

# Estimation, Prediction and Policy Design for Population and Universal Primary Education in Pakistan

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The positive relationship between education and sustainable economic development is now widely recognized. This study develops a dynamic model for population and primary education of Pakistan. Primary education sector in Pakistan is operating in both public and private sectors. Pakistan has a clear socio-economic division of rural and urban areas that get different priorities in allocations of public funds, believed to be instrumental for universal primary education. The public financial allocations are available to some extent from different publicly available sources but that too on country basis and not on area basis. On the other hand, there is no data available for private sector investment. Based on its assumptions this study estimates area-wise public and private sector investment in primary education in Pakistan, predicts development path of its population and literacy. This study finds that Pakistan may not be able to achieve universal primary education by 2015 due to alarming dropout rate and suggests channeling her resources to reduce it.

## Introduction

Pakistan, being one of the signatories of UN's MDGs<sup>1</sup>, has committed to ensure that by 2015 children everywhere boys and girls alike will be able to complete a full course of primary schooling. However, her current low educational status, highly fragmented allocations, and area and gender disparities have created intractable problems to fulfill her commitment. Such a continued low educational status is likely to hamper human capital formation and probable sustainable national development as suggested by new growth theories. Not only the theories, but also the development path followed by the countries like Malaysia, Korea and Taiwan strongly presents the case that without education, economic development is not possible.

Pakistan is placed at 135<sup>th</sup> position out of 175 countries in terms of the Education Index. The level of public spending is an important indicator of a government's commitment to the cause of education. Education, observed to be the least priority in Pakistan, has suffered not only from persistent and severe underinvestment by the government, but also bitty allocations have resulted into so obvious and critical area and gender based disparities that it will be hazardous to consider a single literacy rate for the country.

The socio-economic importance of universal primary education is unquestioned. A good educational system, that provides universal primary education, strengthens equality of opportunities, human capital endowment, and income distribution (Tanzi 1998). Hence provision of basic education is both an individual and public investment. However in a country like Pakistan where around 33% people live below poverty line, government cannot abdicate all responsibility by making education a service made available in the market for those who could buy it. Moreover, article 37 of The Constitution of Pakistan makes it one of the core responsibilities of the state to remove illiteracy and provide free, compulsory and equitable access to basic education with special care of interests of backward classes and areas.

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<sup>1</sup> Millennium Development Goals

This study indicates that limited and fragmented financial allocations, otherwise believed to be instrumental for universal primary education, have been responsible for current low educational status in Pakistan. Through reduced public allocations, government presumably is encouraging private sector investment in education, but being commercially motivated it focuses more on urban areas not only denying equitable access to basic education to people of backward classes and areas but also perpetuating poor educational status that may have implications for population growth and sustainable development of Pakistan.

### Model and its Assumptions

The purpose of this model is to estimate population, primary education rate and financial allocations by public and private sectors of Pakistan. Based on these estimates and maintaining trend in financial allocations the model will predict development path of population and primary education in Pakistan.

The model, which is a component of a national model under progress, gets its inspiration from T21 of MI<sup>2</sup> and comprises of two sectors; Population with a sub-sector called Fertility and Primary Education. The conceptual framework of this model is based on the demographic transition theory coined by W. S. Thompson (1929) and refined by Frank W. Notestein (1945) which suggests a definite relationship between population change and socio-economic development. Even though the neglect of cultural factors is one of the shortcomings of this theory, it does provide an effective generalized picture of the population development on an aggregated level that serves the purpose of the model. This framework defines the model. The adult literacy rate and level of economic development are taken as proxies of socio-economic development. It is commonly observed that these are the major factors that affect population. Adult literacy rate will be determined endogenously. However, level of economic development is taken as exogenous which may be a limitation of this study and will be addressed in future research.

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<sup>2</sup> Threshold 21 is an integrated simulation model of Millennium Institute, Washington D.C.

