Transparency and Affordability of Housing Market: Evidence from Sectorial Level Analysis in Turkey

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ABSTRACT

This study aims at investigating the transparency and affordability of the Turkey housing market through the supply and demand for housing in Turkish sectorial level (public, private, and cooperative sectors). This study has been motivated by official reports of the Global Real Estate Transparency Index, and the World Bank Group relating to transparency and housing affordability in Turkey's housing markets. Inferences made through those documents revealed that transparency and affordability of the housing market in Turkey are necessary to examine at this moment. To achieve the main objective of this study, quarterly data ranging from 2002Q1 to 2021Q4 was obtained from the Statistical Institution of Turkey (TURKSTAT). The variables used in this study are supply and demand for housing in Turkey, construction permit, and occupancy permit, consumption on a fixed income, transparency, and financing variables. We employed the NARDL framework and granger causality test for the analysis. The findings of this study revealed that there is significant evidence of a long-run asymmetric relationship between housing supply and demand in both public and private housing market sectors, but the relationship is symmetrical in the cooperative housing market sector. The finding further revealed evidence of lower affordability in acquiring houses through the three sectors. Thirdly, relationship between transparency and supply of housing in the public sector exhibit asymmetric long-run relationship but symmetric relationship in the short run. The finding further revealed that both transparency and consumption on a fixed income are among challenges facing housing affordability in the Turkish market. At the same time, findings revealed that the sectorial housing market in Turkey is interrelated.

Keywords: Supply and demand, housing affordability, consumption, transparency, Turkey.

1. INTRODUCTION:

Housing affordability and transparency have been issues in which well researched by several researchers as a separate issues. Housing affordability is a measure of the socio-economy stability of a country (Suhaida *et al.*, 2011). As of January 2022, the Turkish affordability housing project portfolio constituted 85% for the low-and-middle-income group while the remaining 14% is for less privileged citizens (toki.gov.tr, 2022). A total of 1,062, 676 housing units are projected to be completed in 81 provinces, with 7,093 tenders finalized amounting to 180 Billion TL. To participate in the scheme, income earners make down-payment after tender followed by the monthly payment due that is subject to increase on a semi-annually basis for10-20 years of settling the mortgage based on beneficiary income pattern. Similarly, an average of 36 months are required for the completion of house construction (toki.gov.tr, 2022). This is consistent with the argument that a series of policies are set in place that tends to prevent low- and middle-income groups from owning houses (Suhaida *et al.*, 2011). Therefore, this study aims at investigating the transparency and affordability of the Turkish housing market through

the supply and demand of the housing market in Turkey from the sectorial perspective (public, private, and cooperative sectors). Similarly, Bajunid and Ghazali (2012) reported that the provision of providing affordable houses is shared between private and public sectors in Malaysia with greater performance traceable to the private sector over public sectors in the 80s and 90s while the recent millennium is facing the problem of affordable houses. The findings on housing affordability have been prone to debate. Hwang and Smith (2006) argued that housing affordability fails to reveal whether the housing price is above or below the intrinsic value but rather observes housing affordability from the inability of most home buyers to pay the price even when the house price is worth the price. Contrary to that, Suhaida *et al.* (2011) argued that housing affordability ensures that all earner income groups could afford the available houses irrespective of low-income, medium-income, and high-income groups. This implies that housing affordability could be view from different perspectives to arrive at a valid conclusion.

Besides the aforementioned, this study was further motivated by official reports made by Global Real Estate Transparency Index, and World Bank Group. The World Bank Group reported that between 2018 and 2019, the Turkish economy experiences a slowdown which caused a drop in real wages (Cuevas, 2020), which is followed by another unfortunate event that the global economy is facing (the COVID-19 pandemic) now. It is obvious that COVID-19 affects nearly sectors and the effect remains active till the time of compiling this article. In addition, the Global Real Estate Transparency Index ranked the Turkish real estate market in 43rd position in 2020 (JLL, 2020), In addition, graph presented in Farzanegan and Fereidouni (2014) study, revealed that Turkish transparency index is steadily increasing between 2004 and 2010 while some countries such as South Korea and Czech experienced a sharp decrease. Therefore, examining the transparency and affordability of the housing market in Turkey is essential at this moment.

