PRIVATE CONSUMPTION AND PUBLIC DEFICIT IN LATIN AMERICA: THEORY AND EVIDENCE OF RICARDIAN EQUIVALENCE HYPOTHESIS

Consumo privado y déficit público en América Latina: teoría y evidencia de la hipótesis de evidencia ricardiana

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Resumen

El escrito aporta un análisis teórico y empírico sobre la hipótesis de equivalencia ricardiana, argumento que supone la neutralidad de un déficit público sobre el consumo individual. El análisis teórico resume las diversas controversias que esta teoría ha generado entre los economistas y su confrontación con las teorías clásica y keynesiana. El análisis empírico aporta una evaluación del cumplimiento de la hipótesis para el caso de 11 países de América Latina y se contrasta frente al modelo de consumo keynesiano. Mediante un modelo de datos panel se estiman las relaciones de largo plazo de los modelos de equivalencia ricardiana y keynesiano. Se concluye que los consumidores en Latinoamérica no tienen en cuenta la forma de financiamiento público al momento de consumir.

Palabras clave: teoría económica, déficit público, consumo privado, cointegración de panel, América Latina.
Clasificación JEL: C23, D11, D12, E21, H62.

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Abstract

This brief provides a theoretical and empirical analysis of the Ricardian Equivalence Hypothesis, this argument implies the neutrality of public deficit over the individual consumption. The theoretical analysis summarizes the various controversies that this theory has generated among economists and their confrontation with the classical and Keynesian theories. The empirical analysis provides an assessment of compliance of the hypothesis for the case of 11 countries in Latin America, and is contrasted against a Keynesian consumption model. By using a panel data model, the long term relations of the Ricardian Equivalence and Keynesian models are estimated. It is concluded that consumers in Latin America do not take into account the public financing way at the time of consumption.

Keywords: economic theory, public deficit, private consumption, cointegration panel, Latin America.
JEL Classification: C23, D11, D12, E21, H62.

1. Introduction

Nowadays, the debate about the role and utility of public expenditure has been very controversial to economists, the arguments are basically divided into having a goal of responsible expenditure and a priority of balancing public finances, which means an equality between income and expenditure; as well as arguments which agree in having an optimal policy of the government expenditure to stimulate the demand, which means reduce taxes or increase transfers finance by the deficit.

Within the theoretical arguments that support the need for a balanced public budget is the Ricardian Equivalence Hypothesis (REH) which is the object of study in this document, this assumption is a theoretical peculiarity about the neutral effect of a public deficit in relation to the individual consumption. This hypothesis assumes that for the consumer, the public deficit is equivalent to future taxes. Therefore, it is an argument commonly used to assert the need for a balanced budget in government expenditures.

The objective is to determine, in a theoretical way, if the main assumptions of the hypothesis are conclusive; and in an empirical way, whether

this hypothesis holds for the case of Latin America (LA), particularly for 11 countries: Argentina, Chile, Colombia, Costa Rica, Ecuador, Honduras, Mexico, Panama, Paraguay, Peru and Uruguay; and to justify an ideological guidance for the fiscal balance. Therefore a contrast between the Ricardian hypothesis and the Keynesian theory is made, being this last one a positive effect on the consumption before the increase in public expenditure. With this comparison it can be determined whether such expenditure promotes the consumption, as the Keynesian model argued, and is more convenient to use an optimal fiscal policy for demand. Or their effect is neutral, and the fiscal balance bias is justified. This empirical analysis is done from the approach of the theory of cointegration of Granger (1987), which allows to review the behavior of the variables in both the long term and in the short term.

In the first section of this document, it is showed a theoretical analysis of the Ricardian Equivalence, within this analysis, some arguments are given to discuss the strength of the assumptions that support it. The second part is an empirical analysis of the Ricardian Equivalence for the Latin American case: a literature review of various empirical evaluations of the hypothesis is made, and considers a function of structural consumption to assess the compliance of the theory. After a contrast between the two theoretical concepts of public expenditure in relation to consumption takes place: the Keynesian and Ricardian Equivalence (in its strong and weak version), this is to determine what is significant in the case of LA.

2. Theoretical Analysis of the Ricardian Equivalence Hypothesis

Basically, the Ricardian Equivalence Hypothesis[1] states that added demand is invariant to the use of a public deficit, as it assumes that to the consumer the deficit is equivalent to future taxes. Therefore, this hypothesis states that consumers understand that a deficit only represents a delay of a future tax burden.

Specifically, the REH applies the logic of the rational consumer in respect of temporary changes in the fiscal policy. Given the possibility of a government

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[1] The name is derived from the economist David Ricardo, who was the first to propose this idea, but at the end he discarded it. To review the complete discussion see Ricardo (1820): *Essay on the Funding System*.

deficit expenditure, the consumer, lead-safe, decides to save now when assessing the possibility that in the future the government has to raise taxes to cover the deficit in the present, therefore an increase of the deficit does not change the individuals consumption. In other words, the well-prepared consumer understands that the current public debt means higher taxes in the future. Wherefore should not encourage consumers to spend more, but to save to pay an inevitable tax increases in the future. That savings exactly compensate the reduction in public savings generated by the deficit.

