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Human capital and economic growth: A macroeconomic model for Pakistan

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ABSTRACT

The paper presents a small macro model for Pakistan economy focusing the impact of investment in human capital on the key macroeconomic variables. The demand side is modeled along the Keynesian lines while the supply side is modeled as per neoclassical theory of production. This framework allows analyzing the effects of investment in human capital on supply side variables (like labor, physical and human capital) and demand side variables (like consumption and investment) at the same time.
The model has small forecasting horizon in which three alternative scenarios regarding government spending on education are evaluated from 2012 to 2016. The model shows that the link between human capital and labor market is weak however a change in education spending affects output through enhancing productivity and through multiplier-accelerator principle. Though the model is small in size and forecasting horizon, it can help in evaluating the future paths of key macroeconomic variables associated with education spending.

1. Introduction

The role of human capital in the economic growth of a country is considered nothing less than necessary. There are numerous studies based on panel, cross sectional and time series data that found human capital as one of the most important factors in growth process. Most of such studies are conducted in the last few decades (Wilson and Briscoe, 2004) because of the availability of large cross country data which allowed the researchers to empirically test the models based on different sets of theories.[1] Various cross sectional studies also illuminated the role of human capital in the income convergence across countries.[2] In the case of Pakistan, the human capital–economic growth linkages are investigated through various studies conducted using time series data.[3] However, when it comes to modelling this theoretical and empirically tested relationship in macroeconomic modeling framework, very little work has been done so far.

Macro modeling has been used as an effective framework for policy analysis and forecasting the paths of key macroeconomic variables for a country or region (like European Union and Organization for Economic Cooperation and Development). Macroeconomic modeling framework does allow not only the analysis of human capital contribution in growth process, but also the running of policy simulations to analyze the effects of investing in human capital on key macroeconomic variables like output, employment, consumption, investment and prices.

There are various macro models available that are built keeping different segments of macro economy in consideration however, none of them explicitly discuss the role of investment in human capital for economic growth. Spending on education (investment on human capital) affects output through at least three channels. First, it increases the productivity of labor so output rises because of high productivity. Second, an increase in the labor productivity leads to an increase in the demand for labor and output rises because of more employed workers. Third, an increase in the stock of human capital attracts physical capital inflow from other countries (Abbas, 2000, 2001) and output rises because of increased foreign investment.

1.1. The macroeconomic models for Pakistan economy

There is very limited literature available on macroeconomic modeling in the case of Pakistan economy. Mainly, there are large macro models like Naqvi et al. (1983), including Naqvi and Ahmad (1986) and Chisti et al. (1992). All of these models are large sized, desegregated models covering different sectors including production, labor market, and monetary, fiscal and foreign sector. Another influential work has been done by SPDC in making a large sized macro model (Pasha et al.,

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[1] See Sianesi and Reenen (2000) or Temple (2000) for a discussion on such studies.
[2] See Nelson and Phelps (1966), Barro (1991), Mankiw et al. (1992) or Qadri and Waheed (2013) for details.
[3] See Abbas (2000 and 2001) or Qadri and Waheed (2011) for details.

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1995) connecting the macro economy with the social sector in Pakistan. Khan and Din (2011) is a small sized dynamic macro model which covered the linkages between aggregate supply, aggregate demand, monetary, fiscal and foreign sectors of Pakistan. Hanif et al. (2011) is a small sized macro model analyzing the impact of monetary policy on key macro economic variables. Since, the supply side is not considered in the model building, the model implicitly assumes that a change in output and prices is mainly because of a change in aggregate demand which is inappropriate in the case of a supply constraint country like Pakistan. Aggregate demand stimulation can cause inflation in the presence of supply constraints (Hirsch, 1977) instead of increasing the output and employment in an economy (Mallick, 1999). All the macro models enlightened the linkages between macroeconomic sectors however; none of the models explicitly discussed the role of investing in human capital in economic growth. This is the first model which illuminates the effect of such spending on key macroeconomic variables in case of Pakistan.

2. Characteristics of the model and data

The model is a small sized, comprehensive macro model which is comprised of three blocks. Two of which are recursive while one is simultaneous block. There are 12 equations in the model out of which, 08 are behavioral equations and 04 are identities. There are 20 variables in total. Out of which, 12 variables are endogenous while 08 are exogenous. The exogenous variables are further classified as policy and non-policy variables. There are 03 policy variables named government consumption, government investment and spending on education as percentage of GDP and 05 non-policy variables.

