Journal of African Real Estate Research

Volume 5, Issue 1

www.journals.uct.ac.za/index.php/JARER/index

Housing Finance and Market Dynamics in Tanzania: An Analysis of Cross Sector Linkages

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To cite this article: Mushi, V.J. (2020). Housing Finance and Market Dynamics in Tanzania: An Analysis of Cross Sector Linkages. *Journal of African Real Estate Research, 5*(1), pp.16-31. DOI: 10.15641/jarer.v5i1.800.

Abstract

This study examines whether feedback from housing price shocks factored into the availability of mortgage credit in Tanzania between 2008 and 2018. This was done by estimating a Vector Error Correction Model (VECM) with mortgage financing and using three measures of house pricing trends in the luxury, mid-end and economy sub-markets as dependent variables. Results showed that mortgage credit expansion is related to housing price growth in the long-run, but the impact mostly ran from housing price shocks to mortgage growth. In the short-term, changes in price for luxury houses led to a mortgage growth in the first quarter after the shocks, which in turn stimulated changes in housing prices. However, variations on mortgage credit flows had a more significant short-term impact on prices of housing units than it did for houses priced on mortgage credit. The dynamic response between mortgage credit flow and housing prices disappeared when housing price indicators for the economy and mid-end sub-markets were used in the analysis. In addition, both mortgage credit and housing markets were highly persistent, but the effect of previous shocks lasted longer in the mortgage lending process. The paper concludes that the substantial increase in housing prices might be a major concern for policymakers, in particular, because it foreshadows a mortgage crisis.

Keywords: Housing Finance; Mortgage; Housing Markets; Co-integration; Causality

1. Introduction

Over the last ten years, both the mortgage credit market and house prices of Tanzania have experienced significant changes. The dynamic evolution of the mortgage sector in the country began to accelerate in 2008 when a market-oriented housing finance approach was established and adopted (TMRC, 2018). Since then, and leading up to the end of 2017, the volume of outstanding mortgages has increased well over 400% in real terms.

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Furthermore, the mortgage credit flow has fallen almost 90% since its peak value in the last quarter of 2015 (TMRC, 2018). Alongside the fluctuations of mortgage credit flow, substantial changes in housing prices have also been reported. As depicted in Figure 1 the average house price rapidly increased until the end of 2014 and started to fall from around mid-2016. The contraction in housing prices implies the end of a long period of expansion in Tanzania's mortgage credit market.

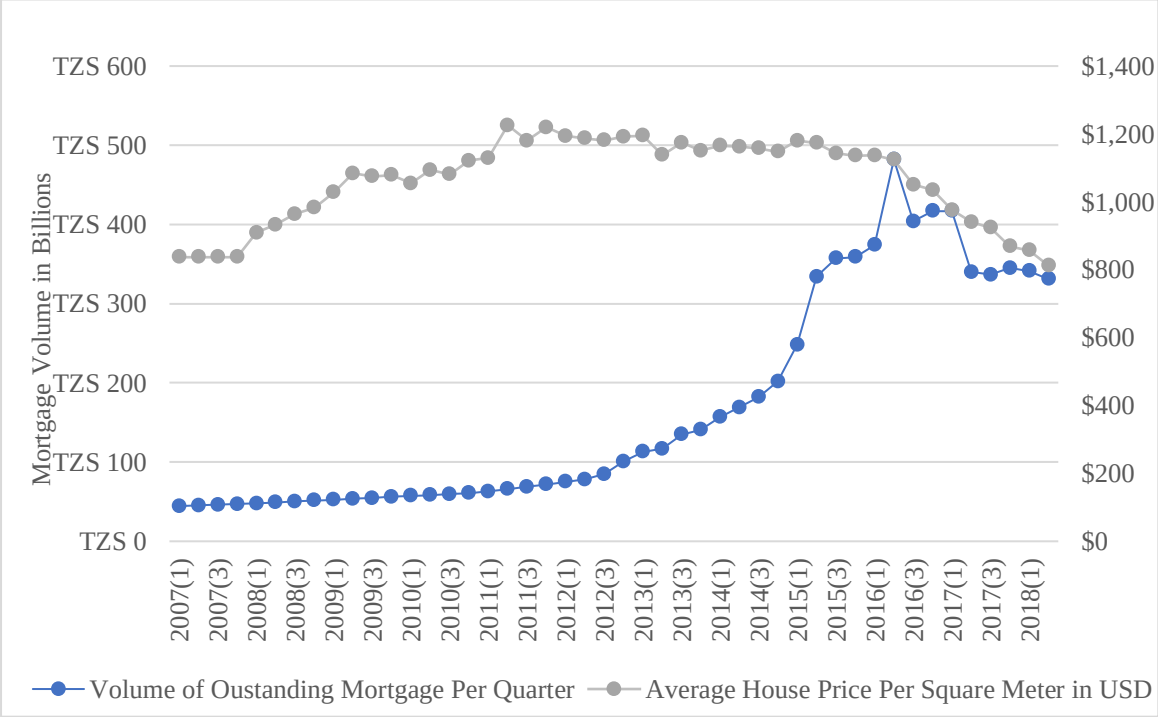

Figure 1. Quarterly Volume of Oustanding Mortgage Credit and House Price Trends in Tanzania From 2007(1) to 2018(4)

Although the structure of the mortgage market and housing prices have commonly been at the centre of economic and policy analysis in Tanzania, the literature on whether feedback from housing price shocks actually factors into the availability of mortgage credit in Tanzania is less well documented. Most studies that have analyzed mortgage credit crises in Tanzania have focused on the importance of macroeconomic stability and establishing effective mechanisms for collateralisation of housing assets in mortgage credit expansion. In particular, because low inflation and borrowing charges minimise default risks on existing loans (Boleat, 2003; Warnock & Warnock, 2008), reducing lengthy and complicated foreclosure procedures encourages primary mortgage lenders (PMLs) to offer mortgage credit to low and middle income households (Beck et al., 2011). Similarly, effective mechanisms for collateralisation of housing assets minimises information asymmetry (Levine et al., 2000; Boyd et al., 2001; Sacerdoti, 2005) [1]. On the more conceptual side, Kombe (2000), Groves (2000) and Tomlinson (2007), among others, have shown that a higher degree of informality in real estate markets and a