Consequently, this particular conception of aggregate consumption that takes REH differs in many ways with the classical and Keynesian theories as to the use of the public expenditure is concerned. In the case of the classical theory, this means that when the government incurred in a budget deficit, consumers will respond by spending more, because their income is increased by the increase in transfers or tax cuts which means the deficit. Therefore, the deficit increases the added demand, and increase the production in the short term, but reduces capital and economic growth in the long term.

In the case of Keynesian Theory, an increase in public expenditure financed by debt generates a multiplier effect in the consumer income, which translates into higher consumption because to this theory the aggregate consumption depends on the aggregate income. Therefore, a higher income generates a higher consumption, which increases the added demand, output and economic growth.

Therefore, for the REH, a public deficit does not produce any of the effects mentioned in the previous theories, because as already mentioned assumes that consumers understand that a deficit only represents the delay of a future tax burden. Given this particular macroeconomic hypothesis, a theoretical analysis is made, assessing key assumptions assumed, as well as the controversies generated by economists to determine the theoretical accuracy of these assumptions.

2.1. Main Assumptions of the REH

The REH is supported by several assumptions, which together can be considered the theoretical strength of the hypotheses: first, it assumes that by financing the public expenditure through a deficit, not wealth added effects on individuals are generated as the classical or Keynesian theories

might assumed, this rational expectations[2] of consumers, who are ahead of the discretionary decisions of the tax authorities making use of the public deficit has a null effect on added income and therefore in the consumption.

Also, for REH, changes in the public expenditure only affect consumption decisions of economic agents if these changes are permanent or long-term, that is, only if it is known with full certainty that the government will lower taxes to reduce its expenditure over an extended period of time, that agents will understand that tax cuts will not require its increase in the future. But it should be noted that the expectations of reduction in public expenditure, which makes agents modify their consumption rather than tax reduction, therefore, a public deficit can not have permanent effects from this theoretical perspective, because the consumer expectations regarding the use of a deficit are associated with going to assume that raising taxes in the future, leading them to increase their savings and thus to sterilize the economic policy measure.

The third assumption of the REH and the economist Robert Barro (1974) helped to specify that the consumer horizon is infinite, i.e., the use of a public deficit falls to subsequent generations. Barro (1974) states that as future generations are the children and grandchildren of current generations should not be assumed as independent economic agents. He argues that what must be assumed is that current generations care about the future generations, in other words, a person decides how much to consume based not only on their own income but also of future family members. Consequently, a reduction in taxes financed through debt can raise the income received by a person throughout his life, but does not increase the total resources of the family. Then, instead of using the additional income generated by the reduction of taxes, the individual saves it and leaves it as an inheritance to their children, who will face the unavoidable future tax increase.

This intergenerational altruism demonstrated by the many people who make donations to their children, often in the form of legacies and inheritance, at the time of his/her death. The existence of donations seems to indicate that many people do not like to take the opportunity to consume at the expense of their children. This breaks with the argument that the REH is

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[2] The rational expectations are a theoretical hypothesis that assumes that economic agents, but do not have perfect knowledge, they do have the relevant information that allows them to avoid making systematic errors before economic policy decisions.

not met when there is a generational change in the payment of the debt, i.e., there is a wealth effect added in the current generation because they think the next generation will pay the shortfall. Barro (1974) shows theoretically that the above does not happen, but there is altruism in every generation that makes people to save in an intergeneration way through legacies and inheritances to pay off government debt. In other words, the REH is true even if there is a generational change in the payment of the debt.

Given these theoretical arguments supporting the REH, then some discussions that challenge these key assumptions are presented and can darken the certainty of the hypothesis in reality.

2.2. Theoretical Discussions of the main Assumptions of the REH

The suppositions mentioned in the previous section are discussed in several aspects by economists who doubt the theoretical strength of the REH; first, the strict rationality of the consumer is questioned: individuals can not know with certainty the discretionary act of a government regarding the use of its expenditure, that is, the argument of the REH does not take into account the uncertainty that leads to use public expenditure, or even the case that individuals do not fully understand the implications of a public deficit. In their theoretical analysis regarding the REH, Mankiw (2010) and Bernheim (1987) consider that this call consumer shortsightedness is a reason that the hypothesis can not be accomplished, since it is possible to make consumers to follow simple rules to choose how much they save and consume. If the assumption of strict rationality of the consumer is not met because the consumer is "myopic", is difficult to sustain the REH, as consumers will end by making use of a public deficit to consume more, as mentioned classical and Keynesian theories .

