

Effects of human capital formation in the generation of employment: an analysis of the state of Hidalgo

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The present research does an empirical analysis of the endogenous growth theory using human capital as a source of growth for Hidalgo State. This analysis takes into account human capital factors such education and healthcare. The econometric evaluation uses a regression model with panel data. Estimation results suggest that the three levels of education have a positive and significant relation with formal employment, in almost all of the cases. However, the higher results are those obtained for medium high educational level, since every equation estimated for this variable got positive and significant results, and there are no changes in signs or significance even in the addition of medical care variables. Medium high educational level has potential and presents conclusive evidence that every educational level generates employment; however, it can do it with larger effects.

Human Capital, Education, Use, Work.

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Introduction

The state of Hidalgo presents some problems not only in economic backwardness, since it occupies places of little relevance on indicators like gross domestic product or marginality index, but also in unemployment and because it has been proven that by forming human capital these differences can be reduced an analysis indicating the effect of human capital formation on formal employment is considered useful.

The results of a research that analyzes different aspects corresponding to human capital formation in Hidalgo and its effect on job creation are presented in this article. This paper presents theoretical and empirical evidence for about 90 percent of the municipalities of the state of Hidalgo.

The theoretical foundations are based on the endogenous theory of economic growth, while a regression model of data panel establishes the empirical evidence, with information from the Statistical Yearbooks of the state published for the period 1996 - 2006 by the INEGI, information is taken for 73 municipalities in the state of Hidalgo.

Under the hypothesis that if in the state of Hidalgo factors (education and health) determining the formation of human capital are increased, employment generation and its mobility and thus to poverty reduction are favoured.

The variables analyzed in this study are; enrollment in elementary, medium and high school, graduates of elementary, medium and high school, and teachers of elementary, medium and high school, institutions of elementary, medium and high school, doctors and medical units.

The dependent variable is the formal employment that is represented by the beneficiaries.

A regression model with data panel is posed for the empirical study of the variables behavior in this analysis, defining the fixed effects as the method of econometric estimation and analyzing the results.

The results show that the variable of human capital formation with highest effect is the high school education; it has potential, in addition to promising results with regard to employment, this variable shows positive and grobust results in all the estimations obtained

The article is organized as follows, first the theory and the hypothesis are proposed, in the second part the characteristics of information which includes the descriptive analysis of each one, are listed; the third part describes roughly the econometric model where the data panel is described, and the results are shown; the fourth part analyzes the results obtained from the estimation and in the end the conclusion and recommendations are exposed.

Theory and hypothesis approach.

Human capital is defined as the ensemble of productive capabilities acquired by individuals through knowledge accumulation, whether general or specific, this capital is intangible and individual, according to Paul Romer (1986) and Robert Lucas (1988) human capital is formed through formal and informal education and the education acquired in the work.

The human capital theory is relevant because of the existent causal relationship between human capital formation and economic growth.

The models of the endogenous type that take human capital as a source of growth, warns that this variable is the most important since its contribution to generate growth can be turned into development and generate richness for the nations.

Since people must be the origin and purpose of organizations and governments, these are often interested in specialize them and provide them more and better services, to the extent that people have access to these services will be to extent that human capital is generated.

Therefore, it is assumed that if an economic unit, in this case the State of Hidalgo, invests in and improves factors of human capital formation, taking in this case two fundamental factors such as health and education, it will be desiging the path to improve their own economic conditions and with this the capability of generating economic development.

The necessity of doing an empirical research for the State of Hidalgo emerges before the theoretical evidence that answers the following questions: does the human capital formation really favor the generation and mobility of employment and thus improve the socio-economic situation of people?

Descriptive analysis of information

Population: it is the number of people by town and its variation during the period of time of the study (1996 – 2006).

The National Institute of Statistics, Geography and Informatics (INEGI for its acronym in Spanish) publishes this information based on Census of Population and Housing 1995, General Census of Population and Housing 2000 and the II Census of population and housing 22005.

The period of time studied is 1996-2006 for all towns, in this ten years population by town and its variations are presented.