The causal assumptions underlying the population sector are the following:

1. The number of births each year is a function of the number of women of productive age (age 15-49, based on UN classification) in the population and total fertility rate.
2. Women of productive age are classified into two types: those who practice birth control, and those who do not. Each type has its own fertility rate.
3. Average adult literacy rate is the only factor determining the proportion of women of productive age practicing birth control.
4. The fertility rate for those females who do not use birth control is the natural fertility rate which changes with female life expectancy, and the fertility rate for those who practice conscious birth control is determined by the desired number of children per woman. It is assumed that relative per capita disposable income and average adult literacy rate inversely affect the initial average number of children per woman to determine the desired number of children per woman.
5. Age specific fertility rate will remain constant based on Haupt & Kane (2004, p16)<sup>3</sup>.
6. Income, health care and nutrition are most commonly cited determinants of life expectancy. It is commonly observed that increase in income improves nutrition intake and also improves access to health care. Life expectancy is therefore, assumed to be income based. The number of deaths each year is assumed as a function of income-based normal life expectancy based on World Resources 1998-99: p-15, and life table death rates for east developed by Coale and Demeny (1983).
7. Migration is treated as exogenous.

Pakistan, like many developing countries, has a clear division of rural and urban areas. The two sets of areas have not only different demographic characteristics, infrastructure,

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<sup>3</sup> They argue that in reality age-specific rates change and fluctuate from year to year, even if only gradually. However, year-to-year fluctuations in the TFR may reflect changes in the timing of births rather than changes in the average number of children women bear.

income sources and per capita income etc. but also get different priorities in allocation of public funds. The population is, therefore, represented by one stock each for rural and urban population broken down into 81-one year cohorts that are further subdivided into female and male. Such a representation will better reflect the reality and will also make the model more transparent.

The *birth rate*, that increases the population of rural and urban areas, is endogenously affected by the *average literacy rate* and per capita *GDP in PPP<sup>4</sup>* of the two areas in line with the demographic transition theory. The impact of these causalities is so estimated that the model output fits the estimated contraceptive prevalence rate, total fertility rate (TFR), and crude birth rate of UN World Population Prospects-The 2002 Revision (WPP-2002), as shown in Figure 1.

