# THE RELATIONSHIP BETWEEN DOMESTIC CREDIT AND INCOME: EVIDENCE FROM LATIN AMERICA

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## Abstract

In this paper, we examine the relationship between the domestic credit by banking sector and Gross Domestic Product (GDP) per capita in the balanced panel framework of 20 Latin America countries from 1960 to 2010. Panel Cointegration tests of Kao (1999), Maddala and Wu (1999) and Westerlund (2006, 2007) suggest that there is a significant long-run relationship between the domestic credit and the GDP per capita in Latin America countries. Furthermore, results from panel causality tests indicate that there is a unidirectional causation which runs from domestic credit to the GDP per capita.

**Keywords:** Domestic Credit, Income, Latin America, Panel Cointegration, Panel Causality.
**JEL Codes**: O16, O54.

## 1. Introduction

There is a large literature showing that the relationship between economic growth and financial development. However, literature that examines the relationship between domestic credit and economic growth or income is limited, particularly considering the developing economies.

In this paper, we investigate the possible direct relationship between the domestic credit by banking sector and the Gross Domestic Product (GDP) per capita in the balanced panel framework of Latin America and Caribbean (LAC) countries. We particularly focus on the domestic credit in LAC, because of a potential sharp and sustained decline in domestic credit growth has been a major concern for Latin American policymakers in the last decades. The role and implications of a deep domestic credit decline may suffer to the economic activity and financial stability. These are well-known facts in the LAC countries, when it is also considered in the experience of banking and financial crises in the 1980's and 1990's (Montoro and Rojas-Suarez, 2012).

Furthermore, the '2007-2010 global credit crunch' pioneers a potentially critical development in the banking sector of many LAC countries. Over the previous several years, lending by foreign banks had also become a significant source of funding for corporations and households in LAC countries (Kamil and Rai, 2010). Thus, existence of significant relationship between domestic credit by banking sector and the GDP (per capita) deserves further investigation in LAC countries, whether to define domestic credit is a significant sign of economic growth or it is a consequence of economic growth.

Domestic credit by banking sector is commonly defined as an indicator of financial development in the literature. The main reason of this based upon the idea by Joseph A.

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Schumpeter. Schumpeter (1912) firstly proposed that investments which are the origin of the economic growth have been financed by the volume of domestic credit in the banking sector. Furthermore, despite Wicksell (1898) and Mises (1912) have also emphasized that mentioned mechanisms in the growth pattern, Hayek (1931) improved the all of these ideas in a 'real-business cycle' theory and he indicated that rapid growth rate is the consequences of low-interest rates that come out of the (banking) credit extension.

On the contrary, Robinson (1952) suggested that banking sector or the financial institutions is an unsubstantial factor in growth pattern and he indicated that growing output will increase the demand for financial services and this pioneers a positive development in the financial sector. In other words, development of financial sector follows output growth and this is actually an opposite suggestion from the 'classical' Schumpeterian view.

The theoretical background of the two possible causal relationships are described as the two opposite views namely 'demand-following hypothesis' and 'supply-leading' hypothesis by Patrick (1966).

Demand-following hypothesis suggests that sustainable economic growth can develop financial system and financial markets; then they can be leading sector in the growth process. Namely, a causal relationship from economic growth to financial development is emerged by this hypothesis, thus an increasing demand for financial services can induce an expansion in the financial sector as the real economy growth. Gurley and Shaw (1955), Goldsmith (1969) firstly showed that an empirical support for this hypothesis.

The supply-leading hypothesis suggests that a causal relationship from financial development to economic growth, which means creation of financial institutions and financial markets can increases the supply of financial services, thus this leads to real economic growth. McKinnon (1973), King and Levine (1993a, 1993b) found that the empirical evidences on the supply-leading hypothesis.

The relationship between domestic credit (or more generally financial development) and economic growth has extensively and empirically been tested in the literature. These papers focus on one specific country with using time series or country groups with panel data approaches. However, there is no general evidence on the relationship between domestic credit and economic growth.

