Chapter 7 Influence of patents on economic growth: An empirical analysis Mexico-Brazil

Capítulo 7 Influencia de las patentes sobre el crecimento economico: Un análisis empírico México-Brasil

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Abstract

This article presents an empirical analysis to observe the influence of industrial property, measured as Patents, on the Gross Domestic Product (GDP) of two Latin American countries: Mexico - Brazil in the period 2000 - 2015 as phase I on study on patents and their effects. A unit root test is applied. The results show the existence of a positive relationship between the level of innovation and GDP.

Economic growth, Patents, Gross domestic product, Innovation

Resumen

Este artículo presenta un análisis empírico para observar la influencia de la propiedad industrial, medida como Patentes, en el Producto Interno Bruto (PIB) de dos países latinoamericanos: México - Brasil en el período 2000 - 2015 como fase I de estudio sobre patentes y sus efectos Se aplica una prueba de raíz unitaria. Los resultados muestran la existencia de una relación positiva entre el nivel de innovación y el PIB.

Crecimiento económico, Patentes, Producto interno bruto, Innovación

1. Introducción

According to ECLAC reports, it is indicated that in order to sustain economic and social advances and respond effectively to the challenges that arise, it is essential to build capacities in the countries. The future requires very rapid and significant increases in productivity, as well as productive diversification that makes it possible to go beyond specialization in basic products. These increases will not occur spontaneously. Investment in basic and higher education, in science and technology, and in technical capacities for production becomes essential to bring about a new stage of growth with greater equality in Latin America and the Caribbean. Productive diversification and the incorporation of capacities must go hand in hand with a more intense and equitable effort to extend education to sectors that have been marginalized until now. ECLAC, 2015

When a country is in full employment of its factors of production, Capital and Labor, the Solow residual indicates that the growth of the Product is due to technological changes since the factors of production cannot be increased. This hypothesis has been studied empirically by numerous researchers over the last 20 years since the publication of the works, Barro (1991).

In this order of ideas, the increases in GDP explained by the residual contain, among other factors, innovation and industrial property, which in turn have positive effects on labor and capital, and therefore on GDP. Accordingly, Stern, Porter and Furman (2000) point out that the level of innovation in a region can be estimated with the number of patents generated.

This paper aims to study the relationship between Patents and economic growth using a panel data model for some Latin American countries, specifically: Mexico and Brazil. Through an econometric analysis for non-stationary panel data, the long-term relationship between production factors (Patents, Capital and Labor) and GDP is estimated, emphasizing the effect that the increase in Patents has on economic growth. of the countries. The analysis will be carried out through the use of GRETL, an econometric software.

In order to determine the order of integration of the series, apply the unit root test. It is necessary to know if there is a long-term relationship between GDP and the number of Patents, in order to know the causality that exists between these two series, which is supposed to be bidirectional, that is, there is a certain feedback between the increase in Patents and economic growth.

This text is organized as follows. The second part presents an overview of empirical studies that have been carried out at the international level on the relationship between patents and economic growth. The third part presents the model and the methodology to estimate. In the fourth part, the results of the unit root and Co-integration tests are presented and analyzed. In the last part, the final considerations are found.

2. Relationship Patents and Economic Growth

The relationship between patents and economic growth has been a well-studied topic in recent years. This section seeks to present international studies that have focused on this relationship, that is, the relationship between patents and economic growth of countries.

The study by (Griliches, 1990), where trends in time series of patents granted in the US are examined and their decline in 1970, is interpreted as a reflection of the changing meaning of these data over time. Therefore, it concludes that patent data remains a unique resource for the study of technical change. For his part, Keller (2004) mentions that differences in productivity explain a large part of the variation in income from one country to another, and technology plays a key role in determining productivity.

The authors Furmanet et al. (2002), present an empirical analysis of the determinants of the production of international patents at the national level.

The analysis of Acs et .al. (2002), focuses on the problem of measuring economically useful knowledge, thus providing an exploratory study and a regression-based comparison of innovation count data and patent count data at the lowest levels. low possible geographical aggregation.

On the other hand, the work of Segerstrom (1998), explains why patent statistics have been more or less constant despite the fact that R&D employment has increased considerably in the last 30 years. In addition to showing through a model that an ever-increasing R&D effort has not led to any upward trend in economic growth rates, as predicted by early R&D-driven endogenous growth models with the “scale effect” property.

In the study by (Kortum, 1997) a theoretical model is developed - search for technological change that accounts for some disturbing trends in industrial research, patents and productivity growth. In the model presented, the researchers show the probability distributions of the possible new production techniques for each good in the economy.