Brief about the findings of this study are; firstly, there is significant evidence of a long-run asymmetric relationship between housing supply and demand in both public and private housing market sectors, but the relationship is symmetrical in the cooperative housing market sector. Still, there is insignificant long-run effect in the relationship between housing supply and demand across all Turkish housing supply sectors which signifies insignificant level of housing affordability across the three sectors. Secondly, consumption and financing established both long-run and short-run asymmetric relationships in the public housing market. This could signifies lower affordability in acquiring houses through the public sector. Whilst, consumption established short-run asymmetric relationships in private and cooperative housing markets. Thirdly, relationship transparency and supply of housing in the public sector exhibit a long-run asymmetric but an asymmetric relationship in the short run. Fourthly, there is evidence of an asymmetric relationship between transparency and housing supply in the cooperative sector in both the long-run and short-run while access to finance is asymmetric with the supply of housing in the long run. In summary, transparency in the housing market has been a concern globally while housing affordability is related to the economic performance of each nation. Both transparency and affordability are also challenging issues in the Turkish housing market. At the same time, findings revealed that the sectorial housing market in Turkey is interrelated.

The remaining of this study is structured as section 2 discusses previous studies on housing affordability followed by section 3 which focuses on the methodology used in this study. Section 4 explains the findings of this study and section 5 is the conclusion of this study.

2. LITERATURE REVIEW

Several studies have investigated the housing market from different perspectives globally. However, studies on transparency, affordability, and financing are closely related to the current study. The following reviewed literature focuses on transparency, affordable housing, financing and consumptions in the context of real estate.

2.1 Transparency

A transparent real estate market is described as a market that is fairly corruption free, and by making necessary information available and consistently operates in a fair manner (JLL 2006). Being that transparency is a strong issue in real estate, several studies have examined transparency in the real estate sector from a different perspectives. Sadayuki *et al*. (2019) examined transparency issues in the real estate sector across 44 countries with data that range from 2004 to 2016 using panel data analysis to find out that regulators play a significant role in enforcing information transparency for the real estate sector which tends to lowering asymmetric information. Similarly, Eichholtz *et al.* (2011) concluded that an increase in transparency of the global real state sector has become an important consideration factor for the foreign investors and significantly contributed positively to the performance of the real estate sector. In addition, Farzanegan and Fereidouni (2014) investigated the implication of real estate transparency concerning foreign investors investing in real estate. Besides this, a lack of transparency prevents effective accountability on how the real estate funds were utilized and lowers the integration of such a sector (Kumeh *et al.*, 2019). This signifies that lack of transparency has been a huge cost to real estate sectors. Brady *et al.* (2018) reported that lack of transparency is costly and even gives rise to several other problems such as on-site communication issues as well as poor process orientation and even increases the level of waste most especially in construction planning and control, linking transparency with climate change issue and sustainability is inevitable. Transparency is further identified as an essential factor necessary to improve performance on climatic issues (Kamil *et al.*, 2021). This strengthens that transparency in the real estate sectors is inevitable as it is essential in achieving sustainability in the foreign funds to the real estate sector, being that sustainability is very essential, so also transparency of real estate sector. As a result, the hypothesis 1 (H_1) is developed as follows:

> H_1: Affordable housing in Turkey is negatively influenced by transparency in Turkish housing markets.

2.2 Affordable Housing

Housing affordability is mostly expressed as a rent-income ratio (Himmelberg *et al.*, 2005; Musa *et al.*, 2011). However, in the current situation where the global economy is experiencing a continuous nearly hyperinflation – continuous increase in the price of commodities. Therefore, it may be inappropriate to use income that slightly increases on yearly basis to judge housing affordability rather using consumption or expenditure may be more appropriate. This is because the saving would lower, when the price of goods and services increases, and at the same time, this could also predict the possibility of getting access to finance. Housing affordability is being pressured by several factors. According to Blakeley (2021), housing, in particular, has become an asset in which attract financial speculation rather than view as a commodity as it was before. Furthermore, Bajunid and Ghazali (2012) reported on the overhang

of affordable houses as provided by private and public sectors in Malaysia. Both housing suppliers and buyers face financial related problems differently. Milwicz and Nowotarski (2015) reported that housing affordability has a great influence on the market condition.

