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Bruno Jordan Orfei Abe

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BRAZILIAN EQUITY RISK PREMIUM ANALYSIS: A MACROECONOMIC APPROACH

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Work Project presented to the Double Degree Masters in Economics Program from Insper and NOVA School of Business and Economics as a part of the pre requisites for the entitlement as Master in Economics.

Area of Expertise: Macrofinance

Advisor: Prof. Dr. Ricardo Dias de Oliveira Brito

Co-Advisor: Prof. Dr. Andre C. Silva

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1. Excess Returns, 2. Expected Returns, 3. Consumption, 4. Wealth, 5. Cointegration

APPROVAL SHEET

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Approved in: January, 2015

Committee

Prof. Dr. Ricardo Dias de Oliveira Brito
Institution: Insper
Signature: ______________________

Prof. Dr. André C. Silva
Institution: NOVA SBE
Signature: ______________________

Prof. Dr. Marco Lyrio
Institution: Insper
Signature: ______________________

Prof. Dr. José Tavares
Institution: NOVA SBE
Signature: ______________________

ABSTRACT

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This research studies the role of fluctuations in the aggregate consumption-wealth ratio cay proposed by Lettau and Ludvigson (2001) as a predictor of stock returns in the Brazilian economy. Using quarterly data, evidence for predictability of asset growth was found with an $\bar{R}^2$ of over 45% and a highly significant coefficient as expected, in contrast to absence of statistical evidence for predictability of stock returns or excess returns. Regressions containing those fluctuations also resulted in worse $\bar{R}^2$. For the data used, dividend yield was not capable of showing predictive power also. The predictability of the returns on the Brazilian economy is not rejected but data fails to show the expected results. Finding macroeconomic data that represent the same agent was a big obstacle. After testing many different datasets and different model specifications, data still failed to show any explanatory power over returns or excess returns.

Keywords: Excess Returns; Expected Returns; Consumption; Wealth; Cointegration.

Summary

1. Introduction

A fundamental discussion in finance is how predictable are stock returns and what drives its intertemporal variation. Over the past years researchers tried to find and improve explanatory power for models willing to accomplish that objective. The capital asset pricing model (CAPM) of Sharpe (1964) and Lintner (1965) marks the birth of asset pricing theory as the first coherent framework to answer part of this question. As this theory was later proven inconsistent with numerous empirical regularities as in Basu (1977), Banz (1981), Shanken (1985), and Fama and French (1992, 1993), asset pricing theory has fallen on hard times. Why has the CAPM failed? One possibility is that its framework fails to account for effects of time-varying investment opportunities in the calculation of an asset's risk.

In response to this failure, intertemporal asset pricing models, such as the most prominent of them, the consumption CAPM (CCAPM) developed by Breeden (1979), initially tried to remedy this defect. Unfortunately, these models also proved disappointing empirically as in Hansen and Singleton (1982, 1983), Mankiw and Shapiro (1986), Breeden, Gibbons, and Litzenberger (1989), Campbell (1996), and Cochrane (1996). The results presented by these researches suggest that both the CAPM and the CCAPM may have inadequate allowances for time variation in the conditional moments of returns.

Lettau and Ludvigson (2001) explore a *conditional* version of the consumption CAPM. They try to express the stochastic discount factor not as an unconditional linear model, as in traditional derivations of the CCAPM, but as a conditional, or *scaled*, factor model. As they discuss, conditioning the model improves the fit of the CCAPM because some stocks are highly correlated with growth in consumption in bad times, or when the risk aversion is high, than in the good times, when the risk aversion is low. In their model, they were able to argue that their results go a long way toward resolving this controversy and show that the scaled multifactor version of the CCAPM can explain a substantial fraction of the cross-sectional variation in average returns on stock portfolios sorted according to size and book-to-market equity ratios.

Their results helped shedding the light on *why* the three-factor model by Fama and French (1996) had performed so well relatively to the unscaled size: while analyzing the data they figure that the Fama-French factors are somehow mimicking portfolios for risk factors associated with time variation in risk premia.

In addition to that, expected excess returns on common stocks appear to vary with the business cycle, which suggests that stock returns should be forecastable by business cycle variables at cyclical frequencies. Financial indicators such as the ratios of price to dividends, price to earnings, or dividend to earnings have been most successful at predicting returns, Fama and French (1988) argues that the power of dividend yields to forecast stock returns increases with return horizon. Campbell (1991), and Campbell, Lo, and MacKinlay (1997) show that this variable performs better in horizons that excess two years. Lettau and Ludvigson (2001) conclude that, for the U.S market, the consumption-wealth ratio was able to add significantly explanatory power to most of the models discussed above.

This article follows Lettau and Ludvigson (2001) applying their micro-founded model that uses the consumption-aggregate wealth ratio cay as a proxy for the intertemporal trade-off in investment opportunities to the Brazilian stock market in order to check if the same results are found when the model is exposed to another economy. To accomplish that objective, it explains the assumptions and mechanics of the model framework and discuss its performance while applied to the Brazilian stock market, also when compared with other disseminated models.

