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1. Introduction

It is widely accepted that real estate lies at the heart of the international financial system (Kuttner and Shim, 2016; Engsted *et al.*, 2016; Duca *et al.*, 2021; Karanasos and Yfanti, 2021). This is unsurprising given that real estate accounts for approximately two-thirds of global real assets[1] and is valued at almost four times global GDP[2]. Significant declines in property prices can have pronounced effects on the real economy by reducing household wealth and consumption, slowing construction activity, and dampening aggregate demand. In parallel, price declines can destabilise the financial sector by adversely affecting both investors and lenders. These effects materialise through higher mortgage default rates, reductions in collateral values, and weakened bank balance sheets. In severe cases, real estate busts have contributed to banking crises and broader financial instability, as witnessed during the global financial crisis of 2007–2009 (Chiang and Chen, 2022; Crowe et al., 2013).

Understanding the drivers of real estate prices is essential not only for preventing economic and financial instability, but also for supporting recovery from crises (Petris *et al*., 2022). The empirical literature has largely focused on observable and officially recorded variables, such as credit expansion, interest rates, and inflation (Crowe et al., 2013). In turn, policy responses have been designed around these variables, particularly at the macroprudential, monetary, and fiscal levels (Kuttner and Shim, 2016; Crowe et al., 2013). This paper investigates, for the first time, the hidden role of the shadow economy in shaping real estate dynamics and financial stability. This contribution is important for two main reasons. First, the shadow economy represents a potentially significant but unexamined driver of real estate prices. It encompasses both illegal and legal economic activities that are concealed from

[1] Estimate by McKinsey Global Institute (2021), *The rise and rise of the global balance sheet: How productively are we using our wealth*?

[2] Estimate by Savills (2022).

official oversight for monetary, regulatory, or institutional reasons (Schneider and Enste, 2000; Schneider, 2005; Medina and Schneider, 2018). Despite estimates suggesting that such activity accounts for over one-third of the global economy - totalling approximately $30 trillion [3] - its implications for real estate markets and stability have received little attention in the academic literature. Second, existing research shows that the shadow economy can materially affect the formulation and effectiveness of economic policy, including fiscal, monetary, and regulatory measures (Schneider and Enste, 2000; Schneider, 2005; Buehn and Schneider, 2012; Schneider and Williams, 2013; Yépez, 2019). In the context of housing markets, ignoring this hidden sector may limit the effectiveness of financial stability policies aimed at curbing excessive price growth or systemic risk.

In this paper, we treat the shadow economy as a source of unregulated liquidity that fuels demand in real estate markets. Similar to credit expansion and income growth, an increase in shadow sector activity is expected to exert upward pressure on property prices. The housing market is highly decentralised and characterised by heterogeneity, where property valuation is often opaque and idiosyncratic. This opacity facilitates price manipulation, particularly when tax evasion or regulatory avoidance is an incentive. Mounting evidence suggests that in many countries, real estate serves as a key vehicle for tax fraud, with undeclared transactions remaining a common mechanism of evasion.[4] In our context, we propose that this excess demand is not only global but also fuelled by both domestic and cross-border shadow economy activity, operating outside the visibility of formal financial systems and taxation authorities.

The literature on real estate and financial stability has identified differences between developed and developing countries. For example, Kuttner and Shim (2016) find that

[3] The World Bank estimates the world GDP at $101.33 trillion for 2022. The average size of the shadow economy exceeds 30% of the GDP worldwide (author estimates).

[4] See for example, OECD (2007), Transparency International (2017), US Office of Regulatory Analysis, Financial Crimes Enforcement Network (2006), European Parliamentary Research Service (2019).

macroprudential tools are more effective in emerging markets. Crowe et al. (2013) find that policy effectiveness and enforcement capacity vary in relation to the stage of economic development of a country. In our context, we expect the effect of the shadow economy to be stronger in developing countries for two reasons. Fist, the size of the shadow sector is much larger in developing countries compared to developed countries. Second, the regulatory framework and enforcement mechanisms are less strict in developing countries compared to advanced countries. This makes property a more attractive channel for funds from the shadow sector. Current research indicates that countries with less developed financial systems often have larger informal sectors (see Capasso et al., 2022).