> H_2: Affordable housing in Turkey is influenced by housing demand in Turkish housing markets.

2.3 Financing and Consumption Literature

Lee *et al.* (2021) investigated fluctuations in housing prices and the stability of financial institutions in 31 OECD and emerging Asian countries to reveal the presence of asymmetric information between the lending institution and individual borrowers. Such moral hazard might have contributed to housing unaffordability. As it could also trigger the possibility of default in refunding the loan and eventually reducing the possibility of giving out mortgage loans by the financial institutions through more stringent policy. Bilal *et al*. (2029) argued that higher housing financing cost increases the unaffordability of housing by low-and-middle-income house buyers and this makes it difficult for the lower and medium income class population to secure financing loan. In the same vein, Razak *et al.* (2015) reported that despite the relentless effort made by the Malaysian authorities to ensure easy accessibility to finance and affordable houses, rather abandoned housing projects constituted a significant proportion in the Malaysian context.

> H_{3a}: Affordable housing in Turkey is negatively influenced by rate of consumption on fixed income.
> H_{3b}: Lack of accessibility to finance negatively influenced housing affordability.
> H_{3c}: Higher consumption rate negatively influenced housing affordability.

3. DATA AND METHODOLOGY

The quarterly data for this study was obtained from the department of statistics of turkey (data.tuik.gov.tr) and the data ranges from 2002Q1 to 2021Q4. Examining housing market from three sectorial levels, namely public, private, and cooperative sectors would prevent being general the finding and as well consistent with the approach used in the UK housing affordability study by Sharpe *et al*. (2015) whereby non-profit oriented and local authorities were considered.

Both supply and demand for housing in Turkish housing market are well regulated through permits to develop (construction permit) and permits to purchase (occupancy permit). Therefore, variables of the study were the number of houses being authorized to develop - construction permit as supply variable; the number of houses being occupied as documented as occupancy permits as demand variable. Occupancy of the houses could be predicted by several factors among which are the proportion of income spending on consumption as well as ability to secure financing and the extent to which transparency level of housing suppliers. We used consumption on a fixed income as an expenditure variable, availability of information as a transparency variable, and availability of financing as a financing variable. Hwang and Smith (2006) considered accessibility to finance as one of the variables for predicting housing affordability. This is because Bajunid and Ghazali (2012) revealed a huge number of unsold

houses started in Malaysia after the 1997 recession and even when they were later sold it usually sold at loss. Data was transformed to logarithm value as presented in equation 1 below:

$$lnY_t = logY_t \quad \text{.....(1)}$$

We employed an analysis approach of the NARDL framework and granger causality test. NARDL technique captures both long-run effect and asymmetric relationship among the variables of the study. NARDL modelling is appropriate for small sample data and variables of a different order of integration (Bildirici and Turkmen, 2015; Aliefendioğlu *et al.* 2021). Similarly, the NARDL framework allows the modelling of a partial sum of negative and positive asymmetric effects of short and long-run effects (Raza *et al.*, 2016). Finally, Granger causality is to explains the variable that granger causes one another. Both modelling techniques were employed because they are appropriate to address the objectives of this study.

3.1 NARDL Modelling

We employed none linear modelling based on the argument by Hwang and Smith (2006) that housing complexity required nonlinear modelling specifications. Therefore, the NARDL modelling of Shin *et al*. (2014) which argued that the relationship between two variables is not necessary to be linear is employed thus implying that housing affordability could be explained by the relationship between housing supply and explanatory variables which is not necessary to be linear. NARDL modelling also prevent enforcing the linearity model on the nonlinearity relationship which may cause biased conclusions. As a result, NARDL modelling is considered appropriate for this study. It has been well argued in the previous study that NARDL modelling allows testing for both linear and nonlinear cointegration (Salami, 2020). In addition, the NARDL distinguished between long-run and short-run effects to explain the reaction of the dependent variable (Hoang *et al.*, 2016). Furthermore, NARDL modelling allows modelling variables of the mixed degree of integration between I~(0) and I~(1). The general form of NARDL is presented in equation 2 presented in the study of Hoang *et al.* (2016) and the specific equation for this study is presented in equation 3 as below:

$$\Delta y_t = \mu + \rho_y y_{t-1} + \rho_x^+ \rho_{t-1}^+ + \rho_x^- \rho_{t-1}^- + \sum_{i=1}^{r} \alpha_i \Delta y_{t-i} + \sum_{i=0}^{s} (\beta_i^+ \Delta x_{t-i}^+ + \beta_i^- \Delta x_{t-i}^-) + \varepsilon_t \quad \text{.....(2)}$$

The partial sum which is denoted by superscripts (+) and (-) captures disequilibrium in the supply and demand for housing across Turkish housing markets.

$$lnHs_t = f(lnHD, lnCFC, lnF, lnIC) \quad \text{.....(3)}$$

Where,

$lnHS$ represents units log of house supply by public, private, and cooperative sectors in Turkey. $lnHD$ represents the unit log of house occupants through public, private, and cooperative demand in Turkey. $lnCFC$ represents the ratio of consumption on the fixed income of the housing demand across public, private and cooperative sectors in Turkey. lnF represents availability to financing through mortgage loans. $lnIC$ represents the transparency of the Turkish housing market. The above variables are used to investigate housing affordability in Turkey. Prior expectations are coefficient of HD is expected to be positive and approximately

equal to 1 to signify nearly equilibrium in housing supply and demand in the Turkish housing market. Otherwise, there is disequilibrium in the supply and demand for housing in Turkey. Coefficient of $lnCFC$, lnF, and $lnIC$ are expected to explain differences in the unaffordability of houses across public, private, and cooperative housing sectors in Turkey.

3.2 Granger Causality

Granger causality test is applied to explain the effect of housing supply and demand across three sectors in Turkey as predicted by occupancy rate, financing, consumption, and transparency. Therefore, Granger causality test result would elaborate on the direction and the extent of interaction of the three housing supply sectors in Turkey. The linear granger test aims to investigate the extent time series historical information could support the present and future prediction.

4. EMPIRICAL ANALYSIS

4.1 Descriptive Summary

A descriptive summary is presented in Table 1. The findings present the supply and demand of the housing market in Turkey through three major housing sectors, namely; the public sector, private sector, and cooperative sector. The findings revealed significant differences in the occupancy rates and supply of housing across each housing sector. This signifies disequilibrium in the supply and demand for housing in Turkey across each sectorial housing market. This is further buttressed by the mean value of each sectorial supply of housing in Turkey relative to demand. For instance, supply of the housing is greater demand for housing in both public sector (Mean lnHS = 9.2016; lnHD = 8.8140) and private sector (Mean lnHS = 11.7288; lnHD = 11.4308), while, demand for housing is greater than supply of the house by cooperative sector (Mean lnHD = 8.7025; lnHS = 8.3617). The disequilibrium in the housing market in Turkey is predicted by the extent of spread in minimum and maximum statistic and are statistically significant as predicted by ANOVA Test (Public sector = 6.1052**; Private sector = 7.8697***, and Cooperative sector = 9.3171***). The hypothesis 2 (H_2) is supported. The finding also revealed that uncertainty concerning the demand for housing provided by the public sector is the highest while uncertainty concerning the demand for housing provided by the cooperative sector is the lowest as predicted by the standard deviation of 1.1695 and 0.6454 respectively. The uncertainty about the public sector supplying housing is the highest followed by the cooperative sector while the private sector has a relatively lower level of uncertainty about the supply of housing across the three sectors. This finding implies that the private sector will be willing to supply to the housing market as it could be viewed as a business opportunity that needs to be trapped while the supply of housing by the cooperative sector may be at a deficit as the members demanding the housing may be greater their financial capacity of the organization. For the public sector, the provision of housing could be viewed as part of government responsibilities but some other unobservable factors may make those houses less attractive for the citizen. Furthermore, the supply and demand for housing in Turkey are negatively skewed. This implies that the logarithm value of an average of the housing supply and demand in each sector is lower than presented by the mean value. The finding also revealed the evidence that all sectors supplying housing in Turkey have experienced different kinds of

catastrophes as predicted by Kurtosis; public sector (K =3.9545), private sector (K = 3.8648), and cooperative sector (K = 3.1555) while demand for housing in the public sector (K = 7.2033) experienced a huge shock as well. Across the three sectors, the public sector experienced over-supply and under-demand housing while the housing supply in the cooperative sector experienced the least effect of catastrophe over the period this study.

