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Abstract

In this paper, we show, using the consumer's budget constraint, that the residuals of the trend relationship among consumption, aggregate wealth, and labour income should predict both stock returns and housing returns. We use quarterly data for a panel of 31 emerging economies and find that, when agents expect future stock returns to be higher, they will temporarily allow consumption to rise. Regarding housing returns, if housing assets are complementary to stocks, then investors react in the same way. If, however, the increase in the exposure through risky assets is achieved by lowering the share of wealth held in the form of housing (i.e., when stock and housing assets are substitutes), then they will temporarily reduce their consumption.

JEL classification: E21, E44, D12.
Keywords: consumption, wealth, stock returns, housing returns, emerging markets.

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1. Introduction

Differences in expected returns across assets are generally thought to be explained by differences in risk, and the risk premium is normally seen as reflecting the ability of an asset to insure against consumption fluctuations (Sharpe, 1964). However, a measure such as the covariance of returns across portfolios and contemporaneous consumption growth has not been found sufficient to account for expected returns differentials (Breeden et al., 1989). The asset pricing literature has concluded instead that inefficiencies in financial markets[1] and the response of rational agents to time-varying investment opportunities[2] provide good explanations for why expected excess returns appear to vary over the business cycle.

In addition, various macro-financial variables that capture time-variation in expected returns have been considered, including the consumption-wealth ratio (Lettau and Ludvigson, 2001), the long-run risk (Bansal and Yaron, 2004), the housing collateral risk (Lustig and van Nieuwerburgh, 2005), the ultimate consumption risk (Parker and Julliard, 2005), the composition risk (Yogo, 2006; Piazzesi et al., 2007), the ratio of excess consumption (i.e. consumption in excess of labour income) to observable assets (Whelan, 2008), and the wealth composition risk (Sousa, 2010a).

In contrast with the literature on the predictability of stock returns, only a few studies have tried to explain the factors behind housing premia. Sousa (2010a) shows that, while financial wealth shocks are mainly transitory, fluctuations in housing wealth are very persistent. As a result, the composition of wealth might also be important because it has implications for the predictability of asset returns. In addition, De Veirman and Dunstan (2008) and Fisher et al. (2010) apply the approach developed by Lettau and Ludvigson (2001) to New Zealand and Australia respectively, and find that the elasticity of consumption to permanent housing wealth changes is higher than that to permanent financial wealth variation.

The present paper combines wealth and macroeconomic data to address the question of asset return predictability. We use the representative agent's intertemporal budget constraint to derive an equilibrium relation between the transitory deviation from the common trend in consumption, aggregate wealth and labour income, labelled as *cay*, and both stock and housing returns.

[1] See Fama (1998), Fama and French (1996), and Farmer and Lo (1999).

[2] See Sundaresan (1989), Constantinides (1990), Campbell and Cochrane (1999), Duffee (2005), and Santos and Veronesi (2006).

The above-mentioned empirical proxy tracks the dynamics of expectations about stock returns, housing returns and/or consumption growth. Specifically, when forward-looking investors expect stock returns to be higher in the future, they will allow consumption to rise above its equilibrium level and, consequently, as in Lettau and Ludvigson (2001) and Sousa (2010a), they insulate future consumption from fluctuations in stock returns. As for housing returns, it is important to understand how housing assets are perceived by agents. If they are seen as complementary to financial assets, then investors allow consumption to rise above its equilibrium relationship with aggregate wealth and labour income when they have expectations of higher housing returns. However, if housing assets are substitutes for financial assets, then investors will allow consumption to fall below its common trend with aggregate wealth and labour income.

Using data for a set of 31 emerging market countries, we show that the predictive power of *cay* for real stock returns is particularly important for horizons from three to four quarters. At the four-quarter horizon, *cay* explains a substantial fraction of real stock returns, namely 20% (Malaysia), 22% (Israel and Latvia), 23% (China), 25% (Colombia), 39% (Brazil), and 46% (Korea). In the case of Argentina, Chile, Estonia, Hong Kong, Indonesia, Peru, Philippines, Poland, Russia, Singapore and Taiwan, the proxy does not seem to track well time-variation in stock returns. (Caporale and Sousa, 2011, using the same type of framework, find equally mixed results for 15 OECD countries).

Concerning housing returns, the analysis suggests that we can cluster the countries under investigation in two groups. In the first group (which includes Chile, Russia, South Africa and Thailand), *cay* has a positive coefficient in the forecasting regressions, which supports the idea that housing and financial assets are complementary to asset wealth. In the second group (which includes Argentina, Brazil, Hong Kong, Indonesia, Korea, Malaysia, Mexico and Taiwan), the coefficient of *cay* in the forecasting regressions is negative. Consequently, agents in these countries treat housing assets as substitutes for financial assets in their portfolios. The trend deviations accurately predict housing returns at three to four quarters horizons in particular. Specifically, at the four quarter horizon, cay_t explains 23% (Indonesia), 24% (Brazil and Chile), 30% (Argentina), 38% (South Africa) and 47% (Mexico) of the real housing returns.