[1] Effective collateralisation of housing assets can be achieved by adopting effective land titling and registration systems (Sacerdoti, 2005), and addressing issues related to information asymmetries (Levine et al., 2000; Boyd et al., 2001).

lack of property ownership rights restrain the majority of households in the country from accessing the formal mortgage credit market. UN-Habitat et al. (2003) and Kironde (2003), provide a detailed discussion on remedies required in the legal and regulatory frameworks in order for the mortgage sector in Tanzania to function properly. The one notable exception is Komu (2015) who, theoretically, argues that mortgage credit flow appeared to drive housing construction output and price bubbles since 2008. That said, knowledge on whether the underdevelopment of the mortgage sector is a symptom or consequence of a limited relationship between mortgage credit flow and housing prices is not well known.

In an international context, the literature on the mortgage credit and housing price system is long and extensive. See, for example, Fitzpatrick and McQuinn (2007), Oikarinen (2009), Adrian and Shin (2009), Gimeno and Martinez-Carrascal (2010), among others. Nonetheless, cross-country generalisations are constrained by a lack of consensus about the direction of causality (Hofmann, 2002, 2004; Gerlach & Peng, 2005; Oikarien, 2009; Gimeno & Martinez-Carrascal 2010; Anundsen & Jansen, 2013; Linder, 2014), and variations on the implied speed of equilibrium-correction (Fitzpatrick & McQuinn, 2007; Caldera Sanchez & Johansson, 2011; Arestis & Gonzalez, 2013).

Given the aforementioned gap in the literature, this research explores whether self-reinforcing effects exist between mortgage credit flow and housing prices in Tanzania over the period 2008 to 2018. The study complements the existing literature twofold. First, by focusing on sectorial house price indicators the study highlights, within country variation, the importance of house price elasticity on the expansion of the mortgage credit market, and vice versa. Second, this research relates to the underdevelopment of the mortgage credit market due to the lack of feedback between the housing market and the mortgage market. Understanding the degree of associations between the markets mentioned above is a major concern, partly because a sudden collapse in the mortgage sector is often a consequence of house price shocks stimulating mortgage credit, which in turn creates a sudden fall in house prices (Bernanke & Gertler, 1989; Kiyotaki & Moore, 1997; Allen & Gale, 1999, 2000; Collyns & Senhadji, 2002; Almeida et al., 2006; Mian & Sufi, 2009; Mian et al., 2010; Flam, 2016).

The rest of this paper is structured as follows: After the background in section one there is an overview of the mortgage sector in Tanzania. The theoretical and empirical perspective on the links between housing price and mortgage originations are discussed in section three. In the fourth part, the research methodology and approach are presented. Section five and six are the test on the mortgage credit and housing price nexus and then a discussion of findings, respectively. Section seven concludes the study.

2. Mortgage Credit Development in Tanzania

The growth of the mortgage credit system in Tanzania has gone through many changes over the last five decades. Before 1972, housing finance was

dominated by housing loan schemes set up for a specific market niche. For example, the African Urban Housing Loan Scheme was set up in 1953 to support urban development by offering long-term (over 20 years) construction loans at a fixed interest rate per annum, while the Revolving Loan Fund, established in 1963, offered mortgage credit for government employees. From 1972 to 1995, the bulk of mortgage credit was mobilised from public housing finance institutions, mostly through Tanzania Housing Bank (THB)[2]. The bank was established in 1972 as a specialised PML to support and move mortgage credit operations down-market. The THB originated mortgages held until maturity, to be repaid over 20 years with a fixed interest rate. However, the bank was liquidated in 1995[3]. Following the collapse of THB, most banks were reluctant to participate in mortgage credit, except for the Azania Bankcrop and the International Bank of Malaysia, which in 2002 introduced a house purchase credit (Kironde, 2003, UN-Habitat et al., 2003).

The dynamic evolution of the mortgage sector in Tanzania began to accelerate in 2008 following the adoption of market-based reforms– that is, the economic and financial sector liberalisation in the mid-1990s. These reforms opened up the financial sector as an improved macroeconomic environment (Boleat, 2003). As a result, a number of PMLs launched various types of mortgage products at relaxed interest rates (Warnock & Warnock, 2008; TMRC, 2018). Additionally, the Tanzania Mortgage Refinance Company Limited (TMRC) (2018) identifies other important drivers as being the availability of flexible, cheap and long-term sourced funds, combined with the establishment of the Credit Reference Bureau and a series of legal reforms. While the Credit Reference Bureau has promoted better sharing of information and minimised information asymmetry and default risks (Sacerdoti, 2005), the latter has increased the maximum Loan to Value (LTV) ratio, mortgage tenor and enhanced the ability to enforce collateral (MLHHSD, 2009; BoT, 2017; TMRC, 2018).

3. Mortgage Financing and Housing Price Interaction: Conceptual and Empirical Contributions

House purchases usually require access to external funding in the form of a mortgage. This arrangement often leads to direct accelerator effects between mortgage credit systems and housing prices (Bernanke & Gertler, 1989; Almeida et al., 2006), but the dynamic response is far more complex. Using the Collateral Effect theory, Allen and Gale (1999, 2000) show that variations

[2] Other institutions include the revolving fund for civil service and National Housing Corporation (NHC). Housing finance from NHC was partly extended through the Tenant Purchase Scheme (TPS) or housing improvement Scheme. In the TPS approach, houses built by the NHC were sold under a long-term repayment option of over 15 years at a fixed rate, while under House Improvement Scheme the NHC carried out repair and respective dwelling owners required to reimburse the NHC over several years.

