Revisiting the housing market dynamics and its fundamentals: New evidence from Cyprus

Andrew Adewale Alola

(Department of Economics and Finance, Faculty of Economics, Administrative and Social Science, Istanbul Gelisim University, Turkey) (Department of Financial Technologies, South Ural State University, Chelyabinsk, Russia)

Abstract

Purpose

Studies have shown that economic expansion is characterized by the activities in the productive and industrial sectors. And, recently, the Republic of Cyprus has consistently experienced a relative economic growth. In this light, the current study revisits the dynamics of the housing market and its fundamentals for Cyprus using the quarterly data from 2005Q1 to 2016Q4.

Design/methodology/approach

Producer price and industrial production indices were employed along with the gross domestic product per capita and urban population as control variables. The empirical technique employed is the Dynamic and Fully-modified Ordinary Least Square approaches where unobserved factors are potentially controlled.

Findings

Empirical evidence of long-run relationship exists between the observed indicators and the house price. Indicatively, statistical evidence reveals a positive and significant long-run relationship between the producer price index and the house price. In like manner, there is a strongly significant but negative long-run nexus the industrial production index and the house price. And, expectedly, the observed long-run nexus of the house price and each of real gross domestic product per capita and the urban population is positive and significant. Interestingly, there exist significant uni-directional Granger causality from each of the independent variables to the housing price. Lastly, the robustness check and the diagnostic test of the investigation suggests a very consistent result and stable model with no problems of serial correlation and heteroskedasticity.

Research limitations/implications

The fragility of Cyprus's housing market suggests the need for the adoption of an effective policy framework.

Originality/value

Although the housing market has been studied in the context of the Republic of Cyprus, the novelty is hinged on the joint incorporation of the industrial and producer price indices in a housing model of the study.

Keywords: housing market; economic activities; cointegration; Republic of Cyprus

1. Introduction

A vibrant housing market with active institutional, industrial and manufacturing activities amidst private sector engagements and the effective use of policy instruments are pointers of an expansive economy. For instance, the World Bank housing reflects that the socio-economic and the wealth of the poor in most developing countries are the indications of the state of the housing system" (see World Bank 2017). Since the last Global Financial Crisis (GFC), a number of studies have continued to indicate the importance of macroeconomic variables in the study of the housing market (Estrella & Mishkin, 1998; Luttik 2000; Aoki, Proudman & Vlieghe, 2004; Kishor & Marfatia 2017; Alola & Alola, 2019; Uzuner & Alola, 2019).

Sporadic scholarly studies have continued to reveal intriguing behavioural trends associated with economic activities or macroeconomic forces and house price indices. The first of this type of study is the work of Mankiw and Weil (1989) which detailed the relationship between house prices and ageing. The recent report of the United Nation (see UN 2017) highlights the reason enormous global investments on businesses, industrial and other economic activities have failed to ameliorate the world's serious housing needs. The organization maintains that population is a vital indicator of the housing prices (see UN 2017). The United Nations further corroborates that about 83 million people are currently being added to the global population annually. This suggests a projection of an increase in world population from 7.6

billion people in 2017 to 8.6 billion, 9.8 billion and 11.2 billion in 2030, 2050 and 2100 respectively. Specifically, the report maintained that as the global population reaches 8.5 billion by 2030, more than half (60%) of the population is expected to reside in urban areas thereby causing rapid urbanization and putting pressure on housing delivery systems. While Škare and Hasić (2016) clearly pointed the nexus of economic growth, corporate governance, firm performance within the framework of theoretical analysis, the studies by Miller, Peng and Sklarz (2011) and Girouard and Blöndal (2001) are selected works that have discussed economic growth and house prices nexus.

Extant literature provides empirical evidence of the house price dynamics in Cyprus (Pashardes & Savva, 2009; Sivitanides, 2015). Using a relatively small and annual data for the period 1998-2008, Pashardes and Savva (2009) hint that the country's population is a leading determinant of housing prices in addition to costs and economic growth. For Sivitanides (2015), and using quarterly data from 2006Q1 to 2014Q2, it maintains that nominal GDP per capita which proxy for economic growth, construction cost and interest rates are leading determinants of house prices in that order. However, the above few relevant studies fell short of investigating whether the long-run equilibrium relationship exists between these determinants of housing prices in the case of Cyprus.

