

Study of Effect of Human Capital on Economic Growth (Case Study of Developing Countries)

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ABSTRACT

In the conducted studies about factors creating economic growth, less than 50% of growth was associated with main factors of production (work, capital and land) and the rest with unknown factors such as change of technology, increased productivity and remaining factor. The quality factor effective on production process is human capital that is not definable by work factor and it seems that it has a source other than education. In this study, the effect of human capital on economic growth of developing countries is studied. The index under the title of structure of human capital is introduced in form of the ratio of the number of academic graduates to total educated population (including primary school, secondary education and university) and investigation of the effect of this index on economic growth is one of the main goals of the study. To achieve this goal, panel data for the period between 1980 and 2010 and generalized moment method (GMM) was used. The studied sample consisted of 25 low income countries, 34 lower middle income countries and 35 upper middle income countries according to classification of the World Bank.

According to the results, the outcome of initial domestic gross production index and the gap of domestic gross production were positive and significant. The effect of balance of human capital on economic growth was only positive and remarkable in the countries with upper middle income. The effect of physical capital was more than the effect of human capital on economic growth and the index of productivity rate was negative and insignificant unlike what was expected.

KEY WORDS: Human capital, Economic growth, Human capital structure, Co-integration data, generalized moment's method.

1. INTRODUCTION

One of the most important effective factors on individuals' income is their human capital. Although there is no agreement on what human capital is, how it is calculated and also how it is accumulated (17), different definitions are given for human capital, particularly the institutionalized abilities and capacities in human, whether physical, intellectual or mental are called human capital. In this definition, human capital is part of the vast concept of intangible capital or intellectual capital. According to this definition, human capital has to have physical (or material) and intellectual aspects. The material aspect is established by investment in nutrition, health, medical treatment and sport and the intellectual aspect is materialized by institutionalizing knowledge by education and experimental learning in human being.

In other words, the concept of human capital refers to any activity that increases quality and productivity of the workforce and consequently leads to growth of individual's income. In addition, human capital is also defined as promotion and improvement of production capacity of individuals.

In the studies conducted on the factors creating economic growth, less than 50% of the growth is concerning the main factors of production (work, capital, land) and the rest refer to unknown factors such as change of technology, increased productivity and remaining factors. The effective quality factor on production process is human capital that is not definable by work factors and it does not seem that it has a source other than education (16).

The role of human workforce in the production process has gone under remarkable changes from the viewpoint of economic theories during time. These developments include a scope which ends in one side to the concept of work force which is assessed by physical capacities and on the other hand there is the concept of human capital which is the result of accumulation of knowledge, skill and experience in human beings (21). Most economists believe that in fact shortage of investment in human capitals is the main factor of low level of economic growth in the developing countries and as long as these countries do not promote education, use of science and knowledge and increased level of professional skills, return and efficiency of the workforce and capital will remain at a low level and economic growth happens slowly and with heavier costs. In fact it could

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be said that physical capitals will be more generative only when the country has the required human resources (18). Efficient human workforce paves the ground for increased production and value added and inattention to this important factor can be one of the reasons for being underdeveloped in some developing countries. Investment in human capital and its increased share in the total state investment leads to better exploitation of physical capital and is an important factor in the process of growth and economic development (21).

Considering the importance of human capital in the economic growth, many countries such as developing countries tried to promote in different ways, particularly the government's support for the accumulation of human capitals in their countries. Emergence of these attempts can be noticed easily in increased average level of educational years in the countries. Now under such circumstances where a positive and strong relation between income per capita and accumulation of physical capital was proved in many studies, this question is raised whether increased human capital which is materialized following government's investments could also have any effect on promotion of growth in these countries (18).

Here, the experience of advanced countries show that the rate of economic growth (economic growth is the frequent/regular increase in the national gross production) is only through physical capital and insufficient working population and there are other factors except physical capital and work factor that intensify economic growth of the societies. These factors that are known as additional or remaining factors are the main cause of increased capital productivity and human workforce. Many economists believe that the additional or remaining factor that describes the important part of the economic growth of advanced countries depend either directly or indirectly on better education. Because the more the workforce enjoys higher education, the more useful this education will be and improvement of the workforce will have larger effect on increased quantity of production (13).