[3] The THB originated mortgages and financed its operations through short-term customer deposits. Thus, the high inflation and rising interest rates together with poor collateral and record-keeping as well as inherently malpractices adversely affected bank's capital base and loan recovery rate (UN-Habitat et al., 2003).

in housing prices are partly linked to increased mortgage credit availability. Conversely, Bernanke and Gertler (1989) highlight the importance of housing price elasticity to mortgage expansion patterns. They show that a more dynamic mortgage credit market might stimulate higher housing price growth, which in turn may positively affect borrowers' equity in the property as well as the level of mortgage credit demanded. Consistently, while Mehta and Mehta (1991) also suggest that expanding mortgage markets might lead to an increase in housing prices if the supply system does not respond adequately, Kiyotaki and Moore (1997) argue that mortgage credit elasticity to housing price growth occurs simply because price increases lowers borrowers' credit constraints. Malpezzi (1990) and Dubel (2007) also observe, however, that the availability of mortgage credit leads to lower-priced housing units if supply responds to credit availability adequately.

The literature on empirical tests on the nature and degree of an extended run response between measures of mortgage credit and house prices is extensive. Nonetheless, findings from these studies are inconclusive and sometimes contradictory (Lindner, 2014). For example, while Fitzpatrick and Mcquinn (2007), Adrian and Shin (2009), Oikarinen (2009), Gimeno and Martinez-Carrascal (2010) show that the two markets are cointegrated, and innovations from each market explain changes, Gerlach and Peng (2005) highlight that in the co-integration process measures of mortgage financing are weakly exogenous. The impact mostly runs from mortgage shocks to house pricing changes. Brissimis and Vlassopoulos (2008) present another view showing that measures of mortgage credit can be predicted (through Granger Causality)[4] by lags in the levels or shocks of housing price measures. Also, studies such as Goodhart and Hofmann (2003), and Davis and Zhu (2004) observe uni-directional causality in which changes in the housing price can predict innovations in mortgage credit. Conversely, Hofmann (2004) and Almeida et al. (2006) found that shocks in housing finance availability factor into the pricing of housing units. The disagreement about the direction of causality is partly linked to countries' differences in sample size and type, as well as the methodology adopted (Anundsen & Jansen, 2012).

4. Methodology

4.1 Data Sources

This study relies on secondary sources to construct quarterly indicators of mortgage flow and housing prices over the 2008 to 2018 period. The data prior to 2008 is less reliable. The data on the level of outstanding mortgage per quarter was compiled from TMRC Mortgage Update reports. The data only shows formal mortgage loans from regulated PMLs. Presently, TMRC data is only available for a cross-section of 31 PMLs since 2012. As such, this study sampled for PMLs in two stages. First, following Saunders (2000) as well as Kombo and Tromp (2006), purposive sampling was employed. To be

[4] Granger Causality is a statistical concept that determines whether the past values of one variable is useful in predicting the other variable. In this case, if the past values of housing finance contain information that is useful in predicting measures of house prices, it can be deduced that housing finance Granger causes house price measures, and vice versa.

included in the sample, PMLs had to have offered mortgage credit for at least five years. This was to ensure that PML types were properly represented in the study. Secondly, the sample size for the PMLs was determined by the formula recommended by Nassiuma (2000). The model is effective for estimating sample sizes for simple random sampling. The required sample size estimate is illustrated through Nassiuma's (2000) formula below. In the formula, 'n' is the required sample size, 'N' is the total number of mortgage lenders, 'C' is the coefficient of variation which is ≤ 30%; and 'e' is the margin of error which is fixed between 2-5%. In this analysis, the total number of mortgage lenders (N) is 31 as of the end of June 2018. The sample size has been calculated at 16% coefficient of variations and a 5% margin of error. A 16% coefficient of variations has been adopted to ensure that the sample is wide enough to justify the relevance of the results.

$$n = {NC^2}/{[C^2 + (N-1)e^2]} \quad (1)$$

$$8 = {31 * (16\%)^2}/{[16^2 + (31-1)(5\%^2)]} \quad (1)$$

Following this procedure, eight out of 31 PMLs were selected for the analysis. The selected PMLs in total supply over 60% of mortgage credit in the market, suggesting a highly representative sample size.

Housing price indicators were constructed from a sample of 750 properties collected randomly from 12 neighbourhoods in the Dar es Salaam region. The housing price data was obtained from different data portals such as online listing agencies, mainly from Zoom Tanzania and Jumia websites. Supplementary information was obtained from discussions with local leaders, real estate agents and brokers. The collected data contains detailed property-level information that has been used to estimate three independent housing price measures for tracking price trends in the three top housing submarkets. The first price indicator tracks the price trend for luxury housing units. In contrast, the second and third (economy) measures track price trends for housing units predominantly occupied by upper and lower-middle-income households. The price indicator for luxury housing units is constructed from a random sample obtained in Oysterbay, Masaki, Msasani Mikocheni, and part of Upanga, and Kawe, while the second measure tracks price trends for housing units mostly occupied by upper-middle income households in areas such as Mbezi beach, Kunduchi beach, Kinondoni, Kijitonyama, and Kinondoni. The final measure tracks price trend in the economy housing submarket, mostly accommodating households in the lower-middle-income bracket, and located in areas such as Kimara, Tegeta, Bunju, Salasala, Ubungo and Kigamboni.

Mean price per square meter is used to measure housing price indicators. The mean price is used because it is least affected by the sample size (Crone & Voith, 1992). The adoption of the three housing price indicators highlights the importance of house price (income) elasticity to the mortgage credit market.