On the other hand, Atz et.al. (2010), within the focus on increasing levels of competition and decreasing products, mentions that the ability of a company to generate a continuous flow of innovations may be more important than ever in what allows a company to improve profitability and maintain a competitive advantage, and investigates several questions that are central to an examination of the productivity of innovation in a company.

The existing literature allows these studies to be grouped into two areas, those that determine a direct effect that goes from patents to economic growth, and those that determine an indirect effect between them. Indirectly, when they affect economic growth through another factor of production, such as capital or labor, for example, Gould & Gruben (1996), through a cross-sectional model on patent protection, study the role played by rights of intellectual property on the economic growth of a country.

Their results present empirical evidence that is on the way to ensure that intellectual property is a determinant of economic growth, and the effect of patents is greater in more open countries, in relative terms. The article examines the role of intellectual property rights in economic growth, using data from different countries on patent protection, the trade regime and the specific characteristics of each country. Evidence suggests that intellectual property protection is a significant determinant of economic growth. These effects appear to be slightly stronger in relatively open economies and are robust both to the openness measure and to other alternative model specifications..

Additionally, Park & Ginarte (1997), show that patents have a positive impact on capital accumulation, and therefore, by increasing fixed capital, they have a positive effect on the economic growth of economies.

Koléda (2004) shows that the effect of novel patent requirements on GDP growth can exhibit an inverted U-shape, implying that a stronger intellectual property protection policy can slow down the economic growth of an economy, and demonstrating that there is an optimal level of requirements which maximizes economic growth.

According to the study by Fink & Maskus (2005), the possibility that the effect of intellectual property rights on the economic growth of countries depends on the level of economic development is high. Added to this finding are the results of Schneider (2005), obtained through a panel data model of 47 developed and developing countries between 1970 and 1990, which argue that legally stronger patent rights have a positive effect on innovation, and therefore on economic growth, only in developed countries. On the other hand, Chen & Puttitanun (2005), using panel data from 64 developing countries, obtain results in favor of stronger patent rights having a positive effect on innovation in developing economies. Additionally, they present empirical evidence on the existence of a U-shaped relationship between intellectual property rights and economic growth, first it decreases and then it increases.

Futagami & Iwaisako (2007) show that a model with patents of infinite duration does not maximize social welfare, while an endogenous model of finite duration, which does not present scale effects in the production function, maximizes social welfare. In the case of Cysne & Turchick (2012), they study the optimal level of protection of intellectual property rights through a model of research and development (R&D) growth with an exogenous rate of imitation.

In the study by Kim et al. (2012), using two models, study the effect of patents and utility models on innovation and economic growth, controlling in turn for the level of economic (technological) development. They first study a country-level model, using a panel data model, for the period 1975-2003, and then a firm-level model in Korea, for the period 1970-1995 using 13,530 firms. Their conclusions ensure that patent protection contributes to innovation and economic growth in developed countries, however, the same does not happen with developing countries since they do not find statistical evidence.

3. Methodology and Econometric Model

The objective is to estimate the relationship between industrial property, measured as the number of patents, and real GDP for the countries: Mexico and Brazil, during the period between 2000 - 2015. During the last two decades, the panel data They have been used as an analysis tool by researchers from various areas to study the relationships between different variables. The main reason is that this methodology combines a dimension of time (time series) with another transversal dimension (Cross Section), which has greater benefits when making statistical inference.

In this order of ideas, when working with macroeconomic panel data, in which the time series is greater than the number of individuals, the existence of a long-term relationship between the variables that are analyzed for the group must be taken into account. of individuals. In other words, we must ensure that a co-integration relationship exists to avoid the problem of obtaining spurious results. Kao (1999) was one of the authors who introduced the term of spurious relationships in the use of panel data, when the time observations are greater than the number of individuals in a panel.

The model to be estimated is the following

$$Ln(Y)_{it} = \alpha_i + \beta_1 Ln(K)_{it} + \beta_2 Ln(L)_{it} + \beta_3 Ln(Pat)_{it} + e_{it} \quad (1)$$

where $Ln(Y)_{it}$ is the logarithm of the country's GDP (i) in the period (t), $Ln(K)_{it}$ is the logarithm of the country's gross fixed capital formation (FBC)(i) in the period (t), is the logarithm of the labor force of each country (FLA) (i) in the period (t), y $Ln(Pat)_{it}$ is the logarithm of the patent registrations of each country (PAT) (i) in the period (t).

3.1. Unit Root Test

It is interesting to ask why the unit root test is important. Because it is common for macroeconomic variables to grow or often decline over time. Variables that increase over time are examples of non-stationary variables. There are also series that do not increase over time, but where the effects of the innovations do not die out over time. These are also non-stationary. There is a major problem with regressions involving non-stationary variables, when the standard errors produced are biased. Bias means that the conventional criteria used to judge whether or not there is a causal relationship between the variables is not reliable. In many cases a significant relationship is discovered when in fact it does not exist. A regression where this occurs is called a spurious regression.