Another aspect to be questioned the REH and denies the absence of wealth effects in the use of public deficit is the assumption of a perfect capital market (for example: Mankiw, 2010; Romer, 2006) i.e., does not take into account any possible restrictions on the liquidity of the agents that might be substituted for the use of public deficit to increase transfers or to reduce taxes. When credit constraints exist to consume, the use of a public deficit would help to use the extra income as a substitute for the lack of access to credit. In other words, people who like to consume more than their current income allows them, will need a loan to increase their consumption beyond

their current budget restrictions, but if the financial system has access to credit limits, or limits on the amount of credit to the consumer, the only way to increase your intake is by way of a public deficit. In other words, when the government lowers current taxes and raises future ones, makes a loan to the taxpayers. For a person who wants to get a loan and can not, reduce taxes and increase your chances stimulates consumption. It is for this reason that the defenders of classical and Keynesian theories assume that an increase in the deficit increases consumption: because for individuals current income is more important than income earned throughout his life, i.e. its permanent income.

This debate about the permanent income in relation to the REH is analyzed by Romer (2006). He contrasts the Ricardian Equivalence from the perspective of the permanent income hypothesis of Friedman.[3] Romer (2006) assumes that the REH comes from the assumption that individuals base their consumption on their permanent income other than their present income, therefore concludes that the Ricardian Equivalence analysis involves the analysis of the Friedman hypothesis. That is, the REH depends on the permanent income hypothesis, and if the latter has errors, may reject in its entirety the Ricardian reasoning.

Romer (2006 385) mentions: "the permanent income model, the only thing that affects a domestic consumption economy is its budget constraint throughout the vital cycle; the temporal evolution of their net income does not matter. Nowadays, a bond issue that is paid by future taxes affects only the evolution of available income but not the budget constraint along the life cycle. So if the permanent income hypothesis is a good description of the behavior of consumption, it is likely that Ricardian Equivalence is also a good approximation. But if there are significant deviations from the permanent income hypothesis is not likely to be fulfilled the Ricardian Equivalence".

Then to Romer, the viability compliance of the Ricardian Equivalence lies in the conception of the permanent income hypothesis, since it assumes that the consumption of individuals depends on their income throughout their life cycle. Romer (2006) argues that a substantial

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[3] Friedman (1957) stated that the conception of the function of the added consumption of Keynes was wrong and concluded that consumption depends only on permanent income, which is the share of income that individuals expect to persist into the future. This argument is known as the permanent income hypothesis.

possibility where the permanent income hypothesis is not met are liquidity constraints, "when the government gives a bonus to a family, and this has to be paid back with higher taxes, means that the government is borrowing some money on behalf of the family. If the domestic economy still has the option to borrow at the same interest rate of government, the policy has no effect on their opportunities and therefore also on their behavior. But suppose that the domestic economy is facing an interest rate higher than the government and that if the domestic economy could borrow at that rate of interest to increase their consumption it would. Under these conditions, the response of home loan taken by the government on its behalf would raise their level of consumption". (Romer, 2006: 581)

When these liquidity constraints exist, consumers will choose to increase consumption at the expense of additional income generated by the tax reduction or increased spending through public deficit. Romer (2006) concludes that liquidity constraints are important causes of significant failures to the permanent income hypothesis, it is likely that the behavior of the economy to deviate significantly from those expected by the Ricardian Equivalence Hypothesis.

The second argument holds the REH is the inability to consider using a public deficit as a long-term instrument, as its temporary use makes consumers have enough foresight to suppose that the deficit at some point have to pay at the cost of higher taxes; therefore, its effect will end back neutral. But if consumers can consider using the deficit as an instrument of long term, this necessarily deny their expectations of future tax payment, which would deny its neutrality and effect on consumption. Feldstein (1976) criticized this assumption: he argues that there can be a permanent tax deferral due to the growth rate of an economy (g) exceeds the interest rate of debt payment (r). Under these circumstances, the government can create debt and yet not have to impose future taxes to pay. Instead, the government simply issues new debt to pay interest, as the ratio of the deficit and the debt becomes stable if the total debt is growing at less than the rate of output growth rate. Therefore, since $r < g$, the relationship between the debt and national income will not increase: the agents who receive debt as a transfer from the government know that they will not need to pay it at higher taxes, even if you consider the intergenerational analysis of Barro (1974), the first generation, i.e., the generation that receives transfer debt as you know that no future generation will pay that debt. Therefore, there is no need to increase savings as preplanned legacy or inheritance. Consequently, the first generation will

increase their own consumption breaking the supposed neutrality of the effect of a fiscal deficit and showing its possible use as a tool for long- term. Otherwise one could not explain the paradox in which agents fall by having expectations of debt payments and never actually pay. Therefore, when the rate of economic growth exceeds the interest rate, the government can reverse the deficit indefinitely. As a result, any consumer, with infinite horizon or not, need to pay the portion of deferred taxes.

The third argument that holds the REH lies in considering future generations are paying to use of the public deficit. Skott and Ryoo (2011) point out that the burden of high public debt and high interest does not necessarily fall on future generations as assumed in the analysis of Barro's REH, but falls in the same generation under a social deferral, i.e., according to the authors, the use of a public deficit is not paid generally in the population or so intergenerations, but is paid intragenerational because the payment of the debt may have a regressive distributional effect which makes the payment falls asymmetrically in society within the same generation.

