SÃO PAULO REAL ESTATE MARKET: INTERFERENCE OF ECONOMIC INDICATORS IN SALES OF RESIDENTIAL REAL ESTATES

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Abstract

This article consists of a specific analysis of the real estate market of São Paulo, the biggest and most representative city in Brazil. The aim of this study is to find factors that have influenced in home sales in this city. Through studies in the literature, we sought variables involved in the real estate market in general. After the choice of variables, we calculated a correlation matrix, and from there, we conducted a multiple linear regression with only significantly correlated variables. Finally, it is concluded that the variables value of letter of credit SBPE and the value of the SELIC rate explain 74.34% of real estate sales in São Paulo between 2004 and 2015.

Keywords: *Real estate market, multiple linear regressions, Economic indicators*

1.0 INTRODUCTION

Among the various sectors active in the national economy, stands out the real estate market, responsible for moving different fields of society, and have considerable ability to boost the economy (Matos and Bartkiw, 2013). The sector includes in addition to real estate, every step of planning, construction and marketing of the same (Moro *et al*., 2015), with features such as "high budget constraints, fragmented design processes and adversity relationships between stakeholders" (Oliva and Granja, 2015) highlighting the need to understand the real estate market so that better decisions can be made, seeking to achieve the expected performance for all involved (Souza *et al.,* 2009).

In recent years the national scene has had an increase in the number of real estate developments (Oliva and Granja, 2015), which drives the studies focused on this market. Despite the increase in the number of real estate developments, the dynamics of economic conditions in decades, which shows successive crises (Anghel and Hristea, 2015), instigates a relentless search for "increased productivity and competitiveness in all sectors of society", which include real estate companies operating in the segment of enterprises for sale (Honda and Lima Jr., 2015).

In designing Anghel and Hristea (2015), the real estate market depends fundamentally on the financial market, which justifies the study set of macro and microeconomic indicators. Thus, significant analysis of triggering investments in real estate, as the country's growth, global trends and government scenario, corroborate a broader view of the decision to purchase real estate or not, so that the acceleration or deceleration of the negotiations shall be linked to various economic factors (Moro *et al*., 2015).

Given the importance of the economic scenario analysis to better trading results can be earned (City of Johannesburg, 2013), part of it is assumed that the macro and microeconomic indicators are correlated with the housing market. In this context, the real estate market of the city of São Paulo, is the most representative of the national scene, since it is currently the largest city and most important commercial center of Brazil, featuring its market as having

favorable conditions "to the practice of real estate transactions, as well as monitoring these through studies and research on the behaviors and phenomena present in it" (Candido, 2012), being able to exercise power transmission housing demand in other cities within the country.

Face with this, this present research pretend to contribute to the expansion of the literature on this area, as well as its findings have practical implications for construction companies, developers, as well as investors. Given the importance of knowing which economic indicators influence the sales of its products, the real estate. From this point of view, this research aims to conduct an analysis of the real estate market in São Paulo between 2004 and 2015, checking the influence of economic indicators in relation to sales of residential real estates, using statistical methods to derive the same. The observation of this influence in the real estate. market is able to assist in the development plans for the sector, strongly allied to the construction industry, as well as in decision-making, in order to obtain better economic results. In addition, this research corroborates with the generation of studies and enrichment of the academic community hits of information regarding the dynamics of the Brazilian real estate market, urging that the research be conducted in order to identify characteristics or behavior patterns. For a better understanding of this, a brief literature review is presented after this chapter describing the issue that surrounds encompassing relevant information about the real estate market as well as on the active economic indicators in real estate market, based on recurring scientific publications in more various means of dissemination. In sequence are exposed the methodological procedures, followed by the presentation of results, as well as the relevant discussions. The study ends with the appropriate conclusions and presentation of ideas for future studies.

2.0   LITERATURE REVIEW

2.1   Real estate market

The real estates are consumer goods that have peculiarities in relation to others, as they encompass various products, such as materials and planning, from the construction, involving many professionals, to commercialization. The real estate market emerges sale and rent of such real estate, or is seen as a business that turns new and used real estate and may sell them or rent them (Heaney and Sriananthakumar, 2012).