Theoretical ground of role of human capital in economic growth

The topic of economic growth was raised since Young, Harrod-Domar, Solow-Swan, Kaldor, Arrow, Lucas, Romer, Becker, Murphy and Tamora, Barro and Mankiw, Barro and Romer and many developments were witnessed from the viewpoint of effective institutions on growth, internalization and or externalization of variables such as human capital in model, type of production function, increasing or decreasing based on taking the production of grounds as scales, defining capital and spreading it to physical, human and political variables. In other words, in the recent six months, there were several different waves regarding growth theory. The first wave was related to Harrod-Domar study. The second wave was development of new-classic theory. One of the most important studies that referred to long-term growth of Solow was according to replacement of work and capital.

The third wave or revolution in the studies of the models of economic growth was the internalized growth models that were like a reaction toward the existing shortages in the neo-classic model.

In the initial models of growth such as Harrod-Domar model, production depends on capital per capita and stable and sustainable growth happened when $g = \frac{s}{v} = n$. In this equation, g is growth, s is saving rate, v is ratio of capital to production and n is externalized rate of population growth. This condition expresses that the rate of guaranteed growth of production $\frac{s}{v}$ is equal to natural growth rate (growth rate of population). In Solow-Swan growth model, using function of production by Cub-Douglas, the substitution of capital and workforce became possible. In this model, change in the balance of capital per capita was equal to $\dot{k} = sF(k) - nk$ and the sustainable long-term balance happens when there is a change to the fixed balance $\dot{k} = 0$, $\delta k - sF(k) = nk$. Political variables in this model are rate of population growth, depreciation rate (δ), saving rate and rate of capital per capita (15).

Regarding the key role of human capital in economic growth, there are strong theoretical grounds. Romer, 1986, 1990; Lucas, 1988; Quah and Rauch, 1990; Grossman and Helpman, 1991; Becker, 1962; Schultz, 1960 and Pheleps, 1991 were vanguards of the theoretical models of relation between economic growth and education. Since early second half of the 20th century, gradually by entry of concept of human capital and education to the economic analysis, educational economy changed to an independent concept in Economics. The new production technology mechanism and therefore formation of human capital was paid attention to vastly in the studies of economic growth. Both theoretical models and experimental studies show that in addition to training at service, education is also one of the main issues to improve human capital (14).

Simon Cuzentz, winner of the noble prize of economy in 1971 believed that the concept of capital consists of the only physical capital and goods capital is a vague and incomplete concept. Thus the human capital and physical capital should both be taken into account (11).

Schultz as the father of human capital theory also believed that the role of improvement of the quality of workforce is materialized through investment in human capital and it has been forgotten as one of the determining factors of growth in the traditional analyses of the effective factors on economic growth (301).

After that Solow and Swan, 1956 presented the theory of neo-classic growth and the concept of human capital gradually entered the economic analyses. Despite the predictions made in Solow and Swan model, the total production depend on the amount of physical capital and human workforce, but the experimental studies showed that the initial source of economic growth was at the level of technology. The neo-classic model of growth has the principal and facilitating assumptions: Firstly, it defines economy that only uses single and homogenous goods for production and consumption. Secondly, it is situated in full engagement model. Considering these assumptions, the general form of a neo-classic model follows production with fixed return in comparison with the scale where the grounds including workforce and capital are only the factors of accumulated capital. Also the factor of technology is considered as externalized and a high percentage of economic growth is associated with an externalized variable (technical progress).

Generally speaking, the internalized growth theories are divided into two branches:

Growth models based on human capital that associate sustainable long-term growth to accumulation of human capital Models based on R&D that are known as economy of thoughts in economy and believe in technological progress through investment in research and development and creation of new ideas (9).

Romer in the production function that has been introduced in his model presented how the reserve of capital is combined with workforce for production of products using knowledge reserve in form of $Y = k^\alpha (AL_Y)^{1-\alpha}$. In this function, production for the certain level of technology defines that return about the scale for k and L_Y is fixed. On this basis, technological innovation affects scientific reserves and production of knowledge in human capital and research and development and scientific reserves are used in production of the final goods and lead to increased rate of growth (6). Considering the role and importance of human workforce in growth and economic development, the societies raise two other topics with regard to human workforce of today that are as follows:

Human development: According to the UNDP report, it is the process of developing the scope of choices of humans and increasing the level of welfare in the light of increased abilities and improvement of their efficiencies.