Our paper empirically analyses a panel of national-level house price data for 40 countries over the period 1991 to 2017. In addition to standard macroeconomic controls commonly used in the literature, we incorporate measures of the shadow economy from the Medina and Schneider (2018) database. Our core finding is that growth in the shadow economy is significantly associated with higher house price growth. Both fixed-effects and pooled panel regressions confirm this positive relationship. A subsample analysis reveals that the effect is approximately five times stronger in developing economies, suggesting that informal liquidity plays a larger role where formal financial systems and regulatory enforcement are weaker. Notably, in the presence of shadow economy activity, short-term interest rates lose statistical significance, implying that monetary policy may have limited traction on housing markets in these settings. Quantile regressions further indicate that the effect of the shadow economy is more pronounced in the tails of the house price distribution, highlighting its role during extreme market episodes such as booms and busts. In a logistic regression framework, we show that shadow economy growth significantly increases the probability of a housing boom, defined as a cumulative 20% real house price increase over a four-year period. Finally, panel cointegration

analysis provides evidence of a long-run equilibrium relationship between the shadow economy and house prices, underscoring the structural nature of this interaction.

2. Empirical Analysis

2.1 Measures of Shadow Economy

There are several methodologies that have been developed to estimate the scale of the shadow economy.[5] First, the direct approaches which measure the shadow economy through sample surveys and tax audits. However, survey-based methods often yield conservative estimates, as respondents may underreport their engagement in informal activities to evade detection by authorities. Similarly, tax audits capture only the portion of the shadow economy identified by income tax authorities, which likely reflects only a small fraction of the actual informal economic activity. In addition to direct methods, indirect approaches have also been developed to measure the shadow economy by using macroeconomic and other indicators.

These methodologies primarily involve assessing gaps between reported income and expenditure, as well as discrepancies between official labour force data and actual employment levels. Key indirect techniques also include the transaction approach, the currency demand approach, and the physical input method, which often relies on electricity consumption data. Although these approaches provide valuable insights, they usually rely on a single indicator to represent the complex effects of the shadow economy, despite the fact that the shadow economy has a broad impact on various economic factors.

[5] Several factors contribute to the expansion of the shadow economy, with the most cited and empirically supported drivers being tax and social contribution burdens (Schneider and Buehn, 2009), quality of public institutions (Schneider and Williams, 2013), labor market regulations or trade barriers (Kucera and Roncolato, 2008; Schneider, 2011) and tax morale (Feld and Schneider, 2010).

In our study, we employ the Medina and Schneider (2018) database, which provides shadow economy indices derived from a Multiple Indicators Multiple Causes (MIMIC) model. This model accounts for various factors and indicators that contribute to the emergence and expansion of the shadow economy. The Medina-Schneider approach identifies a range of elements that may drive the growth of the shadow economy, including tax and social security contribution burdens, the quality of institutions (such as corruption), and regulatory factors like labour market constraints and trade barriers. By integrating multiple indicators, the MIMIC model enhances our understanding of the shadow economy's impact on the broader economic landscape.

The MIMIC model is a structural equation model that employs the statistical theory of unobserved variables to estimate the shadow economy as a latent variable using an analytical factor method. Within the Medina-Schneider approach, the shadow economy is treated as a latent variable. Initially, this latent variable is linked to the observed variables through a factor analytical model, commonly referred to as the measurement model. This model utilizes covariance information among the observed variables to establish the relationships. Following this, the structural model delineates the connections between the latent variable and the observed explanatory variables. Once these relationships are defined, the model integrates the data from multiple countries to produce a consistent dataset that captures the shadow economy indices for each country throughout the entire period. Following this approach, the Medina-Schneider database, provides a comprehensive panel dataset on shadow economy indices for 158 countries from 1991 to 2017. This index reflects the economic activities concealed from official authorities due to monetary, regulatory, or institutional factors, expressed as a percentage of each country's GDP.

The index has been studied in a financial setting by Markellos et al (2016) who demonstrate the effect that the shadow economy has on national credit ratings and economic stability.