In addition, the housing market itself, is composed by type of use and the type of contract, fitting the type of use of the land, housing, social and business, which wrapping houses (a bedroom, two bedrooms, three bedrooms, more than four rooms), apartments, offices, commercial real estates, production, among others. But the type of contract appears to the purchase and rental market (Brauer, 2011; Elmetwaly, 2011; Sanfelici, 2013).

It is known that the main intermediaries of the types of contracts, sales and rent of real estate, are the real estate agencies, since trading of real estates, like houses, apartments, land, and administration of rents. The builders and developers are responsive to market fluctuations, and then seek investment and available real estate, cultivating a network of purchase and sale of this consumer goods (Elmetwaly, 2011; Sanfelici, 2013).

This market fluctuates along a time line, high and low cycles, due to facts that provide these oscillations, cite the economic times, and monetary policies that are used to slow credit offers. Moreover, the political impact, directly across the economy, since there is a need to check the current demand to define the measures to be taken (Sanfelici, 2013).

2.2   Economic indicators in the Real Estate Market

It sought by means of bibliographic analysis, variables that could be correlated with the real estate market. Thus, it is clear that research involving indicators are widely found in various scientific activity means of dissemination.

Gonzalez (2002) used in its literature, variables such as General Market Price Index (IGP-M), Special System of Clearance and

Custody (SELIC) and mortgage values, aiming to propose a new approach to the assessment of real estate through market data, using tools such as multiple regression.

In order to gain understanding of the real estate market in São Paulo, Favero (2005) conducted an exploratory analysis of the housing finance data, exchange rate and minimum wage together with data on household consumption expenditure. Later Cagnin (2012) studied the evolution of housing finance in Brazil between 2005 and 2011 using financial instruments such as SELIC rate, the National Index of Consumer Price (IPCA), exchange rate and GDP.

Cerqueira, Ribeiro and Martinez (2014) used the SELIC rate, IPCA, housing finance data, exchange rate, to assess the monetary shock in the economy of the Brazilian real estate industry. In the previous year, Mendonça (2013) plunged into analyzing the volume of mortgage credit and monetary policy, making use of variables such as the National Construction Cost Index (INCC), IPCA, income, unemployment, delinquency and volume of mortgage concessions.

Internationally, Huan Wang and Gai (2011) analyzed the main factors that influence sales in the real estate market of China, using regression methods the authors concluded that the per capita income of the population and the price of real estate are the two factors that influence the sales in China. Corroborating, Liu and Li (2009) proposed an equation using multiple regression to analyze indicators affecting real estate sales in Beijing after the Olympics in 2008. The income, family size and the price of housing were found as variables independent.

Studies relating to the real estate market using indicators such as GDP, INCC, IPCA, Housing Finance, exchange rate, the SELIC rate, changes in the minimum wage and IGP-M are found in various literatures (Barbosa and Bueno, 2011; Rock *et al.,* 2011; Carrara and Corrêa, 2012; Martinez and Cerqueira, 2013; Rossi, 2014). Thus, there is a wide use of such studies on the real estate market and thus justified the inclusion of them in this research.

3.0   METHODOLOGY

In the search for resolution of the proposed objective, first we made the survey of the number of real estate units in the market in the city of São Paulo on a monthly basis, ranging from 2004 to 2015, provided by the Union of Housing of the State of São Paulo (SECOVI-SP) and the Brazilian company of real estate studies (Empresa brasileira de Estudos de Patrimônio - EMBRAESP). Subsequently, through literature searches (section 2.2 of the literature review) sought to obtain indicators that are connected with real estate sales. In Table 1 visualizes the variables to be used in research and its source collection.