The paper is organised as follows. Section 2 describes the theoretical framework. Section 3 provides the econometric methodology. Section 4 presents the estimation results of the forecasting regressions for asset returns. Section 5 offers some concluding remarks.

2. Theoretical framework

We consider the case of a representative consumer for whom the intertemporal budget constraint can be expressed as

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

where W_t represents aggregate wealth, C_t denotes private consumption, and $R_{w,t+1}$ corresponds to the return on aggregate wealth between period t and $t+1$.

Under the assumption that the consumption-aggregate wealth ratio is stationary and that $\lim_{i\to\infty} \rho_w{}^i (c_{t+i} - w_{t+i}) = 0,$ Campbell and Mankiw (1989) use the following Taylor expansion approximation of equation (1)

$$c_t - w_t = \sum_{i=1}^{\infty} \rho_w^i r_{w,t+i} - \sum_{i=1}^{\infty} \rho_w^i \Delta c_{t+i} + k_w, \tag{2}$$

where $c \equiv logC$, $w \equiv logW$, and k_w is a constant. According to equation (2), deviations of consumption from its equilibrium relationship with aggregate wealth reflect changes in the returns on aggregate wealth or in consumption growth.

Similarly, one can decompose the aggregate return on wealth as

$$R_{w,t+1} = \omega_t R_{a,t+1} + (1\text{-}\,\omega_t) R_{h,t+1}, \tag{3}$$

where ω_{t} is a time varying coefficient and $R_{a,t+1}$ is the return on asset wealth, and Campbell (1996) uses the following approximation of equation (3)

$$r_{w,t} = \omega_t r_{a,t} + (1\text{-}\,\omega_t) r_{h,t} + k_r, \tag{4}$$

where k_r is a constant, and $r_{w,t}$ is the log return on asset wealth.

The log aggregate wealth can be approximated as

$$w_t = \omega a_{\mathrm{t}} + (1\text{-}\omega)\mathrm{h}_{\mathrm{t}} + k_a, \tag{5}$$

where a_t is log asset wealth, h_t is log human wealth, ω is the mean of ω_{t}, and k_a is a constant.

Following the suggestion of Campbell (1996) and Jagannathan and Wang (1996), who interpret labour income, Y_t, as the dividend on human capital, H_t, we can define the return to human capital as:

$$1+R_{h,t+1}=\frac{H_{t+1}+Y_{t+1}}{H_t}. \qquad (6)$$

If we log-linearise this relation around the steady state, we obtain

$$r_{h,t+1}=(1-\rho_h)k_h+\rho_h(h_{t+1}-y_{t+1})-(h_t-y_t)+\Delta y_{t+1}, \qquad (7)$$

where $r\equiv log(1+R)$, $h\equiv logH$, $y\equiv logY$, k_h is a constant of no interest, and the variables without time subscript are evaluated at their steady state value. Imposing the condition that $\lim_{i\to\infty}\rho_h{}^i(h_{t+i}-y_{t+i})=0,$ the log human capital income ratio can be rewritten as a linear combination of future labour income growth and future returns on human capital:

$$h_t-y_t=\sum_{i=1}^{\infty}\rho_h^{i-1}(\Delta y_{t+i}-r_{h,t+i})+k_h. \qquad (8)$$

Replacing equation (4), (7) and (8) into (2), we get

$$c_t-\omega a_t-(1-\omega)(y_t+\sum_{i=1}^{\infty}\rho_h^{i-1}\Delta y_{\mathrm{t+i}})=$$

$$=\omega\sum_{i=1}^{\infty}\rho_w^i r_{\mathrm{a,t+i}}+(1-\omega)\sum_{i=1}^{\infty}(\rho_w^i-\rho_h^{i-1})r_{\mathrm{h,t+i}}-\sum_{i=1}^{\infty}\rho_w^i\Delta c_{\mathrm{t+i}}+k, \qquad (9)$$

where k is a constant. This equation holds ex-post as a direct consequence of agent's budget constraint, but it also has to hold ex-ante. Taking time t conditional expectation of both sides gives

$$\underbrace{c_t-\omega a_t-(1-\omega)y_t}_{cay_t}=\omega E_t\sum_{i=1}^{\infty}\rho_w^i r_{\mathrm{a,t+i}}+(1-\omega)E_t\sum_{i=1}^{\infty}\rho_h^{i-1}\Delta \mathrm{y}_{\mathrm{t+i}}-E_t\sum_{i=1}^{\infty}\rho_w^i\Delta \mathrm{c}_{\mathrm{t+i}}+\eta_t+k, \qquad (10)$$

where $\eta_t\equiv(1-\omega)\sum_{i=1}^{\infty}(\rho_w^i-\rho_h^{i-1})r_{\mathrm{h,t+i}}$, is a stationary component.