In conclusion, in theory, the REH has generated controversy among economists, this hypothesis can not be sustained in emphatic due to the rigid restrictive assumptions assumed, therefore, did not satisfy these assumptions because of the theoretical peculiarities raised above, the use of a public deficit is not likely to alter perspectives on consumption of individuals, but to know precisely if reality deviates substantially from this theoretical hypothesis, we need an empirical analysis that evaluates the accuracy of the REH.

3. Empirical analysis of REH for LA

3.1. Review of empirical literature

The empirical analysis provides evidence of the actual behavior of the data and can help to verify the accuracy that has the REH. The main subject of study in this document is to empirically analyze the accuracy of the Equivalence Hypothesis for the case of Latin America, i.e., to assess consumer behavior in LA in relation to public deficit, so in this literature review are only considered those empirical analyzes with an orientation towards estimating structural consumption function and its comparison with REH.

Following that order of ideas, Kochin (1974) conducted one of the first empirical work on the REH. It does so by defining a consumption function

which theoretical formulation of the permanent income hypothesis. Specifically, Kochin introduces the deficit as an explanatory variable in a function dependent consumption of disposable income. Using data from the United States for the period 1952-1971, it is estimated a coefficient deficit variable, obtaining a significant and negative coefficient, but lower compared to income coefficient. Kochin concludes that if individuals have considered government expenditure to consume and to save. This analysis supports, although a very weak version of the REH.

Subsequently Yawitz and Meyer (1976) conducted an analysis that aims to extend the findings of Kochin. This specifies a function of consumption with a theoretical justification from the Life Cycle Hypothesis of Ando-Modigliani.[4] That is, the estimated consumption function that depends on available income portfolio to private sector debt market prices, and private wealth (equity) net before debt. The results obtained for the United States in the period 1953-1967 do not support the existence of a discount or tax payment, and conclude in their analysis that government debt is perceived as net wealth.

Buiter and Tobin (1980) criticized the work of Kochin and proposed its own structural consumption function, containing same independent variables as national income, taxes, the deficit and lagged consumption. By applying the estimate for the United States in the period 1949-1979, it is concluded that the REH is not justified because the public deficit parameter is not significant, but says that further empirical research for forcefulness in the results obtained is necessary.

Indirectly, Feldstein (1982) analyzes the fiscal neutrality that argues the REH. For him, the effectiveness of fiscal policy depends on how consumers link a tax change to their future tax obligations; and how these tax obligations affects their temporal behavior. Specifically, Feldstein estimates a consumption function which relates the individual consumption to available income, wealth and fiscal variables, such as public expenditure, tax revenues, among others (using the variables in real terms). The results of their estimates for

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[4] During the 1950 decade Franco Modigliani and Albert Ando studied the relationship of the individual consumer. They proposed the *Life Cycle Hypothesis*, which assumes that people manage their income to maintain their level of constant consumption throughout their lives. Therefore argued that individuals save to use those resources in periods of hardship. They conclude that individuals save when their income is high, and when they stop saving when they do not work anymore.

the United States in the period 1930-1976, suggest that the REH is not supported because changes in tax rates or government expenditure can have substantial effects on added demand.

Furthermore, Kormendi (1983) estimates a function similar to the consumption model of Kochin and Buiter-Tobin. Structural consumption function that depends on the estimated net national income, the lap of the same income, total government expenditure (government consumption plus investment expenditure), total tax revenue, public debt, transfers and private wealth excluding debt, corporate earnings not assigned, and the payment of the interest of the government. The results of the analysis support the approach of the REH: the estimated parameters show that a tax increase does not affect private consumption while an increase in public expenditure reduces it; it also obtained a coefficient associated with a not significantly positive public debt.[5]

In the case of Europe, Raymond and Gonzalez-Paramo (1987) estimate a structural consumption function that depends on lagged consumption, available income, taxes, transfers, public expenditure, and public deficit (use these variables in per capita terms). This specification is inspired by the consumption function proposed by Buiter-Tobin, and the authors argue that it has the advantage of nesting as special cases the Keynesian consumption function and the REH.

Raymond and Gonzalez-Paramo contrast two theoretical opinions for the specific case of the Ricardian Spanish economy in the period 1955-1986, and concluded that the Equivalence Hypothesis, in its strictest version of fiscal neutrality contradicts data, and also its explanatory ability is lower than that derived from the Keynesian approach; therefore they conclude that Keynesian conception of consumption in Spain is more significant than the REH.

Subsequently, Fuster (1993) takes up part of what was done by Raymond Gonzalez-Paramo, and Buiter-Tobin, and the difference lies in the method

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[5] However, Feldstein and Elmendorf (1987) replicated Kormendi's work using the same econometric specification, but excluding specific years that, because of the authors altered the behavior of consumption and saving in the United States. This is due to the Second World War, in which shortages, rationing and patriotic rhetoric for the consumption caused an abnormally high amount of savings, while increasing government deficits exceptionally for defense spending. By eliminating those years, Feldstein and Elmendorf came to the opposite conclusion to that of Kormendi.

of estimation and slight additions to the structural consumption function that supports the theoretical arguments. Fuster, instead of making individual estimates, makes general contrasts of the REH, against the Keynesian model for five countries in the European Community: Spain, Italy, Germany, France, and the UK in the period 1964 to 1988.