4.2 Estimating the Vector Error Correction Method Process

The Vector Error Correction Method (VECM) approach as defined in Equation (2) is adopted to examine whether the size of the mortgage credit market is both dependent on changes in housing price, and in turn, whether it helps to stimulate growth. In this formulation, Δ indicates the first-order difference process; either for the measures of housing prices ($\mathrm{hp_t}$) or mortgage credit ($\mathrm{mtg_t}$). Subscripts "i" and "t" indicate various measures of housing price and time at a quarterly frequency. The vector (ψ) and Ω_t capture the respective trend and mean effects in the mortgage credit or housing price deterministic process, while coefficient matrix Φ_i determines how the mortgage credit or house price adjusts in the short-run. The innovations ε_τ are such that error terms are normally distributed and not correlated. Engle and Granger (1987) present a detailed theory underlying the framework. This approach has been applied in, among others, Brissimis and Vlassopoulos (2008); Oikarinen, (2009), Gimeno and Martinez-Carrascal (2010), and Linder (2014).

$$\begin{pmatrix}\Delta hp(i)_t \\ \Delta mtg_t\end{pmatrix} = \Pi \begin{pmatrix}hp(i)_{t-1} \\ mtg_{t-1}\end{pmatrix} + \sum_{i=1}^{k} \Phi_i \begin{pmatrix}\Delta hp(i)_{t-i} \\ \Delta mtg_{t-i}\end{pmatrix} + \psi\Omega_t + \varepsilon_\tau \qquad (2)$$

In equation (2), the coefficient Π is called the lagged error correction term and determines how the level of the mortgage credit or house prices adjusts to the long-run equilibrium level. If $\Pi = 0$ at 5% level of significance, then there is no long-run response (no co-integration) between the two variables. The presence of equilibrium-correction (cointegration) is determined by testing for the order (rank "m") of integration (Π) using trace and maximum eigenvalue tests proposed by Johansen (1988). The trace statistical testing proceeds by the sequence of the null of: $\mathrm{Rank}(\Pi) = \text{"M"} = 0$, against the alternative hypothesis that there is at least one cointegration relationship (i.e. $\mathrm{Rank}(\Pi) > \text{"M"}$). Then "M" is selected as the first insignificant statistic. The maximum eigenvalue approach tests if there are "M" cointegrating vectors within "$\mathrm{M} + 1$". In addition, and following Ng and Perron (2001), the Augmented Dickey Fuller (ADF) tests on residual sequence from cointegrating regression is used to examine if the two variables are non-stationary and thus co-integrated. The ADF test has the null hypothesis of non-stationarity and stationarity after the first difference as an alternative hypothesis.

Following Johnsen (1988), the lagged error correction term (Π) in (2) can be further decomposed into the feedback coefficients ("$\alpha\begin{pmatrix}\mathrm{hp(i)_{t-1}} \\ \mathrm{mtg_{t-1}}\end{pmatrix}$") and the equilibrium-correction terms ("$\beta'\begin{pmatrix}\mathrm{hp(i)_{t-1}} \\ \mathrm{mtg_{t-1}}\end{pmatrix}$") as in Equation (3). That said, if measures of mortgage credit and housing prices are co-integrated ($i.e. \Pi \neq 0$), determining which process drives the other is established by testing if individual elements in the feedback coefficients ("$\alpha\begin{pmatrix}\mathrm{hp(i)_{t-1}} \\ \mathrm{mtg_{t-1}}\end{pmatrix}$") are significant at 5% level using T-tests. If "α" is not statistically significant, it suggests that the process does not adjust to the "equilibrium" in the long-run

(i.e. is weakly exogenous), and therefore drives the other process (Engle et al., 1983).

$$\begin{pmatrix}\Delta hp(i)_t\\ \Delta mtg_t\end{pmatrix} = \alpha\beta' \begin{pmatrix}hp(i)_{t-1}\\ mtg_{t-1}\end{pmatrix} + \sum_{i=1}^{k} \Phi_i \begin{pmatrix}\Delta hp(i)_{t-i}\\ \Delta mtg_{t-i}\end{pmatrix} + \psi\Omega_t + \varepsilon_\tau \qquad (3)$$

Additionally, the test for whether measures of mortgage credit and housing prices can predict each other (i.e. Granger Causality test, 1986) is done by using the Wald test in the vector $\Phi_i\Delta hp$ and $\Phi_i\Delta mtg$. Significant coefficients will have a P-Value of less than 0.05. If coefficients in the vector $\Phi_i\Delta hp$ and $\Phi_i\Delta mtg$ are jointly significant at 5%, this implies dual causality. If the coefficient in one of the vectors is significant this suggests unidirectional causality. When the process is weakly exogenous and does not predict (Granger Cause), the other process is strongly exogenous. Finally, if estimated coefficients in the vector (Φ_i) are close to one, this means that shocks to the process are highly persistent, while a close to zero coefficient in the vector (Φ_i) indicates that impulse response is more transitory.

Estimation of equation (3) is done by using the cointegration dynamic system analysis available in PcGive module, OxMetrics. For estimation overviews see Doornik et al. (1998). A logarithmic transformation of the variables included in equation (2) and (3) is used to eliminate problems related to heteroscedasticity and non-normality in the data. The modified Akaike Information Criterion (AIC) is used to determine the appropriate lag length to create white noise for the ADF tests. Starting with an initial lag length of four the specification with the lowest AIC valued was adopted.

5. Results on Cointegration Analysis

5.1 The Trend on Housing Price and Mortgage Growth in Tanzania

As a preliminary exploration, Figure 2 depicts the dynamic evolution of the mortgage credit and housing prices over the 2008 to 2018 period. The trend shows a sudden rise and fall on the quarterly house price indicators. However, the housing price growth trend differs across income levels. The most significant increases in housing prices have been in the main areas accommodating luxury and upper-middle income housing units compared to neighbourhoods characterised with economy housing units. The price levels for the upper-middle income households has increased more than 20% since mid-2009 and deteriorated shortly after 2012. Still, the market for luxury housing quickly recovered. In synchrony with the rise and fall in house prices are fluctuations in mortgage credit flow. The mortgage credit growth in 2012 was already three times as high as the growth rate prices for luxury housing, signifying that the expansion of mortgage credit flow contributed to increasing house prices, which in turn stimulated growth. The contraction in housing prices for luxury houses in 2016 implied the end of a long period of expanding mortgage credit in Tanzania.