Sousa (2010a) highlights the importance of the composition of wealth in pricing the risk premium.[3] By disaggregating returns, $r_{a,t}$, into returns on financial assets, $r_{f,t}$, and returns on housing assets, $r_{u,t}$, one can link the trend deviation, cay_t, to the market expectations about future financial and housing asset returns:

$$\underbrace{c_t-\omega a_t-(1-\omega)y_t}_{cay_t}=$$

$$=\omega_f E_t\sum_{i=1}^{\infty}\rho_w^i r_{\mathrm{f,t+i}}+\omega_u E_t\sum_{i=1}^{\infty}\rho_w^i r_{\mathrm{u,t+i}}+(1-\omega_f-\omega_u)E_t\sum_{i=1}^{\infty}\rho_h^{i-1}\Delta \mathrm{y}_{\mathrm{t+i}}-E_t\sum_{i=1}^{\infty}\rho_w^i\Delta \mathrm{c}_{\mathrm{t+i}}+\eta_t+k,$$

[3] Sousa (2010b) also shows that monetary policy can have a strong impact on the composition of wealth in the euro area as a whole.

(11)

where $\eta_t \equiv (1-\omega)\sum_{i=1}^{\infty}(\rho_w^i - \rho_h^{i-1})r_{\mathrm{h,t+i}}$.[4]

As a result, when agents expect future stock returns to be higher, they will temporarily allow consumption to rise. Regarding housing returns, if housing assets are complementary to stocks, then investors react in the same way. If, however, the increase in the exposure through risky assets is achieved by lowering the share of wealth held in the form of housing (i.e., when stock and housing assets are substitutes), then they will temporarily reduce their consumption. This behaviour reflects the degree of separability between financial and housing assets: when they are separable, financial and housing assets will be substitutes, so agents can easily "smooth out" any transitory movement in their asset wealth arising from time variation in expected returns; if, however, they are non-separable, financial and housing assets will be complements, and agents will not be able to "smooth out" exogenous shocks. Therefore, valuable information can be extracted by looking at the sign of the coefficients on *cay* in the forecasting regressions for stock and housing returns.

3. Econometric methodology

We use quarterly data spanning the period 1990:1-2008:3 for 31 emerging market economies, namely: 10 from emerging Asia (China, Hong Kong, India, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan, and Thailand), 6 from Latin America (Argentina, Brazil, Chile, Colombia, Mexico, and Peru), 12 from emerging Europe (Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, and Slovenia) and 3 other countries (Israel, South Africa, and Turkey).

Data on housing and equity wealth are not available on a broad basis for emerging economies. Therefore, we use stock market and house price indices as proxy variables for these wealth components. This is in line with the studies that have investigated the (in)direct impact of stock market prices on aggregate consumption

[4] On the basis of theory, some authors take the view that housing wealth effects should be small. For instance, Buiter (2008) argues that an increase in the value of housing leads to higher housing consumption costs, which offset the housing wealth effect on non-housing consumption. Muellbauer (2008) suggests that the positive effect on non-housing consumption from an increase in housing prices is counterbalanced by a fall in housing consumption. Calomiris et al. (2009) emphasise that changes in housing wealth are typically correlated with changes in expected permanent income.

(Romer, 1990) or the role played by housing prices (Miles, 1992; Aoki et al., 2003), as well as the work of Peltonen et al. (2009).

Housing price (residential property) indices have been obtained from CEIC (for the emerging Asian countries), the IMF (for the Latin American countries), and Haver Analytics (for the remaining countries). Stock price indices (composite indices) are from the Global Financial Database. Money wealth is proxied by broad money, M_2, available from Haver Analytics, which, therefore, also captures indirectly the role of monetary policy in emerging market economies (Mallick and Mohsin, 2007).[5]

With regard to the other series, the source for real private consumption is Haver Analytics, with the exception of China, Hong Kong, Indonesia, and Singapore for which the data come from CEIC. We use a measure of aggregate consumption and hence one cannot distinguish between non-durable and durable consumption. Conventional theories look at the flow of non-durable and services consumption, since durable consumption can be thought of as a replacement and addition to the capital stock. In addition, total consumption measures include expenditure on housing services. Nevertheless, as Mehra (2001) points out, total consumption is the variable of interest when investigating the consumption-wealth channel. In particular, stock market crashes are more likely to lead to a postponement of durable consumption decisions, while a fall in non-durable consumption might have minor effects (Romer, 1990). Furthermore, durable consumption goods are among the main items on which resources raised by mortgage refinancing are spent.

Data on income (either salary or wage income) are from CEIC (for emerging Asian countries), and from Haver Analytics (remaining countries). The CPI price index is taken mainly from Haver Analytics, with the exception of Argentina, Brazil, and Chile, for which the data source is the IMF. Finally, population statistics are obtained from the UN World Population Statistics database.