Table 1: Variables used in the research, unit of measure e source of data

Varible	Unit of measure	Source of data
Marketed Real estate in São Paulo	Unit	SECOVI-SP e EMBRAESP
IPCA	%	IBGE
SBPE	R$	BACEN
IPCA-H	%	IBGE
INCC	%	FGV
Exchange rate (Dollar)	%	BACEN
SELIC	%	BACEN
IGP-M	%	FGV
National Minimum Wage	R$	IPEAdata

Source: Prepared by the authors

After meeting the variables we conducted a correlation study, generating a correlation matrix to the level of $\alpha = 5\%$ to see if the variables actually influence the real estate sales in the city of São Paulo, to confirm this. A Hypothesis Test was then used to see if the correlation was presented as significant.

We generated a multiple linear regression proposed by Montgomery *et al*. (2006) using the variables significantly correlated with the number of real estate sold in the city of São Paulo. In general, a regression is multiple when there is involvement of two or more explanatory variables X to the response variable Y, so that the multiple linear regression model is defined by the Equation (1):

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon \qquad (1)$$

That β_0, β_1 and β_2 are the parameters or coefficients of regression and $\mathcal{E}$ is the error associated with the template. Thus, a linear regression equation was made, where independent variables were used to explain the numerical dependent variable. In Figure 1 you can see the objective and methodical steps of the research.
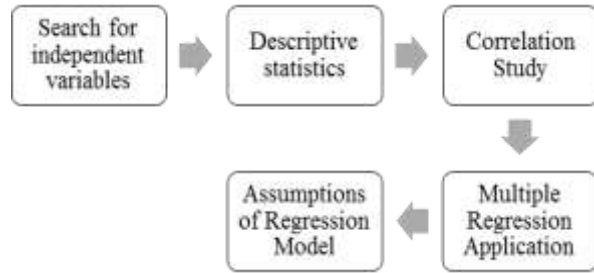

Figure 1: Methodology used in the research

For the regression model to be valid, it is necessary that some assumptions be met, to ensure non-biased, efficient and consistent assessments. The conditions to be met are: (a) the errors have zero mean; (b) the waste is homoscedastic (Breusch-Pagan test); (c) waste is independent (Durbin-Watson test); (d) errors are normally distributed (Kolmogorov-Smirnov test, Lilliefors test and Shapiro-Wilks test); (e) there are no problems of multicollinearity (VIF - Variance Influencion factore); and (f) no outliers

(Bonferroni correction). Please note that for all these research tests we adopted the 5% significance level. The software used to perform multiple regression analysis and testing the assumptions were *Statistica* 7 and *Action Stat*.

4.0 RESULTS AND DISCUSSION

4.1 Descriptive statistics

In general, it appears in Table 2 that the average of the dependent variable, represented by marketed units in the analyzed period was 2387.47, along with the observation of the maximum and minimum value, indicates that the variable values had a large dispersion, analyzing the coefficient of variation, we observed a relative variation of 41.92%.

Explanation is essentially economic: faced with a high exchange rate volatility, which reflects internal uncertainties and / or external agents seek demanding protection dollars and, consequently, pushing its price to high causing variation in the dollar rate which is similarly expound by Pillatti and Brito (2009), which also found a high variability of the exchange rate between the years 1999 and 2002.

Table 2: Descriptive statistics of the variables under study

	Mean	Median	Minimum	Maximum	Standard Deviation	Variation Coefficient
Marketed Unit	2387.47916	2228.5	732	5663	1000.94514	0.419247699
IPCA	0.48819444	0.475	-0.21	1.32	0.26082615	0.534266948
SBPE (R$10mi)	399.0296	353.7166	16.7848681	975.4894	301.33504	0.755169574
INCC	0.00594027	0.0043	-0.0017	0.0267	0.00493247	0.830343583
Exchange	0.310625	-0.61	-9.42	17.13	4.58215224	14.75139555
SELIC	0.97104861	0.9323	0.5384	1.5425	0.24268611	0.249921696
Minimum wage	506.662162	510	240	788	173.579033	0.342593244
IGP-M	0.51680555	0.485	-0.74	1.98	0.57372132	1.110129947
IPCA-HAB	14.3778173	13.835	12.8044	17.7178	1.66851933	0.116048166
INCC	0.59402777	0.43	-0.17	2.67	0.49324715	0.830343583

Source: Prepared by the authors

The variation of the IGP-M due to the fact that this indicator is composed of three other, 60% of the Wholesale Price Index, 30% of the Consumer Price Index and 10% of the National Construction Cost Index, and so for Couto and Fraga (2014) is influenced by many sectors such as agriculture, retail and construction, thus justifying its high variability.

