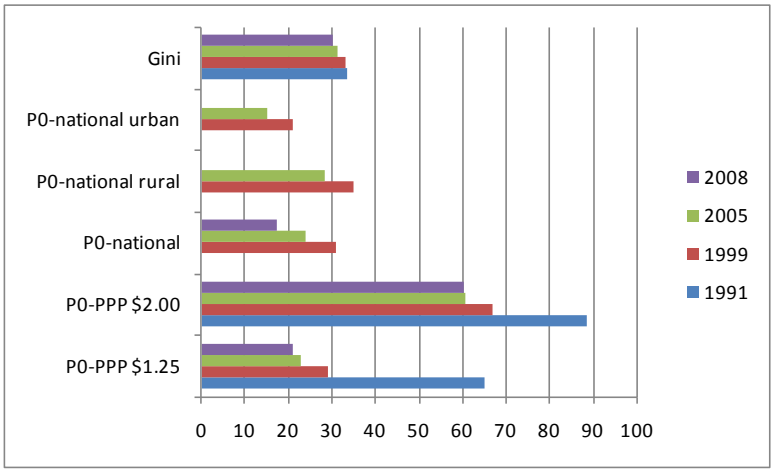


Between 1990 and 2008, Pakistan raised the share of the total population that was employed by 15.3 percent, from 27.7 to 32.0 percent. This suggests that the country managed to benefit from the above-noted demographic dividend (from a higher population share in labor force age). A simple decomposition (see Table A2.1) attributes this increase to the following factors: 84.0 percent to the change in the population age structure; 32.3 percent to an increased labor force participation rate; and -16.3 percent to the change in the (un)employment rate. In sum,

both demography and labor force participation have contributed strongly to the share of the total population that is employed, while the increase in the unemployment rate significantly reduced the gain.

Welfare is a multi-faceted concept. As noted above, real household consumption per capita increased substantially between 1990 and 2010, growing at an average annual rate of 2.1 percent. The different MDGs provide a complementary set of welfare indicators. Multiple measures are available for headcount poverty (Figure 2.15) all of which have declined since 1990, at the same time as the Gini coefficient, which initially was low according to initial standards, declined further.

Figure 2.15. Headcount poverty and inequality



For most other MDGs, Pakistan has also registered progress (Figure 2.16): the population shares of the population that die before reaching five years of age, or lack access to improved water and sanitation have both declined. Life expectancy at birth is an additional broad measure of well-being that reflects many influences, including quantity and quality of different types of goods and services that are used by the population – food, housing, health, education, and physical security – provided either by the private or government sectors: for Pakistan, life expectancy increased at a slow but steady pace during the last two decades, from 61 years in 1990 to 65 years in 2010.

Also in the area of education (Figure 2.17), Pakistan's performance has improved, at least during the last decade for which more data is available: the enrollment rates for the three main levels of education have gone up and, for primary education, the gross completion rate has also increased. Literacy, a basic learning indicator, has also increased both for the general population (aged 15 and above) and for those aged 15-24. However, it is still far from universal even among the latter group, something that does not bode well for Pakistan's prospects in the global knowledge economy.

Figure 2.16. Non-poverty MDG indicators and life expectancy

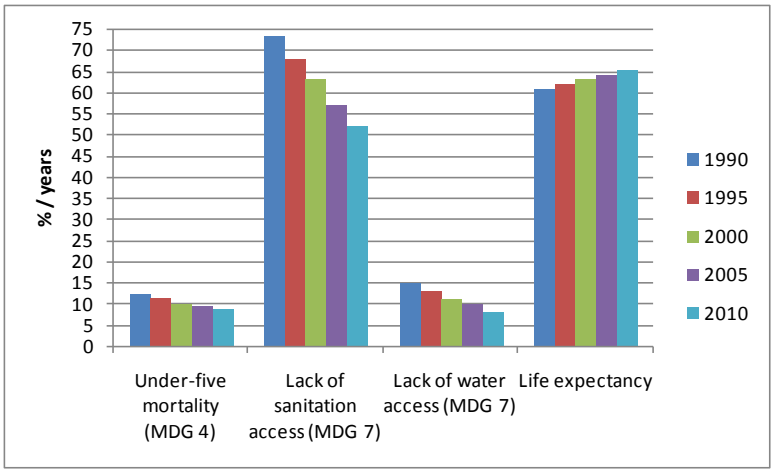
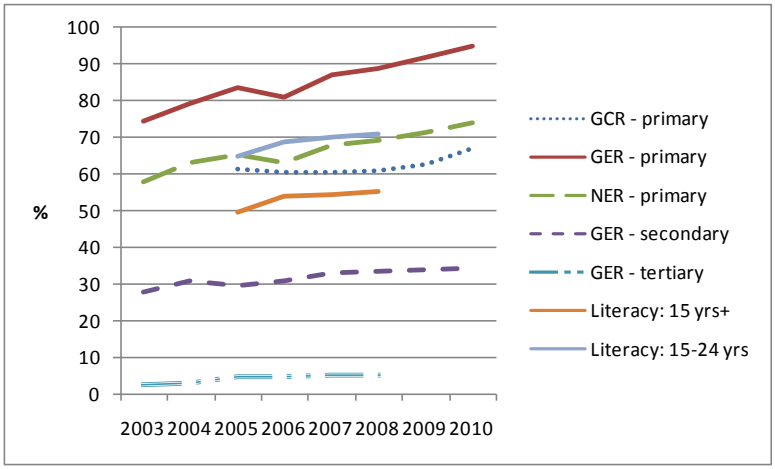


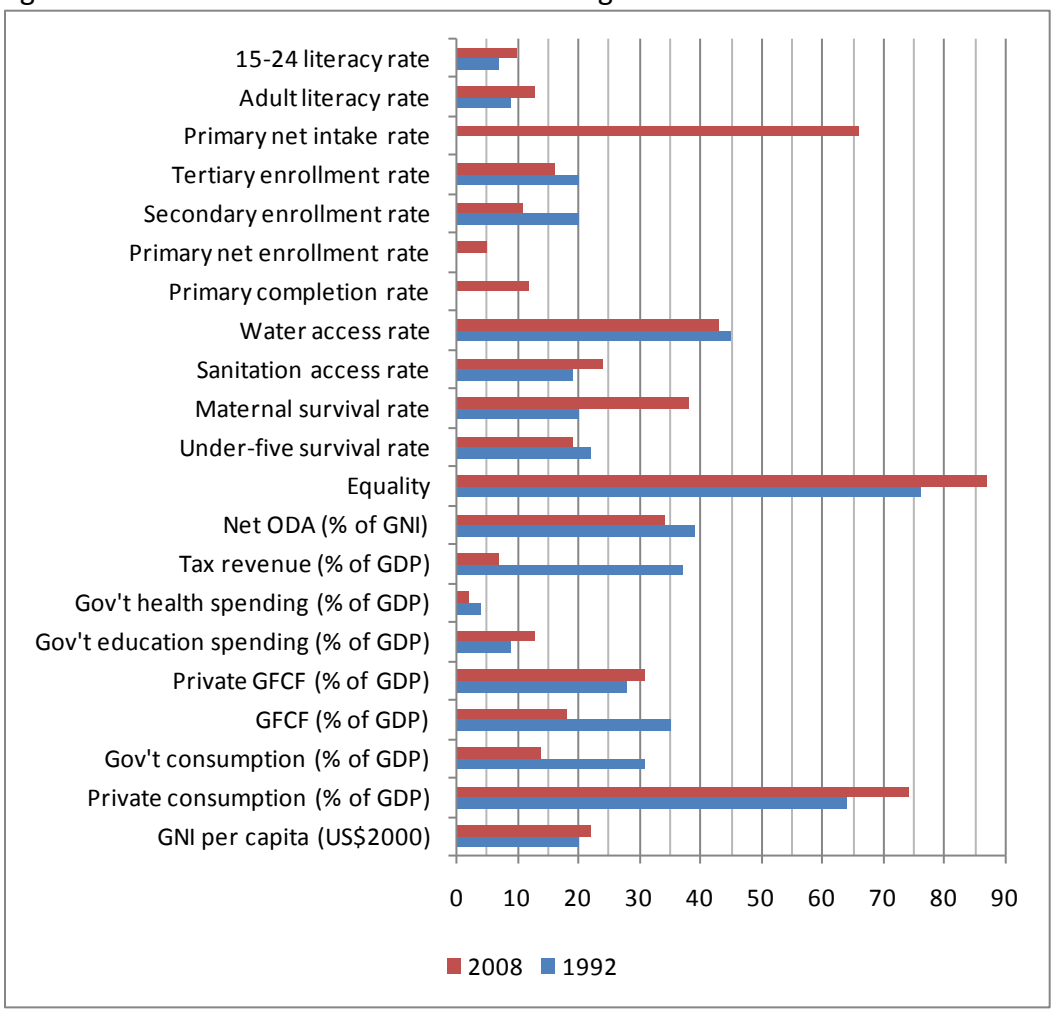
Figure 2.17. Education indicators



Instead of looking at Pakistan's progress on its own, it may be measured by the extent to which the country has made more or less progress than other countries in a similar situation. Figure 2.18 sheds some light on the latter issue: it compares Pakistan's percentile rank in 1992 and 2008 (or for adjacent years with data if data for 1992 or 2008 is missing) in the universe of all countries with data available, covering indicators that are related to development objectives (10 indicators) and economic structure (8 indicators). The number of country observations is above 100 for most indicators and only in a few instances below 50. Development indicators have been defined so that, to the extent that they refer to an objective, a higher value is desirable – for example, rather than referring to the under-five *mortality* rate, we refer to the under-five *survival* rate. Among the 10 objectives, Pakistan's ranking has improved for 6 and deteriorated for 4; the gains are particularly strong (5 percentiles or more) for equality, maternal survival, and sanitation access. The rankings for GNI per capita, adult and youth literacy also improved. On the negative side, Pakistan's ranking has declined for secondary and tertiary enrollment rates, water access, and under-five survival, with the strongest decline for the secondary enrollment rate. Among the structural indicators, all measured by GDP shares, the country's rankings have increased for private consumption, private investment, and

government education spending, most strongly for private consumption. The structural rankings declined for government consumption, total gross fixed capital formation (sum of private and government), government health spending, and tax revenue. Among all structural percentile ranking changes, the strongest is the loss of 30 points for tax revenue. In sum, this global comparison suggests that Pakistan's progress for different objectives is quite similar to other countries at its level of development. Compared to other countries, the striking structural change deviation for Pakistan is a decline in tax revenues, matched by a less dramatic decline in the role of government final demands compared to private final demands (both consumption and investment; cf. Figure 2.4).

Figure 2.18. Percentile rank for Pakistan among all countries -- selected indicators



Note: Percentile rank is defined as the % of all countries with data that fall below Pakistan's value. Data is for averages around the central years 1992 and 2008 (averages of central year ± 2 years if multiple observations are available). Indicators for which a high value is undesirable have been redefined so that a high value is desirable (e.g. mortality rate changed to survival rate).

In sum, this brief review of Pakistan's economic and social development indicates that, across a wide range of indicators, Pakistan has made considerable progress if its current state is compared the situation in 1990. From a cross-country perspective, Pakistan's pace of progress is quite similar to that of other countries at a similar level of development. The main distinguishing features of Pakistan's evolution relative to that of other countries are a diminished role for the government, represented by a reduced GDP share for tax revenues as well as related reductions in the GDP shares of government final demands and increases in the shares of private final demands.

3. MODEL STRUCTURE AND DATABASE

MAMS is a dynamic Computable General Equilibrium (CGE) model designed for country-level analysis of medium- and long-run development policies, including strategies for reducing poverty and achieving the Millennium Development Goals (MDGs). Like other CGE models, MAMS provides a comprehensive picture of the economy drawing on basic features of standard economics. Key decisions of private domestic actors are driven by optimization – producers maximize profits and households utility. The decisions of the government and the rest of the world follow explicit rules, influencing and in some instances overruling market mechanisms (for example by fixing prices). As a result of their interactions in markets, demanding and supplying goods, services and factors, payments are made by demanders to suppliers. In addition to market transactions, different entities may make transfers payments and pay taxes. Consistency is a hallmark feature of the modeled economy (and the real world): budget constraints are imposed on producers, households, the government and the interactions of the country with the rest of the world (appearing in the balance of payments) are subject to budget constraints, reflected in that spending and receipts have to be equal; in markets, quantities supplied and demanded are also equal, an outcome that typically but not necessarily is achieved via flexible prices.

