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Foreign direct investment and gross domestic product growth

Carlos Encinas-Ferrer* Eddie Villegas-Zermeño**

Abstract

It has been assumed that foreign direct investment (FDI) is an important factor of economic growth (EG). The reason for this is that as investment is the dynamic element of gross domestic product (GDP), therefore, FDI is the independent variable and GDP growth the dependent. Recent studies in Argentina and Mexico have shown by the contrary that the consistent increase of GDP is the attractor of FDI. In our investigation we include other countries: China, Brazil, South Korea and Peru beside Mexico and the results are consistent with the prior studies and were proved empirically by testing causality in the Granger sense, adjusted by Toda and Yamamoto´s method using the software e-views. We found that FDI, as a percentage of total gross fixed capital formation (GFCF), is so small that it has only a marginal influence in economic growth. In this paper we show only the econometric results for China.

Selection and/or peer-review under responsibility of the Organizing Committee of ICOAE 2015.

Keywords: Foreign direct investment, gross domestic product, economic growt, groos fixed capital formation.

Introduction

Investment is the dynamic element of Gross Domestic Product (GDP), the only one that allows domestic production to increases and with it employment. It impacts the consumer and government spending, the latter through increased tax revenues.

We must remember that in economics we do not mean investment in the sense of the so-called financial investing but in the productive one (Mankiw 2012), which is done in fixed capital –machinery, equipment, structures and buildings, such as the residential construction-; and allows increased production of goods and services.

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In a closed economy investment equals savings and the latter has its origin in the sacrifice of present consumption of a nation. But in an open economy like the World in which we live, investment and savings are not equal and, therefore, domestic investment may be higher, equal or lower than the national savings. In the case of emerging countries with the characteristics of Mexico, that is, with a chronic deficit in the trade balance, the required investment is higher than the national savings and that means that this differential has to come from foreign direct investment (FDI) or portfolio international savings.

Since the late eighties and especially during the nineties, nations in the developing stages, following neoliberal lines, placed great importance to FDI. Under the assumption that the flow of investment from developed countries have as a necessary consequence in economic growth; more and more programs and policies generated within and outside our countries were designed to attract to emerging countries the financial flows that exist in the World without taking into account that most of them correspond to portfolio flows and a minor part to direct investment.

For all the above, it has been assumed that FDI generates economic growth and there is a "common sense" clear cause-effect relation. Therefore, FDI is the independent variable and GDP growth the dependent.

Oglietti (2007) and Abello (2010) conducted econometric studies in Argentina with information covering almost 40 years, which showed that FDI did not lead to Economic Growth (EG), but on the contrary; the latter (measured as an increase in GDP), is the biggest attraction generating flows of foreign direct investment and portfolio one also. The paradigm established that stated that an increase in FDI would result in an increase in GDP, was not showing results but on the contrary, when the GDP grows more attractive a country becomes to foreign investment funds

Villegas-Zermeño (2012), applied Oglietti and Abello investigations to Mexico and the results also showed the absence of a causal relationship between FDI and GDP growth.

This motivated us to extend the study including other countries since it was not possible to generalize conclusions with only two cases studied. We decided to include in the investigation, besides Mexico, Brazil, Peru, China and South Korea. In this paper we show only the results for China.

Alternative hypotheses were:

H1: FDI has a positive impact on EG as measured by GDP.