One problem with unit root tests is that they suffer from low power and distorted size. In the framework of classical hypothesis testing, the null and alternative hypotheses, the two competing conclusions that can be inferred from the data, are specified. Next, the data is examined, to see if we may be able to reject the null hypothesis and therefore accept the alternative. We are usually interested in rejecting the null hypothesis, so to be sure, we need to be completely confident that it is incorrect before rejecting it. Consequently, significance levels such as 90% or 95% are used. This means that using the data we feel more than 90% (or 95%) confident that the null hypothesis is wrong.

Two types of errors can be made: 1. incorrectly reject a true null hypothesis (this is often called a type I error), or 2. accept a null hypothesis as false (a type II error). The consequences of errors depend on the circumstances and the researcher must choose the level of significance appropriately. The size of the test is the probability of committing a type I error, which would be the level of significance chosen. The size is distorted if the true probability is not what one thinks one is testing for. This will occur if the true distribution of the test statistic is different from the one one is using. A major problem with unit root tests in general, and the Dickey-Fuller test in particular, is that the distribution of the test statistics is both nonstandard and conditional on the order of integration of the series, the time series properties of the errors, if the series has a trend, etc. This means that size distortion issues are common.

For example, you may want to test at the 95% level, but you don't know the correct distribution. Suppose the value of the test statistic at the 95th percentile is α for the distribution you are using, but α is at the 90th percentile for the true distribution. In this case, you would be rejecting more hypotheses than you expect and reducing your chances of making a Type I error. Although the reduction is at a cost, because the probability of making a Type II error is inversely related to the probability of making a Type II error. type I error. The power of a test is the probability of rejecting a false null hypothesis, that is, one minus the probability of making a type II error. Unit root tests are notoriously underpowered. Note that the size of the test and its power are not equal, since they are conditional probabilities based on different conditions: one is based on a true null hypothesis and the other is based on a false null hypothesis. When unit root tests are performed, the null hypothesis is usually: the variable has a unit root. The low power of unit root tests means that we are sometimes unable to reject the null hypothesis, wrongly concluding that the variable has a unit root.

3.3. Cointegration Test

After verifying that the series are integrated of order one, that is, that they contain a unit root in the panel, the co-integration test was continued, in order to find evidence of the existence of a relationship between the variables in the long-term. This is tested using the well-known Pedroni heterogeneous panel co-integration test (1999, 2000, 2004).

4. Empirical Data and Results

This section presents the data and results of the unit root and co-integration tests..

4.1. Data

The data of the countries: Mexico and Brazil, for this work were obtained from the World Bank, data are used on GDP (in millions of dollars), Gross Fixed Capital Formation (in millions of dollars), Labor force (in millions of people) and Patents (registration number). The database covers the period between 2000 and 2015.

4.2. Unit Root Test

According to Table 1, the unit root test applied to the time series indicates that in levels these series have a unit root since the probability of the tests does not allow rejecting the null hypothesis of the existence of a unit root, the null hypothesis is that the series is stationary, for which, as can be seen, it is rejected at 1% significance. The results of the applied tests are also presented in the Annex. In short, the results of the unit root test on the variables that are included in the model show that the series are I, that is, they are integrated of order one.

Table 1 Unit Root Test

México	Brasil
Contrastes aumentados de Dickey-Fuller, orden 3, para PIB: tamaño muestral 12 hipótesis nula de raíz unitaria: a = 1	Contrastes aumentados de Dickey-Fuller, orden 3, para PIB: tamaño muestral 12 hipótesis nula de raíz unitaria: a = 1

Source: Own Elaboration with GRETL Econometric Software

The model chosen for each series and country is shown. The test gives evidence to reject the null hypothesis of stationarity for each of the series.

In the case of Mexico, the variable that has the greatest impact on GDP is the variable corresponding to the country's gross fixed capital formation (FBC); in the case of Brazil, the variable with the greatest impact is the labor force of each country (FLA).).

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Conclusions

In this work, an empirical study was carried out on the relationship between Patents and economic growth for two Latin American countries Mexico-Brazil, using annual information on the number of patents and GDP, during the period 2000-2015, additionally, this relationship is observed with other factors of production such as Capital and Labor.

The unit root test is applied in order to determine the order of integration of the series. This test determines that the model series are integrated of order one.Los resultados presentan evidencia estadística sobre la existencia de una relación de largo plazo entre las Patentes, el Capital, el Trabajo y el PIB para los dos países considerados.