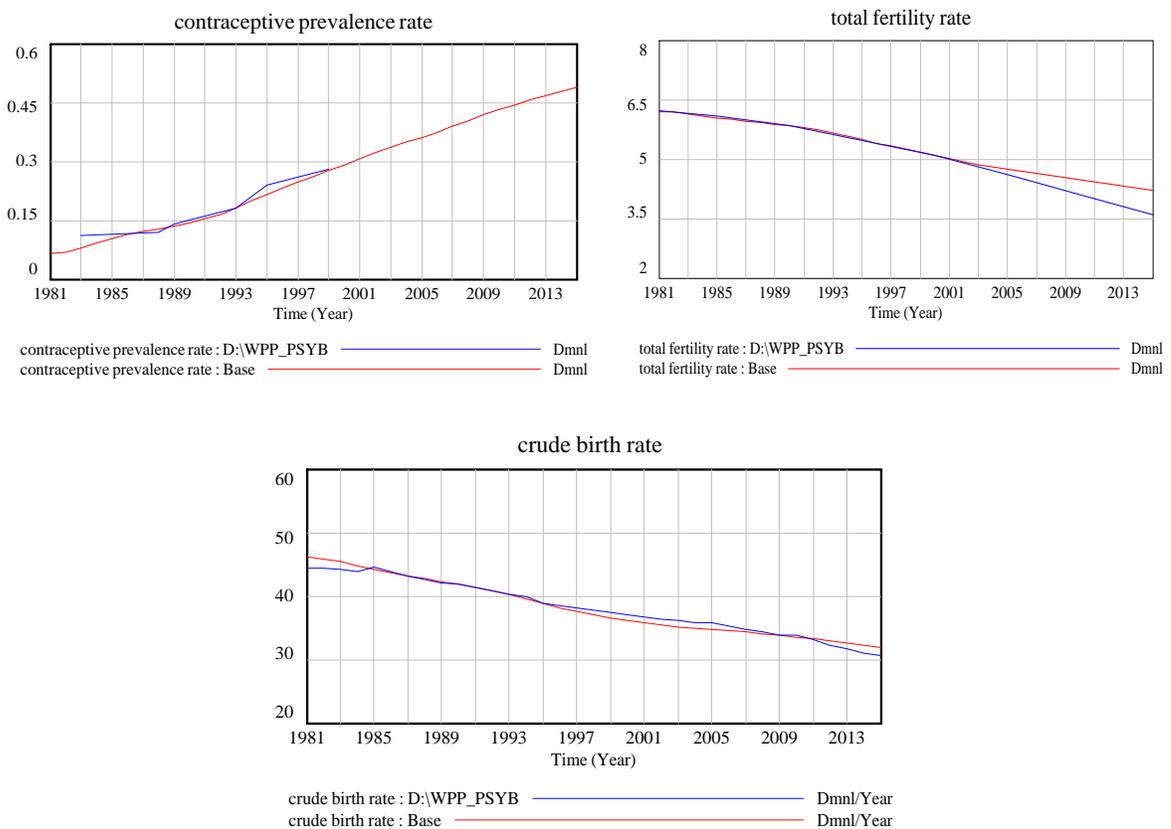


Figure 1. Contraceptive Prevalence Rate, Total Fertility Rate and Crude Birth Rate

(Data till 2001 is estimated and after that are projections. Source: WPP-2002)

<sup>4</sup> Gross Domestic Product in Purchasing Power Parity

The model output indicates that given the literacy level as estimated by this study the TFR in Pakistan is likely to be higher than the TFR projected by WPP-2002. On the other hand *death rate*, that decreases the population of two areas, is determined by the *Life Table Death Rates Function* developed for eastern countries by MI based on Coale (1983) mapped over *life expectancy*. It is commonly observed that life expectancy, and also as indicated by demographic transition theory, improves with the improvement in economic conditions that brings in improved access to better nutrition, sanitation and health facilities. The nature of such a relationship between income and life expectancy is estimated based on World Resources 1998-99 to fit model output to the estimated average life expectancy and crude death rate data of WPP-2002, as depicted in Figure 2. Even though such is simplification, however for the purpose of the model this level of aggregation and simplification is very much required.

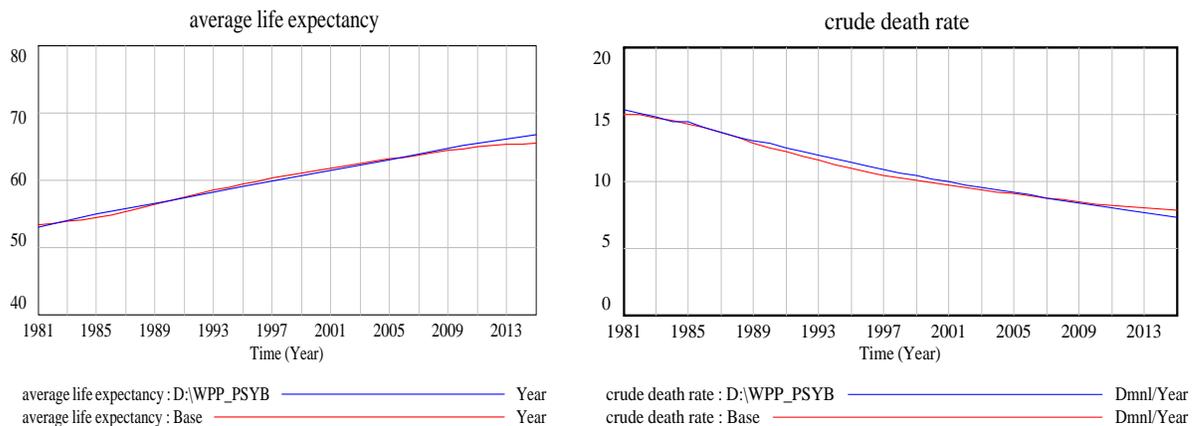


Figure 2. Average Life Expectancy and Crude Death Rate  
(Data till 2001 is estimated and after that are projections. Source: WPP-2002)

The results show that crude death rate, given the assumed GDP, is likely to be higher than rate projected by WPP-2002. This will be considered in future research by making GDP endogenous and also adding access to basic health care to the model. Another flow that affects population is migration from rural to urban areas and from country to abroad. This flow is governed by the historical migration trend observed in Pakistan.