Compared to other CGE models, MAMS is distinguished by its coverage of human development, including MDGs, education and its link to the labor force and its educational make-up, as well as the interaction of human development with other aspects of economic policy and performance. In MAMS, government spending is disaggregated by function, singling out spending on education (disaggregated by level), health, and infrastructure, and other areas. Government financing is disaggregated into different types of taxes, domestic and foreign borrowing, and foreign grant aid. MAMS generates a wide range of measure of economic performance including the evolution of

- macro indicators: private and government consumption and investment, exports, imports, GDP and absorption; [4] the government budget, the balance of payments; the

[4] Absorption is defined as total domestic final demand, i.e. the sum of household and government consumption and investment. Starting from the 1993 revision of the System of National Accounts (SNA), absorption is referred to as "gross national expenditure" although the latter term does not yet seem to be widely used.

savings-investment balance; total factor productivity; and domestic and foreign debt stocks;
- the sectoral structure of production, employment, incomes, and trade;
- the labor market: unemployment; and the educational composition of the labor force; and
- poverty and selected other MDG indicators.

This section provides a non-technical summary of MAMS, split into two modules – core, and MDG and education – and its Pakistani database, developed for this application.[5]

Core module

Figure 3.1 summarizes the payment flows that are captured in MAMS, including its application to Pakistan, in an individual simulation year. Drawing on this figure, we will explain the main features of the model. Most of the features of the figure – boxes, markets and payment flows -- are further disaggregated; we present the current disaggregation later in this section.

Activities produce, selling their output at home or abroad, and use their revenues to cover their costs (of intermediate inputs, factors, and taxes). Their decisions to pursue particular activities and employ factors are driven by profit maximization. The shares exported and sold domestically depend on the relative prices of their outputs in world and domestic markets.

MAMS includes three core institutions: households, government, and the rest of the world. Households earn incomes from factors, transfers and interest from the government (with the interest due to loans from the households to the government), and transfers from the rest of the world, net of interest on household foreign debt.[6] These are used for direct taxes, savings, and consumption. The savings share depends on per-capita incomes. Their consumption decisions change in response to income and price changes. By construction (and as required by the household budget constraints), the consumption value of the households equals their income net of direct taxes and savings.

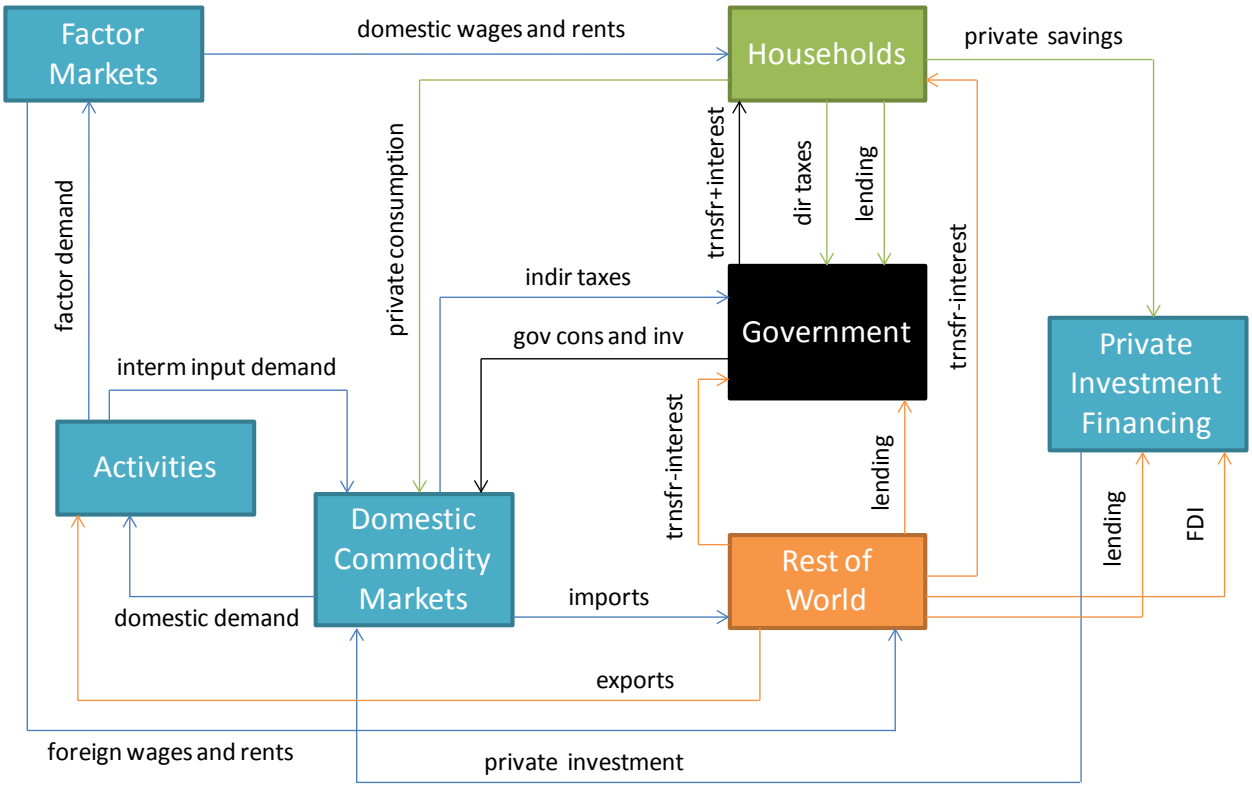
The government gets its receipts from taxes, transfers from abroad, and domestic and foreign borrowing; it uses these for consumption, transfers to households, and investments (providing the capital stocks required for activities producing government services). To remain within its budget constraint, it either adjusts some part(s) of its spending on the basis of available receipts or mobilizes additional receipts of one or more types in order to finance its spending plans.

The rest of the world (which appears in the balance of payments) sends foreign currency to Pakistan in the form of transfers to government and households (net of interest payments on

[5] For a detailed presentation of MAMS, see Lofgren et al. (2012).
[6] The household may lend to the government and borrow from the rest of the world; if it does, it receives interest payments from the government and makes interest payments to the rest of the world.

their foreign debts), FDI, loans, and export payments. Pakistan uses these inflows to finance its imports. The balance of payments clears (inflows and outflows are equalized) via adjustments in the real exchange rate (the ratio between the international and domestic price levels) which take place when the balance of payments is in surplus or deficit.[7]

Figure 3.1. Aggregate payment flows in MAMS



Private investment financing is provided from domestic private savings (net of lending to the government) and foreign direct investment (FDI). For the domestic component, either private savings must adjust to private investment (which, if so, follows some other rule, for example being fixed as a share of GDP or absorption; a case of investment-driven savings) or vice versa (a case of savings-driven investment).

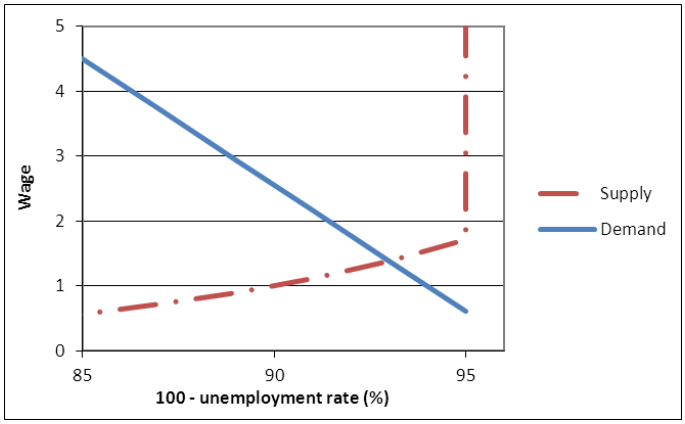
In domestic commodity markets, flexible prices ensure balance between demands for domestic output from domestic demanders and supplies to the domestic market from domestic

[7] For example, starting from a balanced situation, a balance of payments surplus could arise from increases in foreign exchange receipts (perhaps due to an increase in foreign aid or the world price of an export). In response, the exchange rate (expressed in Pakistani rupees per unit of foreign currency) would decline, reducing the rupee price of exports and imports relative to domestic outputs in the same sectors, i.e. an appreciation of the real exchange rate. Such a relative price change would encourage domestic producers to switch part of their outputs from exports to domestic sales and induce domestic demanders to switch part of their demands from domestic sources to imports. This process would continue until the balance of payments surplus is eliminated. The opposite would happen in the case of a balance of payments deficit.

producers. Domestic demanders decide on the shares of imports and domestic production in their demands on the basis of the relative prices of commodities from these two sources. Similarly, as already noted, domestic suppliers (the activities) decide on the shares for exports and domestic supplies on the basis of the relative prices received in these two markets. Import demanders and export suppliers face exogenous world prices – Pakistan is viewed as a small country in world markets without any impact on the international prices that it faces.

Factor markets reach balance between demands and supplies via wage (or rent) adjustments. Across all factors, the factor demand curves are downward-sloping, reflecting the responses of production activities to changes in factor wages. On the supply side of the labor market, unemployment is endogenous – the model includes a wage curve (a supply curve) that is upward-sloping until full employment is reached, at which point it becomes vertical (see Figure 3.2; its wage curve assumes a minimum unemployment rate of 5%). Unemployment is defined more broadly than in official statistics to include un- and under-employment. In the simulations, a broad definition of unemployment increases the scope for the existing labor force to generate a larger (smaller) amount of effective labor if the incentives to work were to improve (deteriorate) without any change in the labor-force participation rate. Such a broad definition of unemployment is clearly appropriate for Pakistan where the low official unemployment hides considerable underutilization of labor (IMF 2012, p. 9). For non-labor factors, the supply curves are typically vertical.

Figure 3.2. Labor market specification



The above discussion did not refer to the evolution of the economy over time. In MAMS, the modeled economy grows over time due to accumulation of capital (determined by investment and depreciation), labor (determined by demography and the educational system), and other factors (following exogenous growth trends), as well as because of improvements in TFP. Apart from an exogenous component, TFP depends on the levels of government capital stocks and, to a lesser extent, an economic openness measured by the ratio between total trade (the sum of exports and imports) and GDP. In the context of factor markets, these developments lead to rightward shifts in both demand and supply curves.

MDG and education module

MAMS includes a set of HD (MDG and education) indicators. A built-in poverty module computes the three standard Foster-Green-Thorbecke poverty indicators (headcount poverty, poverty gap, and severity of poverty) on the basis of the assumption that, for the household types in the database (or for aggregations of these household types, per-capita consumption follows a lognormal distribution parameterized on the basis of an initial headcount poverty rate and an additional parameter (standard deviation, Gini coefficient, or initial poverty elasticity).[8]

A different treatment is used for other MDG and education indicators: MDGs 4 (under-five mortality), 7w (improved water access), 7s (improved sanitation access); net intake rate to first grade of primary, promotion rate to next grade (one rate for each of the three education cycles), and continuation into next cycle (the share of those who are promoted from the last grade who continue to next cycle; for primary and secondary). For these indicators, a two-level formulation is used. At the bottom level, an intermediate variable specific to each indicator is expressed as a CE function of a set of determinants, summarized in Table 3.1 and extracted from the literature on determinants of these outcomes.

Table 3.1. Determinants of selected MDG outcomes

MDG	Service delivery	Household consumption per capita	Wage incentives	Public infra-structure	Other MDGs
2. Primary education	x	x	x	x	4
4. Under-five mortality	x	x		x	7w, 7s
7w. Access to safe water	x	x		x	
7s. Access to basic sanitation	x	x		x	

Note: Service delivery refers to services in the relevant area (primary education, health, water, or sanitation).