H2: EG in a country causes the attraction of FDI and,

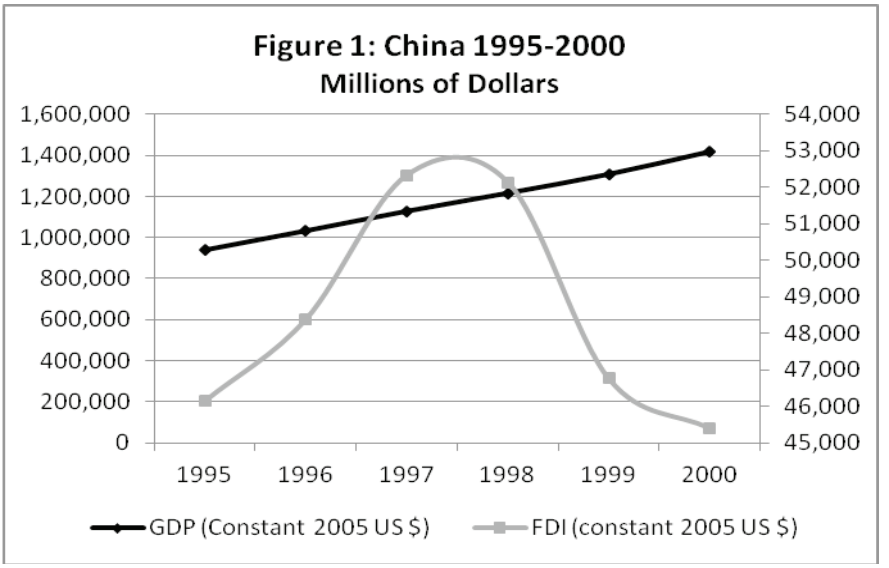
H3: There is a bidirectional relationship between FDI and EG.

To test the validity of one or more of these hypotheses we begin by examining the descriptive relationship between GDP and FDI in the countries mentioned during the period covered by the study, first globally and then segmented into six-year terms. Later we replicated the studies by Abello in Argentina using the methodology Sims (1980) of atheoretical macroeconometrics and Engle and Granger (1987) of stationarity, cointegration and causality to determine the causal relationship between variables.

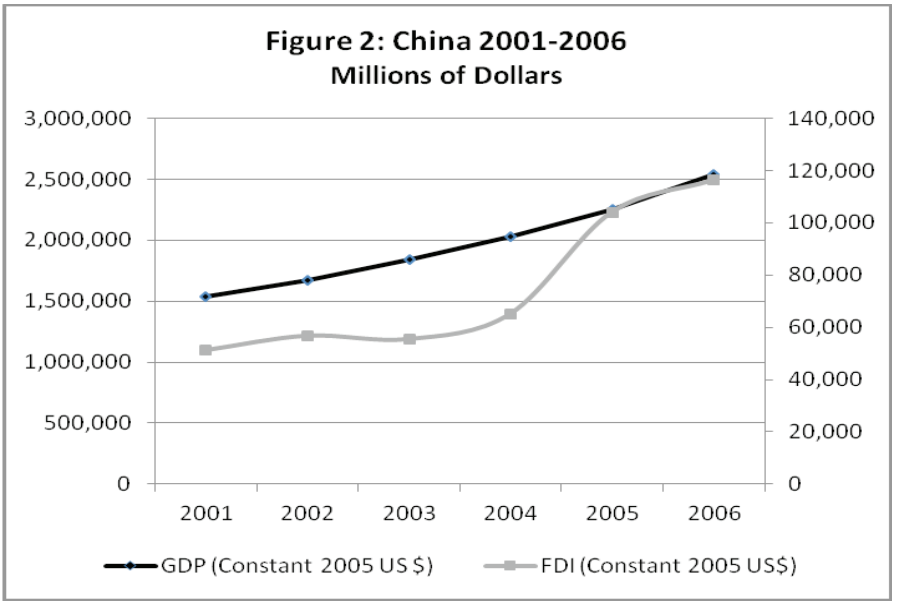
The data used are in constant 2005 dollars and the sources of information are the databases of The World Bank.

Causal relationship between FDI and EG in China (1995-2012)

In the six years between 1995 and 2000, FDI in China grows until 1997 dropping from this year. The GDP of China notes with steady growth throughout the period.