An interesting result is then presented, and it is the impact that Patents have on the GDP and on the economic growth of the countries. One possible explanation for the low elasticity of GDP with respect to patents is that, in most Latin American countries, the majority of patent registrations are carried out by non-residents, with the registration of residents being very small in terms of relative.

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Annexes

Table 2 Unit Root Test

Mexico	Brasil
Contrastes aumentados de Dickey-Fuller, orden 3, para PIB: tamaño muestral 12 hipótesis nula de raíz unitaria: a = 1 contraste con constante modelo: (1 - L)y = b0 + (a-1)*y(-1) + ... + e Coef. de autocorrelación de primer orden de e: -0.155 valor estimado de (a - 1): -0.241171 Estadístico de contraste: tau_c(1) = -1.15305 valor p asintótico 0.6968 con constante y tendencia modelo: (1 - L)y = b0 + b1*t + (a-1)*y(-1) + ... + e Coef. de autocorrelación de primer orden de e: -0.356 valor estimado de (a - 1): -2.97785 Estadístico de contraste: tau_ct(1) = -3.17972 valor p asintótico 0.08847	Contrastes aumentados de Dickey-Fuller, orden 3, para PIB: tamaño muestral 12 hipótesis nula de raíz unitaria: a = 1 contraste con constante modelo: (1 - L)y = b0 + (a-1)*y(-1) + ... + e Coef. de autocorrelación de primer orden de e: -0.141 valor estimado de (a - 1): -0.330632 Estadístico de contraste: tau_c(1) = -3.72829 valor p asintótico 0.003751 con constante y tendencia modelo: (1 - L)y = b0 + b1*t + (a-1)*y(-1) + ... + e Coef. de autocorrelación de primer orden de e: -0.139 valor estimado de (a - 1): -0.339947 Estadístico de contraste: tau_ct(1) = -0.566914 valor p asintótico 0.9804 con constante y tendencia cuadrática modelo: (1 - L)y = b0 + b1*t + b2*t^2 + (a-1)*y(-1) + ... + e Coef. de autocorrelación de primer orden de e: -0.102 valor estimado de (a - 1): 0.927866 Estadístico de contraste: tau_ctt(1) = 1.22083 valor p asintótico 1