The rest of the paper is organized as follows. The next section replicates the framework Lettau and Ludvigson (2001) used on their model showing the link between consumption, aggregate wealth, and expected returns, and how they express the important predictive components of the consumption-aggregate wealth ratio in terms of observable variables. Section three shows how this research managed to deal with the required time series to replicate their study for the Brazilian market. Section four documents the main findings on the predictability of stock returns while the model is applied to the Brazilian economy. Section five concludes.

2. Model and Methodology

2.1. The Consumption-Wealth Ratio

This section replicates and analyzes the model Lettau and Ludvigson (2001) used to present a general framework linking consumption, asset holdings, and labor income with expected returns. The authors use a micro-founded model that studies a representative agent and its choices while consuming or investing its wealth and income.

Consider a representative agent economy in which all wealth, including human capital is tradable. Let W_t be the aggregate wealth (human capital plus asset holdings) in period t. C_t is the consumption and $R_{w,t+1}$ is the net return on aggregate wealth. The accumulation equation for aggregate wealth may be written[1]

$$W_{t+1} = \left(1 + R_{w,t+1}\right)(W_t - C_t) \tag{1}$$

They define $\mathrm{r} \equiv \log(1+R)$, and use lowercase letters to denote log variables throughout. Campbell and Mankiw (1989) show that, if the consumption-aggregate wealth ratio is stationary, the budget constraint may be approximated by taking a first-order Taylor expansion of the equation. The resulting approximation gives an expression for the log differences in aggregate wealth

$$\Delta w_{t+1} \approx k + r_{w,t+1}(1 - 1/\rho_w)(c_t - w_t) \tag{2}$$

where ρ_w is the steady-state ratio of new investment to total wealth, $(W - C)/W$, and k is a constant that plays no role in their analysis.[2] Solving this difference equation forward and imposing that $\lim_{i\to\infty} \rho_w^i \,(c_{t+1} - w_{t+1}) = 0$, the log consumption-wealth ratio may be written

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[1] Labor income does not appear explicitly in this equation because of the assumption that the market value of tradable human capital is included in aggregate wealth.

[2] Lettau and Ludvigson omit unimportant linearization constants in the equation from now on.

$$c_t - w_t = \sum_{i=1}^{\infty} \rho_w^i \left(r_{w,t+i} - \Delta c_{t+i} \right) \tag{3}$$

This equation holds simply as a consequence of the agent's intertemporal budget constraint and therefore holds ex post, but it also holds ex ante. Accordingly, we can take conditional expectations of both sides of it to obtain

$$c_t - w_t = E_t \sum_{i=1}^{\infty} \rho_w^i \left(r_{w,t+i} - \Delta c_{t+i} \right) \tag{4}$$

where E_t is the expectation operator conditional on information available at time t. This equation shows that, if the aggregate consumption-wealth ratio is not constant, it must either forecast changing returns on the market portfolio or changing consumption growth. Put another way, as the equation (4) shows, the aggregated consumption-wealth ratio can only vary if consumption growth or returns or both of them are predictable.

The aggregate consumption-wealth ratio is a function of expected future returns for the market portfolio in a broad range of optimal consumption models. The information set upon which expectations are conditioned will depend on the state variables in the model. These models may differ in their specification or preferences, or in the assumptions about the stochastic properties of consumption properties of consumption and asset returns. All of them, however, will imply that the consumption-aggregate wealth ratio is a function of expected future returns, and that agents' expectations about future returns and consumption growth may be inferred from observable consumption behavior. Moreover, there is no need to explicitly model how returns to wealth and consumption growth are determined by some specific set of preferences.

Because aggregate wealth, in particular, human capital, is not observable, the framework presented above is not directly suited for predicting asset returns. To overcome this obstacle, assumptions about the nonstationary component of human capital, denoted H_t, can be described by aggregate labor income, Y_t, implying that $h_t = k + y_t +$

z_t, where k is a constant and z_t is a mean zero stationary random variable. As shown by the authors in many models linking labor income to the stock of human capital, the log of aggregate labor income captures the nonstationary component of human capital.

Let A_t be the asset holdings, and let $1 + R_{a,t}$ be its gross return. Aggregate wealth is therefore $W_t = A_t + H_t$ and log aggregate wealth may be approximated as

$$w_t = \omega a_t + (1 - \omega) h_t \tag{5}$$

Where ω equals the average share of asset holdings in total wealth, A/W. This ratio may also be expressed in terms of the steady-state labor income and returns as $R_h A/(Y + R_h A)$.