At the top level, each MDG and education indicator is a logistic function of its intermediate variable. The parameters of these two-level functions are calibrated to replicate data on projected progress for the top-level indicators under the *base* scenario, with upper or lower limits imposed on the basis of logic or cross-country experience (e.g. the net intake rate has an upper limit of 100 percent; the under-five mortality rates cannot fall below some low positive value). As shown in Table 3.1, the determinants include the supply of services by government or private sector (measured per student for each cycle of education and per-capita for health), the stocks of different types of relevant government infrastructure (energy and other), real household consumption per-capita (an indicator of the ability of households to make purchases in support of stronger MDG and education outcomes), and other MDG indicators (to reflect the fact that progress for one MDG may have a positive impact on other MDGs). A wage incentive

[8] It is widely accepted that the lognormal provides a good approximation for within-country income and consumption distributions even though it may fail to account for phenomena such as consumption smoothing (Easterly 2007, pp. 5-6; Lopez and Servén 2006, p. 2).

indicator is a determinant specific to education; it is expressed as the ratio between the wages for labor at the next higher and current levels of education for the student in question (an indicator of payoff from continued education). MDG 2 – the objective of making sure that each child completes primary education -- is measured by the net (on-time) primary completion rate expressed as a period measure, i.e. the share of the population that enters the first primary grade in the relevant year that would graduate on time if the rates of net intake and promotion in the year in question were to prevail throughout their primary cycle (in the case of Pakistan a total of five years).[9] In MAMS, primary education is an integral part of a broader education module tracks base-year stocks of students and new entrants through the different grades of the three cycles (primary, secondary, and tertiary). In each year, students will successfully complete their grade, repeat it, or drop out of their level. A share of labor-force-age students exiting from the school system enters the labor force in the segment that matches their educational background. Similarly, a share of the non-school population (perhaps drop outs at an earlier age) that each year reaches labor force age enters the labor force, typically in its least educated segment.

Database

The database for the MAMS application to Pakistan consists of an extensive data set for the simulation base-year – a social accounting matrix (SAM);[10] stocks for production factors (including different types of labor and capital), population, and school enrollment; indicators for selected MDGs and the educational system – as well as a set of elasticities (for production, consumption, trade, and human development relationships), and projections into the future (for growth in GDP at factor cost and the evolution of disaggregated MDG and education

[9] More specifically, the net completion rate is defined as net completion rate expressed as a period measure, i.e. the share of the population that enters the first primary grade in the current year that would graduate on time given the current rates of net entry (neting1) and promotion (prom), i.e. the measure uses current rates assuming that the rate of promotion of the current year prevails throughout their primary cycle (for Pakistan the current year and four more years). Mathematically, $NPCR_t = NIR_t \cdot (PR_t)^y$ where *NPCR* = net primary completion rate; *NIR* = net intake rate ($0 \leq NIR \leq 1$); *PR* = promotion rate ($0 \leq PR \leq 1$); and *y* = number of grades in the primary cycle. As a simplification, MAMS assumes a uniform *PR* for all primary grades. Compared to alternative indicators, the gross completion rate or the gross or net enrollment rates, the net completion rate provides a better measure of the performance of primary education in terms of ensuring completion of the full cycle for each child. Gross completion rates (the total number of students completing primary education, irrespective of age, as a share of the total population in the theoretical graduation age) may reach above 100 percent at the same time as far from all children manage to complete the full primary cycle; enrollment rates do not provide information about completion of the cycle.

[10] A SAM is a square matrix with identical row and column accounts, providing a comprehensive representation of payments flows in the economy of a geographical unit (typically a country) during a period of time (typically one year). Cell entries represent payments from its column account to its row account. In a SAM without errors, row and column totals are equal. SAMs appear with widely varying degrees of disaggregation. The payments flows are expressed in current local currency or some transformation thereof – in Table 3.3, the value of each cell has been transformed into percent of GDP at market prices in the same year. For more on SAMs, see for example Reinert and Roland-Holst (1997) and Round (2003). The detailed Pakistan MAMS SAM for this application is available on request.

indicators and determinants), to which the MAMS baseline simulation is calibrated. (See Appendix 1 for more details.)

The database for the current application was designed in light of data availability and the analytical objective of shedding light on the impact of alternative changes in government spending and taxation on MDGs and other major social and economic indicators. It includes 30 activities and commodities with one-to-one mapping (i.e., one commodity output matches every activity and vice versa), including 5 in agriculture, 6 in industry, and 19 services, 9 of which are provided by the government. Among the 19 services, 9 (5 government and 4 private) are related to human development. The government sectors also include infrastructure services and capital stocks, split into agriculture, energy, and other. The factors of production are split into two types of land (for large and small farms) and different types of labor and capital.

4. SIMULATIONS

BASE

The *base* scenario is designed to represent a plausible, business-as-usual projection for Pakistan's economy for the period up to 2022, responding to the question: what is the likely evolution of Pakistan's economy up to 2022 given it current state and in the absence of major policy changes? It also serves as a benchmark for comparisons with alternative simulations. The simulations start in 2008, the base-year for the SAM and the bulk of the database. In the reports, 2012 is treated as the starting point given the objective of providing comparisons to the current situation and given the forward-looking nature of this analysis.[11] Our presentation of the *base* scenario starts with the key assumptions, followed by an analysis of its simulation results.

Key Assumptions

For the *base* scenario (but, unless otherwise noted, not for the other scenarios), growth in GDP at factor cost is exogenous. Drawing on the current World Bank assessment, for 2013-2016 and 2017-2022, the annual growth rates are set at 4.1 and 4.5 percent, respectively, the latter coinciding with Pakistan's long-term trend growth. This growth exceeds the annual average of 2.8 percent that was observed for 2009-2012. Among other assumptions, it is important to take note of the following:

- Government receipts. Taxes (direct, domestic indirect, and import) and foreign grant aid, all expressed as shares of GDP, evolve on the basis of IMF projections up to 2016

[11] The assumptions and the results for the period 2008-2012 are identical across all simulations. They are focused on the replication of changes for this period (as opposed to year-to-year changes). The solution for 2012 is calibrated to a macro SAM for this year (see Table A2.2), ensuring that the solution for 2012 replicates available macro data and projections. The macro SAM is primarily based on data in IMF (2012).

and stay at the 2016 shares up to 2022.[12] Government domestic and foreign borrowing is defined to keep the domestic and foreign debt/GDP ratios at roughly the observed levels for 2012.

- Government spending and government closure.[13] Each government function requires recurrent (consumption) and capital (investment) spending, set to make sure that growth in real consumption and capital stocks are in balance. For most government final demands (disaggregated by function), the GDP share of spending on consumption or investment (depending on whether the function is service-oriented, dominated by consumption spending, or infrastructure-oriented, dominated by investment spending) is scaled to ensure that total government spending stays within the limits of fiscal space. The only exception among government final demands is for education since it is important that service growth rates at each level be sensitive to differences in enrollment growth between levels; drawing on cross-country evidence, educational quality (the quantity of real services per student) at each level is set to grow at roughly the growth rate of GDP (or absorption) per capita. Among other spending items (i.e., items other than final demands), the main subsidy, on electricity (in the database represented by the "energy and heat" sector) and domestic transfer payments both remain at the 2012 GDP shares (1.5 and 4.5 percent, respectively) throughout the simulation period.
- In the savings-investment balance, domestically financed private investment is exogenous as a share of GDP at the 2012 level. The balance clears via adjustments in household savings rates for the two household types with the highest savings rates (non-farm non-poor rural households and urban non-poor households).[14]
- In the balance of payments, FDI and net receipts of private transfers from abroad (including "worker remittances") are both fixed as shares of GDP. Private net foreign borrowing (which is small) is set to maintain a roughly unchanged ratio between private foreign debt and GDP. The balance clears via adjustments in the real exchange rate, which influences the trade balance (as described in above Section 3).

Key results for the *base* and other scenarios are summarized and compared in Tables 4.1-4.4 and Figures 4.1-4.4. (Additional results are shown in Appendix Tables A2.3-A2.4.) Macro results are found in Table 4.1. GDP at factor cost grows at an average annual rate of 4.3 percent out of which 1.5 percent is due to TFP growth) while the growth rates for most other national account aggregates are quite similar, in the range of 4-6 percent. If viewed from a per-capita perspective, growth rates should be lowered on the basis of an annual population rate of 1.9 percent. The real exchange rate is roughly unchanged. Growth is sufficient to reduce the

[12] The GDP shares are generated via endogenous and uniform scaling of the disaggregated tax rates that are implicit in the 2008 SAM.

[13] The term "closure" refers to the rule on the basis of which an account is balanced. In MAMS, alternative options are available for the government and rest-of-world balances (i.e., the government budget, and the balance of payments, respectively).

[14] Among the other savings and investment categories, FDI (which may be viewed as a type of savings from abroad earmarked for private investment) is automatically translated into investment whereas government investment is financed as part of the government budget.

unemployment rate to 12.6 percent, starting from a 2012 rate of 15.7 percent (defined to account not only for open unemployment but also for underemployment). Both foreign and domestic government debts grow at rates that leave the debt-to-GDP ratios with little change.

Table 4.2 compares the government budgets (expressed as percent of GDP) in 2012 and 2022. By construction and intention, the changes are minor. The most important change in 2022 compared to 2012 is an increase in the GDP share of taxes by around 3.5 percent of GDP partly countered by a decline in domestic borrowing (by 2.4 percent of GDP). After accounting for other smaller changes, total government receipts increase by around 1.4 percent of GDP. On the spending side, consumption increases more than investment. In terms of functions, the GDP shares on human development and other government increase while the infrastructure share is virtually unchanged. Among the two other major macro balances, the main changes in the savings-investment balance (also expressed as percent of GDP) are increased government savings (from -2.9 to -0.5 percent of GDP) and a matching decrease in private savings, in effect a displacement of private savings by government savings in a setting with unchanged government and private investment and only a smaller change in foreign savings. The changes in the balance of payments are minor; the most noticeable change is an increase in profit remittances, driven by a gradual build of foreign-owned capital. (See Tables A2.3 and A2.4 for macro and balance of payments data, respectively.)

The annual growth rates for aggregate sectors are also quite uniform, in the range of 4-5 percent (Table 4.3). In terms of ranking, the highest growth rates are for government services (for which government demands are supplemented by household demands), followed by private services and industry, with the lowest growth rate for agriculture. Among the more disaggregated government sectors, most growth rates are at 3-6 percent; the only exception is tertiary education, for which growth is driven by quality improvements and growing number of graduates from the secondary level.

Finally, MDG and education indicators improve across the board (Table 4.4). For headcount poverty, this reflects the impact of the disaggregated pattern of growth in real per-capita household consumption. For the education indicators and the non-poverty MDGs, the improvements are the result of increased real services, in education measured per student (referred to as “quality improvement”) and elsewhere per capita, provided by the government and the private sector, complemented by reinforcing positive developments for other determinants: growth in real household consumption per capita and in different government infrastructure capital stocks.