2.2 Housing Prices and Known Effects

We combine our shadow economy measures from Medina and Schneider (2018) with house prices in a panel data set between 1991 and 2017 for 40 countries.[6] The Jordà, Schularick and Taylor (2017) Macrohistory Database is used to collect house price indices for 18 of the advanced countries in the sample. For the remaining 22 countries, we use house price indices from OECD. Mortgage and private credit by deposit money banks to GDP data are drawn from the World Bank. Short term interest rates are taken from the OECD, and population data from World Bank. We draw house rent to price ratio data from the OECD and nominal GDP per capita from the World Bank, respectively. All variables, except for interest rates and house rent to price ratios, are converted to growth rates using a logarithmic transformation.

The house price index growth is used as a dependent variable to capture movements in the real estate market for each country in our sample. In order to test our hypothesis, we examine the empirical relationship between the real estate market and shadow economy. Following the literature, we use a number of control variables with house price growth as the dependent variable: rent-price ratio (positive effect, Gallin 2008), income growth (positive effect, Case and Shiller, 2003), interest rate (negative effect, Sutton et al., 2017), mortgage growth (positive effect, Jordà et al., 2015), and population growth (positive effect, Mankiw and Weil, 1989). All independent variables are lagged in order to capture the typically assumed delayed effects and avoid problems in relation to endogeneity. The explanatory variables and their expected sign are summarised in Table 1.

[6] Australia, Austria, Belgium, Bulgaria, Canada, Chile, Colombia, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Russia, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, Turkey, UK and the US.

[Insert Table 1 Here]

Descriptive statistics of our variables are presented in Table 2. In our data house prices have increased over the sample studied by an average of around 2% annually. The growth has a wide variability with a standard deviation exceeding 7% and a range between -45.5% and 37.5%. House price growth has fat tails, with kurtosis above 7. The rent-price ratio takes values between 2.9% to 0.5% in our sample period. Mortgage growth also displays substantial variation in our sample with a range between -42.7% and 34.9% In line with other findings in the literature, shadow economy has shrunk over our sample period by an average annual rate of -1%. This trend may indicate a gradual decline in informal economic activities, potentially due to improvements in governance and regulatory reforms. Variation in this negative growth has been substantial, with a standard deviation of 5.2%, and a range between -14.8% and 28.1%.

[Insert Table 2 Here]

[Insert Figure 1 Here]

Figure 1 presents the average shadow economy index levels for the 40 countries included in our analysis. The evolution of the shadow economy is shown across two country groups—advanced and emerging/developing—over the period from 1991 to 2017. As shown in Figure 1, developing and emerging economies (blue line, right axis) consistently exhibit higher levels of shadow economy activity compared to advanced economies (red line, left axis), highlighting the greater prevalence of informal economic activities in these regions. In line with other findings in the literature, shadow economy has shrunk over our sample period by an average annual rate of -1%.

2.3 OLS Regression Analysis

In the empirical analysis we estimate OLS regressions with house price index growth as the dependent variable:

$$HR_{i,t+1} = a_i + bX_{i,t} + \varepsilon_{i,t} \quad (1)$$

where $HR_{i,t+1}$is the next year log growth of real house prices in country *i* and X_t is a vector of explanatory variables. This regression tests if the set of explanatory variables *X* (e.g., shadow economy growth, income growth, short term interest rate, mortgage growth and population growth) can explain one-year ahead changes in the growth of real house prices. We include country fixed effects since a Hausman test suggests that a fixed rather random country effects specification is more appropriate for the panel regression. The relevant Chi-squared test statistic is 38.51, which is significant at the 1% level. For robustness, we also estimate the models using a pooled regression (without fixed effects).

According to regression estimates presented in Table 3, the rental yield, income growth and mortgage growth are positively associated to one-year ahead house price growth. As expected, the short-term interest rate has a negative effect on house price growth. The coefficient of population growth is positive and statistically significant in the regression without fixed effects, but the coefficient turns out to be insignificant when country fixed effects are included in the regression.