The return to aggregate wealth can be decomposed into the returns of its two components

$$1 + R_{w,t} = \omega_t\left(1 + R_{a,t}\right) + (1 - \omega_t)\left(1 - R_{h,t}\right). \tag{6}$$

Campbell (1996) shows that (6) may be transformed into an approximate equation for log returns taking the form

$$r_{w,t} \approx \omega r_{a,t} + (1 - \omega) r_{h,t}. \tag{7}$$

Substituting (7) into the budget constraint (4) results in

$$c_t - \omega a_t - (1 - \omega) h_t = E_t \sum_{i=1}^{\infty} \rho_w^i \left\{\left[\omega r_{a,t+i} + (1 - \omega) r_{h,t+i}\right] - \Delta c_{t+i}\right\}. \tag{8}$$

This equation still contains the unobservable variable h_t, on the left-hand side. To remove it, we substitute $h_t = k + y_t + z_t$ into (8), which yields an approximate equation describing the log consumption-aggregate wealth ratio using only observable variables on the left hand side:

$$c_t - \omega a_t - (1-\omega)y_t = E_t \sum_{i=1}^{\infty} \rho_w^i \{[\omega r_{a,t+i} + (1-\omega) r_{h,t+i}] - \Delta c_{t+i}\} + (1-\omega) z_t. \qquad (9)$$

Since all the terms on the right-hand side of (9) are presumed stationary, for this equality to hold, c, a, and y must be cointegrated, and the left-hand side of (9) gives the deviation in the common trend of c_t, a_t, and y_t. In what follows, the trend deviation term $c_t - \omega a_t - (1-\omega)y_t$ is denoted as cay_t. Moreover, equation (9) shows that cay_t will be a good proxy for market expectations of future asset returns $r_{a,t+i}$ as long as expected future returns on human capital, $r_{h,t+i}$, and consumption growth, Δc_{t+i}, are not too variable, or as long as these variables are highly correlated with expected returns on assets.

2.2. Dynamic Dividend Growth Model

It is instructive to compare (9) to an expression for another variable that has been widely used to forecast asset returns, the log dividend-price ratio. Let d_t and p_t be the log dividend and log price, respectively, of the stock of asset wealth. Campbell and Shiller (1988) show that the log dividend-price ratio may be written

$$d_t - p_t = E_t \sum_{i=1}^{\infty} \rho_a^i (r_{a,t+i} - \Delta d_{t+i}). \qquad (10)$$

where $\rho_a = P/(P+D)$. This equation is derived by taking a first-order Taylor approximation of the equation defining the log stock return, $r_t = \log(P_t + D_t) - \log(P_t)$. Put in another way, if the dividend-price ratio is high, agents must be expecting either high returns on assets in the future or low dividend growth rates.

Note the similarity between (10) and (4). The role of consumption in (4) is directly analogous to that of d_t in (10): when the consumption-aggregate wealth ratio is high, agents must be expecting either high returns on the market portfolio in the future or low consumption growth rates.

3. Data

Lettau and Ludvigson (2001) rely on existing data series for the U.S. market in order to compose the cay index: aggregate consumption, asset holdings, and labor income. For the aggregate consumption, they use data for consumption of nondurable goods and services, excluding clothing and shoes articles. For the labor income, they combine a set of factors to generate the model that they believe are the most realistic one to replicate reality about that information. Data for these series come from the Bureau of Economic Analysis. Finally, for the household wealth, they use data provided by the Federal Reserve. All series at quarterly frequency.

To generate comparable results, in this article, prices are expressed in Brazilian Reais from 1996, deflated by the index IGP-DI[3]. Series were chosen aiming to approximate the observed series by the same representative agent. This section show information used for the estimation of the best model found.

3.1. Population

The population series are from IPEA Data, although, the original provider for this information is the Brazilian Institute of Geography and Statistics (IBGE). The available series is annual and it was broken in quarters by an exponential interpolation method vertex by vertex. As population data are available only until the last quarter of 2012, an extrapolation procedure was used on the data by using a simple linear trend equation for the last information (the linear trend equation seemed to be a realistic representative of the data for the short run).

[3] IGP-DI is an inflation index calculated monthly by the FGV since 1944. It is a weighted average from another inflation indexes, created to measure the general price behavior in Brazilian economic.