The cross-country empirical evidences of both hypotheses are examined by King and Levine (1993a), Levine (1998), Levine and Zervos (1998), Deidda and Fattouh (2002) Levine (2002), McCaig and Stengos (2005). The time series empirical evidences of both hypotheses are investigated by Gupta (1984), Jung (1986), Xu (2000). Furthermore, panel data approaches are applied by De Gregorio and Guidotti (1995), Rajan and Zingales (1998), Henry (2000), Levine *et al.* (2000) Beck and Levine (2002), Calderon and Lui (2003), Beck and Levin (2004).[3]

The rest of the paper is organized as follows: Second section discusses the data and methodology and empirical findings are described in the third section. Final section concludes.

[3] See Ang (2008) and Hassan *et al.* (2011) for a brief review of literature.

## 2. Data and methodology

Our study bases on 20 LAC countries[4], from 1960 to 2010 and data frequency is yearly. Following the seminal paper by Calderon and Lui (2003), we define the 'Domestic Credit (DC)' as the domestic credit provided by banking sector % of GDP and 'GDP per Capita (RGDP)' as (constant 2000 US$) GDP per capita. We obtain data from database of World Bank.

To examine the possible long-run relationship between the domestic credit and the GDP per Capita, we firstly employ panel unit root tests can be arranged in groups by cross-section dependence and independence, heterogeneous and homogenous unit roots which are defined by Maddala and Wu (1999), Breitung (2000), Hadri (2000), Choi (2001), Levin *et al*. (2002), Im *et al*. (2003).

To define these test's approach, we consider a following AR(1) process for panel data (Quantitative micro software, 2009: 395-401):

$$y_{it} = \rho_i y_{it-1} + X_{it}\delta_i + \varepsilon_{it}$$

Where $i = 1, 2, .....N$ cross-section units or series that are observed over periods $t = 1, 2, .....T_i$ $X_{it}$ represent the exogenous variables in the model, including any fixed effects or individual trends, $\rho_i$ are the autoregressive coefficients, and the errors $\varepsilon_{it}$ are assumed to be mutually independent idiosyncratic disturbance. If $|\rho_i| < 1$, $y_i$ said to be weakly (trend) stationary. On the other hand, if $|\rho_i| = 1$ then $y_i$ contains a unit root.

For purposes of testing, there are two natural assumptions that we can make about the $\rho_i$. First, one can assume that the persistence parameters are common across cross-sections so that $\rho_i = \rho$ for all $i$ Levin *et al*. (2002), Breitung (2000), and Hadri (2000) tests all employ this assumption. Alternatively, one can allow $\rho_i$ varying freely across cross sections. The Im *et al*. (2003), and Fisher-ADF and Fisher-PP tests define by Maddala and Wu (1999) and Choi (2001) are of this form.

Levin *et al*. (2002), Breitung (2000), and Hadri (2000) tests all assume that there is a common unit root process so that $\rho_i$ is identical across cross-sections. The first two tests employ a null hypothesis of a unit root while the Hadri (2000) test uses a null of no unit root. Levin *et al.* (2002) and Breitung (2000) both consider the following basic ADF specification:

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j-1}^{p_i} \beta_{ij} \Delta y_{it-j} + X'_{it}\delta + \varepsilon_{it}$$

Where we assume a common $\alpha = \rho - 1$ but allow the lag order for the difference terms, $\rho_i$ to vary across cross-sections. The null and alternative hypotheses for the tests may be

[4] Namely; Argentina, Bolivia, Brazil, Chile, Colombia, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay, and Venezuela.

written as $H_0$: $\alpha = 0$ $H_1$: $\alpha < 0$ so under the null hypothesis, there is a unit root, while under the alternative, there is no unit root.

The Im *et al*. (2003), the Fisher-ADF and PP tests all allow for individual unit root processes so that may $\rho_i$ vary across cross-sections. The tests are all characterized by the combining of individual unit root tests to derive a panel-specific result. Im *et al*. (2003) begin by specifying a separate ADF regression for each cross section:

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j-1}^{p_i} \beta_{ij} \Delta y_{it-j} + X'_{it}\delta + \varepsilon_{it}$$

$H_{0:}\, \alpha = 0$ for all $i$ while the alternative hypothesis is given $H_1 \begin{cases} \alpha_i = 0 \; for \ldots i = 1, 2, N_1 \\ \alpha_i < 0 \; for \ldots i = N+1, N+2, \ldots . N \end{cases}$

(Where they may be reordered as necessary) which $_i$ may be interpreted as a non-zero fraction of the individual processes is stationary.