For the regression analysis, data are transformed in several ways. First, the wealth variables are deflated using the CPI price index (all items), while the real private consumption data are deflated by the national authorities using National Accounts data. Second, we divide real money by the population in order to express it in per capita terms. Third, income corresponds to real wage or salary provided by National Statistics authorities, except for Argentina, China, Indonesia, Malaysia, Russia, and Thailand, where nominal wages (or salaries) are deflated using the CPI price index. Fourth, data

[5] For Thailand, we use M_3 instead of M_2.

on population and real private consumption for China are annual, and, therefore, we interpolate them using a cubic conversion method. Finally, the semi-annual nominal wage data for Hong Kong are interpolated using the same method for the period 1990:1-1998:4.

Table 1 - Long-run relationship between consumption, financial wealth, and labour income. $cay_t = c_t - \beta_1 a_t - \beta_2 y_t$.

	A	y	ADF t-statistic	Critical values	
			Lags: 1	5%	10%
Argentina	0.07***	0.98***	-1.70	-1.95	-1.61
	(9.41)	(28.22)			
Brazil	0.05***	1.38***	-3.84	-1.95	-1.61
	(3.15)	(12.39)			
Bulgaria	-0.01	0.98***	-0.46	-1.95	-1.61
	(-0.56)	(14.42)			
Chile	0.04**	1.54***	-3.01	-1.95	-1.61
	(2.48)	(34.94)			
China	0.00***	0.90***	0.36	-1.95	-1.61
	(3.82)	(698.73)			
Colombia	-0.04***	1.66***	-2.87	-1.95	-1.61
	(-3.39)	(17.59)			
Croatia	-0.04***	1.27***	-3.40	-1.95	-1.61
	(-4.01)	(27.27)			
Czech Republic	-0.01**	0.87***	-2.92	-1.95	-1.61
	(-2.20)	(34.25)			
Estonia	0.06***	0.95***	-1.92	-1.95	-1.61
	(5.60)	(41.87)			
Hong Kong	0.23***	0.49***	-2.53	-1.95	-1.61
	(8.22)	(5.44)			
Hungary	-0.07***	1.23***	-1.34	-1.95	-1.61
	(-6.81)	(41.93)			
India	-0.06***	1.22***	-5.06	-1.95	-1.61
	(-5.31)	(36.57)			
Indonesia	-0.01**	1.08***	-2.26	-1.95	-1.61
	(-2.23)	(44.94)			
Israel	0.30***	0.32	-2.97	-1.95	-1.61
	(4.81)	(0.72)			
Korea	-0.05***	0.94***	-2.84	-1.95	-1.61
	(-5.49)	(70.11)			
Latvia	-0.15**	1.44***	-1.33	-1.95	-1.61
	(-2.47)	(11.83)			

Notes: Newey-West (1987) corrected t-statistics appear in parenthesis. *, **, *** denote statistical significance at the 10, 5, and 1% level, respectively.

	a	y	ADF t-statistic	Critical values	
			Lags: 1	5%	10%
Lituania	0.04*	1.09***	-1.36	-1.95	-1.61
	(1.84)	(15.24)			
Malaysia	-0.05***	2.22***	-4.50	-1.95	-1.61
	(-3.15)	(61.59)			
Mexico	0.01	1.97***	-2.61	-1.95	-1.61
	(1.42)	(32.78)			
Peru	-0.03***	1.45***	-2.01	-1.95	-1.61
	(-3.66)	(29.11)			
Philippines	-0.05***	1.84***	-4.74	-1.95	-1.61
	(-3.74)	(26.98)			
Poland	-0.01*	0.87***	-4.62	-1.95	-1.61
	(-1.92)	(57.84)			
Romania	0.02	1.37***	-1.43	-1.95	-1.61
	(0.89)	(16.00)			
Russia	0.06***	1.16***	-2.74	-1.95	-1.61
	(7.13)	(37.29)			
Singapore	-0.27***	1.66***	-2.34	-1.95	-1.61
	(-3.88)	(22.53)			
Slovakia	-0.02*	0.92***	-2.41	-1.95	-1.61
	(-1.93)	(26.88)			
Slovenia	-0.02	0.80***	-2.39	-1.95	-1.61
	(-1.19)	(19.68)			
South Africa	0.00	1.64***	-1.94	-1.95	-1.61
	(0.03)	(9.14)			
Taiwan	-0.02	1.11***	0.12	-1.95	-1.61
	(-1.09)	(46.89)			
Thailand	-0.04***	1.16***	-1.11	-1.95	-1.61
	(-10.05)	(39.19)			
Turkey	-0.04**	1.45***	-2.74	-1.95	-1.61
	(-2,37)	(25.20)			

Notes: Newey-West (1987) corrected t-statistics appear in parenthesis. *, **, *** denote statistical significance at the 10, 5, and 1% level, respectively.

We start by testing for unit roots in consumption, aggregate wealth and labour income using the Augmented Dickey-Fuller and the Phillips-Perron tests. These show that the three variables are first-order integrated. Then, we employ the methodology of Engle-Granger to test for cointegration.