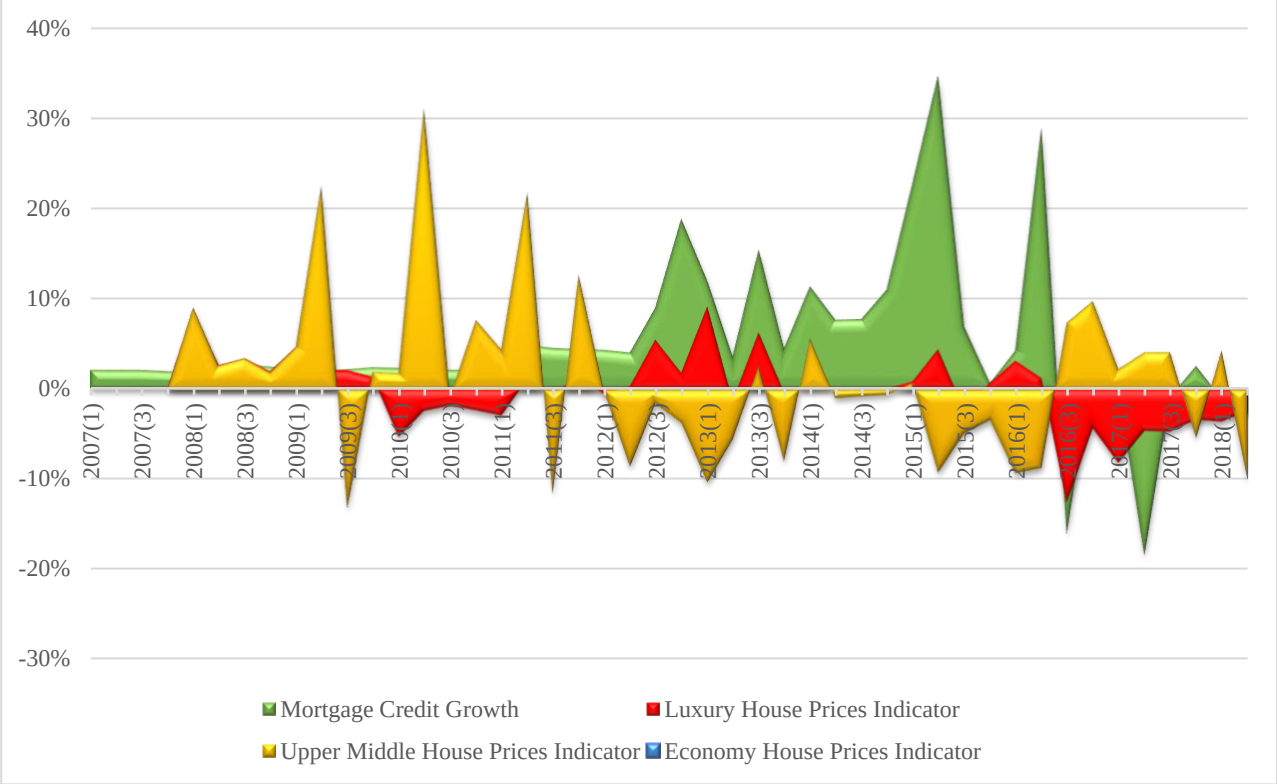

Figure 2: Mortgage Credit and House Prices Growth Trend in Tanzania

5.2 Cointegration Tests

Judging from the results of the ADF test presented in Table 1, the residual sequence from housing finance and price measures is stationary at a 5% level after first differencing. This sequence signifies that the level of house prices and mortgage credit measures are non-stationary and possibly co-integrated (See Granger, 1986; Engle & Granger, 1987; Mackinnon, 1991; Banerjee et al., 1993; and Johansen 1992, 1995). According to AIC, the VAR model, with two lag lengths, was enough to crease white noise on residuals.

Table 1: Unit Root Test

Variable	ADF Critical Value	Order of Integration	Decision at Level
Measure for Luxury Housing Prices	-5.8352**	I(1)	Non-Stationary
Measure for Mid-End Housing Prices	-5.5954**	I(1)	Non-Stationary
Measure for Economy Housing Prices	-4.5736**	I(1)	Non-Stationary
Mortgage Credit		I(1)	Non-Stationary
Note 1: ** significant at 5% level *Source: Author Analysis (2018)*			

The maximum eigenvalue test (output in Table 2) shows there are two very small eigenvalues, suggesting that the rank of the long-run matrix to be less

than three, while the Trace test rejects the null hypothesis of no co-integration at 1% level and shows the rank of co-integration is one based on the P-values. As discussed below, the model is well specified and indicates measures of mortgage credit and housing prices adjusted to the long-run equilibrium level.

Table 2: Co-integration Analysis

Hypothesised No. of Co-integration Relationship	Maximum Eigenvalue	Trace Test Statistic	P-Values**
None		52.204	0.017*
At Most 1	0.51489	20.376	0.409
At Most 2	0.28764	5.4522	0.760
At Most 3	0.09254	1.1794	0.277
At Most 4	0.02645		
* Denotes rejection of the Null hypothesis at 1% level, *Source: Author Analysis (2019)*			

5.3 The Long-run Dynamic Evolution of House Prices and Mortgage Credit

Panel 1 of Table 3 summarises the results on the long-run effect of disequilibrium in the mortgage and house markets. Loading factors suggest that both indicators of housing prices and mortgage credit flow are adjusted in the subsequent quarter if the data generating processes differ significantly from values implied by their corresponding fundamentals. The degree of long-run adjustment to the effect of disequilibrium in mortgage credit flows range from 14% to 17%. The level of adjustment to the effect of disequilibrium in house prices is 57% for the luxury housing price indicator and 64% for the upper-middle income housing price indicator. Conversely, the house price indicator for the economy houses does not adjust in the long-run. Estimations are significant at the 5% level.

Results summarised in Panel 2 of Table 3 show how the level of the mortgage credit adjusts to the long-run equilibrium level (as contained in vector β) to the effect of disequilibrium in house prices, or vice versa. The evidence implies that mortgage credit corrects any deviations from the long-run equilibrium in response to house price growth, meaning that an increase in housing prices drives the size of the mortgage credit flow in the long-term. The speed of adjustment ranges from 30% to 36% per quarter. Conversely, house prices do not respond to fluctuations in the mortgage debt market, and it is therefore weakly exogenous. All results are significant at the 5% level. Furthermore, output in diagnostic tests (Panel 3, Table 3) shows that residuals are not correlated and seem to be relatively normally distributed and homoscedastic, signifying that all models are properly specified, and results are robust and valid.