Education: four educative levels are studied; preschool, elementary school, medium school and high school and four variables for each one of them: enrollment, graduated, teaching staff and schools.

The information is gathered from the Secretariat of Public Education (SEP for its acronym in Spanish) and the Department of Statistics of the Education Institute of Hidalgo.

Elementary education

The elementary education includes: general, indigenous, communitary and particular courses.

Medium education

The medium education contains: communitary, general, technique, for workers, telesecundaria (a model of medium school applied in Mexico that uses the television broadcast to give lesson to people of the countryside) and industrial, agricultural and livestock, and agro-industrial technique medium schools.

Upper médium education (high school graduation and medium pregade)

High school, in addition to public and private high school in tegrated to the Universidad Autonoma del Estado de Hidalgo (a Public University), includes the technological and agricultural and livestock high school, CETIS, CBTIS, CONALEP that also offer the opportunity of continuing a pregrade education, also the Telebachilerato (a model of high school applied in Mexico that uses the television broadcast to give lesson to people of the countryside), Colegio de Bachilleres and the CECand TEH. In this section, the graduated of medium professional formerly called Capaciation for work and highschool graduation are included since both have a period of three years of study.

In recent years, preschool education is part of basic education increasing it to a total of 12 years, 3 years of preschool, 6 of elementary school, 3 of medium school and 3 of high school, totaling 15 years of instruction.

Enrollment: it refers to all students enrolled in different educative levels, for the period of study (1996 – 2006). Through this period basic education has concentrated more than fufy percent of the enrollment, nevertheless, since 1996 until 2006 enrollment in elementary school has decreased a 5%.

Graduated: it refers to students who had finished successfully the school grades in its different levels.

Graduated are distributed by level in the following way: preschool 29%. Elementary school 33%, medium school 26% and high school 11%.

The level that has more graduated number is elementary school, in addition to have a constant behavior. Meanwhile high school and high school education have increased the number of alumni throughout the period at 43.35% and 87% respectively.

Regarding graduation rates, in 1996 it was 14% and has increased, in 2006 it has reached 36.6, namely for every 100 enrolled students, 36 obtain a diploma in elementary school. The graduation rates for high school have been stable, rising in 1.5% since 1996 to 2006. Medium school had had a 22% graduarion rated during this period.

Teaching staff: it is considered as the ensemble of teachers before a group, including management and administrative staff who have a group. During the studied period, elementary school has had the largest number of teachers, for 2006 there were 16,000 elementary school teachers while other levels together had a total of 19,050.

Educational institutions: this paragraph refers to the shifts that are offered at every school and not just the physical building.

The State of Hidalgo has 7143 educational institutions according to the Annual Yearbook 2006, in the diferent educational levels, of which the majority is divided between preschools and elementary school, while medium and high school have lees number of institutions.

Each elementary school has an average of 119 students; medium schools have an average of 149 students. Behavior for the aforementioned institutions has no significant changes during the period of study while the high school level observed an increase from 260 students per school in 1996 to 364 in 2006.

Health: this section is divided in rightholders, doctors and medical units by town and its variation through this studied period.

Rightholders: this concept is applied to the set of people who by law are entitled to receive benefits in kind or money by the health insurance institutions, this is, direct insured or contributors, retirees and family members of both beneficiaries. There are 92645 pensioners statewide. This population is obtained from reports of the health institutions, Head of Planning and Finance of the Mexican Social Security Institute (IMSS for its acronym in Spanish) in Hidalgo, Social Security and Services of the State Employees Institute (ISSSTE for its acronym in Spanish) Delegation of the State and the Medical Subdirectorate of the General Hospital of Tula by PEMEX.

The total number of insured has increased in 373,274 since 1996 until 2006, which means an increase of 65.33% beneficiaries. In total, there are 944,641 beneficiaries in the state, representing 40.27% of the total population. During this research, the beneficiaros variable is used as the variable that we use to gauge the state as the variable that tells us the indicator of employment in the state.

Doctors: This section includes general practitioners, specialists, residents, interns and dentists working in a public institution (IMSS, ISSSTE and PEMEX) or social assistance (SSAH³³, Hospital del Niño DIF and Mexican Red Cross).