Table 1: Descriptive Summary Table of Housing Market in Turkey

Variables	Mean	S.D	Min.	Max.	SK	K	Obs.	ANOVA
$\ln HS_{Public}$	9.2016	0.7750	7.0992	10.2622	-1.2477	3.9545	80	6.1052**
$\ln HD_{Public}$	8.8140	1.1695	3.6376	10.0012	-1.9026	7.2033	80	
$\ln HS_{Private}$	11.7288	0.6314	9.6968	13.1281	-0.7702	3.8648	80	7.8697***
$\ln HD_{Private}$	11.4308	0.7099	9.8514	12.4631	-0.7702	2.5751	80	
$\ln HS_{Corpora}$	8.3617	0.7619	5.9532	10.1160	-0.3260	3.1555	80	9.3171***
$\ln HD_{Corpor}$	8.7025	0.6454	7.3563	10.0312	0.0340	2.4060	80	
lnCFC	17.8712	0.8518	16.3596	19.7164	0.2331	2.1453	80	
lnF	15.3316	0.8046	13.7695	16.8406	-0.1058	2.0030	80	
lnIC	14.7466	0.8426	13.0987	16.4800	0.1015	2.1487	80	

Note that ***, and ** represent 1% and 5% significant level respectively. lnHS, and lnHD represent logarithm value of housing supply and demand respectively. lnCFC represents logarithm value of consumption on fixed income, lnF represents logarithm value of proxy for financing accessibility. lnIC represents logarithm value of proxy for degree of transparency in housing sectors.

4.2 Correlation Matrix

Table 2 presents the correlation between sectorial housing markets in Turkey. It could be observed that the public housing and private housing market are positively correlated while the cooperative housing market is negatively correlated with both public and private sectorial housing markets. This implies that both public and private sectors are moving in the same direction. As the public sector may view making housing available as part of fiscal policy so also the private sector views it as a potential opportunity that is inevitable for every individual. Unfortunately, financial capacity of the cooperative sector to compete in the same direction as the public sector. The extent in which cooperative housing sector is predicted by the members' financial capacity to invest. The negative correlation of housing supply and demand by the cooperative sector signal healthy housing market for Turkey, which may mitigate the effect of having huge houses that could eventually turn into ghost houses as a result of a shortage in demand. In addition, the coefficient of correlation across the three sectors ranges from -0.2520 to 0.7279. This signifies that the sectorial housing markets in Turkey are interrelated and could consistently adjust when the housing market in Turkey is experiencing either oversupply or under-demand in the housing market. From the coefficient of correlation, it could be observed that there is no evidence of multicollinearity across the variable of the study throughout the studies

Table 2: Correlation matric among sectorial housing market in Turkey

	$\ln HS_{Public}$	$\ln HD_{Public}$	$\ln HS_{Private}$	$\ln HD_{Private}$	$\ln HS_{Corporative}$	$\ln HD_{Corporative}$
$\ln HS_{Public}$	1					
$\ln HD_{Public}$	0.5054[a]	1				
$\ln HS_{Private}$	0.6363[a]	0.5092[a]	1			
$\ln HD_{Private}$	0.4952[a]	0.7035[a]	0.7255[a]	1		
$\ln HS_{Corporative}$	-0.0653	-0.3224[a]	-0.1169	-0.5377[a]	1	
$\ln HD_{Corporative}$	-0.2520[b]	-0.3328[a]	-0.4104[a]	-0.6221[a]	0.7279[a]	1

Note that superscripts [a], and [b] represent 1% and 5% significant level respectively. lnHS, and lnHD represent logarithm value of housing supply and demand respectively.