Following Stock and Watson (1993), we use a dynamic least squares (DOLS) method, specifying the following equation

$$c_t = \mu + \beta_a a_t + \beta_y y_t + \sum_{i=-k}^{k} b_{a,i} \Delta a_{\text{t-i}} + \sum_{i=-k}^{k} b_{y,i} \Delta y_{\text{t-i}} + \varepsilon_t \qquad (12)$$

where the parameters β_a and β_y represent the long-run elasticities of consumption with respect to asset wealth and labour income respectively, Δ denotes the first difference operator, μ is a constant, and ε_t is the error term.

Table 1 shows the estimates for the shared trend among consumption, asset wealth, and income. It can be seen that the long-run elasticities of consumption with respect to labour income are very close to unity, which implies that labour income is the main determinant of consumption over long-run horizons. Moreover, the disaggregation between wealth and labour income is statistically significant for a large number of countries. The table also presents the unit root tests on the residuals of the cointegration relationship based on the Engle and Granger (1987) methodology and shows their stationarity.

4. Forecasting regressions

4.1. Stock returns

Equations (10) and (11) show that transitory deviations from the long-run relationship among consumption, aggregate wealth and income, cay_t, mainly reflect agents' expectations of future changes in asset returns.

Table 2 summarises the forecasting power of cay_t at different horizons. It reports estimates from OLS regressions of the H-period real stock return, $SR_{t+1} + ... + SR_{t+H}$, on lagged cay_t. It shows that cay_t is statistically significant for almost all countries and the point estimate of the coefficient is large in magnitude. Moreover, its sign is positive. These results are in line with the theoretical framework presented in Section 3, suggesting that investors will temporarily allow consumption to rise above its equilibrium level in order to smooth it and insulate it from an increase in real stock returns. Therefore, deviations from the long-term trend among c_t, a_t and y_t should be positively related to future stock returns.

Moreover, they account for a sizeable percentage of the variation in future real returns (as described by the adjusted R-square), especially at horizons of three or four quarters. Specifically, at the four quarter horizon, cay_t explains 20% (Malaysia), 22% (Israel and Latvia), 23% (China), 25% (Colombia), 39% (Brazil), and 46% (Korea) of real stock returns. In contrast, its forecasting power is poor for countries such as Argentina, Chile, Estonia, Hong Kong, Indonesia, Peru, Philippines, Poland, Russia, Singapore and Taiwan.

Table 2 – Forecasting real stock returns.

$SR_{t+1}+ SR_{t+2}+...+ SR_{t+H} = f(cay_{t-1})$, H=1, 2, 3, 4, 8.