Table 4.1. Real macro indicators by simulation (% annual growth 2013-2022)

	2012	base	inv-og	inv-tx	inv-sb	trn-og	inv-og-	inv-og+	inv-tx-	inv-tx+	inv-ogsb+	hi-grw
Absorption	12,273.1	4.2	4.4	4.3	4.3	4.3	4.0	4.8	3.9	4.7	5.0	6.7
Consumption - private	9,885.2	4.0	4.2	3.9	3.9	4.2	3.8	4.6	3.5	4.2	4.5	6.1
Consumption - government	783.4	6.0	3.8	6.2	6.1	3.6	3.8	3.8	6.2	6.2	4.0	6.2
Fixed investment - private	1,179.8	4.5	4.9	4.0	4.4	4.8	4.0	5.7	3.1	4.9	5.6	9.5
Fixed investment - government	424.7	5.0	9.0	9.4	8.6	4.4	8.4	9.6	9.4	9.5	12.4	11.6
Exports	1,494.9	4.6	5.0	4.5	4.7	4.8	4.5	5.6	3.9	5.1	5.7	8.5
Imports	2,313.9	4.1	4.4	4.0	4.1	4.2	4.0	4.8	3.6	4.4	4.8	6.8
GDP at factor cost	10,858.4	4.3	4.5	4.4	4.4	4.3	4.1	5.0	3.9	4.8	5.1	7.0
Total factor productivity (index)		1.5	1.5	1.5	1.5	1.5	1.3	1.7	1.2	1.7	1.7	3.1
GNDI per capita	0.1	2.2	2.4	2.3	2.3	2.2	2.0	2.8	1.9	2.6	2.9	4.7
Real exchange rate (index)		0.0	0.0	0.1	0.0	-0.1	-0.1	0.1	0.0	0.2	0.2	0.1
Unemployment rate (%)	15.7	12.6	11.7	13.8	13.2	12.0	13.4	10.2	15.7	11.9	10.6	5.0
Foreign government debt	25.7	25.4	25.1	25.5	25.3	25.3	25.9	24.3	26.3	24.7	24.2	20.2
Domestic government debt	35.6	36.2	35.5	36.0	35.8	36.2	37.0	34.0	37.6	34.5	33.5	31.5

Note:

1. Unless otherwise noted, column for 2012 shows data in 2008 rupees.

2. For unemployment, the 2012 and simulation columns show the 2012 rate and simulation-specific 2022 rates, respectively.

Table 4.2. Government receipts and spending in 2012 and by simulation in 2022 (% of nominal GDP)

			2022										
Indicator		**2012**	**base**	**inv-og**	**inv-tx**	**inv-sb**	**trn-og**	**inv-og-**	**inv-og+**	**inv-tx-**	**inv-tx+**	**inv-ogsb+**	**hi-grw**
Receipts	**Direct taxes**	3.5	4.7	4.7	5.5	4.6	4.8	4.7	4.7	5.7	5.4	4.6	4.8
	Import tariffs	1.0	1.3	1.4	1.3	1.3	1.3	1.4	1.4	1.3	1.3	1.4	1.4
	Other indirect taxes	4.2	6.1	6.2	7.5	7.6	6.1	6.1	6.2	7.7	7.3	7.7	6.3
	Foreign transfers	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.3	0.3
	Factor income	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Domestic borrowing	5.8	3.3	3.3	3.3	3.3	3.3	3.4	3.3	3.4	3.3	3.2	3.6
	Foreign borrowing	0.9	1.1	1.0	1.1	1.1	1.1	1.1	1.0	1.1	1.0	1.0	0.8
	Total	15.9	17.3	17.3	19.5	18.7	17.4	17.4	17.3	20.0	19.0	18.7	17.6
Spen-	**Consumption**	6.8	8.0	6.4	8.2	8.1	6.3	6.6	6.2	8.5	7.9	6.3	6.8
ding*	**Fixed investment**	3.7	3.9	5.6	5.9	5.3	3.7	5.4	5.7	6.1	5.8	7.1	5.6
	Human development	3.2	3.8	3.7	3.8	3.7	3.8	3.8	3.6	3.9	3.6	3.6	3.1
	Infrastructure	2.5	2.5	4.5	4.6	4.0	2.5	4.4	4.7	4.8	4.5	6.1	4.4
	Other consumption+investment	4.9	5.7	3.7	5.7	5.6	3.8	3.8	3.7	5.9	5.6	3.6	4.9
	Domestic transfers	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	4.5	4.5	4.5	4.5
	Domestic interest payments	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Foreign interest payments	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6
	Total	15.9	17.3	17.3	19.5	18.7	17.4	17.4	17.3	20.0	19.0	18.7	17.6

*Government final demands may be split into (a) consumption and fixed investment; or (b) by function (here broadly into human development, infrastructure and other.

Table 4.3. Real GDP at factor cost for aggregate sectors -- annual growth 2013-2022 (%)

	base	inv-og	inv-tx	inv-sb	trn-og	inv-og-	inv-og+	inv-tx-	inv-tx+	inv-ogsb+	hi-grw
Agriculture	3.9	4.2	4.0	4.1	4.1	3.8	4.7	3.5	4.5	4.9	6.4
Industry	4.1	4.5	4.2	4.1	4.3	4.0	4.9	3.8	4.7	4.9	6.8
Services	4.6	4.7	4.6	4.6	4.5	4.3	5.1	4.2	5.0	5.2	7.3
Private	4.5	4.7	4.5	4.5	4.5	4.3	5.1	4.0	4.9	5.2	7.3
Government*	5.7	4.4	5.9	5.8	4.2	4.3	4.5	5.8	6.0	4.7	6.6
Primary education	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Secondary education	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
Tertiary education	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Health	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Water-sanitation	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
Agriculture infrastructure	4.8	7.7	7.7	7.4	4.8	7.4	8.0	7.7	7.7	10.1	8.1
Energy infrastructure	4.8	7.8	7.8	7.5	4.8	7.5	8.0	7.8	7.8	10.2	8.1
Other infrastructure	4.3	7.3	7.3	7.0	4.3	7.0	7.5	7.3	7.3	9.7	7.6
Other	5.2	2.9	5.3	5.2	2.8	2.7	3.1	5.1	5.4	3.1	6.4
Total	4.3	4.5	4.4	4.4	4.3	4.1	5.0	3.9	4.8	5.1	7.0

*Government services may be demanded both by government and non-government.

Table 4.4. MDG and education indicators in 2012 and by simulation in 2022

	2012	base	inv-og	inv-tx	inv-sb	trn-og	inv-og-	inv-og+	inv-tx-	inv-tx+	inv-ogsb+	hi-grw
MDG 1: Headcount poverty (%)	15.0	8.6	7.9	9.0	8.5	7.4	9.1	6.7	10.8	7.6	6.7	3.1
MDG 2: Primary net completion rate (%)	48.0	59.5	62.3	61.7	61.6	59.9	61.4	63.3	60.9	62.5	65.0	66.7
MDG 4: Under-five mortality rate (‰)	85.5	74.8	72.4	73.1	73.2	74.3	73.3	71.6	73.9	72.3	70.4	68.6
MDG 7: Water access (%)	93.2	96.9	97.5	97.4	97.3	97.0	97.3	97.7	97.2	97.5	98.0	98.3
MDG 7: Sanitation access (%)	49.5	57.4	59.2	58.7	58.7	57.7	58.6	59.8	58.2	59.3	60.9	62.2
GER* -- Primary (%)	90.9	94.0	94.8	94.7	94.6	94.1	94.6	95.1	94.4	94.9	95.6	96.0
GER -- Secondary (%)	41.2	54.6	55.6	55.3	55.3	54.7	55.2	55.9	55.0	55.6	56.6	57.1
GER -- Tertiary (%)	6.7	14.7	15.0	14.9	14.9	14.8	14.9	15.1	14.9	15.0	15.3	15.5
GCR** -- Primary (%)	81.9	82.4	83.7	83.4	83.4	82.6	83.3	84.1	83.1	83.8	84.9	85.5
GCR -- Secondary (%)	27.2	38.7	39.2	39.1	39.1	38.8	39.0	39.4	38.9	39.2	39.8	40.1
GCR -- Tertiary (%)	3.6	9.4	9.6	9.5	9.5	9.4	9.5	9.7	9.5	9.6	9.8	9.9
Gini	0.329	0.347	0.347	0.344	0.345	0.344	0.348	0.345	0.344	0.343	0.344	0.345

*GER = Gross Enrollment Rate; **GCR = Gross Completion Rate

Figure 4.1. GDP and private consumption: real growth deviations from base

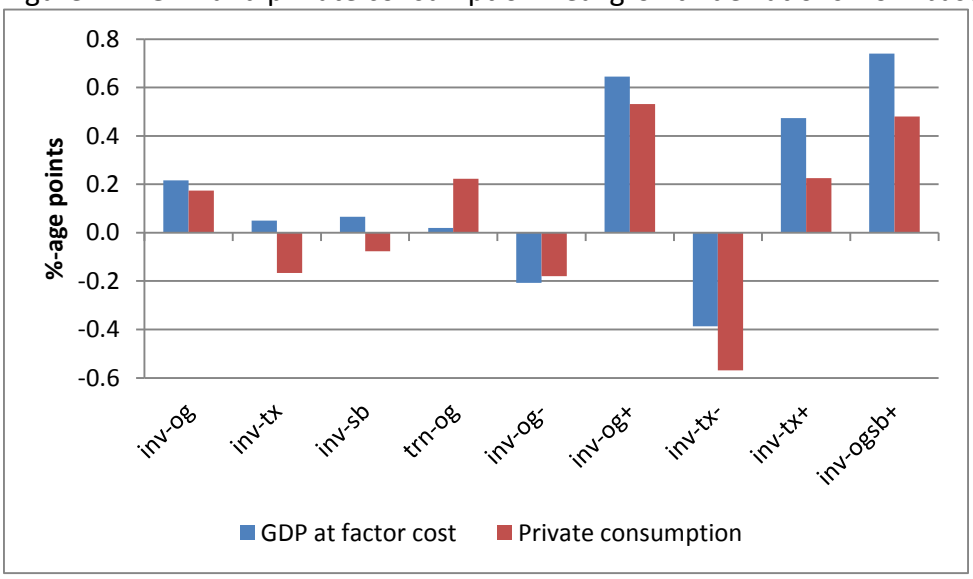


Figure 4.2. Household consumption per capita by: real growth gains from base by year

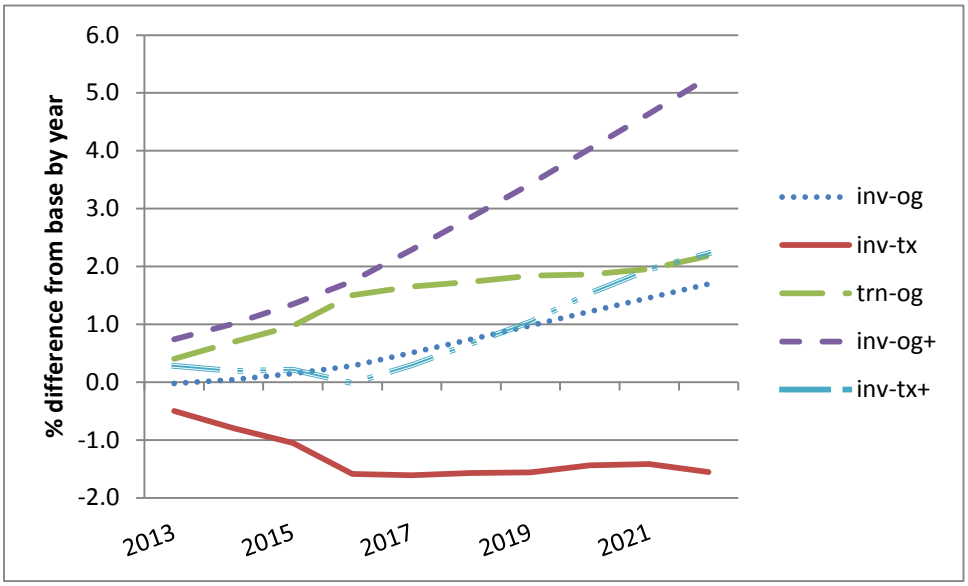


Figure 4.3. Poverty rate in 2012 and by simulation in 2022 (%)