During the period, there is a 53% increase on the medical staff, in 2006 was reported that a doctor attends an average of 729 service users of the health sector per year and the state has one doctor for every 680 inhabitants. It should be noted that the private medicine has 241 doctors of which 149 are specialists.

Econometric model

Dimensions and characteristics of data panel

The statistical information that makes up the panel data presented in this research is obtained from the Statistical Yearbook of the State of Hidalgo elaborated by INEGI (National Institute of Statistics and Geography) for the period 1996-2006.

The state of Hidalgo has 84 municipalities, but 11 of them had to be omitted since they did not have the needed information for the elaboration of this database, this because they are little communities with less than 1000 inhabitants, therefore the sample is reduced to 73 municipalities.

The analyzed variables are population, health, and as an endogenous variable a proxy is used, which is beneficiaries; uniting all available information is obtained a balanced panel that has 12045 data for 73 municipalities during the period 1996-2006. There is the same number of periods and the same number of variables for each municipality within the panel.

The model

There is a panel consisting of 803 observations, which represent the analysis of 73 municipalities over eleven years.

³³ Servicios de Salud de Hidalgo

Therefore, it is considered appropriate to use a regression model with panel data. Regression models with panel data have many advantages, the first one is that it allows grouping data in time series and transversal series making it possible to analyse transversal units' movement in time over time, hence shows a high degree of efficiency and allow a greater approximation to reality. It should be mentioned that panel data models do not use multicollinearity, homoscedasticity and serial correlation as standard tests. However, they should be evaluated using the Lagrange Multiplier (LM) test that follows an asymptotic distribution χ^2 and is applied to large samples under conventional significance levels (1%, 5%, 10%) and serves to prove hypotheses derived from models of linear and nonlinear regression.

The Hausman specification test (1978) should also be applied and the hypothesis of this test is that there is no correlation between the error term and regressor variables (autocorrelation test). Like the LM test, it presents a distribution χ^2 and is applied under conventional significance levels. If the null hypothesis is rejected and it is determined that there is a correlation between the error term and the regressors, the fixed effects method is preferred over random effects method. Both methods are explained in the next paragraphs.

Additionally, in this study statistical tests such as *F-fisher* and *t-student* are used.

The analysis consists of four sets of explanatory variables; the first set is the population for each municipality through eleven years, the second set is formed by education indicators, third is the set containing the health information and finally a fourth block representing the employment proxy which is beneficiary's population.

The analysis begins by using variables of education and then and then health variables are added. Employment variable is also included as this is a crucial indicator.

Analysis of Results

In order to show the effect of the formation of human capital through education (at their different levels) and the main indicators of social health, chart 1 shows a summary of the results of the estimates.

The estimate helps us determine the effect of enrollment and graduates of elementary, medium and high school levels in formal employment, represented by beneficiaries.

The effect of the number of doctors and hospitals is also analyzed, in other words health spending on beneficiaries

It is noted that the variable that best affects to formal employment is the high school level enrollment, of all estimated models this is the variable that gets the highest setting.

Furthermore, it is observed that the parameter obtained with the number of high school graduates *ebach* has less effect.

Adding variables to the model, the effects on elementary and medium school levels decreases because they change sign or lose significance, even a negative effect is registered on the formal employment with graduates of elementary education, which can be interpreted as being less robust. While high school education keeps a positive sign, stating its importance.

The parameters that remained positive and significant, when the doctor variable was included, were the high school level. this means that the variable is robust and consistent.

Numbers in parentheses are P values obtained for each variable, do not forget that the significance level is 1%, 5% and 10%.