The novelty of the current study by examining the nexus of the housing market vis-à-vis the house price dynamics and its fundamentals are further presented. Importantly, this is done by incorporating the producer price index, industrial production index, the real gross domestic product per capita, and the urban population in a single model. Although Cyprus companies and business models are relative of small sizes, the contribution of the country's chain of industries (food, textile, chemical, and metal products manufacturing industries) is hugely

significant (Dickson & Hadjimanolis, 1998). This would not be far from the reason World Bank reference Cyprus as the fastest growing small economies in the Euro area. Also, considering the ambient economic environment obtainable in small developing countries (Adeboye & Clark, 1997; Akadiri, Akadiri & Alola, 2017; Alola & Alola, 2018), it potentially makes the case of Cyprus in this context an interesting one. Hence, reflecting from the aforesaid motivations, this study is built on investigating few hypotheses. First, to show empirical long-run evidence of the linkage between the house prices and the producer price index, industrial production index, real gross domestic product per capita, and urban population in Cyprus. Secondly, the study is designed to observe the magnitude of the impact of the aforementioned fundamentals on the housing market. Lastly, the nature of Granger causality between the housing market and the observed fundamentals is investigated. Nevertheless, investigating these hypotheses is vital, especially because the country's housing market is one of the most active in both the Mediterranean region and the island nations of the European Union (EU). Therefore, this study will potentially add empirical evidence of the house prices and economic activities indicators[1] cointegration in Cyprus to the existing scholarly literature. The visual observation of the co-movement of these indicators in Cyprus is perceived in Figure 1.

<Insert Figure 1.>

The rest of the study is structured as follows. Section 2 highlights existing studies and trends of housing market dynamics, the peculiarity of the housing market fundamentals which is characterized by the economic activities of Cyprus. Section 3 covers the data description and

[1] Cyprus economic and sector-wide activities are mainly contributed by its tourism, real estate, professional services, and education among others (Cyprus Mail July 2017).

empirical methodologies. The empirical findings are reported in Section 4. Concluding remarks and implications for policy are provided in Section 5.

2. House market dynamics: contextual studies

In a recent study, while affirming the relationship between housing price and population, Hiller and Lerbs (2016) further simplified population effect to three distinct perspectives. These are the investment demand effect, the age effect (age composition of the population) and the size effect (size of the population). The study maintained that the total population is not as important as the size of the household. This argument was based on the fact that if household size i.e. a number of people in a family decreases (resulting from family members' independence, divorce, e.t.c.), housing price is expected to increase due to increase in the number of people in need of housing. Hiller and Lerbs (2016), while studying the relationship between housing price and changes to the age distribution using 87 German cities of strong cross-sectional dependence over 1995 to 2014, employed a mixed-regression spatial panel model with an underlying multivariate framework. The results revealed a minimal appreciation in housing price across cities with higher more aged people and heterogeneous effects caused by populations ageing across housing segments. Similarly, the study by Park et al. (2017) used panel regression to show significant evidence of an inverse correlation between housing prices and dependency ratio in the overall regional market while a positive correlation was observed between real GDP per capita and housing prices in each region. By implication, negative correlation estimates between dependency ratio and house price are expected to cause between 3 to 12% decline in house prices by 2020 and about 20% by 2030 especially in the observed cities of South Korea.