Human ability: It concentrates on the subjective role and ability of humans to achieve their preferred life and increase the scope of their actual choices. In this approach unlike the concept of human development, human honor is the goal and objective of development and human abilities expand in the light of increased freedoms such as participation in political and public affairs, use of economic facilities and capacities, access to suitable social opportunities, etc.

Thus it could be said that although in the approaches of human capital and human capacity, human is the center of attention, these two approaches are fundamentally different from each other. In the concepts regarding human capitals, emphasis is put on the instrumental role of human to increase production facilities, while the concept of human ability emphasizes on the subjective role and ability of humans to achieve their preferred life and to increase their domain of selection (5).

2. Research history

Hooshmand, Mahmoud et al, 2008, writing a paper studied the role of human capital in economic growth. For this purpose, a model of human capital was presented which was estimated by MRW during 1978-2006 for economy of Iran using self-return model method with distributive pauses (ARDL). In this study, the average educational years was used as the index of human capital. The results of the estimation of the long-term and short-term model indicate that the attraction of the human capital variable in short-term and in long-term is positive and significant. One percent increase of the human capital increases the domestic gross production per capita by 0.203% and 0.58% in long-term. One percent increase of physical capital of the governmental sector increases the domestic gross production per capita by 0.066% in short term and by 0.19% in long term. One percent increase in the physical capital of the private sector also increases the domestic gross production per capita by 0.107% in short term and 0.306% in long-term (21).

Tabibi, Komeil et al, 2008 in a study investigated the effect of industrial exports and human capital on productivity and production and economic growth factors selected out of the member states of OIC during 1980-2005 using panel data economic assessment models. The obtained results in the selected countries who were members of the OIC can depend on development of human capital. Investment on human resources by increased level of skills and expertise of workforce and making it efficient and increasing its capacities can promote the production qualitatively and quantitatively, make the exports of raw materials and goods to manufactured and industrial goods diverse and create relative advantage in the group of exported goods so that it provides the ground for competition in global markets and increases the productivity of total factors of production and reach economic growth (14).

Mahdavi, Abolqasem, Naderian, Mohammad Amin, 2010 in a study investigated this issue whether human capital is considered in a country as a consumer goods with no effect on the economic growth or as an investment good and has significant effect on economic growth. In this study, it was tried to use the methods of

correcting vector errors over Granger casualty test and short-term and long-term relation between human capital and domestic gross production growth based on oil and non-oil economy in Iran during years 1961-2001. The results of the casualty test showed that there is a bilateral relation between economic growth and human capital in short-term and long-term. This issue shows that Iran's non-oil economy sector pays special attention to human capital and invests in its incomes in this sector. Also the results of the relation between economic growth and oil and human capital show that in short-term, there is no relation between economic growth and human capital, but in long term this relation becomes a significant bilateral relation (18).

Chunaguao Zhang, Lihuan Zhuang, 2010 studied the effect of composition of human capital on economic growth in China using GMM method. The results showed that higher education plays a more important role than primary or secondary education in economic growth of China. In addition, the role of combining human capital and regional economic growth is related to level of development. The more developed provinces enjoy higher education more. While the less developed regions are mainly dependent on primary and secondary education (34).

Corrado Dimaria and Emiliya A. Lazarova, 2011 in a study investigated the effect of immigration of professional workforce on formation of human capital and economic growth in some developing countries. In this study that was conducted in the period between 1990 and 2000, the results showed that the rate of immigration has statistically a significant effect on the level and composition of human capital. The results of studying the effect of immigration changes on economic growth using regression analysis as indicated and although there are both winner and loser countries in immigration, about 70% of the sample population under study experienced lower economic growth as a result of immigration and this reduction of economic growth in countries that have lower professional technology is higher.

Imran et al, 2012 in a study under the title of 'relation between human capital and economic growth' investigated the relation between human capital and economic growth in Pakistan. In this study, Granger casualty test to determine the relation and direction of casualty between social costs (as an approximation of human capital) and economic growth was used. The results of the study indicate that the GDP corresponds with the explanatory variables of the model (major education costs, public health costs, formation of fixed gross capital and services to pay debt) during the determined period and this meant that there is a long-term relation between GDP and social costs in Pakistan. Also in this study, increased public costs of education and health were recommended regularly because they caused increased productivity and movement toward sustainable economic growth (30).

