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Abstract

In this paper, we consider Brazil, Colombia, Peru and Venezuela for a study on aggregate consumption behavior, in which we test the life cycle-permanent income hypothesis prediction that consumption growth depends only on interest. Our results suggest that only Venezuelan data supported this prediction. To identify possible reasons for rejection in the other cases, we checked for liquidity constraints, myopia and perverse asymmetry. We found that for Brazil the perverse asymmetry was rejected, whereas for Colombia the liquidity constraint hypothesis was rejected. The results were uninformative about Peruvian consumption.

Keywords: South America, consumption, permanent income, liquidity constraints, myopia.

JEL codes: C22, E21

1. Introduction

The life cycle-permanent income hypothesis (LCH-PIH) implies that predicted changes in income should not affect consumption. Indeed the solution of the intertemporal consumer problem implies that consumption growth should respond only to interest rate, since its fluctuations affect how consumers smooth their consumption. However, the findings of Campbell and Mankiw (1989, 1990; hereafter CM) for aggregate data and Shea (1995a) for household data suggest that consumption is affected by predictable movements in income, but the reasons behind the failure of LCH-PIH are not well known. Two hypotheses have received most attentions: myopia and liquidity constraints.

Consumers display myopic behavior when their consumption is a direct function of their current income, which would be an explanation for the relationship between consumption and predict income. The myopic consumers are also known in the literature as Keynesian consumers. On the other side, such rule of thumb casts doubts on consumers' ability to maximize their well-being, which is a usual assumption. The liquidity constraint hypothesis states that although consumers are not able to borrow, they can certainly save. This generates an asymmetric relationship between consumption and income. When income falls, the consumption reduction can be smoothed using savings. Thus, while myopia causes a symmetric relation between consumption and income, liquidity constraints implies that consumption should be more strongly related to expected income increases than to expected income decreases. Finally, since they have distinct implications over consumption, Shea (1995b) proposed a test using aggregate data to distinguish between them.

The purpose of this paper is to test the ability of the LCH-PIH to explain consumption behavior in four South American countries: Brazil, Colombia, Peru and Venezuela. Following Shea (1995b), we also consider the case of myopic and credit constrained consumers in our estimations. To the best of our knowledge, this is the first paper using data from the Penn World Tables (Heston et al., 2002) to investigate these questions for these four South American countries.

Few studies focused on consumption in South American countries in part due to lack of data. Indeed, to the best of our knowledge only Gomes and Paz (2004) analyzed this region. For South American countries, Gomes and Paz (2004) used CM's approach and Penn World Table

6.1 (Heston et al., 2002) annual data from 1951 to 2000. They found that LCH-PIH does not hold for Brazil, Peru and Colombia and a significant share of consumers of these countries were of Keynesian type. Focusing only in Brazil, there is a large literature that employed CM's framework and their findings strongly support that consumption growth depends on predicted income growth (Cavalcanti, 1993; Reis et al, 1998; Issler and Rocha, 2000; Gomes and Paz, 2004; Gomes, 2004; Gomes et al, 2005).

The approaches used in all these previous papers cannot distinguish credit constraint from myopia. Hence it is not possible to know the reason behind the failure of the LCH-PIH. For Brazil, we found two exceptions. Paz (2006) was the first to tackle this question using quarterly data from 1991:1 to 2004:4 and Shea (1995b) procedure. For consumption data he used the real household final consumption per capita from Ipeadata, and his real interest data was constructed from the Selic nominal interest rate (i_t), which is the average rate of the central government bonds and the benchmark for private sector lending rates, and from the inflation index (π_t), IGP-DI, according to the formula: $1+r_t = (1+i_t)/(1+\pi_t)$. His findings indicate that neither liquidity constraints nor myopic consumers could generate the finding that consumption is sensitive only to expected income declines, i.e. Brazilian households exhibited the Shea's (1995a) "perverse asymmetry".

Gomes (2007) analyzed annual data from 1947 to 2005 for Brazil. His consumption and income data were, respectively, household final consumption and gross disposable income; the per capita series were obtained using the mid-period population. These data were extracted from Ipeadata. Real interest data were constructed from the CDB (certificate of deposit) and "poupança" (savings account), using the IGP-DI inflation index to obtain real series. The results found by Gomes (2007) could not reject the presence of myopia and liquidity constraints in Brazil.