An alternative approach to panel unit root tests uses Fisher's (1932) results to derive tests that combine the p-values from individual unit root tests. This idea has been proposed by Maddala and Wu (1999) and by Choi (2001).

We then use Panel cointegration tests in order to determine whether long-run relationships exist between domestic credit and per capita GDP in LAC countries. Maddala and Wu (1999) Fisher Johansen-type and Kao (1999) cointegration tests do not take structural breaks into account in the series. By the way, Westerlund (2006, 2007) panel cointegration test allows for multiple structural shifts in the series. To define these test's approach, we consider a simple following equation:

$$y_{it} = \alpha_i + \beta x_{it} + \varepsilon_{it}$$

In this equation, $i = 1$,....., N and $t = 1$,....., T, $\alpha_i$ are constant terms, $\beta$ is the slope $y_{it}$ and $x_{it}$ are non-stationary series, and $\varepsilon_{it}$ are stationary disturbance terms.

Kao (1999) proposes two types of Panel cointegration tests as the Dickey-Fuller (DF) and the Augmented Dickey-Fuller (ADF) tests. He calculates the statistics of these tests as follows:

$$\hat{\varepsilon}_{it} = \rho \hat{\varepsilon}_{it-1} + \sum_{j=1}^{p} \theta_j \Delta \hat{\varepsilon}_{it-j} + u_{it}$$

In this equation, residuals in the system are derived to calculate the test statistics and for the distributions. The null hypothesis of this test is $H_0 : \rho = 1,$ and alternative $H_1 : \rho < 1$ in other words, the null hypothesis of his test is no cointegration. Pedroni (1999) also develops a Panel cointegration test with using seven residual-based tests in order to test the null hypothesis of no cointegration in dynamic panel series. In this study, we don't employ this test due to it is only efficient in the multiple regression. However, we employ the Fisher Johansen-type Panel cointegration test by Maddala and Wu (1999). In their study, they obtain results by Fisher (1932) and they apply a new methodology in Panel cointegration tests by combining results from each individual cross-section to obtain the Panel test statistic.

This test statistic for the panel data under the null hypothesis of no cointegration can be defined as follows:

$$-2\sum_{i=1}^{N}\log(p_I)\rightarrow\chi^2(2N)$$

In this equation, $\rho_i$ is the probability of null hypothesis rejection for individual cross-section, panel statistic is under $\chi^2(2N)$ chi-square distributed with $2N$ degrees of freedom. This test is also based on p-values by MacKinnon et al. (1999) in the Cointegration Trace and Maximum Eigenvalue tests by Johansen (1991).

In this paper, we also employ the Panel cointegration test developed by Westerlund (2006, 2007) and this test allowing for multiple structural breaks in the level variable as well as in the trend of cointegrated regression. The main advantage of this test is that it allows for the possibility of known a priori multiple structural breaks or it allows for breaks in the locations that they are endogenously determined from the series. This test is based on four residual-based tests in order to test the null hypothesis of no cointegration in dynamic panel series.

Furthermore, this test allows for structural breaks that may be placed at different locations in different individual series. Westerlund (2006, 2007) apply the global minimisation of the sum of squared residuals approaches by Bai and Perron (1998) for estimation of the location of breaks. The system of equations in the Westerlund (2006, 2007) Panel cointegration test can be written as follows:

$$y_{it}=z_{it}'\alpha_{ij}+x_{it}'\beta_i+e_{it}$$

$$e_{it}=v_{it}+u_{it}$$

$$v_{it}=v_{it-1}+\varphi_i u_{it}$$

In this system, $z_{it}$ is a vector of deterministic components and $x_{it}$ is a vector of regressors, $\alpha_{ij}$ and $\beta_i$ are vectors of parameters where $j=1,\ldots..,\ M_i+1$ with $M_i$ breaks or $M_i+1$ regimes. The null hypothesis of this test is $H_0:\varphi_i=0$ for all $i=1,\ldots..,$ N implying the existence of cointegration relationships between estimated non-stationary variables. The alternative hypothesis is $H_1:\phi_i\neq 0$ for $i=1,\ldots..,\ N_1$ and $\phi_i=0$ for $i=N_1+1,\ldots\ldots,\ N$. The alternative hypothesis indicates the rejection of the cointegration hypothesis.