	MEF con Matrícula	MEF con Egresados	MEF con Matrícula y Médicos	MEF con Matrícula y Médicos	MEF con Médicos y Unidades Médicas
<i>mprim</i>	0.115 (0.899)				
<i>msec</i>	0.475 (0.014)				
<i>mbach</i>	1.203 (0.000)				
<i>eprim</i>		-0.257 (0.000)			
<i>esec</i>		0.655 (0.009)			
<i>ebach</i>		0.595 (0.046)			
<i>mprim</i>			0.223 (0.001)		
<i>msec</i>			-0.435 (0.837)		
<i>mbach</i>			1.067 (0.000)		
<i>meds</i>			35.66 (0.000)		
<i>eprim</i>				-0.115 (0.086)	
<i>esec</i>				0.150 (0.545)	
<i>ebach</i>				0.694 (0.015)	
<i>meds</i>				46.774 (0.000)	
<i>meds</i>					47.438 (0.000)
<i>umeds</i>					15.698 (0.193)
<i>R²</i>	0.96	0.96	0.96	0.96	0.96
Observaciones	803	803	803	803	803
Municipios	73	73	73	73	73

Chart 1 Summary of Results for Method of Fixed Effects

The results lead to the following conclusions:

Elementary school enrollment

Elementary education is positively associated with formal employment, 16 of every 100 inhabitants attend to elementary school and according to the results an increase in one percentage unit in elementary school enrollment increased by 0.115 percentage units formal employment. In other words, it is necessary to raise elementary school enrollment by 22 of every 100 people to increase one beneficiarie per hundred in formal employment.

Medium school enrollment

There is a relationship between this variable and formal employment. On average 7 out of 100 people attend high school, according to the estimate, before an increase in one student per hundred inhabitants in medium education enrollment, formal employment increases by 0.476 percent and increasing enrollment on 2, ie 9 of 100 inhabitants attend medium school, the beneficiaries increases by 1 for every hundred inhabitants. Not all elementary school graduated are part of the medium education enrollment.

High school enrollment

This variable has a positive and significant parameter for all estimates demonstrating consistency for this level.

On average 3 out of 100 people enrolled in some degree of high school education. It is concluded that, from the estimate, rising enrollment by one unit, which is 4 out of 100 inhabitants enrolled in high school, formal employment can be increased in 1.2 beneficiaries for every 100 inhabitants.

In other words, this level has potential and generates more employment; therefore, it is a great opportunity to reduce poverty

Graduates of elementary education

On average, three out of every 100 people graduate from elementary school for 2006.

The estimate shows a negative parameter indicating that there is an inverse relationship with formal employment, the latter diminishes; recalling, in the analysis above primary education gets a positive parameter and adding variables this tends to be weak besides that loses significance.

Graduates of medium education

On average, there are two medium school graduates per 100 inhabitants. According to the estimate, the increase in one percentage unit of high school graduates results in an increase of 0.655 percent units of beneficiaries. It is necessary to increase in 4 out of 100 inhabitants the number of graduates to increase formal employment in one percentage unit.

Graduates of high school education

It is estimated that for every 100 inhabitants there is only 1 high school graduate, if it were possible to increase, ie the graduation of one more inhabitant increases the number of formal employees in 0.595 units. Graduations should be increased to 3 out of 100 inhabitants in order to increase employment in the formal one unit.

Doctors. Doctors are related positively and significantly with formal employment, a 47.438 parameter is obtained, there is on average one doctor for every thousand inhabitants, the beneficiaries variable increases in 47 units per thousand inhabitants.

Medical units. There is an average of 5 hospitals registered in the State of Hidalgo (clinics, hospitals and health houses are included) for every 10000 inhabitants. Therefore, an increase of one more clinic, ie six clinics per 10,000 inhabitants, means an increase in formal employment of 15 units per 10 thousand inhabitants.

Conclusions

In this research, we have tried to analyze the theory of human capital through empirical evidence, to prove the hypothesis that in the State of Hidalgo the increase in the factors determining the formation of human capital favors the generation and mobility of employment, and hence reducing poverty.

Remember that the determinants of human capital used for this project are education and health. Certainly, education is the primary factor in the formation of human capital, and considered by some authors as a source of growth.

It is necessary to establish the following assumptions:

- The portion of state spending that goes to education is called human capital formation

- Investment in human capital expects positive returns measured by its productivity, Gary Becker (1964).
- Presents increasing and constant returns, and, along with production, have increasing returns to scale, Barro (1990).
- Is positively related to productive investment and negatively related to population growth.³⁴
- Human capital is intensive in human capital; therefore, its accumulation requires only of himself, Usawa (1965) and Lucas (1988).
- Reduces poverty.