Finally, based on CM's and Shea (1995b) methodology, the empirical findings of our paper indicate that only in Venezuela the LCH-PIH seemed to be valid. In the remaining three countries, we found that the LCH-PIH was rejected. For Brazil, contrary to Paz (2006) findings and in line with Gomes (2007), there was support for liquidity constraints and myopia, whereas for Colombia the estimated parameters suggested myopic consumers and the existence of Shea's "perverse asymmetry". Last but not least, for Peru the results were uninformative about the causes behind the rejection of the LCH-PIH.

The paper is organized as follows. In section 2 the estimated models are presented and the data set is described. Section 3 reports and discusses the regressions' outputs. Last section summarizes the conclusions.

2. Model specification and data

Following Hall (1978), the rational and forward-looking consumer maximizes her utility by solving the following problem:

$$\underset{\{c_{t+i}\}_{i=0}^{\infty}}{Max}\ E_t\left\{\sum_{i=0}^{\infty}\left[\beta^i\, u(C_{t+i})\right]\right\},$$

$$s.a.\quad A_{t+1+i} = (A_{t+i} + Y_{t+i} - C_{t+i})(1 + r_{t+i}),$$

where A_t, Y_t, C_t e r_t are, respectively, wealth, income, consumption and real interest rate in period t, while β is the discount factor. Thus, subject to the budget constraint, the consumers optimize their entire stream of consumption. The solution $\{C_t^*\}_{t=0}^{\infty}$ is described by an equation called Euler Equation**,** which is depicted in equation (1) below.

$$\begin{aligned} &u'(C_t) = \beta E_t\left[u'(C_{t+1})(1 + r_t)\right] \\ &\beta E_t\left[\left(\frac{C_{t+1}}{C_t}\right)^{-\sigma}(1 + r_t)\right] = 1 \end{aligned} \qquad (1)$$

where the second line comes from the CRRA utility function and σ is the coefficient of relative risk aversion. Following Mankiw (1981), using a first-order Taylor expansion equation (1) becomes equation (2).

$$\Delta c_t = \alpha_1 + \frac{1}{\sigma}\hat{r}_t + \varepsilon_t \qquad (2)$$

where $c_t = \ln(C_t)$, Δc_t is consumption growth between t-1 and t, $\hat{r}_t$ is the expected real interest rate between $t-1$ and t, ε_t is the error term. Thus, the LCH-PIH points out that consumption growth should respond only to the expected real interest rate and Δc_t should not be affected by expected changes in her future income.

According to CM, there are two types of consumers. The first consume according to equation (2), i. e. her consumption is done according to the LCH-PIH, and the second follow a simple rule of thumb: consume her current income, Y_t. In order to evaluate this conjecture, CM estimated the following specification given by equation (3):

$$\begin{aligned}\Delta c_t &= \lambda \Delta \hat{y}_t + (1-\lambda)\left[\alpha_1 + \frac{1}{\sigma}\hat{r}_t + \varepsilon_t\right] \\ \Delta c_t &= \alpha_2 + \lambda \Delta \hat{y}_t + \phi \hat{r}_t + \xi_t\end{aligned} \tag{3}$$

where $\alpha_2 = (1-\lambda)\alpha_1$, $\phi = (1-\lambda)/\sigma$ and $\xi_t = (1-\lambda)\varepsilon_t$. Once $y_t = \ln(Y_t)$, $\Delta\hat{y}_t$ is expected income growth between $t-1$ and t. Following CM, $\Delta\hat{y}_t$ and $\hat{r}_t$ were set as linear projections of ex-post income change and ex-post real interest rate on variables in the *t*-1 information set.

By controlling for the returns to savings, the LCH-PIH result that predictable income changes should not affect consumption is observed if the estimated λ is zero. If estimated λ is different from zero, we will consider the alternative hypotheses discussed previously.

Myopic (or Keynesian-type) agents' consumption follows the current income (i.e. they consume a fixed share of current income) therefore consumption should increase and decrease in response to increases and decreases in the expected income, respectively. Another explanation for myopic behavior could be, as suggested by Madsen and McAleer (2000), that income uncertainty would induce a more cautious behavior, i.e. a decline (increase) in income would increase (decrease) precautionary savings and therefore decrease (increase) consumption. This mechanism would create a positive correlation between consumption and current income.

