



Relationship between School Education and Economic Growth: SAARC Countries

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ABSTRACT

For long increasing economic growth is the major objective of macroeconomic policy makers of the country. Many studies have tried to put forward a theory which can explain the pattern of gross domestic product growth, in this series Cobb-Douglas were most prominent in making a production function using physical capital and labor as inputs. But later studies highlighted that human capital is also a significant component of this production function. This study used three proxies for the human capital for the case of SAARC countries to see whether higher proxy has better marginal impact on the growth of the selected countries. The results for dynamic panel data models reveal that tertiary education enrollment has highest impact on growth as compare to primary and secondary education enrollment.

Keywords: Gross Domestic Product, Human Capital, Panel Cointegration

JEL Classification: I25

1. INTRODUCTION

In pursuit of economists to increase the economic growth of the country, decomposition analysis of the gross domestic product (GDP) was of the essence as it played its role in finding policy options. First breakthrough in this domain came from Cobb-Douglas who provided a mathematical expression of production function which determined the macroeconomic inputs-outputs relationship in an economy. This mathematical expression was anticipated first by Kunnt Wiksell and then empirically tested by Charles Cobb and Paul Douglas in 1928. In their study, Cobb-Douglas measured the amount of produced output through the amount of capital invested and the total labor resource in the production, for USA for the time period of 1899-1922. The mathematical expression is:

$$P(L,K) = bL^\alpha K^\beta \tag{1.1}$$

Cobb-Douglas production function and constant elasticity of substitutes are very effective models and widely used in policy analysis and economic forecasts of CBO and others (Miller, 2008).

In 1922, Cobb-Douglas function was accepted as an effective production model, which was later used as a foundation with other important factors like role of inflation, political regimes, and most importantly the role of human capital. This study has also used role of human capital in the Cobb-Douglas framework as this was the greater force in the development of later countries which are known as Asian Tigers.

As conventionally, estimates of the education contribution towards economic growth can be calculated by using one or a new variation in the alike basic above Equation (1.1) mathematical frame. Assuming, here subsist accumulative production function connecting output (Y) to a mixture of inputs such as Labor (L) and physical Capital (K)

$$Y=f(K, L) \tag{1.2}$$

The observed average annual growth rate (g) of the economy for a given period of time could be disaggregated into physical capital and labor elements (see right hand side of Equation 1.2, respectively).

$$g_y = \frac{I_r}{Y} + g_L S_L \quad (1.3)$$

Whereas, in Equation (1.3) I/Y is investment to output ratio, r stands for rate of return to investment, g_L is the average annual rate of growth of the labor force, and S_L is the share of labor in national income. Early efforts to statistically balancing the both sides of Equation (1.3) have resulted in well identified significant “residuals,” and which provided an academic support for attempting to lessen it (residuals) by introducing additional variables, such as, in the present study “education.” Education can include into Equation 1.3.

$$Y=f(K, L, H) \quad (1.4)$$

In present study education is taken as a production function of growth because of its importance as it is universally admitted that education is a primary factor to augment growth of an economy. It plays an important role in economic growth by enhancing skills and knowledge of human capital. It increases productivity and competency. Education gives benefits to individual and the country and society as a whole.

Economic growth performance of Pakistan has been very inspiring over the past two decades as compared with most of the developing countries in the World. Owing to some disturbing factors that have existed along with economic growth, Pakistan’s productivity and growth performance has been judged as a development puzzle. These factors includes social factors in Pakistan’s economy which remains strictly poor, the balance of payment deficits enough large despite of the ability to avoid inflation, there exists low adult literacy rate and primary and secondary school enrolment ratios are very low, the state of investment and savings remained very much low as compared to the developing world and there is unequal distribution of wealth which enhances the gap between the rich and the poor. Illiteracy rate is very high in Pakistan amongst the world.

Pakistan’s adult illiteracy rate exceeding the average amongst the world in most critical situation is related schooling achievements. Pakistan’s secondary and primary enrolment ratio is to a large extent below the average as compared with every other region in the world and also female education discrimination exists in Pakistan. Education is a basic and important factor to improve human capital and has positive effect on economic development.