Research hypotheses

- Human capital has positive and significant effect on economic growth of selected developing countries.
- Human capital structure has positive and significant effect on economic growth of selected developing countries.

Introduction of variables and stipulation of model

Since World Bank classifies all economies members of the World Bank and other economies with the population over 30000, due to the Gross National Income per capita of the year 2010 and or use of Information Encyclopedia of the World Bank, the member states are divided into income groups. These groups are:

- Low income with income of US\$ 1005 or less
- Less than lower middle income with income of US\$ 1006-3975.
- Upper middle income with income of US\$ 3976-12275.
- and high income with income of US\$ 12276 and or higher

Considering the mentioned classification, as it was said, this study was conducted for developing countries, 25 countries of the first group, 34 countries of the second group and 35 countries of the third group (Iran is also situated in the third group). They were studied as samples.

In this study the model variables are: domestic gross production per capita, domestic gross production gap, balance of human capital, pre-post graduate studies, post graduate studies, structure of human capital, total productivity rate, formation of domestic gross capital. Further on upon introduction of the used variables in the model, the average trend of each is given for the countries of low income group, lower middle income group and higher middle income group.

In this study, the relation between economic growth and composition of human capital was used by Chuanguo ZHANG, Lihuan ZHUANG, 2010 article with some changes. They both followed Bond, Hoeffler and Temple, 2001 to estimate the model of economic assessment as follows using panel data.

$$\Delta y = y_{it} - y_{it-1} = \beta_1 y_{it-1} + \beta_2 (y_{it-1} - y_{it-1}^T) + \beta_3 H_{it} + Z_{it} \beta_z + \gamma_i + u_{it}$$

y : Domestic gross production logarithm per capita (according to basic price of 2005).

y^T : Trend of production per capita or potential production

$y_{it-1} - y_{it-1}^T$: Production gap in the beginning of the cycle

(H) : H H_1 H_2 HS HS^2 : Total human capital indexes including the afore-mentioned.

Z : Total control variables
 γ : It shows the individual effects or individual non-homogeneity (sections or countries)
 u : It shows the error of each observation
 I : It shows the number of sections (countries)
 t : period or cycle

3. Estimated model of research

$$\text{Log}(GDP_{it}) = \beta_0 + \beta_1 \log(GDP_{it-1}) + \beta_2 \log(GAP_{it}) + \beta_3 H_{it} + \beta_4 HS_{it} + \beta_5 HS^2_{it} + \beta_6 K_{it} + \beta_7 F_{it} + \gamma_i + u_{it}$$

Log(GDP_{it}) : Domestic gross production logarithm per capita (according to basic price of 2005).

Log(GAP_{it}) : Production gap in the beginning of the cycle

H: Balance of human capital

Hs : Structure of human capital

K_{it} : Formation of gross capital (physical capital)

F: Rate of productivity

γ : It shows the individual effects or individual non-homogeneity (sections or countries)

u : It shows the error of each observation

I : It shows the number of sections (countries)

t : period or cycle

Results of studying durability and co-integration of model

In this section, firstly the statistical properties of panel data was studied from the viewpoint of durability and existence of common root and then the long-term relation among variables based on co-integration was studied. The number of maximum pauses was selected automatically and the number of maximum pauses as automatically selected is called Schwarz Information Criterion as the selection of optimal automatic pause.

Table 1: Results of reliability test with common root (Levin, Lin and Chao), panel data of model