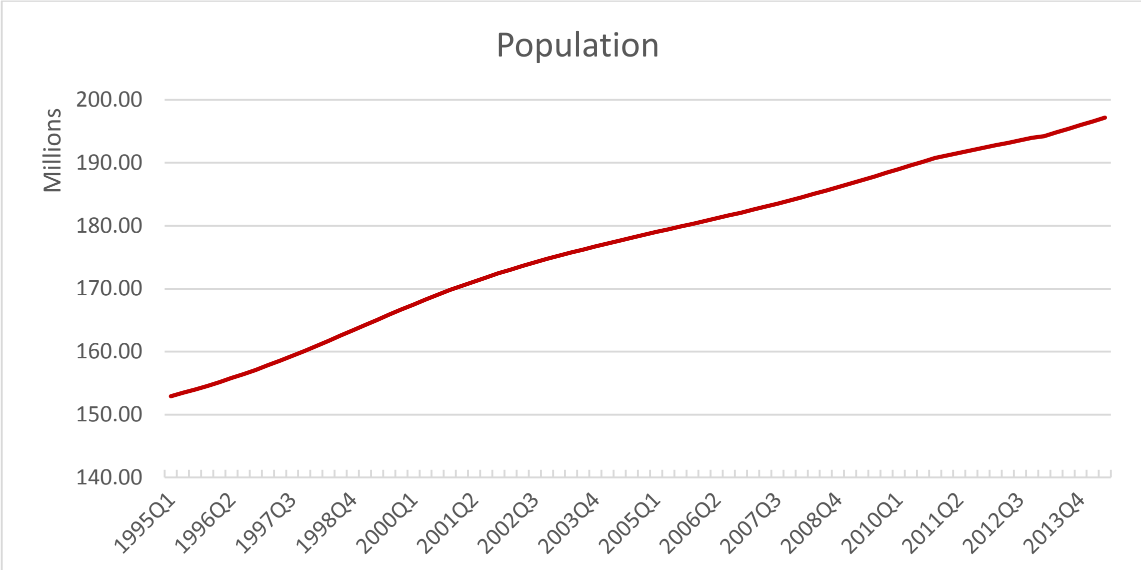

Figure 1 - Quarterly Population Series in millions of habitants from 1995Q1 - 2014Q2

3.2. Consumption and Labor Income

Consumption is the Final Consumption Expenditures and labor income is the Gross National Disposable Income from the quarterly economic account available with the GDP decomposition on the complimentary tables, provided by IBGE. This is the best pair of aggregated information available that represent the same individual. Consumption contains information about durable goods and it should not, given that these expenditures represent additions to capital stock and not the *flow* of capital. Unfortunately, there is no information available to decompose this series and get only expenditures with non-durable goods and services. Both series were seasonally adjusted with a Census X12 filter. With this adjustment, it is expected that the ratio of the share of durable and non-durable goods in total consumption become more static, diminishing the problem of using this series as an indicator for the consumption flow. Other macroeconomic series were tested to check the validity of this choice but all of them generated worse results. Further discussion containing the other series is in the Results section.

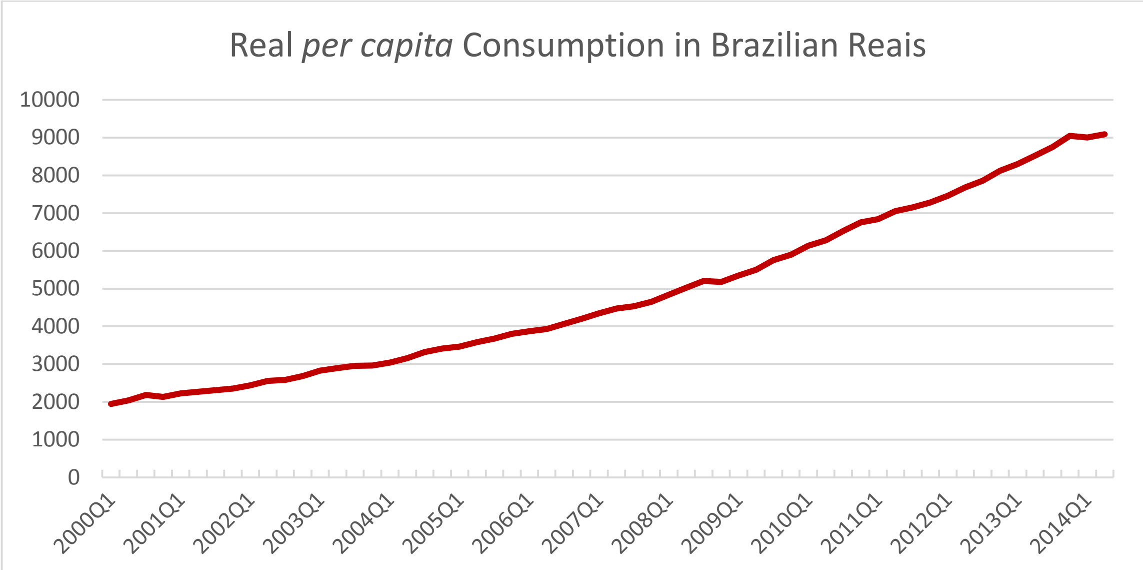

Figure 2 – Quarterly Seasonally Adjusted Real per capita Consumption in Brazilian Reais from 2000Q1 - 2014Q2