Sirmans, Macpherson and Zietz (2005) used a hedonic regression analysis to estimate the marginal contribution of each of the eight enumerated characteristics of macroeconomics to

house prices. Their study further characterized the macroeconomics variables affecting house prices as construction and structure variables, external house features, internal house features, environmental neighbourhood and location factors, natural and environmental characteristics, public service amenities, marketing, occupancy and selling factors, and financial issues. Previously, Tu (2000 & 2004) clearly noted the importance of real GDP per capita, total housing stock, affordability, housing finance and supply, inflationary effects and demographic variables on house price. The dilemma caused by the nature of these variable dynamics on house price paved the way to the study by Berry and Dalton (2004) in categorizing these factors affecting housing price as institutional, short-run and long-run factors. Similarly, Canarella, Miller and Pollard (2012) empirically discovered that effect of shocks to the capital gain series on housing price which could be permanent or transitory would rather depend on the test assumptions because the result shows evidence of lack of uniformity. This evidence supports the fact that a slow pace of housing price movement is impacted by income shocks while investigating housing supply elasticity (Harter-Dreiman 2004). While studying house prices in Australia, Abelson and Chung (2005) reported the lack of reliable published data for housing prices in the country resulting from the estimation of an authoritative account of apartment and house prices. Both the long-run equilibrium and short-run asymmetric error correction of housing price dynamics were established as well revealed that both real disposable income and consumer price index significantly were positive determinants of Australia house prices.

Using a carefully simplified model, Reichert (1990) previously hinted on the demand-induced factors as studied by Pitkin and Myers (1994) and Flavin and Yamashita (2002) in addition to the supply-related effects examined by Painter and Redfearn (2002) and Ball et al. (2010), all as dynamic components of housing price. Also, non-economic and finance-related

variables or policies have been empirically revealed to have a significant impact on house prices (Bajic, 1983; Katz and Rosen, 1987; Pollakowski and Wachter, 1990; Campbell and Cocco, 2007; Ihlanfeldt, 2007). Conversely, housing prices impact on some of the aforementioned variables has been widely studied (Johnes and Hyclak, 1999; Meen, 2003; Hämäläinen and Böckerman, 2004). Using an error correction model, Johnes and Hyclak (1999) evidently showed that unemployment and labour force changes affect house prices and interestingly that house prices also have a significant effect on the size of the labour force. Also, evidence of volatility in the housing prices dynamics (Case and Shiller, 2003; Case, Quigley and Shiller, 2005) have well been researched along with stock market (Ding, Granger and Engle, 1993) studies. These are consistent with the observations of Luo, Liu and Picken (2007) and Case and Shiller (1990) where the dynamics of housing prices were evidently regarded as unstable in nature.

2.1 *Trend of economic activities: newly emerging Cyprus*

Cyprus is a small island and European-Mediterranean island country of about a million people and had its economy devastated by the 1974 civil war that saw the country partitioned into North (Turkish occupied region) and South (Greek Cypriot dominated area). Like Germany, a post-war Cyprus has continued to lean on innovation and quest for industrial expansion in achieving a self-sufficient economy. Also, emerging from the recent financial and economic crisis of 2013, the island state has consistently enjoyed economic recovery and progress which has recently earned it a place among the fastest growing European Union (EU) economies (see World Bank 2017). Originally as an agrarian economy and business gateway between Europe, Asia, Middles East and Africa (see country map in Figure), the country's industrial sectors, infrastructure and communication technology (ICT), and manufacturing among others have

continued to constitute huge economic activities. Although a small island, Mehmet and Tahiroglu (2002) noted that such characteristics as the size of a state could turn out to be a comparative advantage. The strength of Cypriot firms in constituting tangible economic activity through industrial productions and manufactures is based on the firms' cooperation with foreign suppliers of raw materials and networking of firms. As such, the country has since made considerable technological progress in construction, manufacturing, service and agricultural sectors. The supporting work by Daniels (1993) strongly ranked Cyprus in a comparatively intermediate position with regard to trade performance in technology-intensive manufactured goods. Although in this regard Cyprus yet ranks below Ireland, Israel, Singapore and Hong-Kong, the country is well-situated above Mauritius, Iceland and New Zealand, the developing nations. A contextual study of the Northern part of Cyprus showed significant evidence of an export-led growth hypothesis (Katircioglu, 2010). The study observed a significant increase in the value added to the economy by both agricultural and industrial production with trading partners in the likes of Turkey, the U.K., Israel, Saudi Arabia, and a handful of others. A sustained growth in the real estate and specifically in tourism sector of the country's economy (Andronicou, 1979; Gillmor, 1989; Ioannides, 1992; Katircioglu, 2009; Sharpley, 2001) has been significantly noticed over time, a trend that is perceived to influence the country's property and housing market, and especially its housing prices as evident in the skyrocketed rent prices (Cyprus Mail July 2017).