Table 3 presents the long-run relationship between supply and demand for housing in Turkey and predicts Turkish housing affordability from the rate of consumption, accessibility to finance, and degree of transparency of the housing supplying sector. The three models are statistically significant as predicted by both t-BDM and F-PSS statistics. Model 1 (t-BDM = -5.6104; and F-PSS = 6.1001); model 2 (t-BDM = -5.4328; F-PSS = 6.2954) and model 3 (t-BDM = -6.4357; and F-PSS = 6.7155), which implies that the findings are valid.

4.3 Long-run Effect Result

Table 3 presents the finding that revealed an insignificant long-run effect between housing supply and demand for all sectors in Turkey which is in contrast to the finding revealed by Sharpe *et al*. (2015) in the context of the UK. In the UK, both non-profit-oriented and local authorities are responsible for affordable housing. In the context of Turkey, the cooperatives housing market tend to have affordable houses since the motive is non-profit oriented and several factors are considered prior to making housing available for purchase. However, the evidence of insignificant long-run effect in the supply and demand relationship of housing provided by the public sector is justifiable since the title deeds will be retained by TOKI until the whole payments are made in full (toki.gov.tr, 2022). This also applies in the case whereby low-cost houses are completed for over nine months and still waiting for buyers. Therefore, the possibility of getting default in payment is considered to be negligible. Affordable housing prices are determined by TOKI and the payment structures for low-income and middle-income are different, most especially for handicapped, martyr families, disabled, and pensioners (https://www.toki.gov.tr).

Furthermore, the significant positive and negative long-run effects are established for the relationship between the rate of consumption and housing supply by the public and private housing sectors while the significant positive long-run effect is established for the relationship between consumption and housing supply by the cooperative housing sector. These indicate that the rate of consumption plays a significant role in predicting housing affordability across all sectors supplying housing in Turkey. The hypothesis 3a (H_{3a}) is supported.

In addition, the finding showed that financing established a significant negative long-run effect on housing supply by public and cooperative housing sectors but not a significant long-run effect on public housing supply by the private sector. This implies that moderate financing is required to secure affordable housing otherwise financing burden may arise later in the future. The hypothesis 3b (H_{3b}) is supported.

Transparency has a significant long-run negative effect in predicting affordable housing from the public housing sector while transparency established both positive and negative long-run effects in securing affordable housing from private housing sectors. Transparency has no significant long-run effect on housing affordability in the cooperative housing sector. In the case of the cooperative sector, house buyers might have been overwhelmed with the necessary information required to make members qualify to secure houses in the cooperative sector. Transparency is essential in the private housing sector since the findings revealed the significance of transparency in both positive and negative long-run effects and to gain required attention of the potential housing buyers.

4.4 Non-linear Relationship Result

Table 3 present the findings that showed both evidence of an asymmetric and symmetric relationship between housing supply and the explanatory variable in Turkey. Housing supply through the private sector is established. Furthermore, there is significant evidence of a long-run asymmetric relationship between housing supply and demand in both public and private sectors but the relationship is symmetrical in the cooperative sector. Consumptions established both long-run and short-run asymmetric relationships with the public housing supply sector while consumption established short-run asymmetric relationships in private and cooperative sectors. The hypothesis 3c (H_{3c}) is supported. In addition, there is significant evidence of asymmetric long-run and short-run relationships between financing and the supply of housing in the public sector. This may be supported by the findings reported by Bajunid and Ghazali (2012) that high demand for affordable houses is expected in Malaysia, instead, many completed houses are still not getting the buyers. Transparency and supply of housing in the public sector exhibit a long-run asymmetric relationship but the symmetric relationship in the short-run. Transparency issue in the public housing sector is supported due to continuous updating of the amount to be paid on a semi-annually basis as a result of using a single-indexed repayment plan (toki.gov.tr, 2022). The hypothesis 1 (H_1) is supported. On the other hand, there is evidence of an asymmetric relationship between transparency and housing supply in the cooperative sector in both the long-run and short-run while access to finance is asymmetric with the supply of housing in the long run. According to Rae (2015), most banks lack transparency in providing a residential mortgage loan. This identifies the presence of asymmetric information in providing finance, which might contribute to a lack of housing affordability. Over the long-run symmetric relationship is established with demand for houses, consumption level, degree of transparency, and accessibility to financing with Turkish private housing supply sector.