Table 3: Long-Run Relationship

Description of House Price Indictor	**PANEL 1 Adjustment Factor (−α)**		**PANEL 2 Equilibrium Correction Term**	
	$\alpha\ hp(i)_{t-1}$	$\alpha\ mtg(i)_{t-1}$	$\beta' hp(i)_{t-1}$	"$\beta' mtg_{t-1}$
For Luxury Housing	0.57 [0.184] ***	0.18 [0.033]***	0	0.30
For Mid-Income Housing	0.64 [0.245] **	0.16 [0.0315]***	0	0.33
For Economy Housing	-0.06 [0.18]	0.144 [0.035]***	0	0.36
PANEL 3: Diagnostic Checks				
AR 1-2 test:	**ARCH 1-1 test:**	**Normality test:**		**Hetero test:**
0.73130 [0.4881]	0.46261 [0.5002]	0.69769 [0.7055]		2.3280 [0.0530]
0.30367 [0.7399]	0.085045 [0.7720]	0.091546 [0.9553]		0.60081 [0.7277]
0.42628 [0.6561]	0.022368 [0.8818]	0.20097 [0.9044]		1.4038 [0.2400]

Note 1: *** represents significant at 1% level, ** indicates significant at 5% level and * shows significant at 10% level. **Note 2:** The 5% critical value for the Test for No Cointegration in the process with two variables is negative 2.31. **Note 3:** Wald test for the joint significance of the various respective coefficients contained in the adjustment factors as well as co-integration parameters.
Source: Author Analysis (2018)

5.4 Can Mortgage Credit and House Prices Predict Each other?

Following Engle et al. (1983), since the notion of weak exogeneity was not rejected in the analysis above, this section presents an insight on whether the pricing of housing units triggers changes in the mortgage credit availability, or vice versa by using the Wald tests as described above. The results are displayed in Table 4. First, the relationship between mortgage credit and the housing price indicator for the luxury units is examined. The bivariate correlation shows that the causal effects appear to operate in both directions. Mortgage credit growth is supported by an increase in house prices, while the expansion of the mortgage credit market further develops house prices for luxury units. What is clear is that both housing finance and price measures can only be predicted by the lag in changes rather than the level of previous information of other processes. Indeed, evidence shows an increase in mortgage credit flow leads to a significant and negative change (1.06%) in housing prices in the first quarter after a shock. Additionally, rising housing prices lead to a significant fall (0.037%) of mortgage credit, and vice versa. This is consistent with Malpezzi (1990) who observed that the deeper the penetration of a country's mortgage credit market, the more affordable its housing units are as long as the supply system responds adequately.

Conversely, Granger Causality is rejected in models estimated using the economy and mid-end housing price measures as dependent variables. The latter results confirm that mortgage credit taken explicitly to finance housing does not seem to drive (or Granger Caused) changes in housing price measures for the economy and mid-end housing submarkets. Indeed, since housing price measures in these submarkets are weakly exogenous as well as somewhat unresponsive to mortgage innovations. They are strongly exogenous.

Finally, Table 4 shows that changes in mortgage finance availability and housing price measures are strongly determined by previous information of each variable. In mortgage lending processes, however, the impact of previous information in the first quarter after the shock is over 50% and strong. The influence of previous knowledge is less than 50% in the price of housing units in the next quarter. This signifies that the mortgage origination process is rather unresponsive to news relative to housing price measures. More striking, however, is the impact of previous information. In the first quarter after the shock there is less than 16% in the mid-housing submarket, while the influence of previous information is approximately between 50% and 39% in the next quarter after the shock in the luxury and economy housing submarkets. This suggests that the data generating process in the mid-housing sub-market adjusts more quickly compared to other measures of housing price.

Table 4: Short-Run Dynamics Using Granger Causality Tests

Type of Housing Market	Variable of Interest	Adjustment Coefficients			Trend Constant	Wald Test:
		$\Phi_1\Delta Mt_{t-1}$	$\Phi_1\Delta hp_{t-1}$	$\Phi_2\Delta hp_{t-}$	φ	
Luxury	ΔMt_t	0.53 [0.08]***	-0.037 [0.019]**		1.23 [0.22]***	105.9 [0.0000] **
	Δhp_t	-1.06 [0.450] **	0.50 [0.128] ***		2.51 [1.55]	
Mid-End	ΔMt_t	0.59 [0.073]***	-0.025 [0.02]		1.077 [0.21]***	81.63 [0.0000] **
	Δhp_t	-1.16 [0.643]	0.162 [0.147]		2.33 [2.33]	
Economy	ΔMt_t	0.65 [0.077]***	-0.017 [0.023]		0.95 [0.22]***	49.82 [0.0000] **
	Δhp_t	-0.15 [0.45]	0.39 [0.15] ***	-0.39 [0.15] ***	0.73 [1.53]	

Note 1: *** represents significant at 1% level, ** indicates significant at 5% level and * shows significant at 10% level. **Note 2:** The coefficient Φ_1 describes changes that help restore an equilibrium market position. The coefficient Π_0 describes short-term changes resulting from previous changes in the market – which need not have permanent effects on the levels. The β coefficients characterise long-run relationships between levels of variables.
Source: Author Analysis (2018)

6. Discussion

In this analysis, three models were estimated based on three housing price measures, and findings showed evidence of co-integration between the availability of housing finance and pricing of housing units. Specifically, the evidence seems to suggest that there is a uni-directional influence where mortgage credit adjusts to the long-run equilibrium relationship (and not vice versa), indicating the lending view expressed in several studies. These include, among others, Bernanke and Gertler (1989), Kiyotaki and Moore (1997), Hofmann (2004), Fitzpatrick and McQuinn (2007), Brissmis and Vlassopoulos (2008), where it is shown that property prices are likely to have induced the ups and downs in the mortgage credits in the long-run. The estimated 0.3 to 0.36 elasticity of mortgage credit concerning house prices in

the long-term is significantly lower than 0.76 as observed by Anunndsen and Jansen (2012) in Norway, or around 1.41% as observed by Fitzpatrick and McQuinn (2007) and Gimeno and Martinez-Carrascal (2010). Part of the reason for the observed low elasticity of mortgage credit flow with respect to changes in house prices is that the housing finance is used by less than 2% of adult households in Tanzania, and most creditworthy borrowers (FinScope, 2006, 2010; Bah et al., 2018). Furthermore, higher housing prices decrease affordability levels, and subsequently the amount of mortgage credit needed from formal PMLs.