3. Data and Empirical specifications

3.1 Data

The quarterly dataset that span from 2005:Q1 to 2016:Q1 (comprising of 49 observations) is employed for this study. Data span restriction is due to the unavailability of

Cyprus's house price (HP) index which was obtained from the European Commission database (Eurostat, 2017). The producer price index (PPI), industrial production index (IND), and import (IMP) series were obtained from the International financial statistics database of the International Monetary Fund (International financial statistics, 2017). The Producer price index (PPI) and Industrial production index (IND) which proxy economic activities had their indices seasonally adjusted to 100 unit using the base year 2010. House price (HP) index is the dependent variable while the other variables are the independent variables. The gross domestic product per capita, the lending or interest rate, consumer price index and population have previously been employed to study the dynamics of house prices (Case & Shiller, 2003; Case et al., 2005; Ding & Kim, 2017; Kheishor & Marfatia, 2017). Hence, our study employs the real gross domestic product per capita (*rgdp*) and urban population growth (*upop*) to proxy for the unobserved factors. These variables which were collected from the World Bank Development Indicator (World Bank, 2018) are employed to enhance the robustness of the investigation. In Table 1, the descriptive statistics of the series are displayed.

<Insert Table 1.>

Previous studies suggest changes in real housing prices through the development of a model for the equilibrium of supply and demand housing market (Reichert, 1990; Park et al., 2017). Such studies have considered fluctuation rate of per capita real GDP, fluctuation rate of population and dependency ratio as key determinants of the housing demand and supply dynamics (Kishor & Marfatia, 2017). In our case, we incorporate specific variables to study the dynamics.

Giving that house price (HP) is a proxy for the housing market, Hence, *hp* is represented as a function of quantity demand (Q^d_t) and quantity supplied (Q^s_t) of housing during a period t as:

$$HP_t = f\,(Q^d_{t,}\, Q^s_t) \tag{1}$$

So that the model is expressed as:

$$hp_t = \alpha_i + \beta_1 ppi_t + \beta_2\, ind_t + \beta_3\, rgdp_t + \beta_2\, Upop_t + \varepsilon t \tag{2}$$

where hp_t represents the housing price, ppi_t is the producer price index, ind_t is the industrial production, *rgdp* is the real gross domestic product per capita, and *upop* is the urban population growth. Other unobserved factors in the other are controlled for by employing the *rgdp* and *upop* for all the period t = 1, 2, …2016:Q4 of Cyprus.

3.2 Empirical specifications

3.2.1 Stationarity test

It is essential to investigate the statistical properties of the series by computing the stationarity at the level and after taking the first difference. Using the Augmented Dickey-Fuller (ADF) test by Said & Dickey (1984) and assuming dynamic data ARMA (*p, q*) structure, the null hypothesis that a time series y_t is non-stationary against the alternative that it is stationary employed. The ADF test is implied below:

$$y_t = \beta^{'}\mathbf{D}_t + \boldsymbol{\phi}\, y_{t-1} + \sum_{j=1}^{p} \psi j\, \Delta\, y_{t-j} + \varepsilon_t \tag{3}$$

where the *p* is the lag difference terms which is set such that the error term ε_t is serially uncorrelated and homoscedastic. The $\mathbf{D_t}$ is a vector of deterministic terms which are constant, time trend, e.t.c. And the null hypothesis (H_0) of y_t is non-stationary i.e. $I(1)$ given $\phi = 1$ as against the alternative hypothesis (H_1).