Liquidity constraints prevent agents from borrowing but not from saving, thus consumption should be more correlated with expected income increases, since agents can't borrow against future income in order to increase her consumption in bad times. Sarno and Taylor (1998) went one step further and making use of the financial deregulation process that happened in the United Kingdom, they were able to check if liquidity constraints effects could be clearly isolated for UK consumption. And in fact, it was found that liquidity constraint was an important factor behind the failure of LCH.

Building on these conjectures that were initially introduced by Altonji and Siow (1987), Shea (1995b) proposed the model specification depicted by equation (4), which could be used to distinguish between liquidity constraints and myopia.

$$\Delta c_t = \alpha + \gamma(Pos_t)(\Delta\hat{y}_t) + \theta(Neg_t)(\Delta\hat{y}_t) + \phi\hat{r}_t + \varepsilon_t \tag{4}$$

where Pos_t is a dummy variable equal to one for periods in which $\Delta\hat{y}_t > 0$ and $Neg_t = 1 - Pos_t$, being equal to one when $\Delta\hat{y}_t < 0$. The LCH-PIH implies that $\gamma = \theta = 0$. Under myopia, γ and θ should be equal and significantly larger than zero. But liquidity constraints imply that γ is positive, statistically significant, and greater than θ. Indeed, when the opposite occurs $(\gamma < \theta)$, consumption is much more sensitive to declines in expected income than increases, being what Shea (1995a) called "perverse asymmetry", whose possible explanation could be that agents' preferences are of the loss aversion type. This type of preferences has the property of attaching more importance to decrease than to increase in utility by the same amount. See Kahneman and Tversky (1984) for more on loss aversion preferences.

In our dataset, the natural logarithm of per capita real income (y_t) and natural logarithm of per capita real consumption (c_t) variables comes from the Penn World Tables version 6.1 (Heston et al., 2002). The scarcity of data about nominal interest rate (i_t) limited the countries encompassed by our sample. For Brazil we used the money market rate, and for Colombia, Peru and Venezuela the discount rate was used, both from IFS (2003), as well as the consumer price inflation (π_t) used to calculate the real interest rate (r_t), according to the formula: $1 + r_t = (1 + i_t)/(1 + \pi_t)$. Our sample period is 1950-2000, making a total of 51 observations, but the regressions used only 44 due to lagged instruments.

The instrument lists used are depicted below:

List 1: $\Delta y_{t-2},\ldots,\Delta y_{t-6}, r_{t-2},\ldots,r_{t-6}$

List 2: $\Delta c_{t-2},\ldots,\Delta c_{t-6}, r_{t-2},\ldots,r_{t-6}$

List 3: $\Delta c_{t-2},\ldots,\Delta c_{t-6}, r_{t-2},\ldots,r_{t-6}\Delta y_{t-2},\ldots,\Delta y_{t-6}, cy_{t-2}$

List 4: $i_{t-2},\ldots,i_{t-6}, r_{t-2},\ldots,r_{t-6}$

List 5: $i_{t-2},\ldots,i_{t-6}, \Delta c_{t-2},\ldots,\Delta c_{t-6}, r_{t-2},\ldots,r_{t-6}\Delta y_{t-2},\ldots,\Delta y_{t-6}, cy_{t-2}$

where Δy_{t-2}, r_{t-2}, and i_{t-2} are defined as before, and cy_{t-2} is the consumption share of the income in *t*-2. Similar results were obtained using other instruments and are available upon request.

3. Results

The instrumental variable regressions output from equations (3) and (4) are reported in tables 1 to 4 for each country. Column (1) shows the Shea's partial R-squared for $\Delta\hat{y}_t$ for each instrument list, when the estimated model is equation (3). This measure, presented in Shea (1997), is used to indicate if instruments have low predictive power, which could generate imprecise or even spurious estimates of λ, γ and θ, as explained in Nelson and Startz (1990). In general, the larger the partial R-squared the better is the set of instruments. The results for interest rate are not reported to save space.