Table 3: NARDL modelling of the sectorial housing market in Turkey

Variables	Model 1: dependent variable: Public Sector	Model 2 Dependent variable: Private Sector	Model 3 Dependent variable: Cooperative Sector
α	6.2628***	5.8021***	6.0410***
$\ln HS$	-0.8286***	-0.6092***	-0.6994***
$\ln HD^{+}$	0.1376	0.0231	-0.1252
$\ln HD^{-}$	-0.0355	-0.4276*	0.2878
$\ln CFC^{+}$	-2.8417**	-3.9831***	-2.7070**
$\ln CFC^{-}$	-10.1470***	-4.9718***	0.0771
$\ln F^{+}$	0.3051	1.3841	2.1128

$\ln F^{-}$	-10.6072***		-1.4530		-7.4176**	
$\ln IC^{+}$	1.3216		1.6254*		1.1098	
$\ln IC^{-}$	4.9878**		1.7836**		-1.6179	
$\Delta lnHS_{t-1}$	-0.2103*					
$\Delta lnHD^{+}$	-0.2851*		1.1302***			
$\Delta lnHD^{+}_{t-2}$			0.6531**			
$\Delta lnHD^{-}$	0.3428**				0.8227**	
$\Delta lnHD^{-}_{t-2}$					-0.5061**	
$\Delta lnCFC^{+}_{t-1}$			3.2642**		4.2283**	
$\Delta lnCFC^{+}_{t-2}$	3.7499**					
$\Delta lnCFC^{-}_{t-2}$	-14.3901**					
ΔlnF^{-}_{t-1}	10.3704**					
$\Delta lnIC^{+}$					-3.3584**	
$\Delta lnIC^{+}_{t-2}$	-2.5850**		-1.5434*		-3.3736**	
$\Delta lnIC^{-}_{t-1}$	-5.3789**				3.6183*	
	Long-run Effect		Long-run Effect		Long-run Effect	
	β^{+}	β^{-}	β^{+}	β^{-}	β^{+}	β^{-}
$lnHD$	0.166	0.043	0.038	0.702	0.179	-0.412
$lnCFC$	-3.430**	12.246***	6.538***	-8.161***	3.870**	-0.110
lnF	0.368	12.802***	2.272	2.385	3.021	10.605**
$lnIC$	1.595	-6.020***	2.668*	-2.928**	1.587	2.313
	Asymmetric Relationship		Asymmetric Relationship		Asymmetric Relationship	
	$F-stat_L$	$F-stat_S$	$F-stat_L$	$F-stat_S$	$F-stat_L$	$F-stat_S$
$lnHD$	3.924*	6.999**	2.076	27.520***	2.669	1.2
$lnCFC$	9.31***	8.916**	0.429	7.081**	1.551	5.234**
lnF	21.29***	7.411**	2.459	-	9.29***	-
$lnIC$	4.674**	0.034	0.283	3.631*	5.036**	8.11***
$\boldsymbol{HQ_{stat}}$	32.99 (0.6127)		44.11 (0.1662)		49.9 (0.0616)	
$\boldsymbol{JB_{stat}}$	1.78 (0.4106)		18.7 (0.0001)		4.541 (0.1032)	
RMSE	0.3534		0.2672		0.3798	

Note that ***, and ** represent 1% and 5% significant level respectively. lnHS, and lnHD represent logarithm value of housing supply and demand respectively. lnCFC represents logarithm value of consumption on fixed income, lnF represents logarithm value of proxy for financing accessibility. lnIC represents logarithm value of proxy for degree of transparency in housing sectors.