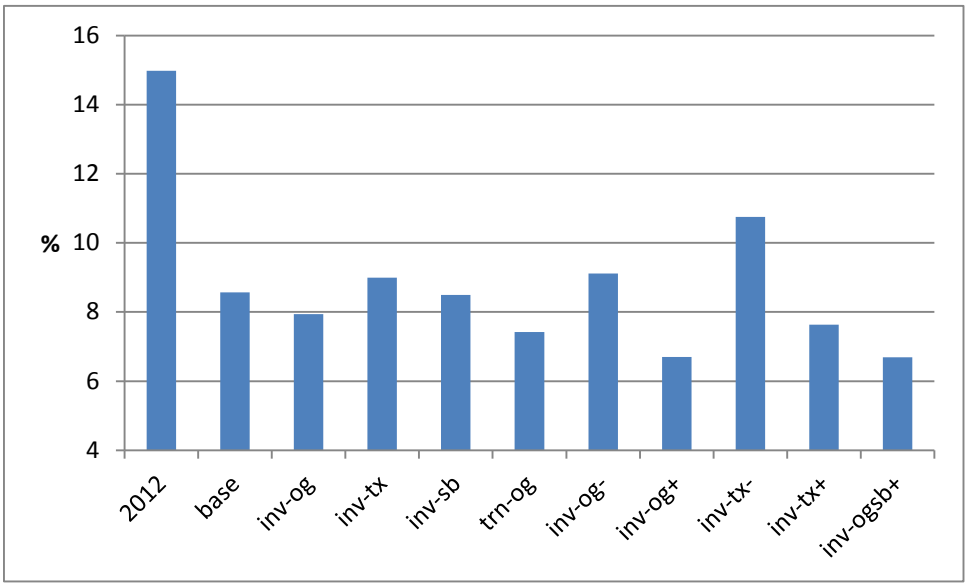
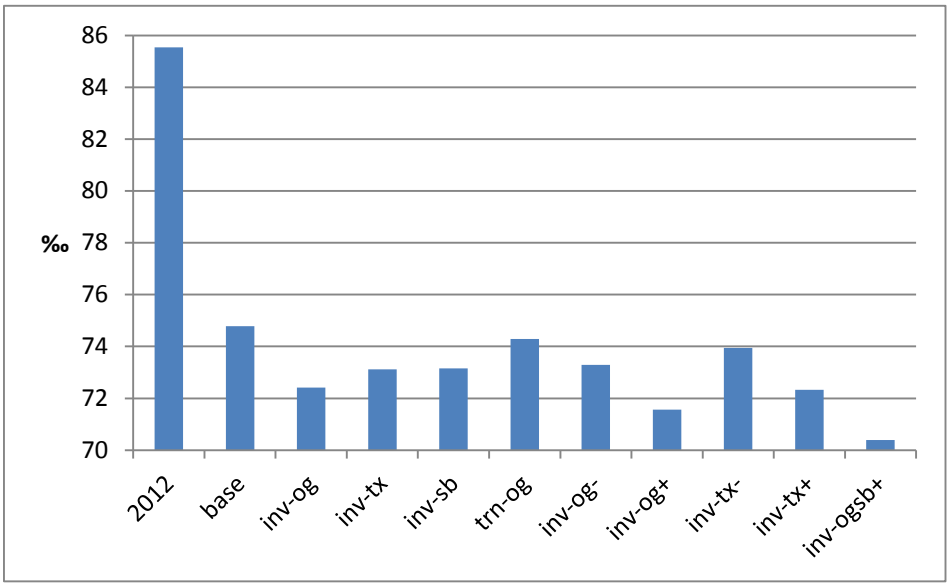


Figure 4.4. Under-five mortality rate in 2012 and by simulation in 2022 (‰)



POLICY SCENARIOS

Table 4.5 defines the policy scenarios, all of which are focused on creating fiscal space for increased government investment in infrastructure. Two basic options exist for creating such space: reducing other types of spending or raising taxes. On the spending side, we consider two alternatives: (a) reduced growth in unproductive government final demands, in this application represented by “other government”, i.e. government consumption and investment in areas without identified benefits; and (b) elimination of electricity subsidies. On the tax side, we test the impact of raising domestic (non-trade) taxes, direct and indirect. We test the sensitivity of

the results to one crucial question: to what extent do additional government investments create capital stocks that contribute to higher productivity? The policy responses are introduced in 2013; i.e., the results for all simulations (*base* and policy scenarios) are the same up to and including 2012. The results for this set of simulations are found next to those of the *base* scenario in Tables 4.1-4.4.[15]

Table 4.5. Definitions of simulation scenarios.

Name	Description
inv-og	75% reduction in growth in other government consumption + fiscal space used for infrastructure investment
inv-tx	same increase in infrastructure investment as inv-og + financing from domestic taxes
inv-sb	elimination of electricity subsidy + fiscal space used for infrastructure investment
trn-og	same reduction in growth for other government as inv-og + fiscal space used for transfers to low-income households
inv-og-	same as inv-og except for 50% decrease in the elasticity of TFP with respect to increase in infrastructure capital stocks over base levels
inv-og+	same as inv-og except for 50% increase in the elasticity of TFP with respect to increase in infrastructure capital stocks over base levels
inv-tx-	same as inv-tx except for 50% decrease in the elasticity of TFP with respect to increase in infrastructure capital stocks over base levels
inv-tx+	same as inv-tx except for 50% increase in the elasticity of TFP with respect to increase in infrastructure capital stocks over base levels
inv-sbog+	same changes in spending policy as inv-og and inv-sb + fiscal space used for infrastructure investment + 50% increase in the elasticity of TFP with respect to increase in infrastructure capital stocks over base levels
hi-grw	high GDP growth driven by increased savings, investment, and TFP growth.

In the first scenario, *inv-og*, the average annual growth rate for other government (the part of government that is not related to human development or infrastructure) is in each year reduced by 75 percent, in rough terms from 3 percent under the *base* to 0.75 percent. One crucial assumption is that the government is able to identify and reduce growth for activities

[15] Apart from the changes that are discussed, the simulations are identical to the *base*. The only exceptions are that, for all non-base scenarios, certain payments are no longer fixed as shares of GDP: domestic government borrowing is fixed in domestic currency (in this case indexed to the CPI) while transfers and borrowing from the rest of the world are fixed in foreign currency; in each case, they are fixed at the levels generated by the base scenario. For the base scenario, working with GDP shares had the advantage of generating plausible values for these indicators. However, when making comparisons between scenarios, it is not reasonable to assume that payments in foreign currency automatically are adjusted in response to changes in the exchange rate or GDP sufficiently to stay unchanged as shares of GDP. Fixing these payments has the additional advantage of leveling the playing field across the different simulations – they are to an identical extent able to rely on payments from the rest of the world and the level of debt is identical at the end of the simulation period.

that, on balance, have zero impact on productivity. The savings are used to scale up investments generating growth for government capital stocks in agriculture, energy, and other areas (including transportation). Drawing on cross-country data, the assumed implicit internal rate of return for these investments is in the range of 12-15 percent.[16] [17] Compared to the *base*, the impact of this policy change is marginal but positive across the reviewed indicators. The annual growth rates for GDP at factor cost, absorption, and private final demands all increase by 0.1 percentage points (Table 4.1). As a result of the shift from other government to infrastructure, government consumption growth decreases while government investment growth increases. The real exchange rate stays roughly the same. Slight decreases are registered for unemployment as well as foreign and domestic government debt stocks as shares of GDP (the combined impact of unchanged borrowing and a higher GDP). The 2022 GDP shares for the different receipts in the government budget are virtually unchanged whereas, on the spending side, around 0.7-0.8 percent of GDP has shifted from other government to infrastructure (Table 4.2). Among aggregate private sectors, sectoral growth rates expand by 0.1-0.2 percentage points while, within the government infrastructure sector, growth expands by 1.4 percentage points at the same time as growth for other government contracts by 1.1 percentage points, all in all reducing government service growth by 0.8 percentage points (Table 4.3). In terms of spending, this decline is matched by an increase in government investment (cf. Table 4.2). These changes lead to across-the-board moderate improvements in human development, a result of the fact that all determinants of poverty reduction and human development (MDG and education indicators) improve (Table 4.4).

What would be the impact if the government decided to embark on the same increase in investment but, instead of reducing growth for unproductive government sectors, decided to generate additional financing via increased (effective) tax rates? The results for the scenario *inv-tx* offer a response to this question. Compared to the *base*, GDP and absorption is virtually unchanged (Table 4.1). Higher taxes reduce growth in private consumption and private investment growth whereas, for the government, consumption and, especially, investment

[16] The computation of the internal rate of return (IRR) mimics what typically is done in cost-benefits analysis. It is computed on the basis of an exogenous total marginal product of each type of capital, a parameter defining the distribution of these output gains (viewed as ceteris paribus TFP gains) across different sectors, simulated value-added (VA) growth for each sector, depreciation rates of government capital stocks, and the value of current (O&M or operations and maintenance) spending per unit of each capital stock (extracted from the SAM). This information is used to generate, for an additional unit of capital (a) a stream of costs represented by an initial investment cost and a stream of O&M costs that decline in proportion to the depreciation of the stock; and (b) a stream of benefits represented by the gains in VA in different sectors, which depend on the growth rates of each sector and the relative increase in its VA due to the productivity gain; the latter will decrease in proportion to the depreciation of the stock. Given this information and assuming that this process proceeds for 100 years (with the full-period simulated average rate of VA growth), we compute an internal rate of return at which the present values of benefits and costs are equal.

[17] Empirical data indicate that internal rate of return (irr) for government investment varies quite widely but that values in the range of 15-20 percent are typical across a wide range of country categories (Foster and Briceño-Garmendia, 2010, p. 71; Estache 2005, p. 13; Prud'homme 2005, p. 161; IMF 2008, p. 20; and World Bank 2007, p. 65). Values at the lower end may be expected for broader aggregates; for example, on the basis of a cross-country analysis for developing countries, Dessus and Herrera (2000, p. 413) generate an average internal rate of return of 14.2 percent for aggregate government capital.

expands. Unemployment increases slightly due to a switch to a less labor-intensive growth path. Relative to GDP, government spending on infrastructure and government investment increase by close to 1 percentage point, an increase that is made possible by an increase in domestic taxes of a similar magnitude (Table 4.2). Real GDP growth rates in the private sector are roughly unchanged while GDP growth for government services increases (Table 4.3). The poverty rate increases slightly while slight improvements are generated for other human development indicators, an outcome that is made possible by the improvements in infrastructure (4.4). Compared to *inv-og*, *inv-tx* leads to weaker outcomes across the board (macro growth, sector growth, and human development), a reflection of the fact that *inv-og* frees up resources for productive use whereas *inv-tx* reallocates resources from one "productive" area (private consumption and investment) to another (government investment).

In addition or as an alternative, the government may finance more investment by reducing electricity subsidies, in the model treated as a negative indirect tax on the heat and energy sector, an option that is captured by the *inv-sb* scenario. This shock is similar to the tax increase in the sense that it redistributes resources from the private sector to the government; it may be more welfare-enhancing since it reduces the distortions in the price system.[18] At the macro level, growth in GDP and absorption increases slightly (by 0.1 percentage point) but only government demands (especially investment) grow more rapidly whereas private demand growth decelerates slightly (Table 4.1). The unemployment rate increases slightly. In the government budget, net indirect taxes increase by 1.5 percent of GDP, a change that is matched by similar increase in government investment and infrastructure spending (Table 4.2). Among the production sectors, the only major change is more rapid growth for the government infrastructure sectors (Table 4.3), with an acceleration that is similar to *inv-og* and *inv-tx*. In terms of human development, the changes are positive and similar to those of *inv-tx* (not surprising given that the financing source is similar) but weaker than for *inv-og*, which generated financing by reducing government waste (Table 4.4). It is worth noting that, as opposed to the tax increase, the subsidy elimination shows MDG improvements across the board, avoiding the trade-off between poverty reduction and improved outcomes for other aspects of human development.