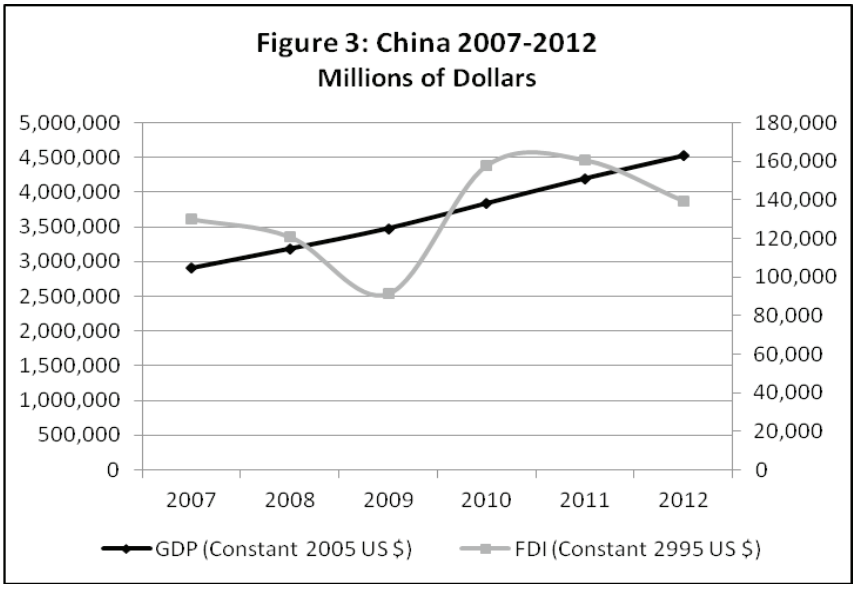


Source: Own elaboration with data from World Bank



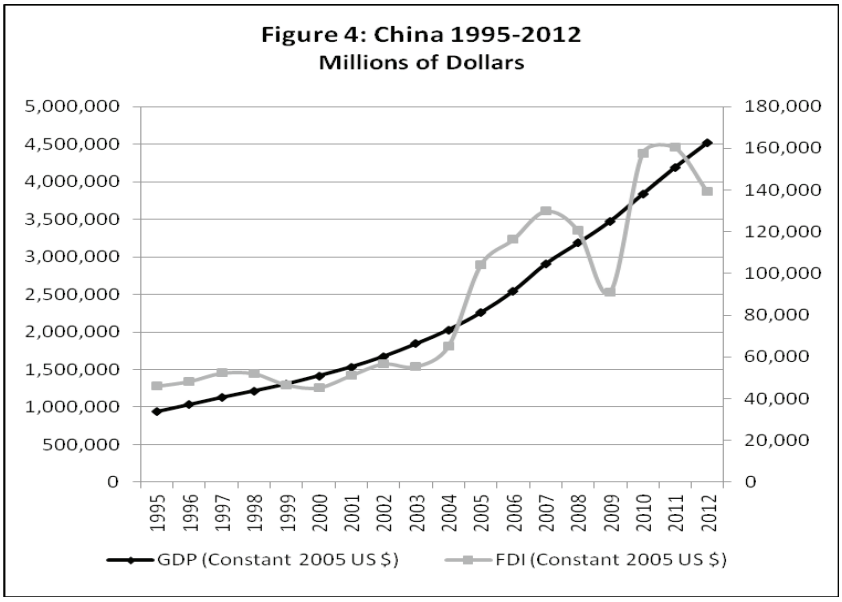
Source: Own elaboration with data from World Bank

In the period 2001-2006 the evolution of FDI and GDP are highly correlated.



Source: Own elaboration with data from World Bank

In the last six years FDI in China fluctuates up and down around the GDP, which could mean a correlation between the two.



Source: Own elaboration with data from World Bank

In general, there seems to be a strong correlation between GDP and FDI in the case of China from 1995 to 2012. The GDP is growing steadily during these years and FDI has ups and downs, but always towards an increase, although at the end of the period shows a decline.

VAR Model

One of the most important steps when specifying a VAR model is the selection of the number of lags. In order to make this selection a sequential analysis of the Akaike information criterion was carried out by which it was concluded that the optimal VAR model for the phenomenon under study has two lags. Therefore we specify it as follows:

$$PIBt=\delta 0+\delta 1PIBt-1+\delta 2IEDt-1+\delta 3PIBt-2+\delta 4IEDt-2+u1t$$

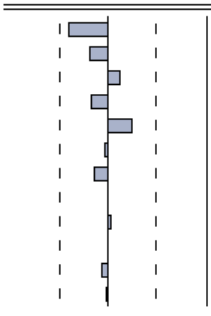
Stationarity

For specific cases of FDI and GDP, the graphic proof (Figure 8) shows in both steady growth during the period studied; that means that the series are not stationary.