The panel OLS regression results suggest that the shadow economy growth has a positive effect on house price growth. The coefficient of the shadow economy index is significant with and without country fixed effects. The size of the coefficient index is about 0.17. Given that the sample standard deviation of the shadow economy index growth is 5%, the size of the coefficient implies that a one-standard deviation shock in the shadow economy is associated

with an approximately 1% increase in real house prices. This result reaffirms our initial hypothesis that the shadow economy is a significant driver of house price growth and acts as a additional form of liquidity alongside traditional variables like mortgage growth.

[Insert Table 3 Here]

As a robustness check, we re-estimate regression (1) by including one-year lagged house price growth as an additional independent variable (Table 4), and separately by excluding the rent-price ratio (Table 5). In both regression specifications, the coefficient for the shadow economy remains statistically significant, with point estimates ranging from 0.16 to 0.17. These results confirm the positive relationship between the shadow economy and house prices.

[Insert Table 4 Here]

[Insert Table 5 Here]

We separate the countries into nine emerging/developing countries (Bulgaria, Chile, Colombia, Hungary, Mexico, Poland, Russia, South Africa, Turkey) and 31 advanced countries using the relevant classification provided by the IMF. Table 6 presents the OLS regression results for each group of countries using the pooled and fixed-effect panel regression specification employed previously. The results confirm that the shadow economy has stronger impact on house price growth in developing countries. Specifically, the effect is positive for both groups of countries, but the relevant coefficient is around 5 times higher for developing countries. A one standard deviation change in shadow economy growth (5.2%) can be associated with a 2.77% increase in housing prices for developing countries. A similar change for advanced

countries translates into a much smaller increase of 0.49% (using the fixed effects specification). [7]

[Insert Table 6 Here]

2.4 Quantile Regression Analysis: Boom and Crash Years

Given the fat tails in the distribution of house price growth, we employ quantile regression to model the lower and upper quantile. This approach makes no assumption about the distribution of the dependent variable and is robust to extreme observations. Table 7 reports the analysis for the pooled and fixed effects. We estimate the regressions using the method of moments as proposed by Machado and Santos Silva (2019). For both the 10% and 90% quantile, we observe a significant positive association with the shadow economy growth, while the effect of the other control variables is comparable to what we found previously. The coefficients for the shadow economy in three out of four regressions are significantly higher than those reported in Table 3. In conclusion, there is some evidence that the link between shadow economy growth and housing price growth is more pronounced for years that display the largest deviations (i.e., the extremes of the distribution). In other words, the shadow appears to have a greater effect during periods of housing market booms and busts.

[Insert Table 7 Here]

[7] The quantile regression and logit regression in the subsamples gave mixed results in terms of statistical significance given that the number of observations becomes much smaller. The results are available from the authors upon request.
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2.5 Logit Regression Analysis: Price Exuberance

Motivated by the possibility of short-term periods of persistent significant growth discussed in the literature (Dotsis et al., 2023), we also consider a house price exuberance (dummy) indicator as a dependent variable. We use an absolute threshold, and we define an explosive episode as a cumulative four-year increase of 20% or more in real housing prices. Therefore, the dummy variable $Y_{i,t}$ that captures a housing market boom episode in each country *i*, is defined as:

$$Y_t = \begin{cases} 1, if\ \Delta Hp_{1,4} \geq 0.2 \\ 0, otherwise \end{cases} \quad (2)$$

where $\Delta Hp_{1,4} = \log\left(\frac{P_1}{P_0}\right) + \log\left(\frac{P_2}{P_1}\right) + \log\left(\frac{P3}{P2}\right) + \log\left(\frac{P4}{P3}\right)$, and *P* represents the deflated house price variable. After the construction of the variable, we use a logistic regression to estimate the probability of the occurrence of a housing market explosive episode in country *i* one-year ahead using the set of explanatory variables *X*:

$$logit(p_{i,t+1}) = a_i + bX_{i,t} + \varepsilon_{i,t} \quad (3)$$

where $logit(p) = \ln(p/(1-p))$ is the log of the odds ratio and $X_{i,t}$ is the vector with the explanatory variables. We include country fixed effects. This regression tests if the set of explanatory variables X can predict future house price boom episodes.