The evidence above shows that variation in mortgage credit flow is closely correlated with pricing measures for luxury houses, which is not surprising given that mortgage credit facilities in Tanzania are mostly used by creditworthy borrowers (FinScope, 2006, 2010; Tomlinson, 2007). Those who can secure mortgage credit are often required to provide an initial payment of up of 20% or higher of the collateral value. The evidence of Granger Causality also signifies that prices for luxury houses and mortgage credit flow are mutually re-enforcing, meaning that an increase in prices for luxury houses leads to an expansion in mortgage credit flow, which in turn puts an upward pressure on housing prices (Fitzpatrick & McQuinn, 2007; Gimeno & Martinez-Carrascal, 2010).

It is also noted that mortgage credit flow does not adjust with changes in prices for the economy or mid-end housing markets, contrary to the aforementioned theory that advocates for significant and positive Granger Causality between housing prices and mortgage credit flow (e.g. Bernanke & Gertler, 1989; Kiyotaki & Moore, 1997; Allen & Gale, 1999, 2000; Almeida et al., 2006). In the case of Tanzania, this is not surprising given that households in low-income brackets are frustrated by their inability to access mortgage facilities for housing purchases. Majale et al. (2011) and Bah et al. (2018) identify essential drivers of this trend as being low income relative to mortgage, combined with high down payment requirements and interest rates. The other part of the reason is the lack of streamlined development of housing and land information systems as well as unregulated real estate market operations which undermine the mortgage credit market in these sub-markets (Levine et al., 2000; Boyd et al., 2001; UN-Habitat et al., 2003; Bah et al., 2018). In such contexts, those who cannot secure a formal mortgage credit are forced to use informal sources of housing finance (Kombe, 2000; Groves, 2004; Sacerdoti, 2005; Tomlinson, 2007), resulting in a low level of correlation between changes in formal mortgage credit and housing prices.

7. Conclusion

This research examined the nature and degree of association between housing prices and mortgage credit flow in the long-run using quarterly sample data from 2008 to 2018. The findings show that the mortgage credit flow over the study period is correlated with housing price measures in ways explained by existing theories. Specifically, price indicators for luxury houses has the highest level of correlation with mortgage credit flows, while price indicators for the mid-end and economy houses have a low level of association with

mortgage credit flow. Furthermore, evidence of a uni-directional co-integrational relationship, where mortgage credit adjusts to the long-run equilibrium, is documented. This outcome supports the view that mortgage credit flow depends on housing prices due to collateral effects. In the short-term, however, evidence of self-reinforcing effects was established in the luxury housing sub-market, where an increase in housing prices leads to mortgage credit growth, which in turn spurs positive changes in housing prices. The inclusion of mid-end and economic housing prices in the estimation dampens the existence of a short-term dynamic response between mortgage credit flow and housing prices. It is thus likely that the increased housing prices in the luxury housing sub-market might have had a substantial positive impact on mortgage credit flow recorded between 2008 to 2018 on the one hand. The slow development signifies how the formal mortgage credit sector is incompatible with the mortgage credit needs of middle and low-income households in Tanzania on the other.

8. References

Allen, F. & Gale, D. (2000). Bubbles and Crises. *The Economic Journal, 110* (460), pp 236-255.

Allen, F. & Gale, D. (1999). Bubbles, Crises, and Policy. *Oxford Review of Economic Policy, 15*(3), pp.9-18.

Almeida, H., Campello, M. & Liu, C. (2006). The Financial Accelerator: Evidence from International Housing Markets. *Review of Finance, 10*(3), pp.321-352

Anundsen, A.K. & Jansen, E.S. (2012). *Self-reinforcing Effects Between Housing Prices and Credit*. Working Paper. University of Oslo.

Bah E.M., Faye I. & Geh Z.F. (2018). Housing Finance in Africa. In: *Housing Market Dynamics in Africa*. London: Palgrave Macmillan.

Banerjee, A., Dolado, J.J., Galbraith, J.W. & Hendry, D.F. (1993). *Co-integration, Error Correction and the Econometric Analysis of Non-Stationary Data*. Oxford: Oxford University Press.

Bank of Tanzania. (2017). Monthly Economic Review. Dar es Salaam: Bank of Tanzania.

Beck, T., Munzele, M., Faye, I. & Triki, T. (2011). *Financing Africa: Through the Crisis and Beyond*. Washington, DC: World Bank Publications.

Bernanke, B. & Gertler, M. (1989). Agency Cost, Net Worth and Business Fluctuations. *The American Economic Review, 79*(1), pp.14-31.

Boyd, J.H., Levine, R. & Smith, B.D. (2001). The Impact of Inflation on Financial Sector Performance. *Journal of Monetary Economics, 47*(2), pp.221-248.

Brissimis, S.N. & Vlassopoulos, T. (2008). The Interaction between Mortgage Financing and Housing Prices in Greece. Finance and Economics. *The Journal of Real Estate, 39*(2), pp.146-164.

Crone, T. & Voith, R. (1992). Estimating house price appreciation: A comparison of methods. *Journal of Housing Economics, 2*(4), pp.324-338.

Collyns, C. & Senhadji, A. (2002). *Lending Booms, Real Estate Bubbles and the Asian Crisis*. Working Paper. International Monetary Fund.

Davis, P. & Zhu, H. (2004). *Bank Lending and Commercial Property Cycles: Some Cross-Country Evidence*. *Journal of International Money and Finance, 30*(1), pp.1-21.