According to economic activity in the state, the most industrialized areas are Ciudad Sahagun, Pachuca, Tepeji del Rio, Tizayuca, Tula and Tulancingo, in them, the largest proportion of economic activities of the three sectors is concentrated, and the remaining municipalities are engaged only to primary activities agriculture, livestock and mining.

The economically active population works in their majority into services 50.9%, 24.9% in industry, and 24.2% in agriculture. State GDP is composed as follows. 9.0% comes from the agricultural and livestock sector, 35.7% from industry and 55.3% from the services sector.

GDP per capita is about 9,234 pesos per year in 2004.

³⁴ According to the AK endogenous growth model and the extended Solow model.

The statistical information available shows that the population in recent years grows about 22 thousand a year with a lower tendency each year; we can say that the population growth is stopped, which favors the factor productivity.

Regarding human capital formation, shows that elementary education concentrates mostly enrollment, teaching staff and educative institutions, followed at a considerable distance by medium education and lastly by high school.

The empirical evidence presented tells us that there is a relationship between the variables of human capital formation and formal employment, all were positive (except for elementary school graduates) and in most cases statistically significant, therefore it is a robust results model that can be applied to the analysis of the reality of the state.

The estimates presented in the last chapter show that investment in education does indeed get positive returns, although this result tends to be stronger in high school education. The empirical evidence is overwhelming for the high school level concerning employment generation; parameters remain positive and significant even when health variables are added. Medium school education consists of all, general, tele, industrial, technical schools, etc. and represents 7 to 9 years of education. by law all people should have the basic education including elementary and medium.

High school education means up to 12 years of education, it includes all public and private schools incorporated in the "Universidad Autonoma del Estado de Hidalgo", all forms of technical high school and job training.

According to the availability of statistical information that has been presented throughout the document, it can be seen that both medium education and high school education have deficiencies that can be remedied, and therefore, have high growth potential and consequently improve formal employment in the state.

Starting with enrollment, since by law it is the duty and right of Mexicans have basic education and statistics show that enrollment in medium schools represents 44% of basic education enrollment.

Is necessary to find a mechanism to make secondary education enrollment increase because that means an increase in high school education and a significant increase in formal employment would be achieved. The estimate shows that an increase by 1.2 percentage units in the average high school enrollment is needed to increase a beneficiary per 100 inhabitants. If the gap between enrollments in elementary and medium school is reduced and continuity is promoted to high school, formal employment would markedly increase.

Estimates for health variables indicate that positive effects occur, the effect is greater for medical variable than for medical units, they have positive and significant parameters, hence the investment in health presents the expected returns to human capital formation and thus in the generation of formal employment.

According to Neo Keynesian theory, skilled workforce improves generation technology through innovation etc., meanwhile the unskilled labor does not necessarily reduce income inequality.

Therefore, it is logical that elementary education obtains as low and even negative parameters in generating employment. It should be mentioned that due to the characteristics of high school education and medium education that are responsible for training students for work since most of the high schools are technical school and job training so it is necessary to increase the investment in education sector. The human capital theory assumes that the more skilled the workforce is the less poverty will be.

The endogenous theory determines that human capital is the most robust source of economic growth. In endogenous theory Romer, Lucas and Barro ensure that investment in human capital makes physical capital more productive due to specialization. On their part, this research demonstrates that by high school education growth can be generated in Hidalgo because is potentially the largest generator of formal employment, confirming the endogenous growth theory with human capital.

Due to the effects of specialization and learning technological progress can be given and, with it, a decrease in poverty. Remember that it is assumed that the level of education is correlated with the increase in productive investment

The state manages different federal programs such as the PRONABES scholarship program and Opportunities program; however, these are not sufficient to achieve minimum goals, as it should be the completion of basic education by state residents. It is necessary to monitor planning and distribution of these supports to reach efficient results and achieve the purposes for which they were created.

Usawa and Luke state that economic growth depends on the education sector and it is the decision of state the amount and quality of education, in this sense the state government should act as a central planner, determining a growth target and establishing the necessary human capital to achieve growth targets.

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