In the previous work of Kakar et al. (2011), they applied co integration model that indicates existence of error correction model which shows exact negative sign for labor force participation rate and real GDP. The labor force participation rate and real GDP are highly significant. In error correction model 35% which is the correct “which is the correct -0.35 ” that shows the past in equilibrium has been eradicated in growth rate of GDP. Human capital and their growth rate both are considered main determinants of growth, Gemmell (1996). Economic growth and schoolings are highly positively associated with each other (Barro, 1991).

1.1. Economic Growth

Real GDP is taken as a measure of Economic Growth of SAARC Countries. This proxy has been used by (Abbas and Foreman-Peck, 2007; Chaudhary et al., 2009; Islam et al., 2007; Jin, 2009). “GDP is the market value of all final goods and services produced during a year within the geographical boundaries of a nation. It does not include the income earned by resources in foreign countries but includes the income of foreigners working in an economy.”

1.2. Education

The activities of getting or acquiring general knowledge, learning process of basics skills such as mathematics, geography and also developing elementary understanding of some other subjects e.g., history, natural sciences, social sciences, art and Arabic, developing reasoning and judgmental mental power, and preparing oneself or others intellectually for mature life. School enrollment, primary (% gross), school enrollment, secondary (% gross) and school enrollment, tertiary (% gross) has been taken as a proxy for primary, secondary and tertiary education, respectively (Loening, 2005). The relationship between education and the GDP is positive that shows education is a significant primary input factor for the growth of an economy. Barro (1991) argued that there is significant and positive association between economic growth and the education. Bils and Klenow (2000) argued that high enrollment rate causes rapid improvement in productivity; therefore, faster growth in per capita income (PCI) resulted in countries where there is high rate of enrollment in schools. Hanushek and Kimko (2000) argued that there is remarkable increase in productivity and national growth rates due to the quality of the education.

1.3. Physical Capital

Physical capital stands for human capital which refers to make investments on humans who have an ultimate effect on economic growth of a country. The expected relationship between physical capitals on GDP is positive. There is positive association between the human capital and the level of investment in education with growth (Keller, 2006; McMahan, 1998). Benhabib and Spiegel (1994) argued that a source of economic growth is the human capital development. Gemmell (1996) argued that the determinants of economic growth are both human capital and their growth rates. Labor force, total is taken as a proxy of physical capital. Labor force participation rate is the number of people employed, unemployed and also those seeking for jobs or work as a proportion of specified baseline (e.g., the total adult population 15+ years) population. It is a key factor that has major contribution in economic development of labor intensive countries.

1.4. Inflation Rate

Inflation rate is increase (% increase) in the price of goods and services; usually annually inflation is sharp upward movement in the price level. This variable is measured by the consumer price index (CPI) 2005=100 which is taken as a proxy for inflation. The expected signs of inflation rate can be mixed (it may be positive or negative) based on condition like Dotsey and Sarte (2000) argued that owing to the variability of inflation, impact of inflation on precautionary saving increased the investment, on the other side Jorda and Salyer (2001) argued that there may be lower nominal interest rate trends due to the monetary uncertainty. Holland (1993)

reports on four studies in which he found a positive association between real economic growth activity and inflation uncertainty, versus 14 other studies that found negative relationship. According to the Elder (2004) the estimated effects of inflation uncertainty changes substantially in terms of timing and magnitude.

1.5. Research Question

Education has a significant impact and major importance for developing countries like SAARC, which is the case in this study. The research question is whether improvement in educational sector has positive impact on improvement of economic growth and whether different level of human capital has different contribution towards the growth of SAARC countries. There comes significant and positive correlation between education and productivity (Cummins, 1980). Decline in human capital deteriorated economic growth and development due to the high turnover from the school (Seebens and Wobest 2003).

2. LITERATURE REVIEW

Education is generally considered as an essential and powerful instrument in upgrading economic growth, enhancing earnings at private level, discouraging and reducing poverty, empowering people, encouraging health and flexibility in environment and developing competitiveness in economy (Shah, 2011).

Education has been given a major importance during the development and growth strategy of an economy. Education plays main role in the determination of growth (Schultz, 1961). It performs an important role in formation of human capital. It has been found that well educated human capital has consistent and strongest direct and positive effect on productivity, prosperity, development and economic growth of a country (Shah, 2011).