	Forecast Horizon *H*						Forecast Horizon *H*				
	1	2	3	4	8		1	2	3	4	8
Argentina	0.34	0.37**	0.09	0.70	2.24	Lituania	-1.43*	-3.35***	-4.58***	-4.95***	-6.73***
	(0.35)	(0.25)	(0.08)	(0.51)	(1.18)		(-1.76)	(-2.86)	(-3.20)	(-3.43)	(-2.67)
	[0.00]	[0.00]	[0.00]	[0.01]	[0.04]		[0.09]	[0.20]	[0.21]	[0.17]	[0.19]
Brazil	4.64**	5.09***	5.84***	7.16***	6.24***	Malaysia	1.39**	3.24***	4.68***	4.47***	1.99
	(2.03)	(2.80)	(4.01)	(3.08)	(2.55)		(2.03)	(3.09)	(4.96)	(3.00)	(1.21)
	[0.38]	[0.37]	[0.40]	[0.39]	[0.23]		[0.11]	[0.25]	[0.31]	[0.20]	[0.03]
Bulgaria	6.25**	7.35**	13.53***	7.53*	2.73	Mexico	0.94*	1.95***	2.20**	2.59**	4.99***
	(2.58)	(2.25)	(2.89)	(1.89)	(0.58)		(1.91)	(2.51)	(2.44)	(2.43)	(4.42)
	[0.26]	[0.16]	[0.31]	[0.07]	[0.01]		[0.03]	[0.07]	[0.07]	[0.07]	[0.18]
Chile	0.69	0.86	2.32	4.74**	2.54	Peru	-0.96	-1.50	1.07	1.04	-1.20
	(0.90)	(0.63)	(1.24)	(2.50)	(1.40)		(-1.49)	(-1.15)	(1.27)	(1.04)	(-0.66)
	[0.01]	[0.01]	[0.04]	[0.14]	[0.04]		[0.02]	[0.03]	[0.01]	[0.01]	[0.00]
China	-0.88***	-1.96***	-3.00***	-3.43***	-3.14***	Philippines	0.06	-0.10	-0.56	-0.97*	-2.74***
	(-2.88)	(-3.72)	(-3.96)	(-3.50)	(3.35)		(0.10)	(-0.11)	(-0.74)	(-1.90)	(-3.42)
	[0.20]	[0.28]	[0.29]	[0.23]	[0.11]		[0.00]	[0.00]	[0.01]	[0.03]	[0.14]
Colombia	1.86**	3.77***	5.51***	6.45***	12.57***	Poland	1.48*	1.84	4.29**	2.92	5.09
	(2.38)	(3.99)	(5.06)	(4.99)	(6.26)		(1.76)	(1.51)	(2.53)	(1.47)	(1.20)
	[0.11]	[0.22]	[0.27]	[0.25]	[0.38]		[0.05]	[0.04]	[0.12]	[0.04]	[0.07]
Croatia	-1.20	-2.78	-7.50**	-7.13*	-0.68	Romania	-2.47**	-4.42**	-4.26*	-5.08*	-1.39***
	(-0.74)	(-0.93)	(-2.46)	(-1.73)	(-0.11)		(-2.52)	(-2.18)	(-1.77)	(-1.97)	(-0.51)
	[0.02]	[0.04]	[0.16]	[0.12]	[0.00]		[0.09]	[0.13]	[0.0.07]	[0.08]	[0.00]
Czech Republic	3.10***	5.94***	8.07***	8.68***	12.46***	Russia	-0.06	0.58	1.78	2.45	2.64*
	(2.84)	(4.13)	(4.54)	(4.09)	(3.62)		(-0.06)	(0.55)	(1.45)	(1.33)	(1.65)
	[0.13]	[0.24]	[0.25]	[0.19]	[0.19]		[0.00]	[0.00]	[0.02]	[0.02]	[0.02]
Estonia	1.59	2.32	4.85*	5.35*	0.30	Singapore	-0.35	-0.65	-1.03	-1.33*	-1.17**
	(1.36)	(1.12)	(1.84)	(1.65)	(0.11)		(-0.98)	(-1.25)	(-1.53)	(-1.95)	(-2.07)
	[0.04]	[0.04]	[0.09]	[0.08]	[0.00]		[0.03]	[0.05]	[0.08]	[0.11]	[0.07]
Hong Kong	0.46	0.80	1.01	1.46**	2.31***	Slovakia	1.67**	2.62***	3.78***	4.74***	9.28***
	(1.50)	(1.58)	(1.60)	(2.10)	(2.95)		(2.32)	(2.61)	(2.91)	(2.77)	(3.27)
	[0.02]	[0.04]	[0.04]	[0.06]	[0.11]		[0.10]	[0.09]	[0.11]	[0.10]	[0.17]
Hungary	0.60	1.56	3.25***	4.50***	6.15***	Slovenia	-0.68	-3.16	-6.29**	-6.84**	-2.86
	(0.89)	(1.51)	(2.70)	(3.08)	(3.05)		(-0.48)	(-1.43)	(-2.34)	(-2.34)	(-0.77)
	[0.001	[0.03]	[0.08]	[0.11]	[0.12]		[0.00]	[0.04]	[0.09]	[0.09]	[0.01]
India	-2.31***	-2.35***	-2.62**	-2.62*	-1.96	South Africa	0.15	0.28*	0.35**	0.41**	0.74***
	(-4.24)	(-2.78)	(-2.07)	(-1.73)	(-0.97)		(1.48)	(1.89)	(1.99)	(2.17)	(3.42)
	[0.15]	[0.07]	[0.06]	[0.05]	[0.01]		[0.02]	[0.04]	[0.04]	[0.05]	[0.09]
Indonesia	1.84	3.67	4.35	5.68*	10.40**	Taiwan	-0.16	-0.27	-0.30	-0.81	-1.79
	(1.01)	(1.54)	(1.41)	(1.67)	(2.19)		(-0.34)	(-0.38)	(-0.37)	(-0.92)	(-1.36)
	[0.02]	[0.04]	[0.04]	[0.06]	[0.15]		[0.00]	[0.00]	[0.00]	[0.01]	[0.03]
Israel	0.35	0.72*	1.46***	1.88***	2.74***	Thailand	0.15	1.09	3.04	3.67*	7.06***
	(1.38)	(1.81)	(2.89)	(3.44)	(4.85)		(0.18)	(0.16)	(1.47)	(1.65)	(2.74)
	[0.03]	[0.07]	[0.16]	[0.22]	[0.33]		[0.00]	[0.01]	[0.05]	[0.05]	[0.08]
Korea	-1.45*	-3.68***	-6.27***	-8.16***	-8.77***	Turkey	0.76	1.51	1.17	-1.23	-3.67*
	(-1.62)	(-3.37)	(-6.21)	(-7.47)	(-6.87)		(0.82)	(0.83)	(0.54)	(-0.52)	(-1.95)
	[0.06]	[0.20]	[0.38]	[0.46]	[0.39]		[0.02]	[0.03]	[0.01]	[0.01]	[0.06]
Latvia	0.82	-0.04	-0.44	-4.59***	-0.38						
	(1.06)	(-0.03)	(-0.22)	(-2.93)	(-0.19)						
	[0.05]	[0.00]	[0.00]	[0.22]	[0.00]						

Notes: Newey-West (1987) corrected t-statistics appear in parenthesis. Adjusted R-square is reported in square brackets. *, **, *** denote statistical significance at the 10, 5, and 1% level, respectively.