The Figure 3 shows that the simulation output of total population fits the estimated/projected total population of WPP-2002.

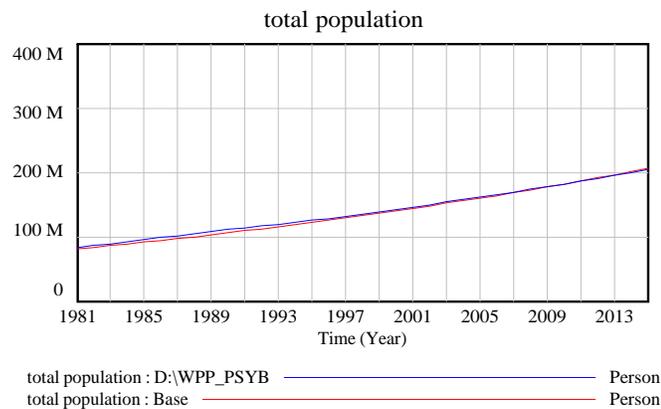


Figure 3. Total Population

(Data till 2001 is estimated and after that are projections. Source: WPP-2002)

In view of the purpose only the system structure of primary education in Pakistan is modeled<sup>5</sup>. It assumes that education expenditure, by public or private sector, and relative literacy rate will proportionately affect the primary gross intake rate and will inversely affect the primary drop out rate. This causality is so estimated that the model output may fit the relevant data of Government of Pakistan and World Bank, which is discussed in the analysis section.

#### Data Estimation

The data for this model is taken from three different sources. The UN's World Population Prospects: The 2002 Revision, The World Bank's World Development Indicators 2003 (WDI-2003) and various issues of Pakistan Statistical Year Book (PSYB) of Government of Pakistan. The population data is taken from WPP-2002 and it is reported in WDI-2003 that rural population in Pakistan was 72% of the total population in 1981. This helps plug-in initial rural and urban population. The net migration per 1000 habitants is taken from WPP-2002. The initial contraceptive prevalence rate is estimated

<sup>5</sup> The model could be obtained from authors on request.

based on WDI-2003, age specific fertility distribution and initial desired number of children is estimated from WPP-2002.

The GDP, current \$ in PPP, is taken from WDI-2003 and its three sectors' composition like agriculture, industry and services is taken from PSYB. It is assumed that rural GDP comprises of 100% of agricultural GDP and 20% from industry and services. While, remaining 80% of industrial and services GDP accounts for urban GDP. The total public spending on education as % of GDP is taken from WDI-2003. However, the available data did not provide allocations for rural and urban areas. Based on our empirical observation we have followed a thumb rule that 70% resources go to 30% population (urban) and 30% resources go to 70% population (rural) following a fundamental 80:20 principle. The education sector in Pakistan was de-regulated in 1979-80 and the following year brought in investments from private sector especially for primary education in urban areas being commercially attractive and lately for rural areas. In view of this event and having the estimated primary education expenditure by government as % of GDP and assuming that the model and its assumptions represent the system structure of population and primary education, and we estimated the primary education expenditure made by the private sector. Such estimation, otherwise necessary due to non availability of data, was verified by fitting multi-layers of historical data series of WDI-2003 and average regional literacy rate of PSYB.

### Analysis and Conclusion

The simulation results, assuming that the current trend of GDP, literacy and spending on education continues, show that the population of Pakistan will likely to be around 205 million people by 2015 in line with the population projected in WPP-2002, of which 15-17.5% is primary school age population. Based on the public spending on education data of WDI-2003 and our assumption on rural-urban allocation, we estimated the private spending on education in rural and urban areas so that the model output fits the average gross enrolment rate of WDI, presented in Figure 4.