	Model variables	Statistic	Value	H0	Test result	Durability rank
Low income countries	LGDP	-1.66232	0.0482	Existence of common root	Durable	At the level
	D(LGAP)	-3.39747	0.0003	Existence of common root	Durable	One difference
	D(H)	-10.6189	0.0000	Existence of common root	Durable	One difference
	D(HS)	-13.7695	0.0000	Existence of common root	Durable	One difference
	D(K)	-7.16963	0.0000	Existence of common root	Durable	One difference
	D(F)	-16.0940	0.0000	Existence of common root	Durable	One difference
Lower middle income countries	D(LGDP)	12.19783	0.0000	Existence of common root	Durable	One difference
	D(LGAP)	-11.2328	0.0000	Existence of common root	Durable	One difference
	D(H)	-8.61780	0.0000	Existence of common root	Durable	One difference
	D(HS)	-9.22465	0.0000	Existence of common root	Durable	One difference
	D(K)	-13.0121	0.0000	Existence of common root	Durable	One difference
	D(F)	-17.6727	0.0000	Existence of common root	Durable	One difference
Upper middle income countries	LGDP	-5.14212	0.0000	Existence of common root	Durable	At the level
	LGAP	-10.2188	0.0000	Existence of common root	Durable	At the level
	H	-2.94992	0.0016	Existence of common root	Durable	At the level
	HS	0.01343	0.5054	Existence of common root	Durable	At the level
	K	-5.58408	0.0000	Existence of common root	Durable	At the level
	F	-23.2466	0.0000	Existence of common root	Durable	At the level

The variables of model at the level and eventually upon one time difference taking is according to the statistic of Levin, Lin, Chao test. It means that the assumption of a single root for difference of the first degree of the mentioned variables is rejected powerfully and all the integrated variables are of 1st degree, thus the existence of first degree co-integration for the mentioned variables can be studied.

Table 2: Results of internal co-integration (low income countries)

Test method	T statistic	Value	H0
Panel v-Statistic	0.145300	0.4422	Lack of co-integration
Panel rho-Statistic	0.527140	0.7010	Lack of co-integration
Panel PP-Statistic	-4.590485	0.0000	Lack of co-integration
Panel ADF-Statistic	-1.688922	0.0456	Lack of co-integration
Group rho-Statistic	2.253262	0.9879	Lack of co-integration
Group PP-Statistic	-9.084214	0.0000	Lack of co-integration
Group ADF-Statistic	-1.704418	0.0442	Lack of co-integration
General result of test	H0 indicating lack of co-integration is rejected		

Table 3: Test results of internal co-integration (lower middle income countries)

Test method	T statistic	Value	H0
Panel v-Statistic	-0.042602	0.5170	Lack of co-integration
Panel rho-Statistic	0.922387	0.8218	Lack of co-integration
Panel PP-Statistic	-3.246012	0.0006	Lack of co-integration
Panel ADF-Statistic	-9.992988	0.0304	Lack of co-integration
Group rho-Statistic	2.446693	0.9928	Lack of co-integration
Group PP-Statistic	-7.257383	0.0000	Lack of co-integration
Group ADF-Statistic	-10.821147	0.0058	Lack of co-integration
General result of test	H0 indicating lack of co-integration is rejected		

Table 4: Test results of internal co-integration (higher middle income countries)

Test method	T statistic	Value	H0
Panel v-Statistic	-1.540688	0.9383	Lack of co-integration
Panel rho-Statistic	2.691934	0.9964	Lack of co-integration
Panel PP-Statistic	-5.035414	0.0000	Lack of co-integration
Panel ADF-Statistic	0.677293	0.7509	Lack of co-integration
Group rho-Statistic	3.731671	0.9999	Lack of co-integration
Group PP-Statistic	-14.98529	0.0000	Lack of co-integration
Group ADF-Statistic	-2.197859	0.0140	Lack of co-integration
General result of test	H0 indicating lack of co-integration is rejected		

As it was noticed, according to the presented results in tables 36.4, 37.4 and 38.4, domestic co-integration test has seven statistics consisting of two intra-group sets (including Panel v-Statistic , Panel rho-Statistic , Panel PP-Statistic , Panel ADF-Statistic statistics) and inter-group (including Group rho-Statistic , Group PP-Statistic , Group ADF-Statistic). Out of seven existing statistics, in four statistics, i.e., Panel PP-Statistic , Panel ADF-Statistic , Group PP-Statistic , Group ADF-Statistic, H0 indicating the absence of co-integration at 5% level of significance is rejected. This result shows that there is a strong long-term relation among dependent variables.

4. EXPERIMENTAL RESULTS

The results of model estimation were reported in table 4.50. GMM estimators are differences including two types of one stage and two-stage and the model for both of these estimators was estimated.