The results Fuster (1993) finds are disparate: none of the countries surveyed got a strict forcefulness of the REH, but indicates the case in the UK, which concludes its approach to the Keynesian conception. However, while not demonstrating compliance of the Equivalence Hypothesis strictly for other countries, says that, in general, consumers consider public financing decisions when making decisions.

As noted, most of the empirical analyzes made come from the structural consumption function proposed by Buiter and Tobin (1980). Following this analysis, and increases made by Raymond-Gonzalez-Paramo (1987), and Fuster (1993), in this document an empirical analysis of the REH for the case of Latin America is proposed based on the structural function and expanded consumer proposal by these authors. The main differences in these models are that the consumer behavior in 11 countries in Latin America is assessed, in contrast to the work of Raymond Gonzalez-Paramo, and Buiter-Tobin. in addition, the proposed estimation method diverges from that used by Fuster .

3.2. Estimation Model of Structural Consumption Function for LA

The general estimation model proposed in this document is the expansion that Fuster makes. That is, it is a simple consumption function to which some price variables are added. "In this function have been considered as explanatory variables the available income of households (dissociated in its three components) and the public deficit (to make it possible to check if consumption is affected by the decisions of fiscal policy)." (Fuster, 1993: 498). In other words, a parametric static panel data model is proposed, which specification is Fuster's expansion, and an analysis is done from a dynamic standpoint of the cointegration of Granger (1987).

For analysis of the estimate various changes are made to the Fuster's extended model to fit it to the case of LA: first, does not include the dynamic aspect of the consumption, i.e. the outdated regressor of consumption as an independent variable, due to the estimation method that arises is the Engle-Granger cointegration (1987), which, by its peculiar methodology ignores

dynamic aspects to observe the temporal behavior of the independent variable in both the short and long term. Second, does not include transfers variable, which is a component of private income, the reason for this is because in the case of LA there is no homogenous information in this section, but it is assumed that this component is already included in the income, therefore, removing this variable does not affect the overall composition of the estimation model. Finally, instead of using the variation in prices, inflation is directly used, this improves the consistency and efficiency of estimators of the regression.

Hence, the general panel model for LA consumption function that serves as a starting point for the contrast of Ricardian (strong and weak versions), and Keynesian specifications is:

$$CP_{i,t} = \alpha_i + \beta_1 Y_{i,t} + \beta_2 IP_{i,t} + \beta_3 DP_{i,t} + \beta_4 \pi_{i,t} + u_t \tag{1}$$

Where CP represents private consumption; Y, the income of domestic economies before tax; IP, public income; DP, government deficit and inflation π.

Inflation variable appears in numerous models, including those of Deaton (1978), Davidson (1978), and Fuster (1993). The interpretation given to the introduction of this variable is that it can pick up possible effects of monetary illusion. That is, the uncertainty caused by inflation can have positive effects on savings and negative effects on consumption. Therefore their exclusion would bias the analysis.

The reason for using a vector of intercepts (α_i) instead of a general intercept (α) in the regression, is due to the persistent heterogeneity that has LA between its countries, therefore, it is desirable to use a fixed effects model (FE) one of pooled effects or one of random effects (Annex 1).

3.3. Individual Contrast Models: Keynesian and Ricardian Equivalence Hypothesis

As mentioned in the previous section, the advantage of the structural consumption function used is that it includes the models of the Keynesian and Ricardian Equivalence Hypotesis. So these conceptions end up being particular cases of equation (1), allowing us to examine the specific case of LA, which has a greater degree of veracity.

For the particular case of the concept of REH, and according to the general model (1), the restriction of weak Ricardian Equivalence Hypothesis implies that the effect on consumption exerts the deficit is the same as the public income. Therefore, the coefficients of the public income variables and deficit must be equal in absolute value and significantly different from zero. So serious restriction $\beta_2 = \beta_3$, and therefore the weak Ricardian Equivalence Hypotesis model is:

$$CP_{i,t} = \alpha_i + \gamma_1 Y_{i,t} + \gamma_2 G_{i,t} + \gamma_3 \pi_{i,t} + u_t \qquad (1a)$$

Where G is the public expenditure (remember that the accounting equation of public expenditure is $G = IP + DP$). To meet this particular model, the coefficient γ_2 should be negative and significant.