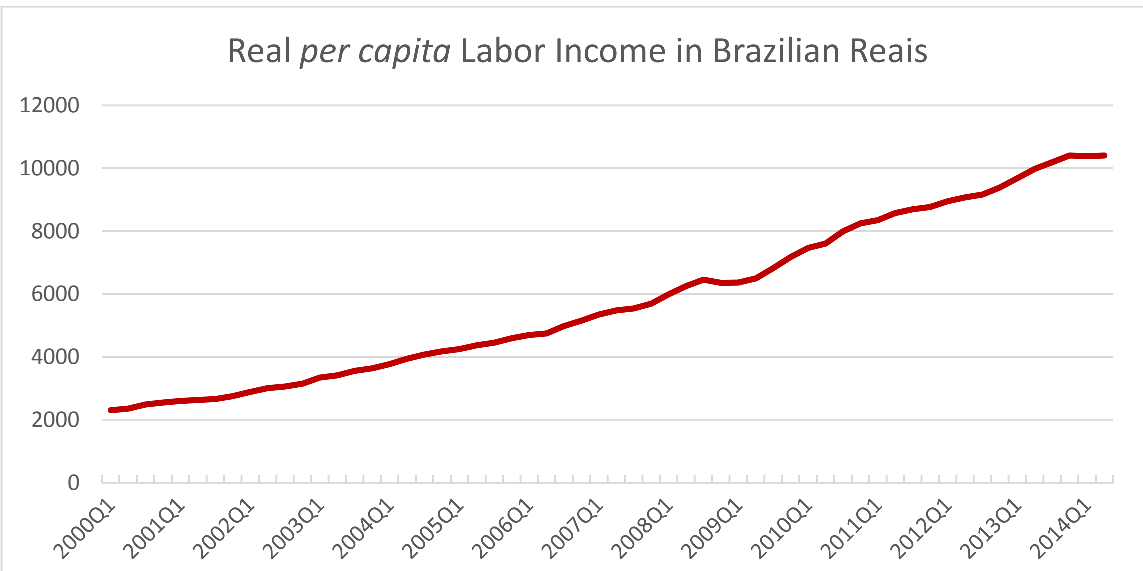

Figure 3 – Quarterly Seasonally Adjusted Real per capita Labor Income in Brazilian Reais from 2000Q1 - 2014Q2

3.3. Asset Holdings

The concept *asset holdings* is not commonly used in Brazilian literature, as a consequence, institutional data providers lack to provide this information. There is no decomposition of the household net worth available. A proxy portfolio containing three weighted components: real estate, risk free assets, and risky assets, stands for this information.

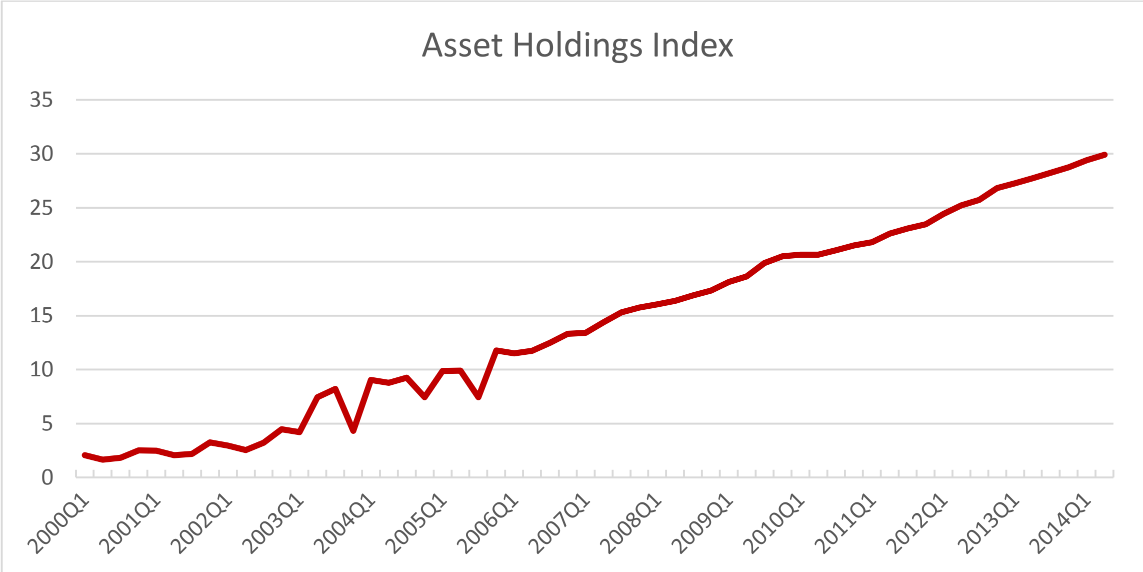

Figure 4 - Asset holdings index from 2000Q1 - 2014Q2

The U.S. household decomposition was the benchmark for the weights used in this portfolio, approximately 90% of the asset holdings derive from real estate assets, 5% from risky assets and 5% from risk free assets. More information about each component of this portfolio is in the next subsections.

4.4.1 Real Estate

The literature suggests that land and building taxes capture variations on the real estate value. As explored by de Carvalho Jr. (2009), this relationship is not trustable for Brazil, and the main reason for this fact is that a significant part of the population (in general the poor population) does not report how much they have to pay for it. Additionally, the available information for this tax is still too short to enter in our model. To overcome this difficulty, a private database containing information about many São Paulo's real estate assets valuated by a specialized company was used to replicate movements in the market[4]. Real estate information for the whole country is not available and as only the agents that are able to smooth consumption are the focus of the study, this series is the best representation of their real estate component.