Source: Own Elaboration with GRETL Econometric Software

Table 3 Heteroskedasticity Test

Mexico	Modelo 1: estimaciones MCO utilizando las 16 observaciones 2000-2015 Variable dependiente: PIB VARIABLE COEFICIENTE DESV.TÍP. ESTAD T VALOR P const -2.38891E+010 8.44288E+011 [illegible] [illegible] PAT 2.70953E+08 1.13904E+08 2.380 0.04323 ** FBC 4.01894E+010 3.71467E+010 1.082 0.30056 FLA -3.15937E+09 1.56774E+09 -2.013 0.06714 * Media de la var. dependiente = 8.75[illegible]e+011 Desviación típica de la var. dependiente. = 2.05506e+011 Suma de cuadrados de los residuos = 2.60477e+023 Desviación típica de los residuos = 1.47331e+011 R-cuadrado = 0.601906 R-cuadrado corregido = 0.502385 Estadístico F (3, 12) = 6.04782 (valor p = 0.00947) Estadístico de Durbin-Watson = 1.40371 Coef. de autocorr. de primer orden. = 0.175883 Log-verosimilitud = -431.857 Criterio de información de Akaike (AIC) = 871.713 Criterio de información Bayesiano de Schwarz (BIC) = 875.904 Criterio de Hannan-Quinn (HQC) = 871.932 Sin considerar la constante, el valor p más alto fue el de la variable 3 (FBC) Contraste de heterocedasticidad de White - Hipótesis nula: No hay heterocedasticidad Estadístico de contraste: TR^2 = 11.1896 con valor p = P(Chi-Square(9) > 11.1898) = 0.26295	gretl: contraste LM (heterocedasticidad) estimaciones MCO utilizando las 16 observaciones 2000-2015 Variable dependiente: uhat^2 VARIABLE COEFICIENTE DESV.TÍP. ESTAD T VALOR P const -1.56696E+024 2.27904E+024 -0.688 0.51704 PAT 7.99999E+019 7.83640E+020 0.102 0.92202 FBC 1.37844E+023 1.78654E+023 0.772 0.46568 FLA 1.74200E+021 1.00444E+022 0.173 0.86602 sq_PAT -3.32229E+015 4.23032E+016 -0.079 0.93998 PAT_FBC -5.25258E+018 3.42699E+019 -0.153 0.88329 PAT_FLA 1.01850E+018 4.69927E+017 2.222 0.06803 * sq_FBC -2.90287E+021 3.56978E+021 -0.814 0.44688 FBC_FLA -1.54910E+020 4.17629E+020 -0.371 0.72344 sq_FLA 8.13143E+018 1.00230E+019 0.810 0.42828 R-cuadrado = 0.699337 Estadístico de contraste: TR^2 = 11.189387, con valor p = P(Chi-cuadrado(9) > 11.189387) = 0.262860
Brasil	Modelo 1: estimaciones MCO utilizando las 16 observaciones 2000-2015 Variable dependiente: PIB VARIABLE COEFICIENTE DESV.TÍP. ESTAD T VALOR P const -4.80526E+012 1.32691E+012 -3.621 0.00351 *** PAT -1.52702E+08 1.15346E+08 -1.324 0.21021 FBC 3.48366E+011 7.56740E+010 4.610 0.00060 *** FLA 1.18994E+010 8.46384E+09 1.406 0.18511 Media de la var. dependiente = 1.47881e+012 Desviación típica de la var. dependiente. = 7.86286e+011 Suma de cuadrados de los residuos = 2.239e+024 Desviación típica de los residuos = 4.31853e+011 R-cuadrado = 0.758546 R-cuadrado corregido = 0.698182 Estadístico F (3, 12) = 12.5663 (valor p = 0.000517) Estadístico de Durbin-Watson = 1.00078 Coef. de autocorr. de primer orden. = 0.387802 Log-verosimilitud = -449.067 Criterio de información de Akaike (AIC) = 906.134 Criterio de información Bayesiano de Schwarz (BIC) = 909.224 Criterio de Hannan-Quinn (HQC) = 906.292 Sin considerar la constante, el valor p más alto fue el de la variable 2 (PAT) Contraste de heterocedasticidad de White - Hipótesis nula: No hay heterocedasticidad Estadístico de contraste: TR^2 = 12.8688 con valor p = P(Chi-Square(9) > 12.8688) = 0.168634	gretl: contraste LM (heterocedasticidad) utilizando las 16 observaciones 2000-2015 Variable dependiente: uhat^2 VARIABLE COEFICIENTE DESV.TÍP. ESTAD T VALOR P const -2.06390E+025 5.71644E+024 -2.341 0.05773 * PAT -1.44826E+022 1.98415E+021 -0.730 0.49264 FBC 2.42074E+024 6.86771E+023 3.525 0.01245 ** FLA 5.24520E+022 5.03752E+022 0.104 0.92068 sq_PAT -2.56608E+016 5.24775E+016 -0.460 0.66196 PAT_FBC 8.71928E+019 1.21483E+020 0.718 0.49990 PAT_FLA 4.30439E+018 1.35376E+018 3.256 0.03818 sq_FBC -7.10810E+022 1.85430E+022 -3.833 0.00863 *** FBC_FLA -2.55366E+021 5.83544E+021 -0.438 0.67882 sq_FLA 5.23781E+020 4.81521E+020 1.088 0.31845 R-cuadrado = 0.804239 Estadístico de contraste: TR^2 = 12.868763, con valor p = P(Chi-cuadrado(9) > 12.868763) = 0.168634

Source: Own Elaboration with GRETL Econometric Software

Table 4 Autocorrelation

Mexico

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Contraste de Breusch-Godfrey para autocorrelación hasta el orden 2
estimaciones MCO
utilizando las 14 observaciones 2002-2015
Variable dependiente: uhat

 VARIABLE        COEFICIENTE       DESV.TÍP.         ESTAD T   VALOR P
  const            6.35858E+011     1.05920E+012    0.400    0.16485
  FAT             -9.18690E+07      1.41804E+08    -0.648    0.53522
  FBC             -2.31398E+010     4.52443E+010   -0.511    0.62266
  FLA             -1.30455E+09      2.60545E+09    -0.501    0.62999
  uhat_1           0.110972         0.428481        0.259    0.80218
  uhat_2          -0.431057         0.573092       -0.752    0.47350

  R-cuadrado = 0.118555

Estadístico de contraste: LMF = 0.540086,
con valor p  = P(F(2,8) > 0.540086) = 0.603

Estadístico alternativo: TR^2 = 1.665435,
con valor p  = P(Chi-cuadrado(2) > 1.66543) = 0.435

Ljung-Box Q' = 1.04408 con valor p  = P(Chi-cuadrado(2) > 1.04408) = 0.593
```

Brasil

```
Contraste de Breusch-Godfrey para autocorrelación hasta el orden 3
estimaciones MCO
utilizando las 13 observaciones 2003-2015
Variable dependiente: uhat