Proposed economic models have a major potential weakness is the economist's negligence regarding human resource development that could be possible through proper educational system. By being an educated person can learn more than skills. Development and enhancement of motivation, confidence and innovative abilities is only one dimension of personal change and human resource development, and that is obtained by education and it is also relevant to economies, (Williams, 1967). Education has impacts on a country both socially and economically. Those who are educated give respect to national values, know about laws, have manners in their activities and speaking styles, able to develop the sense of responsibilities and also become socially responsible towards their country.

On the other hand educated people are less likely to engage in crimes towards the welfare of country and citizens. Education provides strong citizens to a country. Education has a highly positive impact on economic growth (Romer, 1990a; Romer, 1986; Lucas, 1988).

Education also creates environmental and structural changes in which children relating to all ethnic groups, regional areas, and income classes may enhance their capabilities in society. Education helps in the development of earned and well-sensitive human

capital which is very necessary for success in such a technological advancement. The consideration of technology transfer from innovating countries, with respect to developing countries is one way of characterizing the role of human capital, (Lucas, 1988). Education helps and facilitates the implementation and adaptation of those new technologies, which are continuously invented, (Nelson and Phelps, 1966).

Educated human capital encourages and understands the use and importance of technology. Whereas, technology takes place in organizations due to educated people. It gives time to make people productive, dynamic and flexible according to the threats and opportunities which enables them to walk in the world. Education plays a basic role in growth determination, (Schultz, 1961). Domestic technological progress result from the search for innovations, (Romer, 1990a; Grossman and Helpman, 1991).

The research and development activities, results in enhancement of domestic technologies which are undertaken by profit maximizing individuals, enhance the productivity and are an ultimate source of long-term growth. The human capital level facilitates the improvements in productivity that ultimately effects growth (Nelson and Phelps, 1966). Educated people also achieve chances to move from one firm or company to another where they present themselves in international seminars conferences and meetings through which they make name of firm or country worldwide.

It has a positive impact on economic growth and attracts investments due to physical and social environmental stability and also cause decline in poverty. Development in education covers the avenues which start from economic progress to overall national development. It has been found that education was an important determinant of farmer's income (Schultz, 1961). High enrollment rates result fast progress in productivity that is the tested growth in PCI and it is due to the high enrollment rate in schools (Bils and Klenow, 2000). It is also very attention driven that as the number of students increase in the schools which require more chairs, more teachers, and more rooms that in turn makes space for investments at private and public level. Education gives birth to skilled and learned human capital. Education makes avenues to eradicate and decline poverty.

Inflation rate as CPI has mixed relationship with the economic growth. It may be significant or insignificant for the economic growth. In some cases inflation fosters investments. In both empirical findings and theory the relationship between economic growth and inflation remains controversial that issue has gave space enduring debates between monetarists and structuralisms. Friedman (1973) defined the nature of relationship between economic growth and inflation without any definite conclusion that is as follows: "Historically every possible combination has come across, without and with development, inflation exists, and there is no inflation existence, without and with development." Findings regarding any meaningful relationship between economic growth and inflation have been linked in earlier works (Wai, 1959), no causal relationship between economic growth and inflation has found (in 40% of the countries) for 1960-1989 period in which 70 countries (48 are developing) are included, the most recent work done by Paul et al. (1997).

The relationship was found negative in some cases and positive in other cases. Inflation encourages consumption and extremely discouraging savings in a country. Owing to the inflation there is high consumption in a country that leads to more investment in different economic sectors which in turn enhance the growth for a period that is why there comes positive relationship between inflation and GDP, (Shah, 2011).

Political policies related to the structure of any government. The proxy for political policies is taken as Official Aid received and Net Official development Assistance US \$ and it has mixed relationship with GDP.

The human capital has a major contribution in development and growth of economy. According to the Lucas (1988) growth theorists such as the human capital accumulation can sustain growth for long time period (Azariadis and Drazen, 1990; Stokey, 1988). These theories have achieved support from macroeconomic regression analysis which emphasized on the positive effect of education on growth and development according to the economic historians work such as (Barro and Sala-i-Martin, 1995; Fogel, 1990; Mankiw et al., 1992).

3. METHODOLOGY

3.1. Population and Sampling

This study is focusing on SAARC countries, SAARC including Pakistan, India, Bangladesh, Bhutan, Nepal, Sri Lanka, Maldives and Afghanistan and all these are developing states. These countries are facing high level of poverty, labor intensive, having huge religious diversity, large in population and more influential by the military forces. The purpose of this study is to analyze the impact and contribution of primary, secondary and tertiary education and the importance of education in economic growth of SAARC region.