The following figures show that both variables have high autocorrelation values when measured at the level value; however when measured in second differences the values are in the ranges, so you could have a pair of stationary series with two lags in the case of China.

Correlogram of D(CHN_IED,2)

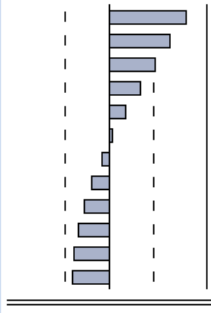
Date: 02/21/14 Time: 19:26
Sample: 1995 2012
Included observations: 16



	AC	PAC	Q-Stat	Prob
1	-0.402	-0.402	3.1015	0.078
2	-0.185	-0.413	3.8068	0.149
3	0.128	-0.207	4.1680	0.244
4	-0.161	-0.389	4.7883	0.310
5	0.259	-0.011	6.5492	0.256
6	-0.020	0.060	6.5609	0.363
7	-0.128	0.085	7.0856	0.420
8	0.002	-0.011	7.0858	0.527
9	0.047	0.072	7.1772	0.619
10	0.006	-0.005	7.1791	0.708
11	-0.055	-0.118	7.3542	0.770
12	-0.013	-0.175	7.3659	0.833

Correlogram of CHN_PIB

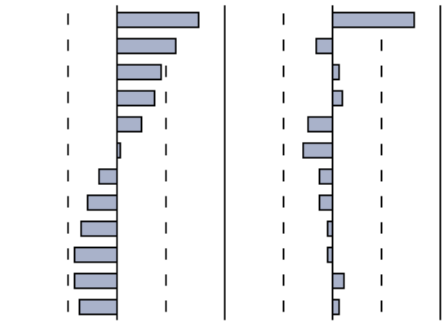
Date: 02/21/14 Time: 19:27
Sample: 1995 2012
Included observations: 18



	AC	PAC	Q-Stat	Prob
1	0.828	0.828	14.504	0.000
2	0.655	-0.095	24.155	0.000
3	0.489	-0.083	29.889	0.000
4	0.333	-0.079	32.734	0.000
5	0.183	-0.097	33.659	0.000
6	0.042	-0.097	33.712	0.000
7	-0.077	-0.063	33.906	0.000
8	-0.177	-0.071	35.029	0.000
9	-0.258	-0.074	37.696	0.000
10	-0.323	-0.075	42.389	0.000
11	-0.368	-0.066	49.354	0.000
12	-0.391	-0.052	58.518	0.000

Correlogram of CHN_IED

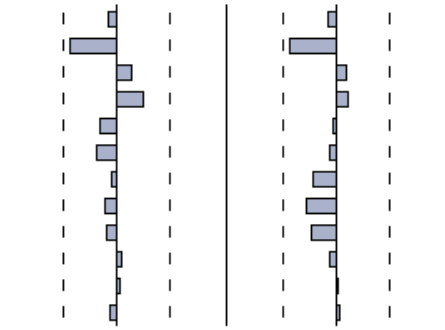
Date: 02/21/14 Time: 19:25
Sample: 1995 2012
Included observations: 18



	AC	PAC	Q-Stat	Prob
1	0.793	0.793	13.332	0.000
2	0.574	-0.151	20.733	0.000
3	0.431	0.076	25.202	0.000
4	0.371	0.106	28.745	0.000
5	0.247	-0.223	30.442	0.000
6	0.034	-0.285	30.476	0.000
7	-0.159	-0.121	31.301	0.000
8	-0.283	-0.123	34.194	0.000
9	-0.343	-0.045	38.902	0.000
10	-0.394	-0.033	45.895	0.000
11	-0.398	0.115	54.041	0.000
12	-0.359	0.067	61.790	0.000