At this point, Panel causality equations in our methodology can simply be defined as follows:

$$DC_{it}=c+\sum_{j=1}^{m}\alpha_{jt}DC_{it-j}+\sum_{j=1}^{m}\lambda_{jt}RGDP_{it-j}+\Delta u_{it}$$

$$RGDP_{it}=c+\sum_{j=1}^{m}\alpha_{jt}RGDP_{it-j}+\sum_{j=1}^{m}\lambda_{jt}DC_{it-j}+\Delta u_{it}$$

In this system, $DC_{it}$ is domestic credit and $RGDP_{it}$ is the GDP per capita.

## 3. Empirical findings

In this paper, we firstly employ the homogenous and heterogeneous Panel unit root tests considering the cross-section independence and dependence We found that series are not

statinonary and we therefore apply Panel cointegration tests and Panel-Wald causality test. We show that our empirical results in the Table 1, Table 2 and Table 3, respectively.

**Table 1.** Panel Unit Root Tests Results

| **Cross-section Independence** | **Domestic Credit** | **GDP per Capita** |
|---|---|---|
| **Homogenous Unit Roots** | **Trend and Constant** | **Trend and Constant** |
| Hadri (2000) Z-stat | 24.604 (0.0000) | 100.7 (0.0000) |
| Hadri (2000) HC Z-stat | 8.249 (0.0000) | 21873.8 (0.0000) |
| Levin, Lin and Chu (2002) t-stat | 2.981 (0.9986) | 4.609 (0.9989) |
| Breitung (2000) t-stat | -1.275 (0.1011) | 0.443 (0.6712) |
| **Heterogeneous Unit Root** | **Trend and Constant** | **Trend and Constant** |
| Im, Pesaran and Shin (2003) W-stat | 1.079 (0.8598) | 4.964 (0.9995) |
| **Cross-section Dependence** | **Cross-section Dependence** | **Cross-section Dependence** |
| **Heterogeneous Unit Root** | **Trend and Constant** | **Trend and Constant** |
| Maddala and Wu (1999) ADF-Fisher Chi Square | 28.157 (0.9202) | 8.826 (0.9996) |
| Choi (2001) ADF-Choi Z-stat | 1.145 (0.8730) | 5.166 (0.9993) |
| Maddala and Wu (1999) PP-Fisher Chi Square | 48.951 (0.1567) | 11.378 (0.9998) |
| Choi (2001) PP-Choi Z-stat | -0.825 (0.2046) | 4.341 (0.9997) |

**Notes**: All panel unit root tests have null hypothesis that non-stationary series, except Hadri (2000) is stationary. All panel unit root tests are defined by Quadratic Spectral Kernel and Andrews (1991) bandwidth selection method. Hadri (2000) also assumes that the Heteroskedasticity Consistent (HC) unit root. The optimal number of lags is chosen by Modified Akaike Information Criterion (MAIC). Probabilities for Fisher tests are computed by an asymptotic chi-square distribution. All other tests assume asymptotic normality. The p-values are in parentheses.

**Table 2.** Panel Cointegration Test Results of DC-RGDP

| **Kao (1999)** | **ADF-statistic** | **P-value** | | |
|---|---|---|---|---|
| | 3.162 | 0.0008 | | |
| **Maddala and Wu (1999)** | **Trace** | **P-value** | **Max. Eigen.** | **P-value** |
| None | 71.43 | 0.0016 | 68.45 | 0.0034 |
| At Most 1 | 47.7 | 0.1883 | 47.7 | 0.1883 |
| **Westerlund (2006, 2007)** | **Z-value** | **Value** | **P-value** | **Robust P-value** |
| Gt | -5.716 | -18.709 | 0.00 | 0.00 |
| Ga | -46.665 | -23.375 | 0.00 | 0.00 |
| Pt | -24.438 | -17.458 | 0.00 | 0.00 |
| Pa | -43.458 | -25.833 | 0.00 | 0.00 |

**Notes**: All panel cointegration tests have null hypothesis of no cointegration. Probabilities for Fisher tests are computed by an asymptotic chi-square distribution. Linear Deterministic Trend is also included in Fisher test. Lag intervals are defined by AIC.