A sample period of 53 years and has been taken for this study for the period ranges from 1960 to 2013 with panel data of SAARC countries. Latest possible sample period has been chosen depending on the availability of data.

3.2. Data Reliability

For analysis of the proposed model, data was collected from World Development Indicators (WDI) official website. WDI is considered as the most authentic and reliable secondary data source. The data is collected from 1960 to 2013 of SAARC countries including Pakistan, Bangladesh, India, Sri Lanka and Bhutan.

3.3. Variables and their Proxies

Five variables have been indicated for the purposed study including one dependent variable economic growth and four independent variables as Education (Edu), and three control variables that are inflation rate (INF), and physical capital (PC) has been taken as independent variables. To avoid probability of specification biased due to omission of important variables from a bivariate regression model, i.e., $GDP=f(\text{Edu})$ and the other variables such as physical capital, inflation and well developed infrastructure have been included in the regression model.

4. ESTIMATION AND FINDINGS

In this chapter the Equation 1.4 will be used as a foundation to form stochastic Equation later be used for the econometric process to generate the marginal impacts useful for the policy making. Following is the stochastic equation which will be used in the estimation

$$LGDP_{it} = \alpha_i + \beta_1 LCPI_{it} + \beta_2 LCAP_{it} + \beta_3 LLAB_{it} + \beta_4 LPRI_{it} + \beta_5 LSEC_{it} + \beta_6 LTER_{it} + \mu_{it} \quad (1.5)$$

The notation of the variables in this equation are explained in the Table 1, this model is based on data is collected from 1960 to 2013 of SAARC countries including Pakistan, Bangladesh, India, Sri Lanka and Bhutan.

4.1. Empirical Findings

In the Table 2 below are the results from the basic panel data models; here we have presented two models. First is the pooled ordinary least squares (OLS) model which assumes that all the countries included in this panel data are similar to each other in every way. While the second is the fixed effect model which assumed that all the countries are same in terms of the effect of the independent variables only after that the countries are heterogeneous which will be represented by the difference in the intercept of the model. These models are also called static models as in this model effect of the past is not incorporated.

Here in this model we can see from the Redundant FE test that the assumption used in the pooled OLS model is invalid hence we will focus on the Fixed Effect model In this model we can see that all the proxies for the human capital are significantly effecting the economic growth. The primary school enrollment showed negative impact on the economic growth whereas secondary and tertiary school enrollment shows positive impact.

From the above diagnostics we can see that in the pooled OLS model although there is not cross sectional dependence but the residuals are not normal. While we compare the two models of pooled OLS and the fixed effect model from the Redundant FE test we can see that FE model is superior to the pooled OLS. The major difference between both models is that the magnitude of the primary education enrollment gets reduced considerably from pooled OLS to FE model, while the sign of Tertiary education gets corrected and becomes significant too.

Since the included years are 21 in each cross section, it is expected that the results might be spurious. From the unit root test of the residuals of both competing models, it can be seen that the residuals from both the models are non-stationary hence for the model to be reliable they must at least be stationary if they are not random. Here we can conclude that the models are spurious, which may be due to non-stationary nature of the variables. We must opt for cointegration based model which can adapt for the non-stationary variables.

Table 3 shows the unit root test results based on four popular tests like LLC (Levine et al., 2002), IPS (Im et al., 1997),

Table 1: Variable and proxies

Variable	Proxies	Notation	Major studies
Economic growth	Real gross domestic product	LGDP	(Afzal et al., 2010; Kakar et al., 2011)
Education	School enrollment, primary (% gross)	LPRI	(Loening, 2005)
	School enrollment, secondary (% gross)	LSEC	(Loening, 2005)
	School enrollment, tertiary (% gross)	LTER	(Loening, 2005)
Physical capital	Gross fixed capital formation	LCAP	(Kakar et al., 2011)
Labor Force	Labor Force, Total	LLA	(Kakar et al., 2011)
Inflation rate	Consumer price index (2005=100)	LCPI	(Afzal et al., 2010; Keller, 2006)