Correlogram of D(CHN_PIB,2)

Date: 02/21/14 Time: 19:27
Sample: 1995 2012
Included observations: 16



	AC	PAC	Q-Stat	Prob
1	-0.068	-0.068	0.0898	0.764
2	-0.431	-0.438	3.9116	0.141
3	0.155	0.103	4.4454	0.217
4	0.263	0.118	6.1023	0.192
5	-0.155	-0.031	6.7340	0.241
6	-0.173	-0.065	7.5917	0.270
7	-0.042	-0.219	7.6492	0.365
8	-0.102	-0.285	8.0223	0.431
9	-0.091	-0.230	8.3625	0.498
10	0.064	-0.064	8.5583	0.574
11	0.042	0.029	8.6580	0.653
12	-0.052	0.041	8.8541	0.715

To prove the existence of unit root test there are different tests, the most commonly used in the literature is the Augmented Dickey-Fuller test (ADF). This test tests the hypothesis (null) that we have a unit root, so the time series under study is not stationary. In the event that the series is not stationary se will have to transform it, taking second differences, and analyzing it again. In the event that this series is stationary, then we say that the original series is integrated of order 2, denoting it I (2).

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CHN_IED(-1)	-0.111113	0.132394	-0.839264	0.4145
C	1.46E+10	1.21E+10	1.208814	0.2454

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CHN_IED(-1),2)	-2.710982	0.523646	-5.177127	0.0003
D(CHN_IED(-1),3)	0.858516	0.315870	2.717941	0.0200
C	2.37E+09	7.46E+09	0.317485	0.7568

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CHN_PIB(-1)	0.025904	0.032159	0.805501	0.4350
D(CHN_PIB(-1))	0.693941	0.312370	2.221534	0.0447
C	1.93E+10	2.47E+10	0.783239	0.4475

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CHN_PIB(-1),2)	-1.687633	0.413771	-4.078663	0.0018
D(CHN_PIB(-1),3)	0.520253	0.275704	1.886997	0.0858
C	3.02E+10	1.28E+10	2.353733	0.0382

Cointegration

Through the analysis of stationarity we have found that the series of FDI and GDP are not stationary, which comes as a problem when estimating the model or applying the causality Engle-Granger test, since the regression of a series of non-stationary time over other non-stationary may cause a spurious regression.

However, as noted by Engle and Granger (1987), a linear combination of two or more non-stationary series can be stationary, which is known as cointegrated series. In economic terms, two variables are cointegrated if there is a long-term relationship or of equilibrium between the two.

To analyze the possibility that series are cointegrated, i.e. that there is a long-term relationship between the variables, Johansen procedure is used.

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.588031	16.30618	12.32090	0.0102
At most 1	0.123947	2.117264	4.129906	0.1717

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

In the above table we found the results of applying this procedure: assuming that the series of FDI and GDP have a linear stochastic trend and non-deterministic, the trace test indicates the existence of a cointegration equation at a level of 5% significance. In other words, there would be a long-term equilibrium between the variables considered.

Causality

What is sought at this stage is to determine the direction of causality between FDI and GDP assuming, as proven through the test of Johansen, that this series would be related in the long term (cointegrated). Based on the Granger representation theorem, it is possible to apply an Error Correction Model (ECM) that will allow us to determine, via the t-test error correction term, if FDI causes GDP, or if GDP causes IED or if there is a bidirectional causal relationship between these variables from 1995-2012 in the case of China.

Pairwise Granger Causality Tests
Date: 02/21/14 Time: 19:58
Sample: 1995 2012
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
CHN_PIB does not Granger Cause CHN_IED	16	7.75956	0.0079
CHN_IED does not Granger Cause CHN_PIB		0.68599	0.5239

The results observed in the above table show that in the period under study, and in the case of China, it can be determined that the growth in GDP leads to an increase in FDI; contrary to the supposed, variations in FDI have no effect on GDP.

In the next table we show the regression analysis performed on these variables, assuming FDI as the cause and GDP as the effect. It can be seen that the coefficient of determination R^2 = 84.44%, confirms a strong relationship between the two variables for China.