In three groups of the selected countries, the initial gross domestic production index is positive and significant. Also the production gap has a positive and significant effect on economic growth. The gap of domestic gross production is smaller (for example, a country gets closer to that trend and or complete capacity of domestic gross production). In the beginning of the cycle, a slower economic growth is noticed. On the contrary, if an economy suffers from economic recession and or takes distance from potential production, it is expected that the economic growth is inclined to go up in that cycle to destroy the production gap (Chuanguo ZHANG, Lihuan ZHUANG, 2010).

In countries with low income and countries with lower middle income the effect of balance of human capital on economic growth is positive, but insignificant and this is similar to some experimental studies. Chen and Fleisher, 1996 noticed a positive effect, but insignificant one of human capital on economic growth in China, while human capital is measured by registration rate at secondary grade. But in countries with upper middle income, the positive and significant effect is confirmed.

The structure of human capital in three groups of selected countries does not have significant effect on economic growth. The physical investment index in most studies is positive and remarkable, but in case of low income countries and in the cycle under study, the results were different and the indexes were statistically insignificant. Although the index of productivity rate is also positive in most studies, here it is negative and insignificant unlike what was expected. In all the following estimations, the paused levels of variables on the right were considered as the instrumental variables. Also Sargan test to study the validity of instrumental variables was used in the model. The results indicate the validity of these variables in all estimations.

Table 4: Results of model estimation

Explanatory variables	Low income countries		Lower middle income countries		Upper middle income countries	
	One stage	Two stage	One stage	Two stage	One stage	Two stage
Log(GDP(-1))	200/0312	174/4331	464/1381	414/4793	2139/599	2158/204
	3/645248	8/560059	2/940539	8/105252	3/510605	13/97061
	(0/0003)	(0/0000)	(0/0034)	(0/0000)	(0/0005)	(0/0000)
Log(GAP)	116/1505	130/5873	806/4011	857/4726	1602/139	1561/215
	2/324667	6/605495	3/744380	9/451063	2/597159	9/356227
	(0/0204)	(0/0000)	(0/0002)	(0/0000)	(0/0096)	(0/0000)
H	0/009023	0/006954	0/001243	-0/000816	0/152113	0/143800
	0/800085	0/638820	0/099232	-0/0141150	2/015975	5/475029
	(0/4240)	(0/5232)	(0/9210)	(0/8887)	(0/0441)	(0/0000)
HS	-114/0959	-21/68673	101/5464	97/73965	275/8207	123/0780
	-1/203112	-0/296356	0/796246	1/543872	0/605730	0/648315
	(0/2294)	(0/7671)	(0/4261)	(0/1231)	(0/5449)	0/5166)
(HS) ²	140/2846	44/13807	-88/95836	-93/68558	-21/59184	140/0721
	1/346917	0/503208	-0/776976	-1/772304	-0/051154	0/592888
	(0/1785)	(0/6150)	(0/4374)	(0/0768)	(0/9592)	(0/5534)
K	-0/293326	0/375503	1/091891	0/850440	17/95461	16/43106
	-0/580373	1/459850	1/56596	3/234849	3/242507	11/19746
	(0/5619)	(0/1449)	(0/1189)	0/0013)	(0/0012)	(0/0000)
F	-0/632099	-0/104628	-7/026553	-4/274933	-21/09895	14/10511
	-0/113329	-0/037923	-0/405844	-0/501617	-0/322915	0/714681
	(0/9098)	(0/9698)	(0/6850)	(0/6161)	(0/7468)	(0/47520)
Sargan test	650/7763	20/80564	1342/225	25/56354	1524/035	28/40262
	(0/0000)	(0/2893)	(0/0000)	(0/3756)	(0/0000)	(0/4432)

Source: Research findings

* Coefficient ** t-Statistic *** Prob

5. Conclusion

In this study according to the presented theoretical ground and in line with studying the effect of human capital on economic growth, the presented model by Hoeffler and Temple studied with some changes the generalized moments method in two one stage and two stage modes for the three groups of selected countries. As a general result, it could be said that the initial domestic gross production index and the gap of domestic gross production were positive and significant. Also the effect of existence of human capital on economic growth was only positive and remarkable in upper middle income countries. The effect of physical capital is more than human capital on economic growth. However this difference was more effective on the countries with upper middle income. The productivity rate index here is negative and insignificant unlike what was expected.

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