Table 2: Estimates from static models

Dep. Log GDP	Coefficients (P)	
	Pooled OLS	Fixed effect
Independent variables		
LCPI	0.48 (0.00)	0.28 (0.00)
LCAP	0.19 (0.15)	0.35 (0.00)
LLA	0.95 (0.00)	0.47 (0.00)
LPRI	-1.63 (0.00)	-0.20 (0.08)
LSEC	1.05 (0.00)	0.29 (0.00)
LTER	-0.23 (0.14)	0.19 (0.00)
C	9.30 (0.00)	13.41 (0.00)
Regression diagnostics		
Jarque Bera ¹	20.16 (0.00)	
Pesaran CD ²	0.003 (0.97)	
Redundant FE test ³		470.6 (0.00)
Residual stationarity test		
Null hypothesis: Residuals are non-stationary, model is spurious		
	Statistic (P)	Statistic (P)
LLC	0.23 (0.59)	0.75 (0.77)
IPS	-0.57 (0.28)	0.33 (0.63)
ADF	18.85 (0.04)	16.62 (0.08)
PP	9.94 (0.44)	8.89 (0.53)

ADF: Augment Dickey-Fuller, PP: Phillips-Perron, LLC: Levin, Lin and Chu, IPS: Im, Pesaran, and Shin, OLS: Ordinary least squared

Augment Dickey-Fuller and PP. We can see that all four test show insignificant results for all the variables at the level which means that null hypothesis is accepted for all concluding that all the variables are I (1). This is the major reason which is making pooled OLS and fixed effect model spurious. Hence in the presence of non-stationary variables, cointegration test is required which provides evidence that these variables are related in long run or not. Below we have shown the result of (Kao, 1999; Pedroni, 1999).

For the case of Pedroni test there are 7 statistics in this majority 4 are significant showing that the selected variables are cointegrated with each other (Table 4). Also based on the KAO test, which is significant showing that these variables are cointegrated as their residuals show convergence. Hence we can estimate the long run coefficients using fully modified ordinary least squared (FMOLS) approach (Table 5).

Since it is confirmed that there is long run relation using the cointegration tests, now this study will use the FMOLS model

1. JarqueBera test for normality by making joint null hypothesis of skewness = 0 and kurtosis = 3.
2. Pesaran cross sectional dependence test checks cross sectional autocorrelation in the data.
3. Redundant FE test compared the OLS and FE model.

Table 3: Unit root test

Variable	Null hypothesis: Variable is I (1)			
	LLC	IPS	ADF	PP
LGDP	1.95 (0.97)	6.13 (1.00)	6.80 (0.74)	5.34 (0.86)
LCPI	1.88 (0.97)	4.85 (1.00)	1.49 (0.99)	2.84 (0.98)
LCAP	0.24 (0.59)	-0.02 (0.49)	13.46 (0.19)	14.87 (0.13)
LLA	-1.20 (0.11)	1.36 (0.91)	4.47 (0.92)	8.84 (0.54)
LPRI	-0.78 (0.21)	1.51 (0.93)	5.43 (0.86)	5.05 (0.88)
LSEC	0.32 (0.62)	3.00 (0.99)	1.40 (0.99)	1.40 (0.99)
LTER	4.49 (1.00)	6.28 (1.00)	1.73 (0.99)	1.40 (0.99)

ADF: Augment Dickey-Fuller, PP: Phillips-Perron, LLC: Levin, Lin and Chu, IPS: Im, Pesaran, and Shin

Table 4: Cointegration test

Null hypothesis: No cointegration among selected variables ⁴	
Pedroni test	
	Statistic (P)
Panel v statistic	-0.11 (0.54)
Panel rho statistic	1.03 (0.85)
Panel PP statistic	-3.57 (0.00)
Panel ADF statistic	-2.43 (0.00)
Group rho statistic	2.31 (0.99)
Group PP statistic	-6.74 (0.00)
Group ADF statistic	-2.74 (0.00)
KAO residual cointegration test	
	t-statistic (P)
ADF	-2.52 (0.00)

ADF: Augment Dickey-Fuller

Table 5: FMOLS long run coefficients (Dep. LGDP)

Independent variable	Coefficient	P	VIF
LCPI	0.44	0.00	4.14
LCAP	0.58	0.00	4.99
LLA	1.25	0.00	5.28
LPRI	-1.29	0.00	4.77
LSEC	0.36	0.00	5.73
LTER	0.37	0.00	7.41
Regression diagnostics			
Included observations	108	Jarque Bera	0.05 (0.97)
R squared	0.99		

FMOLS: Fully modified ordinary least squared

to generate the long run coefficients here we can see that all the variables are significant as the Fixed effect model. And according to the VIF test none of the value is greater than 10 so, there is no hint of multicollinearity between the independent variables. And the JarqueBera test being insignificant shows that the residuals are normally distributed hence we can apply inference to the coefficients.