The results are presented in Table 8. Our main hypothesis is again confirmed with the shadow economy having a statistically significant positive impact on the likelihood of a surge in house prices. The coefficients associated with the shadow economy are statistically significant with and without fixed effects. The computed marginal effect is about 0.79 without fixed effects and 0.34 with country fixed effects, respectively. A one standard deviation shock in the shadow growth index can be expected to increase the probability of a house price run up

over the next four years by about 5% without fixed effects and by 1.7% in the model with fixed effects). These are non-negligible effects given that in our sample the unconditional probability of an event that corresponds to a cumulative four-year inflation-adjusted increase exceeding 20% is about 16%.

[Insert Table 8 Here]

2.6 Cointegration Analysis: Long Term Equilibrium

The previous analysis investigated the relationship between growth rates in the shadow economy and growth rates in the house price index. We now focus on examining the possibility of a long-term equilibrium relationship between the levels of these variables. Specifically, we analyse the logarithmic levels of the shadow economy, income, mortgages, and population. We do not use the rent-price ratio and interest rate as these are stationary variables. Formal stationarity tests confirm the level of integration in the variables used in our study (results available upon request). The Kao (1999) residual panel cointegration test was performed with an individual intercept and one lag. The relevant ADF t-statistic is -5.6347, which is highly significant (p=0.000). The cointegrating regression of real estate index levels against those of shadow economy, income and mortgages produces positive coefficients (0.234, 0.4096, 0.056, 1.0389, respectively). This confirms that the shadow economy is linked to house prices through a long-term equilibrium relationship. Deviations from this relationship can be used to predict changes in house prices through an error-correction model. These deviations can be represented by the error-correction term, which is the residual from the cointegrating regression between house prices, shadow economy, income and mortgages.

The average value of this error-correction term across countries is depicted in Figure 2. We can observe a long-term swing in the error-correction term throughout our sample. The error-

correction term grew for almost 10 years after 1996, reaching the maximum value of disequilibrium in our sample in 2007. After the financial crisis of 2008, the error correction term reduced in magnitude steadily until 2013, after which it started increasing again. Estimation of an error-correction model (results available upon request) confirmed that the coefficient of the error correction term is significant at the 1% level with a negative sign, meaning that house prices will reduce if the cointegrating variables deviate from their equilibrium. The shadow economy growth remains significant in the error-correction model representation. The other variables have coefficients with reasonable signs.

[Insert Figure 2 Here]

3. Discussion and Conclusions

Our paper presents for the first time empirical evidence of a positive relationship between changes in the shadow economy and changes in house market prices. We argue that the shadow economy positively affects house prices by serving as an additional source of liquidity beyond formal credit, as unreported income is frequently channelled into the real estate market. We also find that in developing countries the effect of the shadow economy is predominant while interest rates do not seem to be related to changes in house prices. This challenges the implementation of monetary policy, since interest rate adjustments alone may prove insufficient to cool down an overheated housing market. Under those circumstances fiscal policy (e.g., tax on houses) may be a more appropriate policy tool. Additionally, in countries with large informal sector house rents also tend to be underreported and that may create an artificial downward bias to the computation of CPI. The understanding of the link between the informal sector and house prices can help central banks preserve financial stability more effectively.

In countries where there is a significant shadow sector, information about the property market will be distorted and prices underestimated. The magnitude of this underestimation will depend on the size of the shadow economy. This will have direct implications for property valuation using the three main approaches: market, cost, and income (Crosby et al., 2018; International Valuation Standards Council, 2022). The market approach resorts to recent selling prices of comparable properties to obtain an estimate of current prices. A significant shadow sector will mean that reported selling prices will be less than actual transaction prices. In practice, published estimates of the proportion of the shadow economy, such as those by Schneider, can be used to correct the downward bias in house prices. The underestimation of property values in the presence of a significant shadow sector has important practical implications. First, the validity of investment and financing decisions will be affected by the incorrect data. Second, price bubbles will appear less prominent, which may delay policy interventions or appropriate investment reactions. Third, relevant fiscal and monetary measures in relation to property, are likely to be less effective as they will influence mostly the formal part of the economy.