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[4] I thank Eribaldo Ximenes for providing the worked real estate time series containing information about São Paulo's real estate market created using the database from Engebanc that contains valuation information for many real estate assets.

4.4.2 Financial Assets

The perfect representation of the Brazilian market portfolio is almost impossible. Literature usually relies on the Ibovespa index as a representation of it. Considering that a small part of the Brazilian population have access to the stock market and the Ibovespa index weights stocks using trading volume, for the purpose of this study, it is not the best option. A portfolio that gives more weight to small companies that are traded on the stock market would better represent all the companies that compose the Brazilian market portfolio. Using Economatica data for all companies that have common or preferred stocks traded since January 1st, 1986 until June 30th, 2014 it is possible to create an equally weighted portfolio index[5] and to create a dividend-price series for it. This index represents the 5% that stands for risky assets. In regressions, excess returns are the $Equally\ Weighted\ Portfolio\ Return - SELIC\ Return$.

The risk free assets series contains 95% of government bonds that are the Government Debt Public Bonds issued by the National Treasury from the Brazilian Central Bank, and 5% savings account that are the saving accounts stock series from the Brazilian Central Bank. This series represent the last 5% of the asset holdings series that stands for risk free assets.

4. Results

The first important task while using cay to forecast asset returns is the estimation of the parameters of the shared trend in consumption, asset holdings, and labor income. Although these three variables are assumed endogenously determined, the asymptotic properties of cointegrated variables can avoid this difficulty.

Testing for cointegration, requires that all variables are integrated of the same order. Summary for the unit root tests are on the table below for each variable shows that all the variables are integrated of first order I(1).

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[5] I thank Max Wienandts for providing the series and its dividend-price ratio for an equally weighted portfolio.

Unit Root Test Summary (Results are p-value for ADF tests where null hypothesis indicates a unit root)					
$\log(Consumption)$		$\log(Asset\ Holdings)$		$\log(Labor\ Income)$	
Level	1st Difference	Level	1st Difference	Level	1st Difference
0.6331	0.0000	0.9988	0.0000	0.8828	0.0001

Table 1 – ADF unity root test summary for all variables composing cay in level and first difference.

The Johansen cointegration test is highly sensitive to lag specification when exposed to small samples. This research considers mainly two factors to determine the number of lags for the models. The first one is statistic, relying on the information criteria; the second one is economic, considering the business cycles. The information criteria pointed to the use of a one lag model. Since data is quarterly, and sample is really small, a one lag VAR[6] was estimated and the Johansen cointegration test was applied, indicating the existence of one cointegration equation between the series. Table 2 and Table 3 show results for these tests. They indicate that the three components do share a common long-term trend. How can deviations from this shared trend be interpreted to check if they are better described as transitory movements in asset wealth or as transitory movements in consumption and labor income?

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.414427	52.98724	42.91525	0.0037
At most 1	0.260504	23.01801	25.87211	0.1088
At most 2	0.103493	6.117963	12.51798	0.4455

Table 2 - Cointegration test (Trace) for cay

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.414427	29.96923	25.82321	0.0134
At most 1	0.260504	16.90005	19.38704	0.1108
At most 2	0.103493	6.117963	12.51798	0.4455

Table 3 - Cointegration test (Maximum Eigenvalue) for cay

To answer this question, it is instructive to examine the error correction term of a vector error correction model where log difference in consumption, asset wealth, and labor

[6] Different lag sets were also estimated in order to check the validity of the chosen model. The same set of information with two and four lags also show cointegration properties but generates less effective models.

income are each regressed on their own lags, also including this cointegration equation. Table 4 presents a summary of this result.

Focusing on the relationship between the estimated trend deviation $\widehat{cay}_{t-1}$ and future growth rates of each variable reveals an interesting property of the data on the three components. As showed in the revision of the framework proposed by Lettau and Ludvigson (2001), estimation of the asset growth equation shows that $\widehat{cay}_{t-1}$ predicts asset growth, implying that deviations in asset wealth from its shared trend with labor income and consumption uncover important transitory variation in asset. With this in hands, the focus now is showing that this variable predicts asset growth because the estimated trend deviation forecasts asset returns.

Dependent Variable	Equation		
	Δc_t	Δa_t	Δy_t
Δc_{t-1}	-0.18324	-16.294	-0.06295
	[-1.01223]	[-1.31119]	[-0.34312]
Δa_{t-1}	-0.00042	0.050503	0.000451
	[-0.22228]	[0.38817]	[0.23496]
Δy_{t-1}	0.103465	8.166102	0.34024
	[0.58167]	[0.66877]	[1.88748]
$\Delta\widehat{ca}y_{t-1}$	-0.08141	**34.82312**	-0.02167
	[-0.89766]	**[5.59325]**	[-0.23582]
$\bar{R}^2$	**-0.02976**	**0.453934**	**0.026418**

Table 4 - Estimates from the VECM for the coefficients of the column variable on the row variable, t-statistics appear in brackets. Statistically significant coefficients are bold.