Strong equivalence model would be one that satisfies the above constraint, and additionally $\beta_2 + \beta_3 = -\beta_1$. That is, the linear combination of the coefficients of public income and the deficit must be equal to the income coefficient of the domestic economies but of opposite sign. In other words, for the strong model of Ricardian Equivalence Hypothesis can be met, the effect of private income and public expenditure must be equal in magnitude (but opposite sign). Therefore, the strong Ricardian Equivalence model is as follows:

$$CP_{i,t} = \alpha_i + \delta_1(Y_{i,t} - IP_{i,t}) + \delta_2 \pi_{i,t} + u_t \qquad (1b)$$

For Keynesian particular case, the consumption model would be obtained by imposing two restrictions on the general model: first, the coefficient of private income, is equal, in absolute value, to the public income. And second, that the deficit will not be meaningful. That is, $\beta_3 = 0$ and $\beta_1 = -\beta_2$. Hence, the Keynesian consumption model is:

$$CP_{i,t} = \alpha_i + \delta_1(Y_{i,t} - IP_{i,t}) + \delta_2 \pi_{i,t} + u_t \qquad (1c)$$

After specifying the general pattern of entry, and the particular models that come from the general, both Ricardian and Keynesian models only remains to try and get the results according to the contrast of both theoretical concepts.

3.4. Results Obtained from the Estimation

To perform the estimation, the panel specification (1) is evaluated from the point of view of the theory of cointegration of Engle-Granger (1987). Therefore, stationary tests are performed to determine the order of integration of variables and avoid spurious regressions. Cointegration tests are also done to determine whether there are long-term relations in the variables and it is also performed a panel regression of corrected fixed effects with Panel-Corrected Standard Error (PCSE) to estimate in a parametric way the short-term relation of consumption in relation to the explanatory variables. This can or can not determine the convergence between long-term relations with the short-term ones to determine the REH contrast with the function of structural consumption proposal.

The data used were obtained from the statistics of the United Nations Economic Commission for Latin America and the Caribbean (ECLAC), covering the period 1990 to 2012 per year for 11 Latin American countries: Argentina, Chile, Colombia, Costa Rica, Ecuador, Honduras, Mexico, Panama, Paraguay, Peru, and Uruguay. The income variables, consumption and fiscal accounts have been deflated to 2005 prices (dollars) and, as discussed above, in the case of the inflation it was taken the annualized inflation for having greater consistency and efficiency in the estimation.

Following the proposed estimation method, and using the general panel model (1) to contrast both Keynesian and Ricardian conceptions, to test the order of integration of these variables with unit root tests for panel the following results were observed:

Table 1
Tests of Stationary (unit root) for Panel*

Tests **	ΔCP	ΔY	ΔIP	ΔDP	Δπ
Levin, Lin, & Chut ***	-5.73037 (0.0000)	-5.87486 (0.0000)	-4.99367 (0.0000)	-5.80244 (0.0000)	-2.05144 (0.0201)
Breitung t-stat ***	-4.80762 (0.0000)	-3.05520 (0.0011)	-4.62605 (0.0000)	-2.97999 (0.0014)	-3.56198 (0.0002)
Im, Pesaran and Shin W-stat ****	-3.95336 (0.0000)	-3.43935 (0.0003)	-4.98576 (0.0000)	-6.57257 (0.0000)	-2.90042 (0.0019)
ADF-Fisher Chi-square ****	53.3435 (0.0002)	46.6286 (0.0016)	64.0714 (0.0000)	82.1776 (0.0000)	46.3326 (0.0018)
PP-Fisher ****	82.7300 (0.0000)	78.6963 (0.0000)	123.064 (0.0000)	211.934 (0.0000)	114.059 (0.0000)
Hadri Z-stat	0.54280 (0.0000)	5.80759 (0.0000)	16.7358 (0.0000)	6.33791 (0.0000)	4.72633 (0.0000)
Order of Integration	I (1)	I (1)	I (1)	I (1)	I (1)

* Series in first differences.
** The values in parentheses represent the P values.
*** Common unit root tests.
**** Individual unit root tests.
Source: own calculations.

The results show, in general, that the variables have no unit root and become stationary to differentiate once (i.e. are of order one), hence, this suggests that models can cointegrate and therefore have functional relations in the long term. To strictly determine there are long term relations in panel data is also used the Pedroni's cointegration test (1999) to determine whether the panel cointegrates and if there is a long-term relation, or linear combination of its variables is not zero order to differentiate once, this test is conducted for the three specifications, the general model and the particular models; the results are shown below:

As can be seen, the results suggest, for most significant statistics, the general pattern cointegrates, and therefore there is a long-term relation between the variables and, moreover, its parametric analysis or short term will not be spurious; in the case of the Keynesian model is also established that cointegrates, and therefore there is a long-term relationship; for the Ricardian particular models was found that do not cointegrate and weak does cointegrate, therefore may be a long-term relation, but because the

Table 2
Predoni's Cointegration Test for Panel*

Model	General	Ricardian equivalence *Weak*	Ricardian equivalence *Strong*	Keynesian
Panel v-Statistic [**]	-1.50476 (0.9338)	-0.063649 (0.5254)	0.88896 (0.1870)	0.546723 (0.2923)
Panel rho-Statistic [**]	0.770932 (0.7796)	-0.405904 (0.3424)	-0.274301 (0.3919)	-0.94626 (0.172)
Panel PP-Statistic [**]	-3.789268 (0.0001)	-3.687871 (0.0001)	-1.123204 (0.1307)	-2.462765 (0.0069)
Panel ADF-Statistic [**]	-4.696459 (0.0000)	-4.778069 (0.0000)	-1.603598 (0.0544)	-3.522837 (0.0002)
Group rho-Statistic	2.081039 (0.9813)	1.033724 (0.8494)	1.039883 (0.8508)	0.5139 (0.6963)
Group PP-Statistic	-3.254618 (0.0006)	-3.550216 (0.0002)	-0.565822 (0.2858)	-2.021017 (0.0216)
Group ADF-Statistic	-3.591752 (0.0002)	-4.749794 (0.0000)	-1.465326 (0.0714)	-3.544632 (0.0002)