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Table 1: Explanatory Variables

Explanatory Variable	Expected sign	Explanation	Indicative references
Rent – price ratio	+	When house prices are high relative to rents future house price growth tends to be slower than usual.	Gallin, J. (2008). The Long-run relationship between house prices and rents. Real Estate Economics, 36(4), 635-658.
Income growth	+	Higher incomes increase the demand for housing. House prices go up.	Case, K.E. & Shiller, R.J. (2003). Is there a Bubble in the Housing Market? Brookings Institution Press 2, 299 – 362.
Interest rate	-	When interest rates increase mortgages are more expensive and demand for housing declines. House prices go down .	Sutton, G.D., Mihaljek, D., & Subelyte, A. (2017). Interest rates and house prices in the United States and around the world. BIS Working Papers, No. 665. Bank for International Settlements
Mortgage growth	+	High mortgage growth increases the demand for housing. House prices go up.	Jordà, Ò., Schularick, M. & Taylor, A.M. (2015). Leveraged bubbles. Journal of Monetary Economics, 76(S), 1-20.
Population growth	+	High population growth increases the demand for housing. House prices go up.	Mankiw, N.G. & Weil, D.N. (1989). The Baby Boom, the Baby Bust and the Housing Market. Regional Science and Urban Economics, 19, 235 – 258.
Shadow economy index	+	Non-declared income could be channelled to the real estate market and create upward pressure to house prices.	

Table 2. Descriptive statistics over pooled sample of 40 countries between 1991 and 2017

Variable	Mean	StDev	Max	Min	Skew	Kurt
House price growth	0.020	0.071	0.375	-0.455	-0.176	7.558
Rent to price ratio	0.011	0.004	0.029	0.005	1.752	6.311
Income growth	0.012	0.100	0.358	-0.475	-0.451	4.125
Mortgage growth	0.038	0.075	0.349	-0.427	-0.107	6.209
Short-term interest rates	0.035	0.032	0.164	-0.020	0.965	3.771
Population growth	0.005	0.006	0.033	-0.022	0.099	4.324
Shadow economy growth	-0.010	0.052	0.281	-0.148	1.191	6.127

Table 3. OLS regression of house price growth

Variables	*No fixed effects*	*Fixed effects*
Shadow economy growth	0.168***	0.166***
Rent-price ratio	5.029***	6.467***
Income growth	0.156***	0.154***
Short term interest rate	-0.494***	-0.852***
Mortgage growth	0.130***	0.171**
Population growth	0.872	0.595
Constant	-0.029***	-0.032*

****, **, *, denote statistical significance at the 1% and 5% and 10% level.*

Table 4. OLS regression of house price growth (excluding rent-price ratio)

Variables	*No fixed effects*	*Fixed effects*
Shadow economy growth	0.175***	0.178***
Income growth	0.156***	0.151***
Short term interest rate	-0.276***	-0.514***
Mortgage growth	0.094*	0.130*
Population growth	1.277**	-1.402
Constant	0.020***	0.043***

****, **, *, denote statistical significance at the 1% and 5% and 10% level.*

Table 5. OLS regression of house price growth (with one year lag house price growth as independent variable)

Variables	*No fixed effects*	*Fixed effects*
Shadow economy growth	0.159***	0.176***
House price growth	0.614***	0.583***
Income growth	-0.009	0.002
Short term interest rate	-0.153**	-0.269***
Mortgage growth	-0.057	-0.037
Population growth	1.136**	-1.490
Constant	0.010***	0.029***

****, **, *, denote statistical significance at the 1% and 5% and 10% level.*

Table 6. OLS regression of house price growth: Advanced and Developing Countries

	Advanced		**Developing**	
Variables	*No fixed effects*	*Fixed effects*	*No fixed effects*	*Fixed effects*
Shadow economy growth	0.103**	0.095*	0.533**	0.533**
Rent-price ratio	5.246***	6.319***	5.054*	10.011***
Income growth	0.111***	0.104***	0.339***	0.299**
Short term interest rate	-0.591***	-0.864***	-0.443*	-0.989***
Mortgage growth	0.188***	0.221***	0.011	0.022
Population growth	0.822*	0.909	0.774	-9.846**
Constant	-0.332***	-0.038***	-0.011***	0.029