Additionally, a non-stationarity or unit root test by Phillips and Perron (1988) which was commonly used in financial time series became advantageous in that it preferably deals with issues of serial correlation and Heteroskedasticity in the errors than the ADF and does not have to specify the lag length. The representation for the Phillips Perron (PP) unit root test is given as:

$$\Delta y_t = = \beta' \mathbf{D}_t + \boldsymbol{\pi}\, y_{t-1} + \mu_t \quad (4)$$

although the error term μ_t which is expectedly stationary *I*(0) may also be heteroskedastic, such anomaly together with serial correction is corrected by the PP test while producing a modified test statistics Z_t and Z_{π} from the normal statistics $t_{\pi=0}$ and $T\hat{\boldsymbol{\pi}}$. Phillips and Perron (1988) gives a detail expression of the modified statistics which possess similar asymptotic distributions as the ADF t-statistics and normalized bias statistics such that the null hypothesis is given that $\pi = 0$ while the alternative $\pi \neq 0$. The vectors of deterministic $\mathbf{D}_t$ of constant, time trend e.t.c. for each series ln*hp,* ln*ppi,* ln*ind* and ln*int* estimated from the equation (4).

The series *hp, ppi, ind*, *int*, *rgdp*, and *upop* are independently assigned the value of y_t of the equations (3 & 4) so that the unit root estimations (showing all series are *I (1)*) are expressed in Table 2. Also, considering the timeframe of the study which includes the periods of economic crisis and banking crisis in the country, we conduct the structural (single) break (Zivot & Andrews, 2002) as indicated in Table 3.

<Insert Table 2>

<Insert Table 3>

3.2.2 Cointegration test

A maximum-likelihood cointegration approach by Johansen (1988) and Johansen & Juselius (1990) using the Trace tests (λ_{trace}) and the maximum eigenvalue test (λ_{max}) is employed to investigate the cointegrating vectors of housing prices, producer price index and industrial production index. The technique is suitable since the stationarity investigation above empirically revealed the variables to be integrated of order *I*(1) and *I*(0) at first difference and especially using the Schwarz (Bayesian) information criteria (SIC) of the maximum lag length selection of one (1).

Hence, the expression of the multivariate cointegration test is given as:

$$Y_t = K_0 + K_1 \Delta Y_{t-1} + K_2 \Delta Y_{t-2} + \ldots + K_{p-1} \Delta Y_{t-p} + \pi \Delta Y_{t-p} + \mu_t \quad (5)$$

but the AIC maximum lag length of five is used[2], is taken into account from the equation (5) above. The components of Y_t, a 3 x 1 vector variables of $I(0)$ from the above equation (5) are *lnhp, lnppi* and *lnind*. The K and π are both a 3 x 3 matrix of coefficients and parameters respectively such that μ_t represents a vector of normally and independently distributed error term. Hence, the null hypothesis of *r* cointegrating relations against the alternative of *r + 1* cointegrating relations for r = 0, 1, … n -1 is tested by the Maximum Eigenvalue statistic tests which is computed as:

$$LR_{max}(r/\ n+1) = -\ T*\log(1-\hat{\lambda}) \quad (6)$$

However, the trace statistics test the null hypothesis of r cointegrating relations against the alternatives of n cointegrating relations where n is equivalently the number of variables in the system for r = 0, 1, 2, …. n-1 and represented as:

$$LR_{trace}(r/\ n) = -\ T*\sum_{i=r+1}^{n} \log(1 - \hat{\lambda}) \quad (7)$$

in both cases expressed above, T is the sample size so that the result of the estimation showing evidence of long-run equilibrium relationship between the variables is given in Table 4.

<Insert Table 4>

3.2.3 The dynamic and fully-modified OLS approach

To further investigate the cointegration of the variables, we use the dynamic ordinary least square (DOLS) and the Fully-modified ordinary least square (FMOLS) estimators. The FMOLS is an asymptotic and unbiased estimator that employs the semi-parametric correction

[2] The AIC, SIC and HQ are Akaike, Schwarz and Hannan-Quinn information criterion.
FPF is Final prediction error and LR is the sequential modified LR test statistics.
Three lag criteria including SIC selected one, but AIC maximum lag length 5 is adopted since it is minimum.

approach to in investigating the long-run relationship (Phillips & Hansen, 1990; Saikkonen, 1992; Stock & Watson, 1993). These estimators have preferred to the OLS in that it accounts for small sample bias by using the leads and lags of first-differenced regressors.