[*] Values in parentheses represent the P values.
[**]Statistical weighted.
Source: own calculations.

strict conception of theoretical argument of REH does not cointegrate, may be grounds for not fully accept such a view.

Following the analysis of long-term in the sense of Engle-Granger, we proceed to perform a parametric estimation of the short-term by Panel-Corrected Standard Error (PCSE) because in panel regression with FE were found some contemporary correlation problems, autocorrelation and heteroscedaticity (annex 2); so with this method the three problems are solved, as demonstrated from the perspe ctive of Granger, to prove that the variables are of order one and cointegrate in the case of the general model, there can be spurious the panel regression, all the above we can say that the coefficients of the parameters will be relatively consistent and efficient.

Therefore, the short term relation that is obtained from the corrected panel static regression by PCSE gives the following results:

Table 3

General model of short-term: panel regression by PCSE

Dependent variable: CP   Number of observations: 253
Group Variable: Country   Number of groups: 11
Time variable: Year   Obs per group: min = 23, avg = 23, max = 23
Method: Corrected Standard   Panel: balanced
Errors for the Panel (PCSE)   Autocorrelation: no autocorrelation

| **Panel-corrected by PCSE** | | | | | |
Variable	**Constant**	**Y**	**IP**	**DP**	**π**
Coefficient	2310.565	.6905016	-.161603	-.0926126	-29.81441
Std. Err.	450.9229	126.374	126.374	.1780235	5.756079
z	5.12	32.25	-1.28	-0.52	-5.18
P> | z |	0.000	0.000	0.201	0.603	0.000
[95% Conf. Interval]	1426.772	.6485325	-.4092915	-.4415322	-41.09612
	3194.357	.7324706	.0860854	.2563069	-18.5327

Covariance estimated: 66	R-squared: 0.9992
Estimated Autocorrelations: 0	Wald chi-square (4): 62089.73
Estimated coefficients: 5	Prob> chi-squared = 0.0000

Source: own calculations.

These results show that income and inflation are significant, which theoretically indicates that consumption depends positively on income and negatively on inflation. It is noted that fiscal variables are not significant, which can warn the non-compliance of the REH in the short term and the main reason for non-convergence in the long- term. The corrected coefficients estimates have certain peculiarities: first, the estimated coefficient of public income is negative, and the public deficit is not significant, with restrictions on this general model compared to Keynesian model are met. Second, the coefficients of both IP and DP are far from being adversely like coefficient Y therefore, the strong restrictions of the Ricardian Equivalence Hypothesis are not met. Finally, although estimates differ both fiscal variables coefficients, the gap between the two is not very large, this may lead to ambiguity in the imposed restrictions on the general model for the *weak* specification of the REH, which can be met and the main reason for their convergence in the long term, but this result may be overshadowed because fiscal parameters were not significant.

In conclusion, it is established that the REH in the LA case is not met in the short -term; and in the long- term it does not have a specific line to affirm or reject this concept, at least in its *weak* version, as the *stronger* version is rejected in both temporal conceptions. In the case of Keynesian contrast, it appears that is true in both temporal specifications, i.e., there is a functional long-term relation, and the parametric estimation of short-term restrictions made to the general model are accepted, concluding that Keynesian specification is accepted. Therefore, it is concluded that consumers in Latin America do not consider the form of public financing at the time of consumption.

4. Conclusions

After an analysis from the theoretical and empirical perspectives was concluded that REH has certain characteristics that may prevent its effective performance in any economy. Authors have discussed the main assumptions that sustain it, concluding that some cases in the REH can not be met; Additional empirical research has been done to support or reject the hypothesis. Based on the theoretical analysis for REH, it is concluded that there are arguments to dismiss the cases that hold and may refuse performance of the hypothesis from the theoretical side.

According to the empirical analysis done for Latin America concludes that consumers tend not to worry about the government funding to consume either the short or the long-term. The Latin American consumers tend to believe that a rising deficit represents a wealth effect because they increase their transfers and therefore increases aggregate consumption, as it is mentioned in the Keynesian theory. Regarding the concept of REH, it is concluded that there are no arguments needed to reject or accept a long-term relationship to this hypothesis, at least in its weakest conception. The strict conception of REH concludes that any temporal specification is met, making the flexible long-term outcome remains overshadowed.