The data set is annual which is taken from various publications of Pakistan Bureau of Statics (Former, Federal Bureau of Statistics). The unit for all monetary variables is million rupees in constant price (1999–00) except for world GDP which is measured in million US dollar in constant price (1999–00), taken from World Development Indicators.[4]

The variable capital stock (K) is calculated through perpetual inventory method. The data set used for model calibration is from 1981 to 2011 except for the private consumption. The data set for private consumption is from 1975 to 2011 in order to get the best fit values for model calibration. The data set for model's solution is from 1981 to 2011.

3. Structure of the model

This model complements the existing macro models which illuminates the macro effects of investment in human capital in Pakistan. The model follows the framework adopted by Welfe (2005 and 2011) which used final demand equations along the Keynesian lines but the output generation is modeled through neoclassical theory of production. This framework allows analyzing the effects of investment in human capital on supply side variables (like labor, physical and human capital) and demand side variables (like consumption and investment) at the same time.[5] The pure Keynesian model is generally criticized because of its inability to cover the supply side of the economy which is very important especially in the case of under developed countries which generally face supply constraints. Moreover, the model does not cover the role of the money market, relative prices and expectations effectively (Valadkhani, 2004). A pure classical model is also criticized because of not covering the demand side of the economy. The model under Klein et al. (1999), Bodkin et al. (1991) and Whitley (1994) framework overcomes the problems associated with pure classical or Keynesian model. Key characteristics of the model are presented in Table 1.

Table 1
Key characteristics of the model.

Number of independent blocks	3
Number of recursive blocks	2
Number of simultaneous blocks	1
Number of equations	12
Behavioral equations	8
Identities	4
Endogenous variables	12
Exogenous (policy variables)	3
Exogenous (non-policy variables)	5

As presented in Table 1, the model classifies exogenous variables into policy and non-policy variables. The exogenous variables on which government enjoys a significant degree of control are exogenous policy variables.[6] Government consumption, government investment and education spending as percentage of GDP are taken as policy variables in the model.[7] The coefficients of all independent variables in the 08 behavioral equations are the long run equilibrium values of the variables as per Engle–Granger two step procedure.[8]

4. Demand block

The demand for products and services comprises of consumption demand, investment demand, inventory and net exports.

4.1. Consumption demand

Consumption demand is the sum of private consumption demand and government consumption demand. Government consumption demand is taken as a policy variable while the estimated coefficients and relevant parameters of private consumption are stated below.

4.1.1. Private consumption

In order to get the best fit consumption function for Pakistan economy, different specifications have been used. In an alternative specification, lag of consumption was found to be statistically insignificant rejecting the existence of adaptive expectations. The relationship between interest rate and consumption depends on the relative magnitudes of income and substitution effect. Generally, a negative relationship between interest rate and current consumption is expected. However, interest rate also turned out to be statistically insignificant in the regression which implies that interest rate has very limited or no role in the intertemporal consumption decision.

Equation 1					
$\log(PC) = 6.854 + 0.329 * \log(Y) + 0.212 * \log(M2)$					Adjusted R^2
t-Statistics	5.630	2.795	5.273		0.996
Prob(t-stats)	(0.000)	(0.008)	(0.000)		
DW statistics	1.624			F-Statistics	4507.348

However, the best fit regression indicates that Keynesian consumption function and wealth effect explain the consumption behavior sufficiently. In Eq. (1), Y represents current income and M2 is taken as a proxy for financial wealth.[9]

[4] http://databank.worldbank.org/ddp/home.do?Step=12&id=4&CNO=2, last accessed on July 2012.
[5] See Klein et al. (1999), Bodkin et al. (1991) and Whitley (1994) regarding studies on similar framework.
[6] See Ra and Rhee (2005) for details.
[7] For details of variables and their description, see Appendix 1.
[8] See Tables in Appendix 1 and 2. Tables show that all the variables in the 08 behavioral equations are I(1) and that the residual series obtained from all 08 equations are I(0).
[9] See Hanif et al. (2011) for a similar specification.