Instead of trying to reduce poverty and promote over-all development via growth promoting investments in infrastructure, the government may opt to transfer resources directly to households. The scenario *trn-og* looks into the consequences of such a policy, creating the fiscal space to do so via the same growth reduction for other government as for *inv-og*. The transfer increase is defined to be identical across all households in per-capita terms, i.e. a distribution of transfers that avoids replicating or strengthening initial inequalities but that is not specifically targeted to low-income households. It is assumed that the transfer scheme can be administered by the existing government administration via a reallocation of existing resources, i.e. no additional financing is needed to administer the program. Compared to *base*, the macro

[18] However, this is an empirical question and the answer cannot be taken for granted given second-best considerations: as long as some optimality condition is violated (e.g. due to remaining taxes or subsidies), a partial elimination of distortionary taxes or subsidies does not necessarily enhance welfare.

impact of this scenario is mainly in the form of a redistribution of part of final demand growth from government to private consumption and investment that leaves growth in absorption and GDP at factor cost virtually unchanged (Table 4.1). Unemployment declines slightly since household demands are more labor intensive than government demands. In the 2022 government budget, the two noteworthy changes are the increase in government domestic transfers accompanied by a reduction in the sum of government consumption and investment, both amounting to around 2 percent of GDP (Table 4.2). The only strong change in GDP growth by sector is a significant decline for other government services (Table 4.3) whereas, in terms of human development, slight improvements are registered across the board, a reflection of the fact that higher private consumption, in the model and in the real world, tends to have positive repercussions (Table 4.4). Compared to the preceding scenarios with increased government infrastructure investments (*inv-og*, *inv-tx*, and *inv-sb*), *trn-og* leads to stronger poverty reduction but weaker improvements for other HD indicators.

The model parameters that determine the strength of the productivity gains from a build-up of government infrastructure capital stocks have a strong bearing on the simulation results and may influence rankings across simulations in terms of development objectives. To get a better sense of this aspect, we repeat the simulations *inv-og* and *inv-tx* both with halved and doubled elasticities of sectoral TFP with respect to changes in government infrastructure capital (naming these simulations *inv-og-*, *inv-og+*, *inv-tx-*, and *inv-tx+*, respectively). For both *inv-og* and *inv-tx*, the annual growth difference for GDP at factor cost (and absorption) between halved and doubled elasticities is around 0.8 percentage points, over time bringing about a difference in 2022 poverty rates of approximately 2.5-3.0 percentage points. Although these changes are not large, they influence the relative standing of *inv-og(+)* and *trn-og* in terms of poverty reduction – compared to *trn-og*, *inv-og+* does better while *inv-og* does worse. It is also worth noting that, in spite of identical rates of aggregate private consumption growth, poverty reduction is weaker for *inv-tx+* than *trn-og*, pointing to the role of distributional changes in mediating the link between the national poverty rate and aggregate private consumption.

The positive effects, albeit moderate, of several of the above policy shifts would be reinforced if they were introduced in tandem. This is demonstrated by the scenario *inv-ogsb+*, which combines reduced growth for other government (same reduction as *inv-og*) and electricity subsidy elimination (same as *inv-sb*), using the resulting fiscal space to accelerate infrastructure investment. The resulting increase in macro growth rates are roughly additive, raising annual GDP and absorption growth by around 0.7 percent, and private consumption and investment growth by 0.5-1.0 percentage points (Table 4.1), in the government budget reflected in an increase in infrastructure spending of around 3.7 GDP percentage points (Table 4.2) and, among the private sectors, leading to a growth acceleration of 0.8-1.0 percentage points (Table 4.3).

Figures 4.1-4.4 offer a visual comparative perspective on the different scenarios. Figure 4.1 shows how each non-base scenario deviates from the *base* scenario in terms of average annual real growth in GDP at factor cost and private consumption. Its main messages are that (a) it matters how increased government infrastructure investments are financed: financing from

reduced waste dominates financing from tax increases or subsidy cuts in terms of growth and avoids biasing final demand growth against private demands; and (b) the extent to which an investment raises productivity may determine whether it has a net beneficial or negative impact on the economy: tax-financed investments may increase (decrease) growth in GDP and consumption if undertaken in a setting with strong (weak) impacts of infrastructure capital on productivity.

Figure 4.2 provides an alternative dynamic perspective on the evolution of household per-capita consumption, in each year showing the percent difference between household per-capita consumption for selected non-base scenarios and the *base* scenario. The scenario *inv-og+* dominates throughout, thanks to the strong impact on GDP growth from high-productivity investments and the fact that they is financed by a more efficient allocation of government resources. Among the other scenarios, *trn-og* (the transfer scenario) dominates up to the year before the last, reflecting the fact that it reallocates resources from the government to households without depending on growth. However, toward the end of the simulation period, its more rapid GDP growth permits the scenario *inv-tx+* to overtake *trn-og* in spite of an allocation of final demands that is more biased in favor of the government; similarly, inv-og is on its way to catch up. The failure of *inv-tx* (the tax-financed investment scenario) to keep up with the *base* and most other scenarios reflects the fact that it only has a minimal positive impact on GDP growth at the same time as its resource allocation favors the government. All in all, this figure leads to the conclusion that a key prerequisite for poverty reduction is more rapid growth and that, by extension, transfer programs should be designed to be growth friendly, perhaps by being conditional on programs in the areas of health, education, or public works.

Finally, Figures 4.3 and 4.4 suggest that, thanks to the broader economywide repercussions of higher private consumption and improvements in infrastructure, MDG indicators (here represented by poverty and under-five mortality) can show strong improvements also without policy changes in the human development area; among other things, it is worth noting that, thanks to their strong infrastructure components, several scenarios bring about a lower under-five mortality rate than the *base* in spite of their lower growth in private consumption.[19] However, low-cost transfer programs financed by reduced government waste (*trn-og*) provide the option of reducing poverty at least for a few years without a commensurate increase in GDP or absorption growth.

[19] The strength of the link between poverty reduction and private consumption growth depends on the extent to which inequality changes. For the current set of scenarios, the simulated changes in inequality, measured by the Gini coefficient, were minimal. (Given the assumed lognormal distribution within each model household group, aggregate inequality would only change due to differences in per-capita consumption growth rates between the different household groups.)

A HIGH GROWTH SCENARIO FOR PAKISTAN

The above scenarios point to the feasibility of improving economic performance on the margin via modest changes in a few policy areas. However, in order for Pakistan to join the group of fast-growing Asian economies, a wider range of changes are needed, going beyond what we considered in the preceding section. This section does not strive to identify what the required policy and institutional changes may be but has the more modest objective of exploring how the key growth-related macroeconomic variables – TFP, factor accumulation, savings, and investment – may need to evolve if Pakistan is to swiftly raise its growth rate from the 4-5 percent range to 7 percent.[20]

To provide a basis for comparison, Figures 4.5 and 4.6 show the evolution of growth related variables under the *base* scenario. As shown in Figure 4.5, throughout the simulation period, total investment and savings were close to 14 percent of GDP, including private investment at close to 10 percent and government investment at 4 percent. Given the fact that government savings initially were negative (at around -3 percent of GDP) and the foreign savings contribution modest (at 2 percent of GDP, including around 1 percent of FDI), private savings had to shoulder the bulk of the burden of investment financing especially in the initial years. A gradual increase in government savings made it possible for private savings to decline slightly relative to GDP.[21] Figure 4.6 shows the simulated rate of growth in GDP at factor cost and decomposes it into growth in TFP and factor accumulation.[22] Over time, growth in GDP and factor accumulation accelerates, gradually reducing the contribution of TFP.[23] Both for labor and capital, employment grows more rapidly. For labor, this reflects the effects of a combination of demography, schooling and reduced unemployment; for capital, it is due to higher investment.

The more specific features of the new high growth scenario, labeled *hi-grw*, are as follows:

- Starting from 2013, annual growth in GDP at factor cost is 7.0 percent.

[20] As suggested by López-Cálix et al. (2012, p. 11), the broader reforms needed to spur rapid growth in Pakistan during coming decades include improvements in the investment climate and in the quality of government institutions, as well as increases in private savings and investments in both physical and human capital.

[21] In MAMS-based analysis, the focus is on the complete government budget, including government borrowing, and on the effects of government spending defined by function, with different being requiring different combinations of current spending and capital stocks, the latter financed by government investment. Growth may be promoted not only by functions with a large investment spending share (like infrastructure) but also by functions with a large current spending share (like education). Government savings, the difference between government current revenue and current expenditures, does not play an important role; in fact, it will almost invariably change whenever spending is reallocated between two functions, given different functional shares for current and capital spending. On the contrary, in a simpler growth model, in which growth is driven by investment in physical capital, government savings may be an important measure of the extent to which the government makes resources available for private or government investment.

[22] For the growth decomposition, factor accumulation refers to the level of factor employment, not factor stocks; i.e. unemployed factors (in this case labor) are not included since they do not contribute to GDP.

[23] Given (a) $Q_t = A_t \cdot F_t$, where t refers to year, Q_t is GDP, A_t is TFP, and F_t is a Cobb-Douglas aggregate of the different model factors (cf. Table A1.1), and (b) known values for Q_t and F_t; A_t is defined as Q_t/F_t . TFP growth refers to growth in A_t over time. The growth rates of A_t and F_t are here scaled so that they sum to the GDP growth rate.

- The levels of government domestic and foreign borrowing that are imposed permit the government to reduce its total debt in 2022 by 10 percentage points of GDP compared to 2012.
- Private savings increase sufficiently to ensure enough financing to gradually raise domestically financed private investment from 9.4 percent of GDP in 2012 to 11.9 percent in 2022.
- Domestic tax revenues (direct and indirect) increase gradually and modestly, by 0.4 percent of GDP.
- The government is assumed to use increased fiscal space to expand spending on infrastructure while keeping spending in other areas constant in real terms.

Figure 4.5. Base: Investment and savings data (% of GDP)

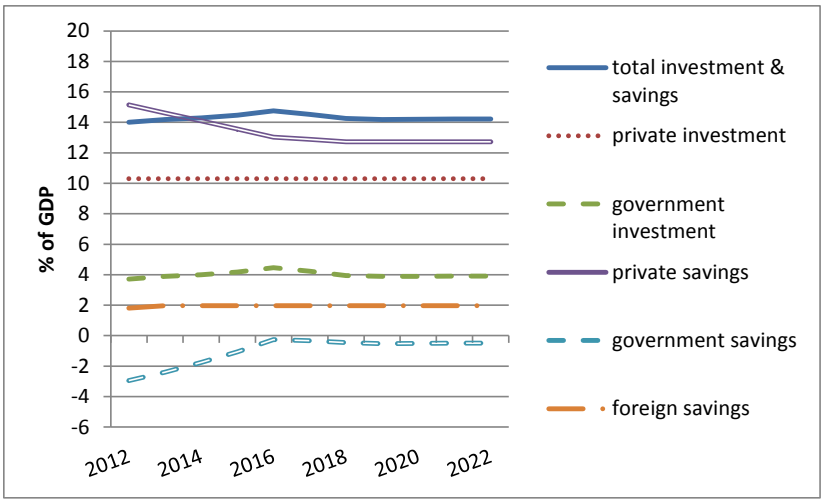
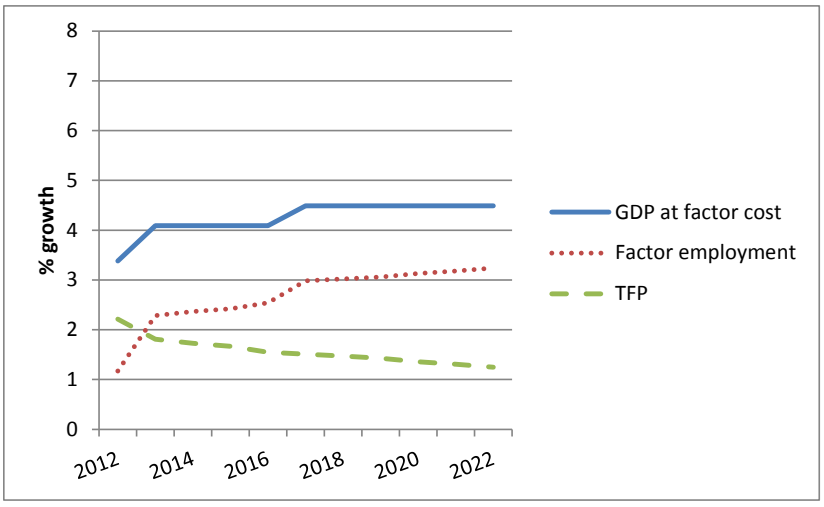


Figure 4.6. Base: Growth decomposition



Figures 4.7-4.8 show the evolution of savings, investment, GDP, TFP, and factor accumulation for *hi-grw*. Total investment and savings gradually increase from 14 to 18 percent of GDP, with private investment accounting for around 70 percent of total investment. On the financing side, the major change is a strong increase in government savings, from -3 to around 1 percent of

GDP; throughout the period, foreign and private savings are at around 2 and 14-16 percent of GDP, respectively. In order to make the jump in growth to 7 percent feasible, an initial jump in TFP growth to close to 4 percent is needed. Over time, factor accumulation growth increases to around 4 percent, permitting a decline in TFP growth to around 3 percent.