4.2. Housing returns

We now consider the power of cay_t in predicting housing returns for which quarterly data are available (Table 3). As mentioned before, if housing assets are complementary to stocks, then investors react in the same way. If, however, the increase of the exposure through risky assets is achieved by lowering the share of wealth held in the form of housing (i.e., when stock and housing assets are substitutes), then they will temporarily reduce their consumption. Therefore: (i) when housing and financial assets are complementary, one should observe a positive point coefficient for cay_t in the forecasting regressions; and (ii) when they are substitutes instead, then cay_t should be negatively related to future housing returns.

Table 3 – Forecasting real housing returns.
$HR_{t+1} + HR_{t+2} + \ldots + HR_{t+H} = f(cay_{t-1})$, H=1, 2, 3, 4, 8.

	Forecast Horizon *H*				
	1	2	3	4	8
Argentina	-0.14***	-0.57***	-1.14**	-1.5***	-3.06***
	(-1.02)	(-1.36)	(-2.05)	(-2.68)	(-8.25)
	[0.01]	[0.10]	[0.24]	[0.30]	[0.08]
Brazil	-0.02*	-0.13*	-0.41*	-0.5**	0.57**
	(-0.13)	(-0.43)	(-1.71)	(-2.8)	(-2.03)
	[0.06]	[0.09]	[0.09]	[0.24]	[0.14]
Bulgaria	No housing data				
Chile	0.56***	0.82***	1.14***	1.37***	1.1**
	(5.39)	(3.53)	(2.94)	(2.89)	(1.33)
	[0.19]	[0.21]	[0.22]	[0.24]	[0.14]
China	1.19*	-1.50*	-2.50*	-11.10*	-135.92***
	(-0.33)	(-0.22)	(-0.2)	(-0.47)	(-3.84)
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Colombia	No housing data				
Croatia	No housing data				
Czech Republic	No housing data				
Estonia	No housing data				
Hong Kong	-0.60***	0.96***	-1.15***	-1.23***	-1.12***
	(-4.09)	(-3.67)	(3.15)	(-2.96)	(-1.68)
	[0.21]	[0.16]	[0.12]	[0.09]	[0.04]
Hungary	No housing data				
India	No housing data				
Indonesia	-0.62**	-0.82**	1.31***	-1.80***	-4.04***
	(2.21)	(-2.43)	(-3.07)	(-4.8)	(-7.91)
	[0.13]	[0.10]	[0.16]	[0.23]	[0.46]
Israel	No housing data				
Korea	0.04*	0.02*	-0.16***	-0.32*	-0.87**
	(0.54)	(-0.13)	(-0.77)	(-1.27)	(-2.22)
	[0.00]	[0.00]	[0.01]	[0.02]	[0.04]
Latvia	No housing data				

	Forecast Horizon *H*				
	1	2	3	4	8
Lituania	No housing data				
Malaysia	-0.02***	-0.07***	-0.08***	-0.27***	0.32***
	(-0.16)	(-0.44)	(-0.44)	(1.6)	(1.42)
	[0.0005]	[0.003]	[0.003]	[0.03]	[0.06]
Mexico	0.09***	-0.23**	-0.36***	-0.56***	-0.67***
	(-1.56)	(-3.34)	(-4.95)	(-5.41)	(-7.29)
	[0.05]	[0.21]	[0.43]	[0.47]	[0.66]
Peru	No housing data				
Philippines	No housing data				
Poland	No housing data				
Romania	No housing data				
Russia	-0.09*	-0.02*	0.28*	1.25**	4.00***
	(-0.42)	(-0.06)	(0.58)	(1.82)	(3.15)
	[0.003]	[0.00]	[0.04]	[0.05]	[0.30]
Singapore	-0.19**	0.24*	0.18*	0.11*	-0.002*
	(1.69)	(1.12)	(0.62)	(0.33)	(-0.01)
	[0.01]	[0.03]	[0.09]	[0.02]	[0.00]
Slovakia	No housing data				
Slovenia	No housing data				
South Africa	-0.112***	0.246***	0.38***	0.529***	1.17***
	(4.46)	(5.01)	(5.68)	(6.44)	(9.45)
	[0.21]	[0.26]	[0.32]	[0.38]	[0.56]
Taiwan	-0.16*	-0.27*	-0.29*	-0.81*	-1.79*
	(-0.34)	(-0.38)	(-0.37)	(-0.92)	(-1.36)
	[0.06]	[0.06]	[0.05]	[0.03]	[0.01]
Thailand	0.37*	0.84**	0.86**	0.70**	-1.05***
	(0.98)	(2.16)	(2.23)	(2.58)	(3.23)
	[0.028]	[0.15]	[0.12]	[0.08]	[0.10]
Turkey	No housing data				

Notes: Newey-West (1987) corrected t-statistics appear in parenthesis. Adjusted R-square is reported in square brackets. *, **, *** denote statistical significance at the 10, 5, and 1% level, respectively.