 VARIABLE        COEFICIENTE       DESV.TÍP.         ESTAD T   VALOR P
  const            1.00541E+012     1.53199E+012    0.656    0.53596
  FAT              5.44507E+07      1.76781E+08     0.308    0.76850
  FBC             -6.13113E+010     9.45471E+010   -0.531    0.61418
  FLA             -7.07962E+09      1.04094E+010   -0.680    0.52198
  uhat_1           0.229635         0.546662        0.420    0.68895
  uhat_2           0.0971010        0.513858        0.189    0.85654
  uhat_3           0.255944         0.398872        0.748    0.48403

  R-cuadrado = 0.185183

Estadístico de contraste: LMF = 0.438548,
con valor p  = P(F(3,6) > 0.438548) = 0.733

Estadístico alternativo: TR^2 = 2.342376,
con valor p  = P(Chi-cuadrado(3) > 2.34238) = 0.504

Ljung-Box Q' = 2.14398 con valor p  = P(Chi-cuadrado(3) > 2.14398) = 0.543
```

Source: Own Elaboration with GRETL Econometric Software

Table 5 Colineality

Mexico

```
Factores de inflación de varianza (VIF)

 Mínimo valor posible = 1.0
 Valores mayores que 10.0 pueden indicar un problema de colinealidad

   2)           FAT    1.221
   3)           FBC    1.076
   4)           FLA    1.281

VIF(j) = 1/(1 - R(j)^2), donde R(j) es el coeficiente de correlación múltiple
entre la variable j y las demás variables independientes

Propiedades de la matriz X'X:

 norma-1 = 10800738
 Determinante = 4.3990816e+012
 Número de condición recíproca = 2.5790489e-009
```

Brasil

```
Factores de inflación de varianza (VIF)

 Mínimo valor posible = 1.0
 Valores mayores que 10.0 pueden indicar un problema de colinealidad

   2)           FAT    1.410
   3)           FBC    1.593
   4)           FLA    1.423

VIF(j) = 1/(1 - R(j)^2), donde R(j) es el coeficiente de correlación múltiple
entre la variable j y las demás variables independientes

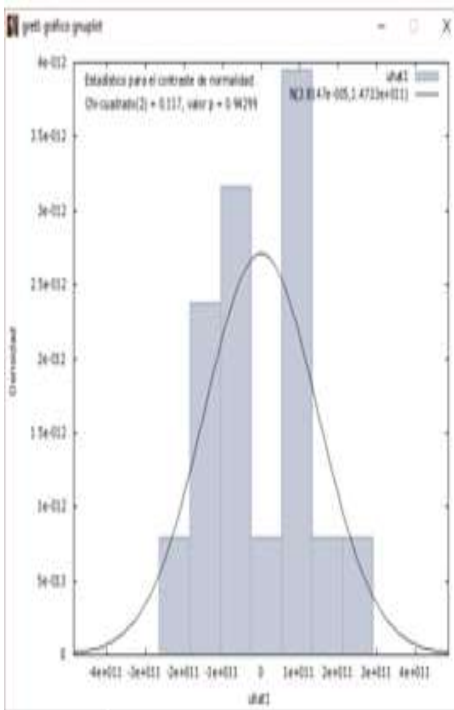
Propiedades de la matriz X'X:

 norma-1 = 2.6282781e+008
 Determinante = 3.1739715e+013
 Número de condición recíproca = 3.8143868e-010
```

Source: Own Elaboration with GRETL Econometric Software

Table 6 Chi-Square

Mexico



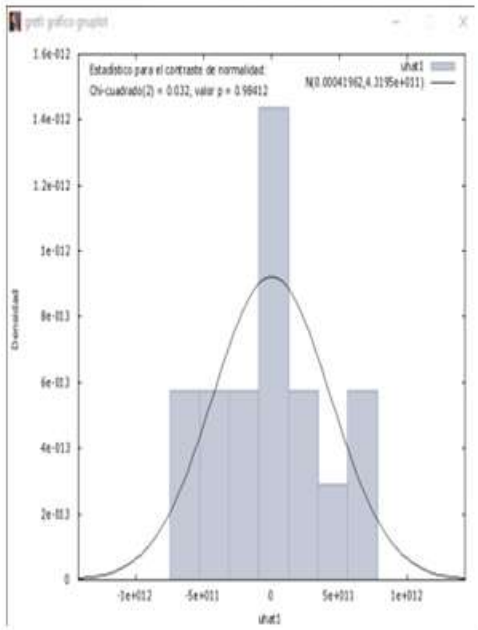

```
Distribución de frecuencias para uhat1, observaciones 1-16
número de cajas = 7, media = 3.8147e-005, desv.típ.=1.47331e+011

       intervalo      punto medio   frecuencia   rel      acum.