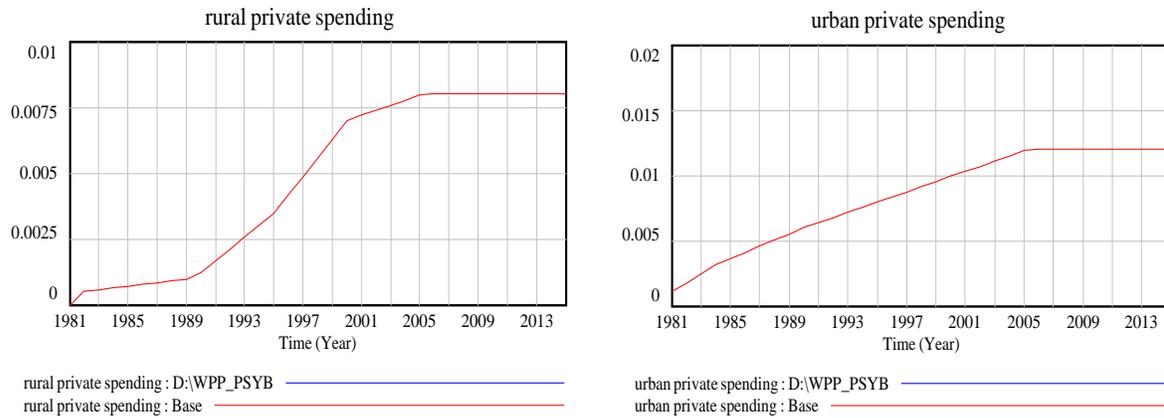


Figure 4. Estimated Private Spending on Education in rural and urban areas as percentage of GDP

The Figure 5 presents the public spending on education as percentage of GDP indicating gradually decreasing role of public sector. The data up to 2000 is taken from WDI-2003 and the data of Government of Pakistan shows that in 2005 they spent 2.86% of GDP on education. The space created by government was filled in inequitably by private sector and resultant overall improved spending on primary education attracted students to schools helped increased gross enrollment rate.

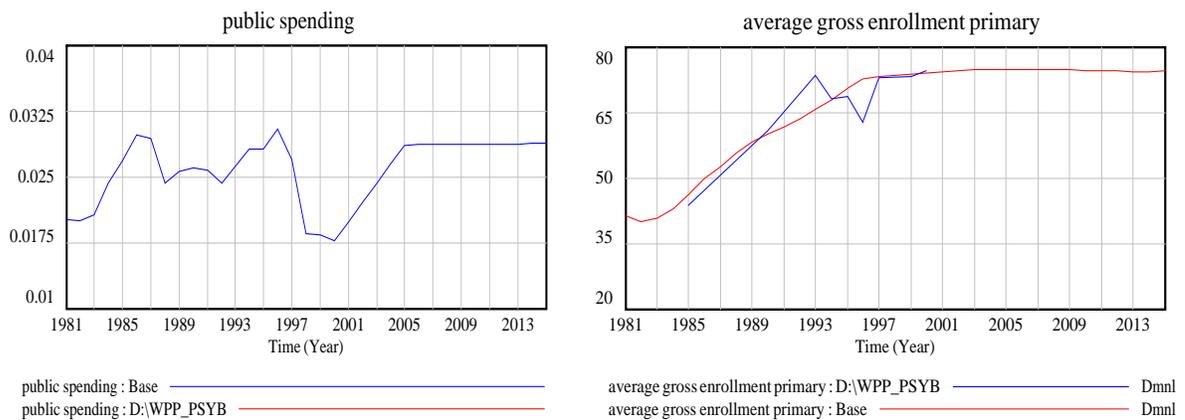


Figure 5. Public Spending on Education as percentage of GDP and Average Gross Enrolment Rate

The Figure 6 depicts the negative impact of low and inequitable allocations on the weaker segments of society.