The estimates from equation (3) and (4) are reported in Tables 1 to 4 for Brazil, Colombia, Peru and Venezuela, respectively. The estimates of λ are shown in column (2), and they were positive and statistically significant, at 5% level, for all instruments lists for Brazil, Colombia and Peru. These results imply a rejection of the LCH-PIH.

For Brazil $\lambda \in [0.513, 0.973]$, however, for instruments lists 3 and 5 the Sargan overidentification test was rejected, at 5%. Excluding these cases, $\lambda \in [0.580, 0.973]$. For Colombia $\lambda \in [0.76, 1.133]$, and surprisingly a value greater than one is obtained, a possibility not contemplated in CM's framework. This can be an indicative that equation (3) suffers a specification problem. In addition, the Shea's partial R-squared for Colombia instrument lists are stable and always greater than 0.55. For Colombia, overidentification test was not rejected in any instrument list. Last, for Peru $\lambda \in [0.559, 0.678]$, which is the narrowest range. Considering the specification with the larger Shea's partial R-squared, we've got a λ of about 0.65. Once again, the overidentification test was not rejected. The rejection of the LCH-PIH for Brazil, Colombia and Peru is in line with Gomez and Paz (2004), which used CM's framework and a similar dataset. Venezuela presented a distinct picture. The LCH-PIH could not be rejected for Venezuela in four of five cases. It is worth mentioning that the overidentification test was not rejected in all cases. Also, this result could not be attributed to weak instruments since the partial R-squared were higher for instrument lists that did not reject the LCH-PIH.

For Brazil, Cavalcanti (1993) found an estimated λ of about 0.32, Reis et al (1998) estimated λ was 0.8, while Issler and Rocha (2000), Gomes and Paz (2004) e Gomes (2004) obtained an average λ equal to 0.74, 0.61 and 0.85, respectively. Thus, excluding Cavalcanti

(1993), the values of λ in the literature are inside the range estimated by us. For Colombia and Peru, Gomes and Paz (2004) estimated λ equal to 0.62 and 0.48, respectively. Both estimates are smaller than the ones from our findings. Despite these point estimations differences, the evidence against the LCH-PIH is clear.

Once the LCH-PIH was rejected for some countries it is imperative to estimate the equation (4) in an attempt to clarify the sources of this rejection. Tables 1 to 4 report the results for Brazil, Colombia, Peru and Venezuela, respectively. Columns (3) and (4) report estimates for γ and θ, from equation (4), where $\Delta\hat{y}$ is broken down into expected increases and decreases. The F-statistic for testing $\gamma = \theta$ is reported in column (5) while column (6) shows the number of years in which $\Delta\hat{y} < 0$. The coefficient of the interest rate is not reported to save space.

Brazil presented a picture of liquidity constraint, being γ positive and statistically significant at 10% level in all regressions, but only in two specifications at 5% level. In addition, θ was not statistically significant even at 10% level in all regressions. Even, when instrument lists 3 and 5 are discarded the analysis remains the same. The difficulty to estimate θ precisely may be due to low number of periods with negative predicted income. Indeed, the percentage of years in which $\Delta\hat{y} < 0$ ranges from 6.8% to 13.6%. The F-statistic for $\gamma = \theta$ did not reject this hypothesis for all instrument lists, at 5% level. An expected result given the larger standard error of θ. Thus, γ positive and statistically significant together with θ insignificant is an evidence in favor of liquidity constraints; while the F test pointed out in favor of myopia. These results are in line with Gomes (2007), which used an annual sample that encompassed the years of our sample. However, these results are different from the ones obtained by Paz (2006). A possible reason for that is that his sample started in 1991, while our paper started in the 1950s. An during this time the Brazilian economy underwent significant structural changes, in particular in the banking sector that could have changed credit availability to consumers. Nevertheless, the reason behind these contradictory results is still an open question.

For Colombia, γ and θ are positive and statistically significant at 5% in two cases (instrument lists 4 and 5). However, the point estimation of γ is lower than θ. These results indicate that consumption is much more sensitive to declines than increases, thus providing evidence in favor of Shea's "perverse asymmetry". For instrument lists 1 and 3 only θ is significant, which reinforce the evidence in favor of perverse asymmetry. But for these four lists of instruments, the null hypothesis $\gamma = \theta$ were not rejected at 5% level of confidence. Last, for the second instrument list, γ and θ were not significant, and then we couldn't reject the validity of the LCH-PIH.