Diamond, D. & Lea, M. (1995). Sustainable Financing for Housing: A Contribution to Habitat II. Washington, DC: Fannie Mae Office of Housing Research.

Doornik, J.A., Hendry, D.F. & Nielsen, B. (1998). Inference in cointegrated models: UK M1 revisited. *Journal of Economic Surveys, 12*(5), pp.533-572.

Engle, R.F., Hendry, D.F. & Richard, J.F. (1983). Exogeneity. *Econometrica: Journal of the Econometric Society, 51*, pp.277- 304.

Finscope. (2006). *Access to Housing Finance in Africa: exploring the issues*. Johannesburg: FinMark Trust.

Finscope. (2010). *Access to Housing Finance in Africa: Exploring the Issues. Issue no 10, Overview of the housing finance sector in Tanzania*. A Johannesburg: FinMark Trust.

Fitzpatrick, T. & McQuinn, K. (2007). House Prices and Mortgage Credit: Empirical Evidence for Ireland. *The Manchester School, 75*(1), pp.82-103.

Gerlach, S. & Peng, W. (2005). Bank Lending and Property Prices in Hong Kong. *Journal of Banking and Finance, 29*(2), pp.461-481.

Gimeno, R. & Martinez-Carrascal, C. (2010). The Relationship Between House Prices and House Purchase Loans: The Spanish Case. *Journal of Banking and Finance, 34*(8), pp.1849-1855.

Goodhart, C. & Hoffman, M. (2003). *Deflation, Credit and Asset Prices.*

Granger, C.W.J. (1986). Development in the Study of Cointegrated Economics Variables. *Oxford Bulletin of Economics and Statistics, 48*(3), pp.213-228.

Granger, C.W.J. (1988). Some Recent Development in a Concept of Causality. *Journal of Econometrics, 39*(1-2), pp.199-211.

Groves, R. (2004). Challenges Facing the Provision of Affordable Housing in African Cities. *Housing Finance International, 18*(4), pp.26-31.

Hendry, D.F. & Richard, J.F. (1983). The econometric analysis of economic time series. *International Statistical Review, 51*, pp.111-63.

Hofmann, B. (2004). The Determinants of Bank Credit in Industrialized Countries: Do Property Price Matters? *International Finance, 7*(2), pp.203-234.

Johansen, S. (1995). *Likelihood-based Inference in Cointegrated Vector Autoregressive Models*. Oxford: Oxford University Press.

Johansen, S. (1992). Testing weak exogeneity and the order of cointegration in UK money demand. *Journal of Policy Modeling, 14*(3), pp.313-334.

Kironde. L., Mabele, R. & Mutagwaba. H. (2003). *Re-establishing Effective Housing Finance Mechanisms in Tanzania: The Potentials and The Bottlenecks, the Government of Tanzania and UN-HABITAT*. Nairobi, Kenya: United Nations Human Settlements Programme in

Kiyotaki, N. & Moore, J. (1997). Credit and Cycles. *Journal of Political Economy, 105*(2), pp.211-248.

Kombe, W. (2000). Regularizing Housing Land Development During the Transition to a Market-led Supply in Tanzania. *Habitat International, 24*(2), pp.67-184.

Kombo, D.K. & Tromp, D.L.A. (2006). *Proposal and Thesis Writing: An Introduction.* Nairobi: Don Bosco Printing Press.

Komu, F. (2015). Delivering Mortgage Finance Services In Tanzania: Spotlights On Housing Boom And Burst. In Proceedings of the African Real Estate Society Conference, p.123.

Levine, R., Loayza, N. & Beck, T. (2000). Financial Intermediation and Growth: Causality and Causes, *Journal of Monetary Economics 46*(1), pp.31-77.

Lindner, F. (2014). The interaction of mortgage credit and housing prices in the US". IMK Working Paper, p.133. Dusseldorf.

Mian, A. & Amir, S. (2009). The Consequences of Mortgage Credit Expansion: Evidence from the U.S. Mortgage Default Crisis. *The Quarterly Journal of Economics, 124*(4), pp.1449-1496.

MacKinnon, J.G. (1991). Critical values for cointegration tests, in R.F. Engle and C.W.J. Granger, eds., *Long-run economic relationships: Readings in cointegration*. Oxford: Oxford University Press.

Nassiuma, D.K. (2000). Survey sampling: Theory and Methods. Njoro, Kenya: Egerton University Press.

Ng, S. & Perron, P. (2001). Lag Length Selection and the Construction of Unit Root Tests with Good Size and Power. *Econometrica, 69*(6), pp.1519-1554.

Oikarinen, E. (2009). Interaction Between Housing Prices and Household Borrowing: The Finnish Case. *Journal of Banking and Finance, 33*(4), pp.747-756.

Sacerdoti, E. (2005). *Access to Bank Credit in Sub-Saharan Africa: Key issues and reform strategies*. IMF Working Paper WP/05/, pp.166.

Saunders, M.K. (2000). Research Methods for Business Students, Second Edition, New York, Prentice-Hall.

Senbet, L. & Otchere. I. (2005). Financial Sector Reforms in Africa: Perspectives on issues and policies. Prepared for the Annual World Bank Conference on Development Economics (ABCDE), Dakar, Senegal, January.

Tanzania National Bureau of Statistics. (2012). 2012 Population and Housing Census. Available from https://www.nbs.go.tz/

Tanzania Mortgage Refinance Company LTD. (2018). Tanzania Mortgage Market Update. [Online]. Available at: https://www.tmrc.co.tz/

Tomlinson, M.R. (2007). *A Literature Review on Housing Finance Development in Sub-Saharan Africa*. Johannesburg: FinMark Trust.

UN-Habitat (2003). *Re-establishing Effective Housing Finance Mechanisms in Tanzania: The potentials and Bottlenecks*. Nairobi: United Nation Human Settlements Programme.

Warnock, F. & Warnock, V. (2008). Markets and Housing Finance. *Journal of Housing Economics, 17*(3), pp.239-25.