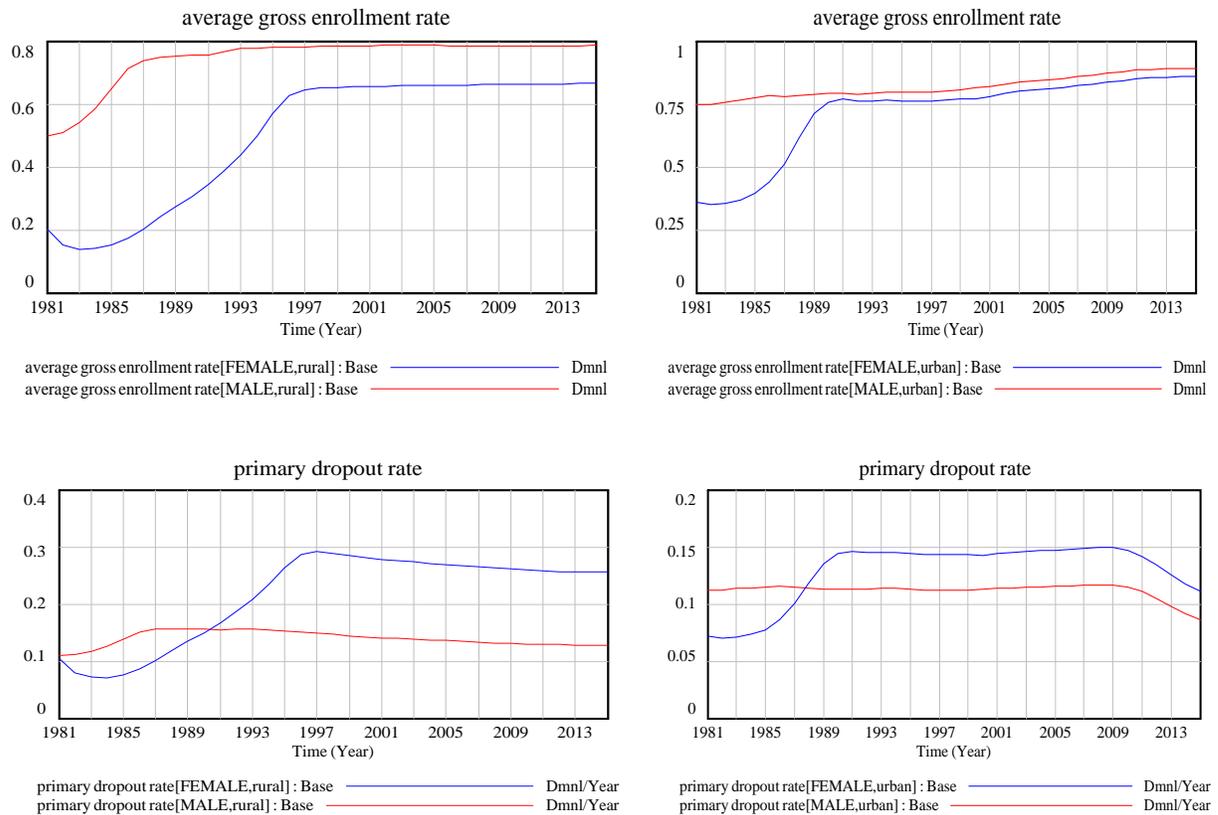


Figure 6. Gross Enrolment Rate and Dropout Rate in Rural and Urban areas.

Assuming the current trend of spending on education the gross enrolment rate of primary education is not likely to exceed 75% rendering Pakistan unable to fulfill its commitment of universal primary education by 2015. The alarming dropout rate pushes Pakistan away from its target MDG. We have tested different levels public spending, assuming that trend of private sector spending on primary education continues, and found that Pakistan may not be able to achieve universal primary education even if she spends five times of its current spending level. However, the increased public spending has substantially brought down the drop out rate. It would therefore, be more appropriate for Pakistan to channel some of its educational spending to reduce its primary drop out rate along with ensuring equity in allocations.

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