Consumption in Peru presented a rejection of the LCH-PIH once γ and θ were positive and statistically significant at 5% level for all instrument lists. According to liquidity constraints hypothesis we should expected a point estimated for γ larger than θ. However, this happened only with instrument lists 2 and 5. Considering the instrument lists 4 and 5, which have the larger Shea's partial R-squared, in one case $\gamma > \theta$ and in other $\gamma < \theta$. Thus, there is evidence in favor of liquidity constraints hypothesis and evidences in favor of perverse asymmetry. Moreover, the null hypothesis $\gamma = \theta$ was not rejected for all instrument lists, at 5% level, which constitutes evidence in favor of myopic behavior. Thus, the results for Peru are inconclusive.

Last, for Venezuela there is only one estimation significantly different from zero, at 5% level: γ with instrument list 4. At 10% level, θ is different from zero with instrument list 1. But, the equality F test was not rejected at 5% level, in all cases. Thus, in general, the evidence is in favor of the LCH-PIH.

Therefore, in several cases either γ or θ were not statistically significant. Thus, at least one of them had a large confidence interval, which reduces the power of the F-test for $\gamma = \theta$. Indeed, the null hypothesis $\gamma = \theta$ was not rejected in all equation (4) regressions with any instrument list. This result generates an extra difficulty to discriminate among myopia, liquidity constraint and perverse asymmetry. For Brazil, at a first glance, there is evidence of liquidity constraint because only γ is statistically greater than zero, however the null hypothesis $\gamma = \theta$ was not rejected. At a first sight, for Colombia we found γ lower than θ, implying perverse asymmetry, but once again $\gamma = \theta$ was not rejected. The absence of rejection of this equality may be due to limited information about predictable income decreases. For Brazil and Colombia, we have at most 6 years with this information. Peru presented the strongest rejection of the LCH-PIH, once γ and θ were always significant. It is worth noting that Peru has, approximately, 37% of the years with predicted income decreases. But, even in this case the results were inconclusive. Finally, Venezuela, which has a significant number of years in which $\Delta\hat{y} < 0$, approximately 70% of the sample, did not rejected the LCH-PIH.

Conclusions

We investigated if the LCH-PIH is able to explain the consumption growth for South American countries. Only Venezuela did not reject this theory. To investigate why the LCH-PIH was rejected, we employ Shea (1995b) model which encompass other three hypothesis: myopia, liquidity constraints and perverse asymmetry.

Our findings supported that: 1) for Brazil the perverse asymmetry was rejected, but we are not able to discriminate between myopia and liquid constraints; 2) for Colombia the liquidity constraint hypothesis was rejected, but it as not possible to distinguish between myopia and perverse asymmetry; 3) for Peru the results were completely uninformative, since we are not able to rejected any of the three hypothesis. Some of our results were in line with the literature that used a similar data and period. Interestingly, our results differed from Paz (2006) results for Brazil, and one reason could be the different coverage of his sample. The reason behind such difference in results are still an open question.

Last, but not least, it is worth mention that CM and Shea (1995b) framework is based on strong auxiliary assumptions. To be precise, the behavior under the LCH-PIH is obtained using an approximation of the Euler Equation. In this sense data for Brazil, Colombia and Peru rejected such approximation of the LCH-PIH.

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Table 1 –Instrumental variables regressions for Brazil

Instrument List	Shea's Partial R^2	λ	γ	θ	F-test $H_0 : \gamma = \theta$	Years $\Delta\hat{y} < 0$
	(1)	(2)	(3)	(4)	(5)	(6)
1	0.076	0.973	2.128	-0.921	2.22	3
		(0.381)	(0.719)	(1.558)		
		[2.55]*	[2.96]*	[-0.59]		
2	0.0561	0.5803	1.0392	-0.308	1.07	4
		(0.258)	(0.516)	(0.948)		
		[2.25]*	[2.01]**	[-0.33]		
3	0.696	0.513	0.739	0.238	0.59	3
		(0.223)	(0.402)	(0.406)		
		[2.3]*	[1.83]**	[0.58]		
4	0.227	0.827	0.82	0.835	0.00	4
		(0.233)	(0.463)	(0.694)		
		[3.54]*	[1.77]**	[1.20]		
5	0.699	0.57	0.653	0.446	0.15	6
		(0.185)	(0.303)	(0.353)		
		[3.07]*	[2.15]*	[1.26]		

Note: Robust standard errors in parenthesis, t-statistics in square brackets, * (**) means statistical significance at 5% (10%) level, λ is from equation (3), θ and γ from equation (4).