And, given that x_t is the vector of independent variables (*ppi*, *ind, rgdp, and upop*) such that β is the vector of parameter, the autoregressive form is given as

$$x_t = x_{t-1} + \varepsilon_t. \tag{8}$$

for all x_t such that $t = 1, 2, \ldots, T$ and $\varepsilon_{i,t}$ are stationary disturbance terms.

Hence, the model estimate the cointegrating vector β through the expression

$$\hat{\beta}_{FMOLS} = \{ \sum \ \sum_{t=1}^{T} (x\,t - \bar{x})\,(xt - \bar{x})\}^{-1} * \{ \sum \ (\sum_{t=1}^{T} (xt - \bar{x})\,(\overline{hpt} - T\Delta\,\varepsilon\,u)\} \tag{9}$$

Specifically, the DOLS approach augments cointegrating regression using lag and lead difference of the independent variables (*ppi*, *ind, rgdp, and upop*) which is presented as

$$hp_t = \alpha + \beta\, x_t \ \sum_{k=-p1}^{p2} \lambda k\, \Delta hp\, t - k \ + \ \sum_{k=-q1}^{q2} \gamma k\, \Delta\, x\, t - k \ + \mu_t \tag{10}$$

where α, β, λ, and γ are the intercept, cointegrating vectors, and dynamic vectors of dependent and independent variables. In Table 4, we present the results of the estimations.

<Insert Table 4>

3.3 Robustness and residual diagnostic tests

We begin a robustness check by in cooperating another variable (in equation 2) and repeat the FMOLS and DOLS estimations. The variable employed is the import of goods and services since Cyprus is still heavily reliant on importations. Giving the desirable results for these estimates presented in Table 4, therefore we perform the residual diagnostics tests. The normality result and the heteroskedasticity LM test by Breusch-Pagan-Godfrey are also presented in Table 4. Complementing the robustness evidence of the model, the stability

diagnostic with CUSUM test (see Figure 3) and normality evidence (see Figure 2) of the skewness, kurtosis and Jarque-Bera estimates are also presented.

< Insert Figure 2>

<Insert Figure 3.>

Additionally, we employ the pairwise Granger causality test to demonstrate the directional relationship between the investigated variables. Using the F-statistics and probability values of the estimates, we present the result in Table 5.

<Insert Table 5>

4. Empirical results

The descriptive statistics indicated in Table 1 reveals the relative uniformity in the mean values, the skewness, kurtosis, and the Jarque-Bera values of the series. As revealed in Table 2, all variables are only stationary at first difference using the Schwartz information criteria (AIC) automatic selection of maximum lag of nine. Additional unit root test using the Zivot and Andrew (2002) structural break implies that there are break periods. As shown in Table 3, the common break periods are 2008:Q3, 2009:Q4, 2011:Q4, 2012:Q4, 2013:Q1, 2013:Q3 and a few others. The periods are within the GFC of 2008-2009 and the Cyprus Banking sector crisis of 2011-2013. From the Johansen cointegration results (see Table 4), the null hypothesis of no cointegration is rejected at 1% significant level for both trace and maximum Eigenvalue statistics) using SIC maximum lag length 1. This indicates a co-movement and behavioural pattern of the estimated variables. Moreover, the long-run estimate using the FMOLS and DOLS are reported in Table 4. With the FMOLS result, the variables exhibit positive and significant relationships except for the industrial price index that exhibits a significant relationship. Similarly, with DOLS, there is significant relationship between the house prices and the producer

price index (1.079), industrial price index (-1.265), real gross domestic product per capita (1.969), and urban population growth rate (51.598) respectively. However, in both cases, the variables are largely insignificant when intercept and trend are included. But, the result of the robustness check (with imports as an additional independent variable in the model) is quite identical to the FMOLS and DOLS mentioned above. In this case, all the variables are statistically significant. Like the previous result, the direction of the relationships is all positive except between industrial production index and the house prices. On a general note, while the house price increases with the producer price index, empirical evidence indicates that it decreases with the industrial production index. This is because the producer price index is a function of price which expectedly causes an increase in the price level of market goods (including housing) as the input price of production increases. On the other hand, the industrial production index is a function of production output which causes prices of market goods (including housing) and more of the goods are produced or manufactured.