Figure 4.7. High Growth: Investment and savings data (% of GDP)

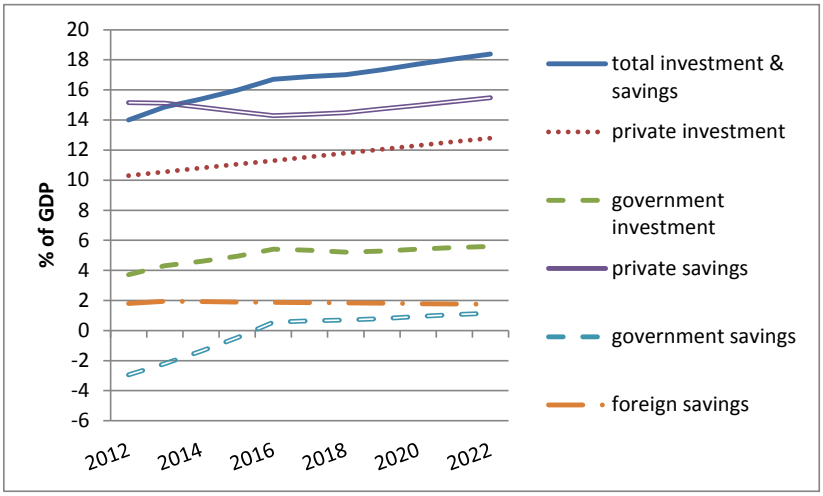
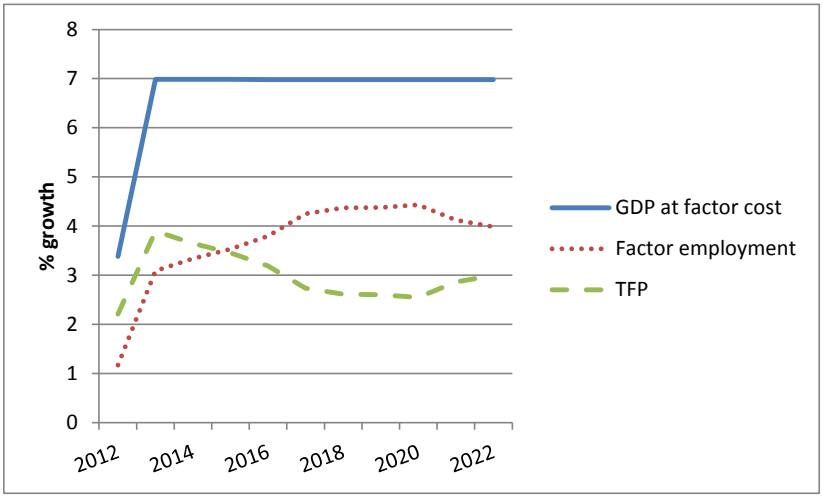


Figure 4.8. High Growth: Growth decomposition



Tables 4.1-4.4 include additional results for *hi-grw*. As shown in Table 4.1, compared to *base*, growth in GDP and absorption increase by around 2.5 percentage points. For GDP, around 1.5 percentage points are due to TFP; the rest is the result of more rapid growth in factor accumulation. Among the final demands (which make up absorption), the growth acceleration is particularly strong for private and government investment but it also spills over into private consumption. Unemployment falls to 5 percent, the minimum level. The decline in government debt by 10 percentage points is roughly evenly split between foreign and domestic debt. Measured relative to GDP, the major changes in the government budget are shifts to infrastructure from other areas and to investment from consumption (Table 4.2), the latter

change echoing the noted relatively strong real growth acceleration for government investment compared to government consumption (Table 4.1). In terms of real GDP growth by sector (Table 4.3), the different private sectors expand by 2.5-3.0 percentage points while the growth expansion for government services is much more modest, at 0.9 percent – the expansion in government investment primarily leads to demands for output from other sectors and for imports, not increased government service production. Among the MDG indicators, improvements are strong across the board (Table 4.4); to exemplify, the poverty and under-five mortality rates decline to 3.1 percent and 68.6 per thousand (compared to 8.6 percent and 74.8 per thousand for the *base*).

To sum up, the results for the scenario *hi-grw* indicate that, unless savings and investment increase drastically, a strong increase in TFP growth would be needed to raise Pakistan's annual GDP growth rate to 7 percent. By 2022, growth at this higher rate would bring about and require broad growth gains for consumption and investment as well as for the major production sectors. Its effects would include significant, broader gains in terms of poverty reduction, and better outcomes for other MDG and education indicators.

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Appendix 1. The Pakistan MAMS Database

Social Accounting Matrix

The centerpiece of a MAMS database is the Social Accounting Matrix (SAM), a square matrix that provides a comprehensive and consistent summary of the payments in an economy during one year, in our case 2008 (i.e., fiscal year 2007/2008). The starting point for the MAMS SAM was an IFPRI (International Food Policy Research Institute) SAM, constructed on the basis of earlier SAMs and new national accounts and sector-specific information on production and consumption. More specifically, the SAM work of IFPRI started with a construction of a new macro SAM with a single sector (split into an activity and a commodity) and a single household. The Pakistan MAMS project team supported this initial phase of the IFPRI SAM work.

In the work on the MAMS SAM, the new IFPRI SAM was aggregated in some areas and disaggregated in others in order to adjust it to the data and analytical requirements of this MAMS application. The main sources for our work on the MAMS SAM include the Pakistan Government (for national accounts data, especially government accounts, and labor and wage statistics), IMF and the Pakistan government (for fiscal and balance of payments data, including educational sector data). In addition, World Bank (2012) and Barro and Lee (2012) were used in the disaggregation of labor market and education data.

The main phases of the MAMS SAM work were the following:

1. Joint construction of an aggregated macro SAM with IFPRI.
2. Disaggregation of the aggregate transaction costs account into domestic, export and import transaction costs.
3. Aggregation of the highly disaggregated IFPRI SAM into fewer factors, activities, products and households to remove aspects not relevant to the current paper. For example: households were aggregated to remove the regional dimension; agricultural sectors (activities and commodities) were aggregated into more aggregate groups.
4. Disaggregation of the two-level labor accounts (skilled-unskilled) into three educational levels. Parallel to this work, employment data was disaggregated accordingly with the help of Pakistan government employment and wage statistics. This work was done by utilizing cross-entropy methods to disaggregate the more aggregated information available on the Pakistan labor market while drawing on agriculture vs. non-agricultural employment data in World Bank (2012).[24]
5. Creation of capital accounts for each non-government institution, defining the uses of their savings and the financing sources of their investments.
6. Allocation of part of government and foreign debt stocks and related interest payments across households.
7. Further disaggregation and reorganization of government expenditure and investment data in order to generate an appropriate functional disaggregation (cf. Table A1.1).

[24] For the application of such methods to SAM estimation, see Robinson et al. (2001).

Table A1.1. Disaggregation of MAMS SAM for Pakistan, 2008

Activities	
a-grain	activity - agriculture of wheat and rice
a-ocrop	activity - cultivation of other crops
a-hort	activity - horticulture
a-for	activity - forestry
a-anim	activity - animal-based farm activties, including fishing
a-mine	activity - mining
a-food	activity - foodstuff industry
a-text	activity - textile industry
a-manf	activity -manufacturing
a-petr	activity - petroleum industry
a-enrg	activity -energy and heat
a-cons	activity-construction
a-trade	activity - wholesale and retail trade
a-trans	activity -transport
a-hsng	activity- housing
a-bserv	activity - business services
a-edupng	activity - education - primary - non-gov
a-edusng	activity - education - secondary - non-gov
a-edutng	activity - education - tertiary - non-gov
a-edup	activity - education - primary -gov
a-edus	activity - education - secondary - gov
a-edut	activity - education - tertiary - gov
a-health	activity - health care - gov
a-healthng	activity - health care -non-gov
a-pserv	activity - personal services
a-wtsn	activity - water and sanitation services
a-aginf	activity - agricultural gov infra services - including irrigation
a-ener	activity - gov energy services
a-oinf	activity - go other infrastructure services
a-ogov	activity - other gov services
Commodities	
c-grain	commodity - wheat and rice
c-ocrop	commodity - other crops
c-hort	commodity - horticulture prods
c-anim	commodity - animal products
c-for	commodity - forestry products
c-mine	commodity - minerals
c-food	commodity - foodstuff
c-text	commodity - textile products
c-manf	commodity - manufactures
c-petr	commodity - petroleum
c-enrg	commodity - energy, gas, heat
c-cons	commodity - construction services
c-trade	commodity - trade services
c-trans	commodity - transport services
c-hsng	commodity -housing
c-bserv	commodity - business services
c-pserv	commodity - personal services
c-edupng	commodity - education - primary - non-gov
c-edusng	commodity - education - secondary - non-gov
c-edutng	commodity - education - tertiary - non-gov
c-edup	commodity - education - primary - gov
c-edus	commodity - education - secondary - gov
c-edut	commodity - education - tertiary - gov
c-health	commodity - public health care
c-healthng	commodity - private health care
c-wtsn	commodity - potable water and sanitation services
c-aginf	commodity - agricultural infra services
c-ener	commodity - energy infra services
c-oinf	commodity - other infra services
c-ogov	commodity - other gov services
Transaction cost accounts	
tac-d	transactions costs - domestic trade
tac-e	transactions costs - exports
tac-m	transactions costs - imports

Transaction cost accounts	
tac-d	transactions costs - domestic trade
tac-e	transactions costs - exports
tac-m	transactions costs - imports
Factor accounts	
f-lab	factor- aggregate labor
f-labn	factor - labor - less than completed secondary education
f-labs	factor - labor - completed secondary education
f-labt	factor - labor - completed tertiary education
f-lnd-l	factor - land - large farms
f-lnd-s	factor - land - small and medium size farms
f-capprv	factor - private capital
f-cap-edup	factor - capital for a-edup
f-cap-edus	factor - capital for a-edus
f-cap-edut	factor - capital for a-edut
f-cap-health	factor - capital for a-health
f-cap-wtsn	factor - capital for a-wtsn
f-cap-aginf	factor - capital for a-aginf
f-cap-ener	factor - capital for a-ener (gov energy infra services)
f-cap-oinf	factor - capital for a-oinf
f-cap-ogov	factor - capital for a-ogov
Institutions	
hhd-lf	household - rural - large farms
hhd-sf	household - rural - small and medium size farms
hhd-0f	household- rural - landless farmers
hhd-agw	household- rural -agricultural workers
hhd-nfnp	household- rural -non-farm non-poor
hhd-nfp	household- rural - landless farmers
hhd-urnp	household - urban non-poor
hhd-urpr	household - urban -poor
hhd-ur	Aggregation of urban households
hhd-nf	Aggregation of rural non-farm households
Taxes	
tax-dir	direct taxes
tax-imp	import taxes
tax-com	commodity taxes
gov	government (compulsory element)
row	rest of world (compulsory element)
Investment accounts (one per capital stock)	
inv-prv	investment - capital factor for private activities
inv-edup	investment - capital factor for a-edup
inv-edus	investment - capital factor for a-edus
inv-edut	investment - capital factor for a-edut
inv-health	investment - capital factor for a-health
inv-wtsn	investment - capital factor for a-wtsn
inv-aginf	investment - capital factor for a-aginf
inv-ener	investment - capital factor for a-ener
inv-oinf	investment - capital factor for a-oinf
inv-ogov	investment - capital factor for a-ogov
Institutional capital accounts (one account per saving institution)	
cap-gov	capital - gov
cap-row	capital - rest of world
cap-hhdlf	capital-hhd- rural - large farmowners
cap-hhdsf	capital-hhd- rural - small farmowners
cap-hhd0f	capital-hhd rural - landless farmers
cap-hhdagw	capital-hhd rural -agricultural workers
cap-hhdnfnp	capital-hhd rural -non-farm non-poor
cap-hhdnfp	capital-hhd rural - landless farmers
cap-hhdurnp	capital-hhd- urban non-poor
cap-hddurpr	capital-hhd- urban -poor
Interest accounts	
int-dom	domestic interest account
int-row	foreign interest account
dstk	stock change
Total	
Total	total (compulsory element)

Note that the acronyms used in the factor and investment accounts refer to activities of the model.