Table 2 –Instrumental variables regressions for Colombia

Instrument List	Shea's Partial R^2	λ	γ	θ	F-test $H_0 : \gamma = \theta$	Years $\Delta\hat{y} < 0$
	(1)	(2)	(3)	(4)	(5)	(6)
1	0.604	0.764	0.412	1.455	0.83	5
		(0.112)	(0.446)	(0.720)		
		[6.81]*	[0.92]	[2.02]*		
2	0.572	0.8229	0.7395	0.9818	0.05	5
		(0.130)	(0.480)	(0.658)		
		[6.28]*	[1.54]	[1.49]		
3	0.550	0.898	0.623	1.355	0.68	6
		(0.096)	(0.378)	(0.544)		
		[9.29]*	[1.65]	[2.49]*		
4	0.569	1.133	0.71	1.612	0.91	1
		(0.294)	(0.349)	(0.767)		
		[3.85]*	[2.03]*	[2.1]*		
5	0.578	0.851	0.671	1.182	1.07	5
		(0.090)	(0.231)	(0.29)		
		[9.41]*	[2.9]*	[4.07]*		

Note: Robust standard errors in parenthesis, t-statistics in square brackets, * (**) means statistical significance at 5% (10%) level, λ is from equation (3), θ and γ from equation (4).

Table 3 –Instrumental variables regressions for Peru

Instrument List	Shea's Partial R^2	λ	γ	θ	F-test $H_0 : \gamma = \theta$	Years $\Delta\hat{y} < 0$
	(1)	(2)	(3)	(4)	(5)	(6)
1	0.391	0.65	0.642	0.653	0.00	17
		(0.081)	(0.201)	(0.117)		
		[8.01]*	[3.19]*	[5.58]*		
2	0.2564	0.559	0.739	0.518	0.53	15
		(0.192)	(0.247)	(0.226)		
		[2.91]*	[2.99]*	[2.29]*		
3	0.277	0.678	0.641	0.697	0.04	19
		(0.088)	(0.174)	(0.150)		
		[7.69]*	[3.67]*	[4.64]*		
4	0.703	0.644	0.489	0.770	1.08	17
		(0.083)	(0.118)	(0.185)		
		[7.75]*	[4.14]*	[4.16]*		
5	0.739	0.666	0.681	0.656	0.02	14
		(0.069)	(0.124)	(0.117)		
		[9.53]*	[5.45]*	[5.6]*		

Note: Robust standard errors in parenthesis, t-statistics in square brackets, * (**) means statistical significance at 5% (10%) level, λ is from equation (3), θ and γ from equation (4).

Table 4 –Instrumental variables regressions for Venezuela

Instrument List	Shea's Partial R^2	λ	γ	θ	F-test $H_0 : \gamma = \theta$	Years $\Delta\hat{y} < 0$
	(1)	(2)	(3)	(4)	(5)	(6)
1	0.527	0.307	-0.868	1.323	2.51	26
		(0.325)	(0.877)	(0.686)		
		[0.94]	[-0.99]	[1.93]**		
2	0.428	0.204	-0.69	0.615	1.32	31
		(0.281)	(0.755)	(0.579)		
		[0.73]	[-0.91]	[1.06]		
3	0.540	0.454	0.52	0.387	0.07	26
		(0.330)	(0.404)	(0.438)		
		[1.38]	[1.29]	[0.88]		
4	0.475	0.883	1.585	0.511	1.11	28
		(0.225)	(0.701)	(0.456)		
		[3.92]*	[2.26]*	[1.12]		
5	0.607	0.462	0.453	0.472	0.00	27
		(0.309)	(0.381)	(0.420)		
		[1.49]	[1.19]	[1.12]		

Note: Robust standard errors in parenthesis, t-statistics in square brackets, * (**) means statistical significance at 5% (10%) level, λ is from equation (3), θ and γ from equation (4).