4.5 Granger Causality Test Result

Table 4 presents the granger causality test. Unidirectional granger causality and bi-directional granger causality were reported in the context of Turkish housing markets. Interestingly, findings from the housing market in Turkey could be broadly categorized into three. Firstly, each housing supply sector granger causes housing demand from own sector, namely; public housing supply granger causes public housing demand; private housing supply granger causes private housing demand; and cooperative housing supply granger causes cooperative housing demand. Contrary to this, is the private housing supply granger that causes public housing demand. Secondly, the housing supply in Turkey may continue to have a different experience in greater favour of cooperative housing suppliers. This may be due to cooperative housing

supply granger causing public housing supply and public housing supply granger causing private housing supply. This implies that cooperative housing supply directly granger causes public housing supply and indirectly granger causes private housing supply. Thirdly, public housing demand directly granger causes demand for housing from private and cooperative sectors. In summary, the findings revealed that the Turkish housing market is interrelated which is supported by a series of statistically significant pieces of evidence as presented in Table 4. In general, it could be inferred that there is no evidence of a monopoly power in the supply of housing and demand for housing in Turkey.

Table 4: Granger Causality Test Result

Granger Causes	F-Stats.	The direction of Granger causality
$\ln HS_{Public} \rightarrow \ln HD_{Public}$	3.8423**	Unidirectional Granger causality
$\ln HS_{Public} \rightarrow \ln HS_{Private}$	3.002*	Unidirectional Granger causality
$\ln HD_{Public} \rightarrow \ln HD_{Private}$	3.9713**	Unidirectional Granger causality
$\ln HD_{Public} \rightarrow \ln HD_{Cooporative}$	3.7857**	Unidirectional Granger causality
$\ln HS_{Corporative} \rightarrow \ln HS_{Public}$	2.4799*	Unidirectional Granger causality
$\ln HD_{Corporative} \rightarrow \ln HS_{Private}$	3.5914**	Unidirectional Granger causality
$\ln HD_{Corporative} \rightarrow \ln HD_{Private}$	8.0298***	Unidirectional Granger causality
$\ln HS_{Corporative} \rightarrow \ln HD_{Corporative}$	2.5770*	Unidirectional Granger causality
$\ln HS_{Private} \rightarrow \ln HD_{Public}$	2.7469*	Unidirectional Granger causality
$\ln HD_{Private} \rightarrow \ln HS_{Private}$	2.4368*	Bi-directional Granger causality
$\ln HS_{Private} \rightarrow \ln HD_{Private}$	2.5350*	
$\ln HD_{Private} \rightarrow \ln HS_{Corporative}$	5.1905**	Unidirectional Granger causality

Note that ***, **, and * represent 1%, 5% and 10% significant level respectively.

5. CONCLUSION:

The Turkish housing market was investigated from the sectorial perspective, namely; public, private, and cooperative sectors. The study used quarterly data from 2002Q1 to 2021Q4 and employed NARDL and Granger causality. The findings revealed some significant similarities and differences across the three housing supplier sectors. Among the similarity across the three sectors is the significant evidence of a long-run relationship between supply and demand for houses in Turkey. This implies that both supply of and demand for housing from the three sectors are moving towards establishing equilibrium in the long-run. This implies that short-run deviation would not result in permanent distortion in the supply and demand for housing across the three sectors in Turkey. In addition, the lag housing supply negatively significant predicts the current housing supply in Turkey. This implies that the number of newly unsold houses may discourage a continuous increase in the construction of new houses across the sectors examined. Similarly, the findings also revealed that the level of consumption significantly predicts housing affordability in Turkey across all sectors examined. The findings revealed that housing occupancy as a proxy for housing affordability is not statistically significant across all sectors examined. This implies that housing affordability is lower across the three sectors, which results in a disequilibrium between the unit of house supply and the unit of the houses demanded. Disequilibrium between supply and demand for houses usually resulted in financial cost, which is being argued to be at a loss if newly developed houses are not sold on time but eventually sold

in the future. The asymmetric long-run relationship between housing supply and demand also supported the evidence of disequilibrium. The asymmetric association of consumption, financing and transparency with the supply of houses supported housing unaffordability. There is a contrast in the symmetric association of consumption, financing and transparency with the supply of houses in Turkey across the three sectors. Degree of transparency, financing, and consumptions are different and contribute low affordability of the houses. As a result of this, authority intervention is essential regarding the low affordability of housing in Turkey as predicted by the occupancy rate, consumption level, financing and transparency indicators. In summary, the findings supported the hypothesis developed.

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Further Readings

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