Estimation of consumption elasticities

In MAMS, household consumption is described as Linear Expenditure System (LES), derived from Stone-Geary direct utility function (see for example Blonigen et al. 1997). For the estimation of the necessary parameters of the LES system (income elasticities of consumption and Frisch parameters), we made use of the Household Income and Expenditure Survey (HIES) of 2008 (also used by IFPRI in the initial phase of the SAM work to split final consumption across different households). We used the individual 15,512 household survey observations together with their sample weights so that together they were a nationally representative sample of household consumption. The estimation was carried out in GAMS modeling environment as a non-linear optimization problem imitating a system of non-linear regression equations.[25] Thus, we could make use of the solver capacity of GAMS, but the downside is that we did not have access to statistical inference tools of statistical software packages. However, many statistical software packages have trouble in coping with such large systems that the disaggregation level of our model results in. Tables A1.2 and A1.3 show the elasticities used in the model.

Table A1.2. LES Expenditure elasticities of demand by commodity and household

	hhd-lf	hhd-sf	hhd-0f	hhd-agw	hhd-nfnp	hhd-nfp	hhd-urnp	hhd-urpr
c-ocrop	0.404	1.878	0.743	0.790	0.734	1.064	0.728	0.990
c-hort	0.490	1.378	0.923	0.858	0.802	1.052	0.932	1.063
c-anim	0.648	0.915	0.978	0.968	1.014	1.209	0.973	1.035
c-food	0.409	0.593	0.680	0.764	0.785	0.937	0.740	0.907
c-text	0.911	0.921	1.277	1.420	1.008	1.148	0.951	0.999
c-petr	1.314	2.549	2.366	1.104	1.220	1.169	1.368	1.300
c-manf	1.198	1.176	1.769	1.110	1.343	0.927	1.033	1.077
c-enrg	0.967	1.165	1.233	1.145	1.176	1.255	0.906	1.162
c-cons	0.819	2.587	3.323	1.847	3.242	0.907	2.353	1.241
c-trade	0.926	0.854	0.977	0.926	1.014	1.006	0.922	0.992
c-trans	0.597	2.651	0.835	0.612	1.035	0.908	1.372	1.039
c-hsng	0.813	1.126	1.264	1.456	1.554	1.464	1.595	1.254
c-healthn	0.248	0.405	0.586	0.801	0.576	0.860	0.573	0.811
c-edupng	2.098	1.833	2.474	1.497	3.296	1.403	2.156	1.383
c-edusng	2.098	1.833	2.474	1.497	3.296	1.403	2.156	1.383
c-edutng	2.098	1.833	2.474	1.497	3.296	1.403	2.156	1.383
c-edup	2.098	1.833	2.474	1.497	3.296	1.403	2.156	1.383
c-edus	2.098	1.833	2.474	1.497	3.296	1.403	2.156	1.383
c-edut	2.098	1.833	2.474	1.497	3.296	1.403	2.156	1.383
c-pserv	2.141	3.006	1.835	3.165	0.742	0.924	1.653	1.125

[25] The GAMS code is available on request.

Table A1.3. Frisch parameter for household LES demand

hhd-lf	hhd-sf	hhd-0f	hhd-agw	hhd-nfnp	hhd-nfp	hhd-urnp	hhd-urpr
-2.512	-4.000	-4.000	-4.000	-3.501	-3.451	-1.864	-1.758

Other data for MAMS

MAMS needs a host of other parameters than those mentioned above. As for production and trade elasticities, the values are based on the international literature and earlier MAMS work. Both historical and projected population data rely on the data of the UN Population Division. A current World Bank assessment has provided us with short and medium term macroeconomic forecasts for Pakistan, as well detailed data on the government income and outlays. We have utilized the memorandum of López-Cálix et al. (2012) in calibrating our TFP growth assumptions under the *base* scenario. Historical data on government consumption and investments (available in the economic surveys of Pakistan's government) and Arslanalp et al. (2010) were used to estimate activity-specific government capital stocks. The elasticities in the MDG and education function are defined in light of the findings in Lofgren (2010) and projections for many of the indicators up to 2022 drawing on cross-country regressions of each indicator on absorption (gross national expenditure) per capita and the simulated growth in this indicator under the *base* scenario.

Appendix 2. Supplementary Data and Simulation Results

Table A2.1. Employment, labor force participation and demography, 1990-2008

	1990*	2008*	1990-2008 (% change)	Decomposition (%)	Decomposition (%-age pts)
Population (mn)	111.8	167.4			
Population in labor force age (15-64) (mn)	58.9	99.4			
Labor force (mn)	31.8	56.3			
Employment (mn)	31.0	53.5			
Employment / population	0.277	0.320	15.3		15.3
Employment / labor force	0.974	0.950	-2.5	-16.3	-2.5
Labor force / population in labor force age	0.540	0.567	4.9	32.3	4.9
Population in labor force age / total population	0.527	0.594	12.7	84.0	12.9
Total			15.1	100.0	15.3

*Units indicated in first column

Source: World Develoment Indicators

Table. A2.2. Macro SAM for Pakistan, 2012 (% of nominal GDP)

	act	com	fac	hhd	gov	row	tax-dir	tax-imp	tax-oind	sub	int-dom	int-row	cap-hhd	cap-gov	cap-row	inv-prv	inv-gov	total
act		100.5																100.5
com				86.6	7.4	12.9				1.5						10.3	3.1	121.8
fac	94.8					0.3												95.1
hhd			94.1		3.6	6.7					3.4							107.8
gov				2.3		0.2	3.5	1.0	5.7									12.7
row		20.3	1.0	0.1								0.8						22.1
tax-dir				3.5														3.5
tax-imp		1.0																1.0
tax-oind	5.7																	5.7
sub					1.5													1.5
int-dom					3.4													3.4
int-row				0.4	0.4													0.8
cap-hhd				14.9											0.2			15.2
cap-gov					-3.6								5.8		0.9			3.1
cap-row						2.0												2.0
inv-prv													9.4		0.9			10.3
inv-gov														3.1				3.1
total	100.5	121.8	95.1	107.8	12.7	22.1	3.5	1.0	5.7	1.5	3.4	0.8	15.2	3.1	2.0	10.3	3.1	

Source: IMF 2012 and authors' calculations.

NOTATION

Account	Explanation	Account	Explanation
act	activities	sub	subsidies
com	commodities	int-dom	interest -- domestic
fac	factors	int-row	interest -- foreign
hhd	current account -- households	cap-hhd	capital account -- households
gov	current account -- government	cap-gov	capital account -- government
row	current account -- rest of world	cap-row	capital account -- rest of world
tax-dir	taxes -- direcct	inv-prv	investment -- private
tax-imp	taxes -- impots	inv-gov	investment -- government
tax-oind	taxes -- other indirect		

Table A2.3. Macro indicators in 2012 and by simulation in 2022 (% of nominal GDP)

		2022										
Indicator	**2012**	**base**	**inv-og**	**inv-tx**	**inv-sb**	**trn-og**	**inv-og-**	**inv-og+**	**inv-tx-**	**inv-tx+**	**inv-ogsb+**	**hi-grw**
Absorption	107.2	106.3	106.2	106.3	106.3	106.3	106.4	106.0	106.5	106.1	105.9	104.9
Consumption - private	86.3	84.1	83.7	82.2	82.7	85.8	84.3	83.1	82.5	81.9	81.7	79.6
Consumption - government	6.8	8.0	6.4	8.2	8.1	6.3	6.6	6.2	8.5	7.9	6.3	6.8
Investment - private	10.3	10.3	10.5	10.0	10.2	10.5	10.1	11.0	9.4	10.5	10.8	12.8
Investment - government	3.7	3.9	5.6	5.9	5.3	3.7	5.4	5.7	6.1	5.8	7.1	5.6
Exports	13.1	13.2	13.6	13.2	13.3	13.4	13.3	14.0	12.8	13.6	14.0	15.1
Imports	-20.2	-19.5	-19.8	-19.5	-19.5	-19.7	-19.7	-19.9	-19.4	-19.6	-19.9	-20.0
GDP at market prices	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Net indirect taxes	5.2	7.5	7.5	8.8	9.0	7.5	7.5	7.6	9.0	8.6	9.1	7.7
GDP at factor cost	94.8	92.5	92.5	91.2	91.0	92.5	92.5	92.4	91.0	91.4	90.9	92.3
GNI	98.5	97.4	97.4	97.3	97.4	97.4	97.3	97.4	97.3	97.3	97.4	97.6
GNDI	105.3	104.3	104.2	104.3	104.3	104.3	104.4	104.0	104.5	104.1	104.0	103.1
Private savings	15.1	12.7	12.9	12.4	12.6	13.0	12.5	13.3	11.9	12.8	13.2	15.5
Government savings	-2.9	-0.5	1.2	1.5	0.9	-0.7	1.0	1.4	1.6	1.5	2.8	1.2
Foreign savings	1.8	2.0	2.0	2.0	2.0	2.0	2.0	1.9	2.0	1.9	1.9	1.8
Gross national savings	12.2	12.2	14.1	13.9	13.5	12.2	13.5	14.8	13.5	14.3	16.0	16.6
Gross domestic savings	6.9	7.9	9.9	9.6	9.2	7.9	9.1	10.7	9.0	10.2	12.0	13.5
Foreign government debt	25.7	25.4	25.1	25.5	25.3	25.3	25.9	24.3	26.3	24.7	24.2	20.2
Foreign private debt	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Domestic government debt	35.6	36.2	35.5	36.0	35.8	36.2	37.0	34.0	37.6	34.5	33.5	31.5

Table A2.4. Balance of payments in 2012 and by simulation in 2022 (% of nominal GDP)

			2022										
Indicator		**2012**	**base**	**inv-og**	**inv-tx**	**inv-sb**	**trn-og**	**inv-og-**	**inv-og+**	**inv-tx-**	**inv-tx+**	**inv-ogsb+**	**hi-grw**
Outflows	**Imports**	20.2	19.5	19.8	19.5	19.5	19.7	19.7	19.9	19.4	19.6	19.9	20.0
	Private transfers to RoW	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Factor income to RoW	0.8	1.9	1.9	2.0	1.9	1.9	1.9	1.9	2.0	2.0	2.0	1.8
	Net interest income to RoW	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6
	Total	21.8	22.3	22.5	22.2	22.3	22.4	22.5	22.6	22.1	22.3	22.7	22.5
Inflows	**Exports**	13.1	13.2	13.6	13.2	13.3	13.4	13.3	14.0	12.8	13.6	14.0	15.1
	Private transfers from RoW	6.7	6.7	6.6	6.7	6.7	6.7	6.8	6.4	6.9	6.5	6.4	5.3
	Official transfers from RoW	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.3	0.3
	Private borrowing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Government borrowing	0.9	1.1	1.0	1.1	1.1	1.1	1.1	1.0	1.1	1.0	1.0	0.8
	FDI	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
	Total	21.8	22.3	22.5	22.2	22.3	22.4	22.5	22.6	22.1	22.3	22.7	22.5