Table 3 shows that cay_t is statistically significant for almost all countries and the point estimate of the coefficient is large in magnitude. It can also be seen that the trend deviations strongly predict housing returns, especially at at horizons of three or four quarters. In particular, at the four quarter horizon, cay_t explains 23% (Indonesia), 24% (Brazil and Chile), 30% (Argentina), 38% (South Africa) and 47% (Mexico) of the real housing returns.

Interestingly, the results suggest that the sign of the coefficient of cay_t is positive for Chile, Russia, South Africa and Thailand, and negative for Argentina, Brazil, Hong Kong, Indonesia, Korea, Malaysia, Mexico and Taiwan. This piece of evidence supports the idea that, in the first set of countries, agents allow consumption to rise above its equilibrium relationship with asset wealth and labour income when they expect housing returns to increase in the future, that is, financial and housing assets are complementary. As for the second set of countries, investors see those assets as substitutes.

4.3. Nested comparisons

A final robustness exercise consists of making nested forecast comparisons by looking at the mean-squared forecasting error (MSE) from a series of one-quarter-ahead out-of-sample forecasts obtained from a prediction equation that includes *cay* as the only forecasting variable and contrasting it with the MSE associated with forecasting equations that do not account for the predictive ability of *cay*.

Our benchmark model is the *constant expected returns* and, as a result, we compare the MSE from a regression that includes a constant to the MSE from regressions that also include *cay*.

Table 4 – Nested forecast comparisons. *cay* model vs. constant/AR models.

	Real stock returns	Real housing returns
	$MSE_{cay}/MSE_{constant}$	
Argentina	1.006	1.012
Brazil	0.794	1.019
Bulgaria	0.873	
Chile	1.004	0.915
China	0.903	1.013
Colombia	0.953	
Croatia	1.006	
Czech Republic	0.941	
Estonia	0.989	
Hong Kong	0.995	0.892
Hungary	1.005	
India	0.933	
Indonesia	1.003	0.947
Israel	0.996	
Korea	0.976	1.005
Latvia	0.989	
Lituania	0.967	
Malaysia	0.951	1.017
Mexico	0.991	0.992
Peru	0.996	
Philippines	1.007	
Poland	0.986	
Romania	0.969	
Russia	1.010	1.020
Singapore	0.992	0.972
Slovakia	0.961	
Slovenia	1.008	
South Africa	0.996	0.895
Taiwan	1.007	0.975
Thailand	1.008	0.994
Turkey	1.003	

Notes: MSE represents the mean-squared forecasting error.
*, **, *** denotes statistical significance at the 10, 5, and 1%percent level, respectively.

A summary of the nested forecast comparisons for the equations of the real stock and housing returns using *cay* is provided in Table 4. In general, including *cay* in the forecasting regressions leads to an improvement in forecasting accuracy vis-a-vis the benchmark model.

5. Conclusion

We use the representative consumer's budget constraint to establish an equilibrium relation between the trend deviations among consumption, aggregate wealth and labour income (summarised by the variable *cay*) and expected future housing returns.

This strategy is followed because *cay* captures variation in agent's expectations about future returns. In particular, when stock returns are expected to be higher in the future, forward-looking investors allow consumption to rise above its equilibrium level.

As for housing returns, the crucial issue is how they are perceived by agents. If they are seen as complementary to financial assets, then investors allow consumption to rise above its equilibrium relationship with aggregate wealth and labour income when they have expectations of higher housing returns. However, if housing assets are substitutes for financial assets, then investors will allow consumption to fall below its common trend with aggregate wealth and labour income.

Using data for a set of 31 emerging market countries, we show that the predictive ability of *cay* for real stock returns is especially high for Brazil, China, Colombia, Israel, Korea, Latvia, and Malaysia. In the case of Argentina, Chile, Estonia, Hong Kong, Indonesia, Peru, Philippines, Poland, Russia, Singapore and Taiwan, the evidence suggests that *cay* does not capture well the time-variation in stock returns.

Regarding housing returns, the analysis reveals that one can group the countries in two sets. In the first set (which includes Chile, Russia, South Africa and Thailand), the coefficient on *cay* the forecasting regressions is positive, i.e. housing assets are complementary to financial assets. In the second set (which includes Canada Argentina, Brazil, Hong Kong, Indonesia, Korea, Malaysia, Mexico and Taiwan), *cay* has a negative coefficient, and consequently agents in these countries see housing assets as substitutes for financial assets. These mixed findings are similar to those reported in Caporale and Sousa (2011) for a group of 15 OECD countries.

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