Meanwhile, the normality test (see Figure 3) as revealed by the Jarque-Bera statistic (0.2883) indicate that the residual error is normally distributed. Also, the model has no problem of heteroskedasticity as shown by the Breusch-Pagan-Godfrey test (p-value of chi-square = 0.1857) of Table 4. Also, as indicated in Figure 2, the system is largely stable except for the last quarter of 2013 (2013:Q4) to the mid of 2014 (2014:Q2). The short period of instability is likely to be associated with the event of the aftermath of the last Banking and the Financial crisis in Cyprus (Central Bank of Cyprus, 2012). This also corroborates the structural breaks test earlier described and fully presented in Table 3. Lastly, the study observes a uni-directional Granger causality between each of the independent variables and the house price. Also, as presented in

Tabel 5, bi-directional Granger causality exists between producer price index, industrial price index, urban population and the real gross domestic per capita.

5. Conclusion and policy implication

This investigation examines the relationship between the housing price, the producer price index, and the industrial production index in the Republic of Cyprus. Generally, in Cyprus, it is observed that the country's active economic and industrial activities are largely due to its tourism, real estate, professional services. But, the recent expansion of the country's manufacturing, production and industrial sectors have continued to increase. Hence, the curious idea of investigating the cointegration of producer price index, industrial production index and the housing market.

In our study, which corroborates Abelson and Chung (2005), the producer price index is observed as a positive determinant of the house prices. It is expected that increased input prices of production are responsible for the high cost of finished products. These finished products include raw materials for housing and building construction, thus causing persistent high volatility as observed by Savva and Michail (2017). Contrary to the nature of the impact of the producer price index, the house prices adjust negatively to the production output in the industrial sector (industrial production index) as indicated by Kishor and Marfatia (2017). This is possibly due to the fact that a greater proportion of the industrial and manufacturing industries comprises of the housing construction essentials. Our result aligns with De Vor and De Groot (2011) and Sivitanides (2015) that respectively informs that industrial activities and construction cost are strong determinants of the housing market dynamics. Additionally, the observed impacts of gross domestic product per capita, urban population and import on the house prices are similar to Pashardes and Savva (2009) and Sivitanides (2015).

5.1 *Policy implication*

On policy pathway, the present economy prowess of countries like South Korea, Japan and Germany are the results of rapid post-war innovative policies adopted by their government. In the case of Cyprus, by implication, the dynamics of industrialization and the housing market could well be checked using policy frameworks. By indication, the 'co-movement' of the variables is an indication that they are key drivers of businesses, industrial activities, and the overall economy of the country. In avoiding a skyrocketing house price, a subsidy or tax policy could be introduced along the chain of production and industrial manufacturing. For instance, the tax regime could potentially arrest the expansionary and contractionary effect on the housing prices to avoid potential economic hardship. Giving the contradictory impacts of the producer price index and the industrial production index, this reveals the fragility of the housing market in Cyprus. Hence, the introduction of a diversification policy could effectively prevent the mortgage sublime that caused the 2008-2009 GFC in the United States. Also, effective and attractive policies should be geared at luring foreign investors. As it is, Cyprus's policy of awarding citizenship right to investors in real estate, property, and the acquisition of beach has proven to be effective (Cyprus Mail July 2017).

In a future study, other salient observations, like migration factor (Alola & Alola, 2018) and the political impasse between the two-divided region of the island (the Turkish and Greek-Cypriot sides) are sources of research interest.

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Compliance with Ethical Standards

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