The financial data include stock returns and the dividend-price ratio, Table 5 below shows some statistics for all this data and also for the trend deviation term $\widehat{cay_t}$ for the biggest common sample available. Focusing on the discussion on the estimated trend deviation $\widehat{ca}y$, results presented in the summary table are discouraging. This variable is negatively correlated to the excess stock returns. Additionally it is well known that the price-dividend yield should be very persistent, and for our sample, it does not show that[7].

[7] In Brazil dividends are usually paid at certain periods, this characteristic can affect the expected results. Seasonally adjusting $d_t - p_t$ using a Census X12 filter makes the results below better, autocorrelation jumps to 64% but worsens further analysis.

	$r_m - r_{f,t}$	$d_t - p_t$	$\widehat{cay}_t$
Panel A: Correlation Matrix			
$r_m - r_{f,t}$	1.0000	-0.0587	-0.0509
$d_t - p_t$		1.0000	0.0324
$\widehat{cay}_t$			1.0000
Panel B: Univariate Summary Statistics			
Mean	-0.0094	0.0072	0.0000
σ	0.0384	0.0031	0.0296
Autocorrelation	0.3150	-0.0240	0.0200

Table 5 - Summary statistics for financial data.

The $\widehat{cay}$ also shows a small autocorrelation. Lettau and Ludvigson (2001) show that autocorrelation for their trend deviation term is lower than the dividend-price ratio but not as low as the ones found with data for Brazil. This affects the forecasting equations, removing the inference problems that exists for estimations with big autocorrelations as it would be expected from the dividend yield.

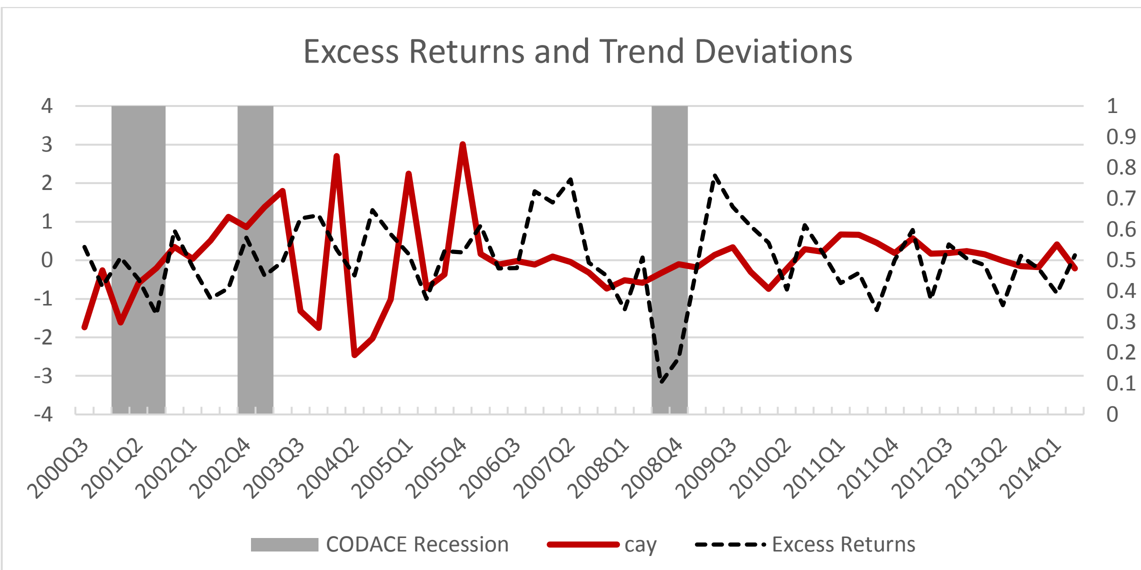

Figure 5 - Standardized cay series with Equally Weighted Portfolio Excess Returns

Figure 5 plots the standardized excess returns paired with the trend deviation. The cay ratio does not seem to work well while predicting changes on the excess returns. At some periods this relation holds, but fails at most others as in 2004Q1, for example, we see deviations showing an upcoming raise on the excess returns, but on the right next quarter, they lower. Predictive powers seems to get even worse within the CODACE[8] recession indicator. Most of the spikes found in the excess returns are not forecasted by the trend deviations.