            < -1.851e+011  -2.247e+011     1      6.25%    6.25% **
 -1.851e+011 - -1.060e+011  -1.456e+011    3     18.75%   25.00% ******
 -1.060e+011 - -2.676e+010  -6.636e+010    4     25.00%   50.00% ********
 -2.676e+010 -  5.243e+010   1.283e+010    1      6.25%   56.25% **
  5.243e+010 -  1.316e+011   9.203e+010    5     31.25%   87.50% ***********
  1.316e+011 -  2.108e+011   1.712e+011    1      6.25%   93.75% **
          >=  2.108e+011   2.504e+011     1      6.25%  100.00% **

Contraste de la hipótesis nula de distribución normal:
Chi-cuadrado(2) = 0.117 con valor p  0.94299
```

Brasil



Distribución de frecuencias para uhat1, observaciones 1-16
número de cajas = 7, media = 0.000419617, desv.típ.=4.31953e+011

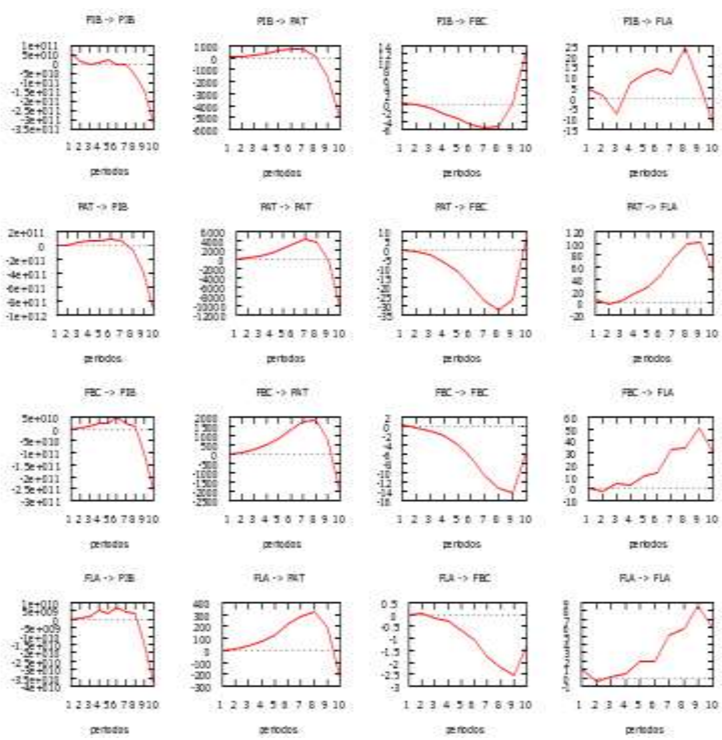
intervalo	punto medio	frecuencia	rel	acum.	
< -5.310e+011	-6.400e+011	2	12.50%	12.50%	****