Regression Statistics	
Multiple correlation coefficient	0.92391599
Coefficient of determination R^2	0.85362076
R^2	**0.84447206**
Typical error	4.5395E+11
Observations	18

ANALYSIS OF VARIANCE					
	Degrees of freedom	*Sum of squeres*	*Average of the squares*	*F*	*Critical value of F*
Regression	1	1.9228E+25	1.9228E+25	93.3051165	0.00
Residuals	16	3.2972E+24	2.0607E+23		
Total	17	2.2525E+25			

We also note in the Analysis of Variance the critical value of F = 0.00 so the hypothesis that $\beta_1=0$ is rejected at a 95% confidence level, indicating that the causal link between FDI and GDP is strong for China in the period of study.

Conclusions of our Econometric Analysis

In our complete investigation, which for reasons of space we do not present here, when applying the econometric analysis to Brazil, South Korea, Peru and Mexico, we found that there is no causal link between FDI and GDP in those countries, only in the case of China that relationship is found but contrary to the predicted direction, GDP growth is which causes an increase in FDI and not vice versa.

In order to explain that results we have to answer the following questions: What proportion represents foreign direct investment in relation to domestic investment? Is that proportion of such magnitude that involves a significant impact on GDP? Or is so small compared to the volume of total investment that loses its status as an independent variable?

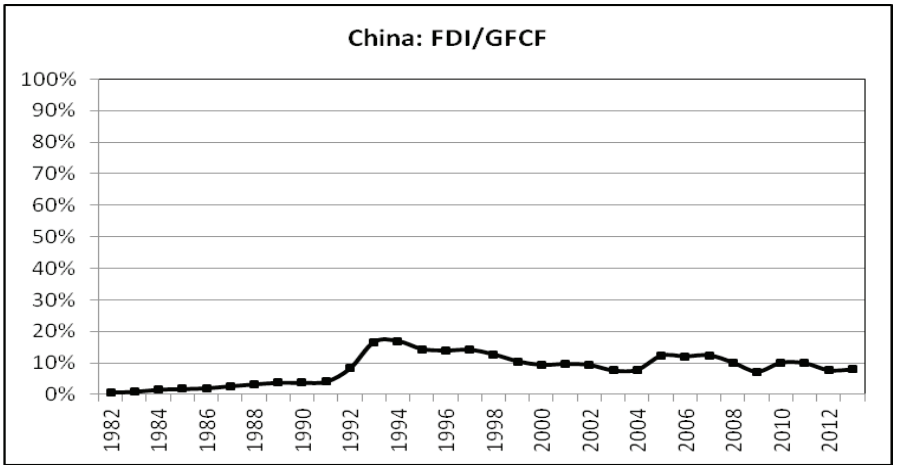
To answer these questions we observed the percentage that FDI represents in relation to GFCF in the countries studied.

We will refer only to China

First of all, what proportion of GDP devotes China to GFCF? The following figure shows us that since 1982 this percentage has been growing steadily rising from 28.2% in 1982 to 47.3% in 2013. The growth rate of China's GDP during that period has averaged 12.23%.

Source: Own elaboration with data from World Bank

In the period 1982-2013 the percentage FDI to GFCF has been on average less than 10%.



In the case of Mexico and Brazil the proportion that FDI had as a percentage of GFCF has been similar to that of China, 10% on average, albeit with fluctuations in the case of Brazil, that led this percentage to 30% in 1999 and 2000. In South Korea the average was less than 3% in the period studied.

Most companies that perform FDI are of transnational type, companies planning processes from the perspective of a single company with an equally unique internal accounting, usually in dollars, which translates inputs produced from one department to another, not as a foreign trade transaction in which a company exports and other imports. We can call this "intratransnational trade" with a very small added value. This implies that it is not in the interest of the big transnational corporation raising the ratio of national integration in the host country.

We conclude that the small proportion that FDI has within the national investment in the countries studied as well as its low multiplier effect on the national economy, explains why it does not show as an independent variable.

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