Moving on to assess the forecasting power of detrended wealth for asset returns, Table 6 show a set of results using the lagged trend deviation, $\widehat{cay}_{t-1}$, as a predictive variable for returns and excess returns. All regressions use the equally weighted portfolio as the benchmark for stock returns. For all the equations, the lagged variable is the only statistically significant, when present. The most relevant finding is that, for this sample, the lagged trend deviations are not statistically significant, showing absolute t-statistic values far below the expected 2. These findings go in the opposite direction as the ones from Lettau and Ludvigson (2001). Models using $\widehat{cay}_{t-1}$ as explanatory variable also diminishes the $\bar{R}^2$ of the regressions. Data show that, for the chosen samples and set of information, $\widehat{cay}$ is neither a good predictor for real returns nor excess returns in Brazil. What could have generated these results? As Lettau and Ludvigson (2001) say, using aggregate data in all analyses would most likely bias downward the forecasting power of the cay_t, especially because it is known that there is a limited participation in asset markets for the population, but this also affects the model estimated for the U.S. market.

On the other hand, the dividend-price ratio from the equally weighted portfolio does not show explanatory power, this goes also against Shiller (1984), Campbell and Shiller (1988), and Fama and French (1988) that find that the ratio of price to dividends have predictive power for excess returns. Bhargava, Dania, and Malhotra (2011) show that this ratio is statistically significant for Brazil, but they use monthly data for Ibovespa instead of quarterly data for an equally weighted portfolio. Using quarterly Ibovespa returns as explained variable instead of the equally weighted portfolio did not result in any better estimation.

The most obvious difference between estimations for Brazil and for the U.S. economy lay down in the information set available for each economy. Data for consumption considers durable goods, which represent replacements or additions to

[8] CODACE is the Brazilian Business Cycle Dating Committee and it establishes reference chronologies for the Brazilian economic cycles.

stock and not the *flow* of consumption. Unfortunately, it is not possible to determine which part of it is attributable to durable goods and which is attributable to nondurables goods and services. Additionally, the samples available are expressively smaller than the ones available on the U.S. economy and used by Lettau and Ludvigson (2001). It is possible that they do not capture the required variability for predicting returns as expected.

#	Constant (t-stat)	lag (t-stat)	$\widehat{cay}_t$ (t-stat)	$d_t - p_t$ (t-stat)	$\bar{R}^2$
Panel A: Real Returns; 2000Q1 - 2014Q2					
1	0.009547 (0.844395)	**0.329801** **(2.592429)**			0.092687
2	0.014271 (1.167747)		-0.011911 (-0.028862)		-0.018852
3	0.009284 (0.787583)	**0.334624** **(2.561183)**	0.036811 (0.093647)		0.077878
Panel B: Excess Returns; 2000Q1 - 2014Q2					
4	-0.006607 (-1.324018)	**0.314699** **(2.459026)**			0.082671
5	-0.009632 (-1.826939)		-0.014509 (-0.081494)		-0.018740
6	-0.006608 (-1.271668)	**0.319073** **(2.427012)**	0.006379 (0.037396)		0.067320
Panel C: Additional Controls; Excess Returns; 2000Q1 - 2014Q2					
7	0.001092 (0.035983)			1.866793 (0.476873)	-0.013989
8	0.000213 (0.006798)		-0.019475 (-0.046816)	1.961432 (0.487270)	-0.033725

Table 6 - Estimates From OLS Regressions of Stock Returns on Lagged Variables Named at the Head of a Column.

Different datasets were tested to validate the samples used. Estimations with average per capita labor income for metropolitan regions from 2001Q3 until 2014Q2 and Gross Disposable Income from 1996Q1 until 2014Q2, both from IBGE as proxies for income and Final Household Consumption, following the same time constraint from labor income, from IBGE as proxy for consumption. All of them, in general, resulted in even weaker evidence than the ones showed for the model on Table 6.

5. Conclusion

Investigating the conditions under which consumption, labor income and asset holdings share a common long-run trend and that deviations from this trend can contain information about time-varying investment opportunities and expectations about future returns on the stock market led to testing the framework of the model developed by Lettau and Ludvigson (2001).

The same methodology was replicated using the best available Brazilian time series that represent the consumption, asset holdings and labor income, but facing some limitations to find specific data and desired sample size. Representation to the same agent while composing the three series explain difficulties for finding good information sets for the Brazilian economy.

In the quest to overcome this difficulties, many models were estimated with different specifications and different datasets, but all of them resulted in undesired lack of explanation power while using cay_t as a predictor to returns or excess returns on the stock market. Effects from cay_t into the asset growth, although, are present in most of the estimated models.

The use of cay_t as a proxy to the intertemporal variation in the investment opportunities was not capable of adding explanation power to the regressions of real returns or excess returns for the equally weighted portfolio. Dividend-price ratio series also faced a lack of explanation power. Results force the belief that the samples used were not able to account for the information needed to explicit the expected predictability.

Deeper research has to be done in order to create better proxies for the information, maybe using other datasets that were not available for this work. A subset of information emphasizing the population of metropolitan areas would also help to clear the data, as they represent better the part of the population that has access to the stock markets and also separate the part of the population that are able to smooth consumption as they do not have a huge budget constraint.

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