**Table 3:** Panel-Wald Causality Test Results of DC-RGDP

| **Wald Causality Test** | **Wald Causality Test** | **Chi-square and -values** |
|---|---|---|
| Null hypothesis | *DC does not cause RGDP* | 9.054 (0.0108)* |
| Null hypothesis | *RGDP does not cause DC* | 1.909 (0.3850) |

**Note**: * denotes the rejection of the null hypothesis at 1% significance level. The p-values are in parentheses.

Our empirical findings suggest that there is a significant long-run relationship between the domestic credit and the GDP per capita in LAC countries. Furthermore, the results of Panel causality tests indicate that there is unidirectional causation which runs from domestic credit to the GDP per capita. These findings are still valid and robust, when we also consider the endogenously determined structural breaks in Panel cointegration test by Westerlund (2006, 2007). In this point, we do not apply to the possible Panel Vector Error Correction (VECM) analysis. Because, theoretical background that investigating in the terms of short-run mechanism and short-run dynamics between domestic credit and GDP per capita are not sufficiently and clearly examined in the literature. Furthermore, frequency of our data is not appropriate for such analysis.

## 4. Conclusion

The relationship between domestic credit and economic growth or income is a noteworthy issue in the literature. A causal relation from domestic credit to economic growth (or the reverse) is still an empirically debating issue. In this paper, we investigate the long-run relationship and the direction of causality between the domestic credit and GDP per capita from 1960 to 2010 in the 20 LAC countries. We employ three Panel cointegration tests in order to examine the long-run impact of domestic credit to the GDP per capita. We also apply Panel causality tests approach which takes into cross-sectional effects account across the countries.

The empirical results show that long-run relationship clearly and significantly exists between domestic credit and GDP per capita in LAC. The direction of causality between related variables is from domestic credit to GDP per capita in the LAC countries. Thus, our empirical findings support evidence on supply-leading hypothesis in LAC countries. It can be said that this means the banking sector and the real sector are tightly interconnected to each other in LAC countries. Economic policies focus on the development of the banking sector can increase the domestic credits and this may result in sustainable economic growth. However, the banking sector should not only provide domestic credit to households or corporations but also should create new resources by using new instruments and institutions for real sector to sustain GDP growth.

As we have already mentioned, there is a diverse instruments in the terms of banking sector in LAC countries, particularly considering the growing share of foreign banks in the banking sector. Furthermore, there are also developing stock and bond markets in many of these countries. We therefore suggest that all of figures in the financial development process, particularly capital inflows, should also be taken into account, since this effect can also significantly provides another channel of resources to the real sector and economic growth. Our study can easily be extended to examine how related variables can possibly effects the economic growth or per-capita income in LAC countries.

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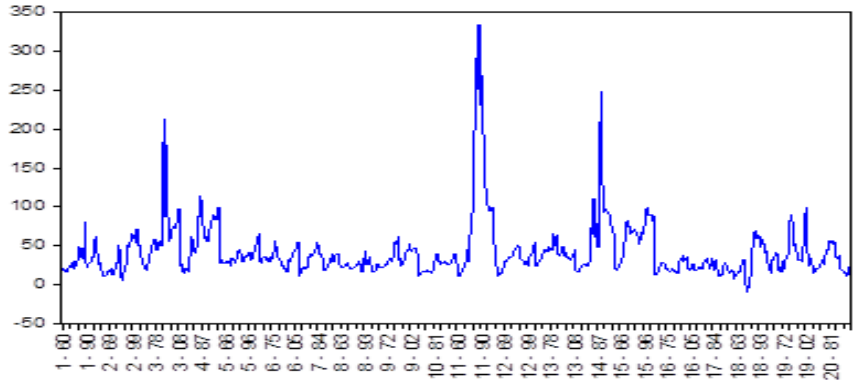
## Appendix I: Graphs of the Series

**Domestic credit provided by banking sector (% of GDP)**




**GDP per capita (constant 2000 US$)**