-5.310e+011 - -3.130e+011	-4.220e+011	2	12.50%	25.00%	****
-3.130e+011 - -9.506e+010	-2.040e+011	2	12.50%	37.50%	****
-9.506e+010 - 1.229e+011	1.392e+010	5	31.25%	68.75%	***********
1.229e+011 - 3.409e+011	2.319e+011	2	12.50%	81.25%	****
3.409e+011 - 5.588e+011	4.498e+011	1	6.25%	87.50%	**
>= 5.588e+011	6.678e+011	2	12.50%	100.00%	****

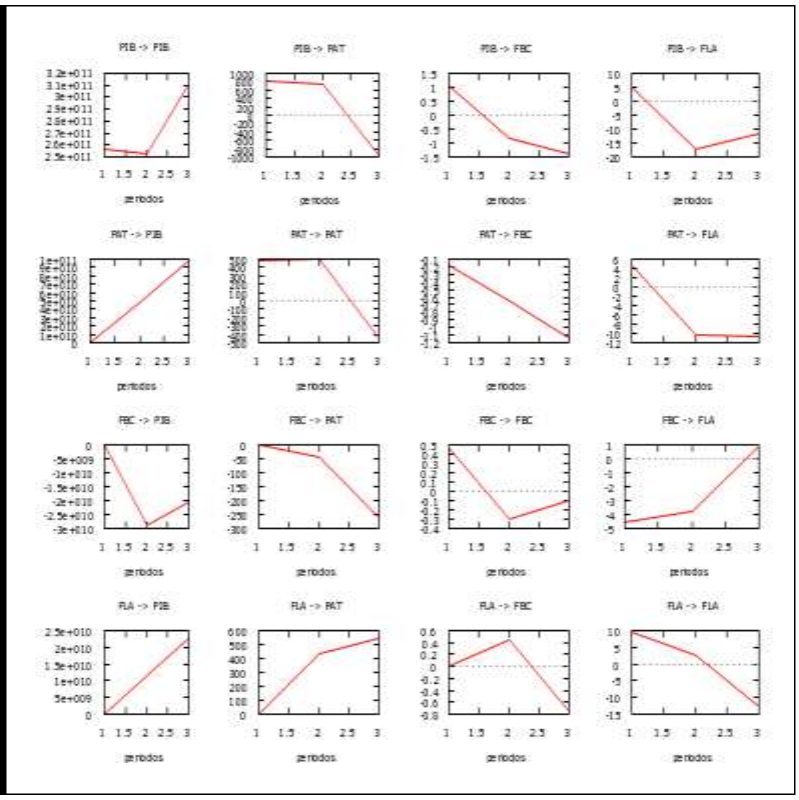
Contraste de la hipótesis nula de distribución normal:
Chi-cuadrado(2) = 0.032 con valor p 0.98412

Source: Own Elaboration with GRETL Econometric Software

Table 7 Contrast of variables by country

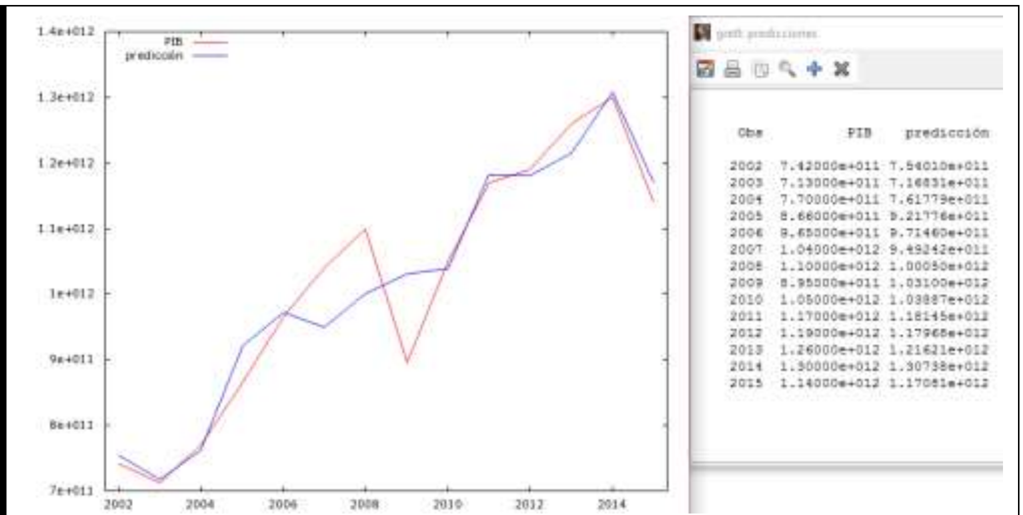
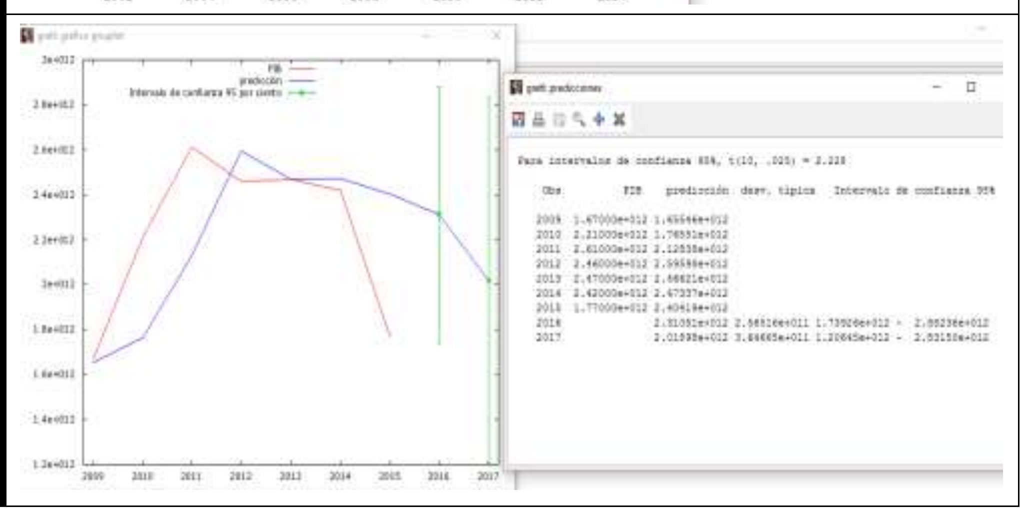
Mexico



Brasil	

Source: Own Elaboration with GRETL Econometric Software

Table 8 Predictions

Mexico	
Brasil	

Source: Own Elaboration with GRETL Econometric Software