These results are important because they provide evidence of the actual behavior of the data on the relation that has a public deficit with the private consumption in Latin America; therefore, based on these results, policy makers can ease the use of deficit hoping that, being higher transfers or lower taxes, increase the income of households, increasing consumption, one of the main components of aggregate demand, this will increase production and enhance the economic development of the countries of the region.

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Annexes 1

1. Proof of the Lagrange Multipliers for Random Effects

This test determines whether it is appropriate to use a homogeneous intercept data panel (pooled, pooled data) or a vector of intercepts (random effects). The Ho is $\sigma_u^2 = 0$. If the test is rejected, if there is a difference between using a general intercept (α) and a vector of intercepts (α_i).

$$CP\ [ID, t]\ =\ Xb\ +\ u[ID]\ +\ e[ID, t]$$

Estimated results:

	Var	sd = sqrt(Var)
CP	2.12 e+10	145559.1
e	1.55 e+07	3934.759
u	1451892	1204.945

Test: Var (u)   = 0
chibar2 (01)   = 29.81
Prob > chibar2 = 0.0000

As Prob. = 0.0000 < 0.10, the Ho is rejected; therefore, the heterogeneity of the data panel makes relevant the intercept vectors and it is preferable to use them instead of grouped data with one overall intercept.

2. Hausman Test to Choose Fixed *vs* Random Effects

This test will determine which model is best suited for data panel being analyzed, whether fixed effects or random effects. Uses to do this a Chi2 test with the hypotheses:

Ho: differences in the coefficients of the fixed effect models *vs* random effect models are not systematic; therefore the random effects model is best explains the relation of the dependent variable to the explanatory.

Ha: differences in the coefficients of the fixed effect models *vs* random effect models are systematic, hence the fixed effects model is more appropriate.

Coefficients			
Variable	(b) Fixed effects	(B) Random effects	(b-B) Difference	Sqrt (diag (V_b-V_B)) S.E.
Y	0.6460192	.6687681	-.0227489	.0147232
IP	0.1094672	-.0182193	.1276865	.0492457
DP	-0.0727036	-.0667915	-.0059121	.0569555
π	-32.2298	-31.51685	-.7129576	2.098775

b = consistent low Ho y Ha; B = inconsistent low Ha, efficient low Ho.

$$chi2(4) = (b-B)'[(Vb-V\_B)^{\wedge}(-1)](b-B)$$

$$= 17.31$$

$Prob > chi\ 2 = 0.0017$

As Prob = 0.0017 < 0.10, the Ho is rejected; i.e., the difference between the coefficients of random and fixed effects if systematic. Therefore it is appropriate to use the fixed effects.

Annexes 2

1. Diagnostic Tests for the Fixed Effects Model

a) *Serial Autocorrelation Test*

Wooldridge test for autocorrelation in the data panel:

Ho: There is no first-order autocorrelation in the fixed effects model.

Ha: There is first order autocorrelation in the fixed effects model.

Statistic F (1, 10) = 151.229

$Prob > F = 0.0000$

Since the probability is 0.0000 < 0.10 Ho rejected the non-existence of autocorrelation and Ha accepted existence of serial correlation in fixed effects model.

Test of independence Breusch-Pagan LM:
Correlation Matrix of Residuals

	e1	e2	e3	e4	e5	e6	e7	e8	e9	e10	e11
e1	1.0000										
e2	0.6698	1.0000									
e3	0.7760	0.3368	1.0000								
e4	-0.8039	-0.3123	-0.9130	1.0000							
e5	0.0094	0.2240	-0.2457	0.1715	1.0000						
e6	-0.7901	-0.3010	-0.9665	0.9555	0.3092	1.0000					
e7	-0.5372	-0.4250	-0.3466	0.2678	0.0154	0.3694	1.0000				
e8	0.0092	-0.0354	-0.3406	0.1194	0.4484	0.2641	-0.0872	1.0000			
e9	-0.7376	-0.2811	0.9665	0.9127	0.4211	0.9706	0.3439	0.3560	1.0000		
e10	0.7906	0.6170	0.7036	-0.7457	0.2699	-0.7067	-0.3569	-0.1169	-0.5950	1.0000	
e11	-0.7134	0.7134	-0.2167	-0.9302	0.2729	0.9462	0.1645	0.2668	0.9345	-0.7103	1.0000

b) Contemporary Autocorrelation Test

Breusch-Pagan LM test of independence: chi2(55) = 423 420, Pr = 0.0000
Ho: There is no contemporary autocorrelation in the fixed effects model.
Ha: There is contemporary autocorrelation in the fixed effects model.
Since the probability (Pr) is = 0.0000 <0.10 Ho is rejected, therefore it is concluded that there is contemporaneous correlation in the fixed effects model.

c) Testing heteroscedasticity

Modified Wald test for heteroscedasticity for the fixed effects model:
  Ho: There is no heteroscedasticity: sigma $(i)^2$ = sigma^2 for all i.
  Ha: There is heteroscedasticity.
Statistic chi2 (11)= 13817.02
    Prob > chi2 = 0.0000

The probability is = 0.0000 <0.10, therefore reject the constant variance **Ho** and accept **Ha** existence of heteroscedasticity.