4. Null and alternative hypothesis are same for both Pedroni and KAO test.

Here controlling for production function and education we can see that inflation has positive impact on the GDP, 1% increase in prices will lead to 0.44% increase in the GDP on average.

If we analyze the production function we can see that for the selected SAARC countries the effect of capital stock is significant and positive, here 1% increase in the capital will lead to 0.58% increase in the GDP. Whereas SAARC countries are being labor oriented the coefficient of labor is more elastic as compared to capital, 1% increase in the labor will lead to 1.25% increase in the GDP on average.

Now if we compare the impact of education we can see that the higher the education the beneficial it gets for GDP. Here 1% increases in the primary enrollment leads to 1.29% decrease in the GDP which can be because of the fact that this level of education requires cost to manage. While 1% increase in the secondary education leads to 0.36% increase in the GDP which shows a considerable difference as the people who are education upto secondary might be able to play their role in the economy. Here 1% increases in the tertiary education leads to 0.37% increase in the GDP which is higher than the secondary enrollment.

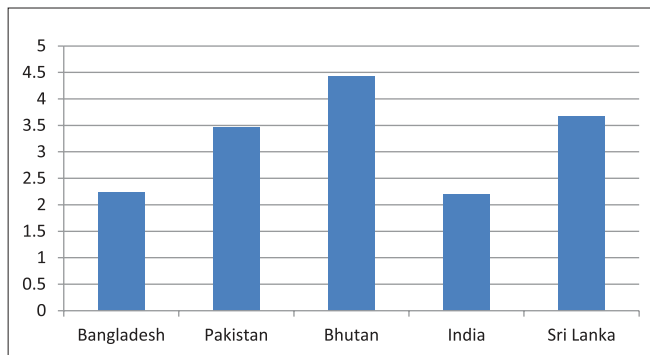
From the Figure 1, we can see the value of intercept for each country generated from the FMOLS model; here the higher the value means that the other policy factors in the country are growth promoting. Here the policies of Bhutan are most growth promoting while incorporating the human capital in Cobb-Douglas framework.

5. CONCLUSION AND POLICY OPTIONS

Building from the Cobb-Douglas production function framework of incorporating the labor and capital, this study presented empirical literature which advocated that the role of human capital is significant which let the development of the East Asian countries. This study has used three proxies for the human capital for the case of SAARC countries in expectation that they will have different effect on the economic growth.

From the pooled OLS and Fixed Effect model as a basic model shows that estimating this model cannot be interpreted from these as there is presence of spuriousness. This issue led us to check the presence of non-stationary presence in the variables using 4 panel

Figure 1: Country Specific Effects from FMOLS



unit root tests. The test results shows that all variables are non-stationary, in such case all the variables must be cointegrated using Pedroni and Kao test. After this panel cointegration test, long run estimates are generated from the FMOLS.

The results from FMOLS showed that, education has robust positive effect on economic growth, the Government can achieve more better results by investing heavily in educational sector e.g. better study conditions, provide teachers according to new and enhanced technology to schools, encourage people to educate their children, make it feasible and cost effective for public, and fair admission process etc. It may be the valuable for developing countries to spend more and more on Education because it is a productive tool for Government to push upward the GDP growth of a country. Proxy for Education can be used as being enrollment by using primary, secondary and tertiary enrollment ratios (% gross) more than 25 years per country can be used to explore results in detail. In these results we can see that expanding the primary enrollment only will only create liability on the economy as these individuals are still not skilled enough to attain better jobs which are productive. While we can see that the effect of secondary and tertiary education enrollment has positive impact showing the if the country increases their enrollment then these individuals will be able to contribute towards the economic growth by gets jobs in productive sectors of the economy.

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