****, **, *, denote statistical significance at the 1% and 5% and 10% level.*

Table 7. Quantile regression of house price growth

	10% Quantile		**90% Quantile**	
Variables	*No fixed effects*	*Fixed effects*	*No fixed effects*	*Fixed effects*
Shadow economy growth	0.266***	0.193**	0.248**	0.141*
Rent-price ratio	5.938***	8.277***	2.561***	4.786***
Income growth	0.165***	0.118**	0.229***	0.188***
Short term interest rate	-0.854***	-1.289***	0.207	-0.447***
Mortgage growth	0.075	0.087	0.149***	0.248***
Population growth	1.801*	1.358	-0.725	0.112
Constant	-0.103***	-0.112***	0.055***	0.041**

****, **, *, denote statistical significance at the 1% and 5% and 10% level.*

Table 8. Logit regression of house price exuberance dummy

Variables	*No fixed effects*	*Fixed effects*
Shadow economy growth	5.013**	7.011**
Rent-price ratio	238.86***	356.85***
Income growth	4.168***	5.421***
Short term interest rate	-3.746	-18.971***
Mortgage growth	4.392***	3.401**
Population growth	-24.074	-17.834
Constant	-3.965***	

****, **, *, denote statistical significance at the 1% and 5% and 10% level.*

Figure 1. Evolution of the Shadow Economy Index: Advanced vs. Emerging/Developing Economies (1991-2017)

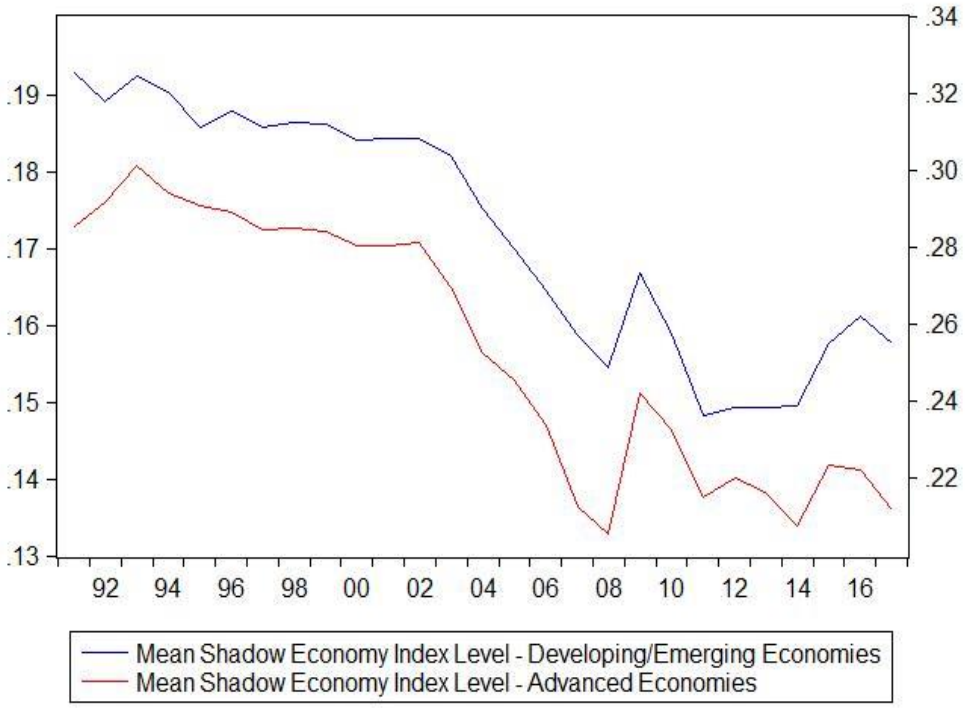

Figure 2. Average Cointegration Error-Correction term across countries