4.2 Correlation Study

After the descriptive statistics and preliminary analysis of the data a correlation matrix took place between the variables in order to identify the variables that are significantly correlated with the dependent variable marketed units. In Table 3 we can check the correlation matrix between the variables and test p-value. It

appears that of the 5% significance level only four variables are significantly related to the dependent variable, they are: IPCA, SBPE, SELIC and IPCA-HAB.

The significant correlation between housing finance, represented here by SBPE, and sales in the housing market was also reported by De Paula (2013) which argues that the need to scale-up, with the increasing encouragement of credit from government programs, led financial institutions to incorporate segments of low income, so the real estate sales had a significant increase. Other studies also cite this correlation between credit supply and increase in real estate sales (Damiani, 2007; Mendonça, 2013).

Table 3: Matrix of correlation and p-values

	IPCA	SBPE (R\$10mi)	INCC	Exchange rate	SELIC	Minimum wage	IGP-M	IPCA-HAB	INCC
Marketed units	-.1998 p=.016	.8560 p<.001	.0613 p=.465	-.0925 p=.270	-.6808 p<.001	-.0604 p=.472	.0602 p=.474	-.4057 p<.001	.0613 p=.465

Source: Prepared by the authors

Other variables significantly correlated with marketed units in São Paulo were all negatively related, this is due to the fact that they are variables that explain inflation. What can be explained by the fact that with high inflation, there is a loss of purchasing power of the salaried population. Inflation impairs decision-making in an uncertain environment, and people do not apply for credit, because they do not know how their income will be in the future, making it difficult for family and financial planning. Inflation also hinders the growth of the country, because it brings many risks, and entrepreneurs are more cautious, their costs grow and its products lose attractiveness, as pointing Favero (2005), Favero *et al.* (2008) and Carvalho (2013), in contrast, they highlight with very low interest rates in past years, families with up to one minimum wage now have direct access to housing credit.

With a higher getting SELIC rate, we also can say a higher interest rate, people will have to pay more for their mortgages and will get less credit. They are losing purchasing power.

Especially in Brazil, where the government decided in 2014 that only 50% of the property value can be financed, had a strong impact on the real estate market. In 2015, the government reviewed their decision and got up to 80% again. But the damage to the real estate market was done and many people decided not to buy because of the future risk of losing their job as it happened to many other.

4.3 Multiple Linear Regression

After completion of the hypothesis test to find the significantly related variables with the variable marketed units in São Paulo, a multiple linear regression was generated using only four

independent variables chosen: IPCA, SBPE, SELIC rate and IPCA-HAB in order to show how much the variable marketed real estates in São Paulo is explained by the survey.

At first there was the t test with four significantly correlated variables, IPCA, SBPE, SELIC and IPCA-HAB, named Model 1, which can be seen in Table 4. Considering a 5% significance level obtained unsatisfactory results

for the variables IPCA and IPCA-HAB, being considered unsuitable for regression, as both a p-value > 5%. Thus, the study proceeded with only two significant variables, SBPE and SELIC, named Model 2 in this way, found p-values were satisfactory for the two variables, indicating that the SBPE and SELIC variables are appropriate for the regression model.

Table 4: Model 1 and Model 2 partial statistics for each variable.

		Beta	Standard Error Beta	B	Standard Error	t(139)	p-value
	Intercept			6137.85	805.9341	7.61582	0
	IPCA	-0.132859	0.078692	-509.86	301.9897	-1.68833	0.093589
Modelo 1	SBPE	-0.261709	0.106593	0.012	0.012	-2.4552	0.015315
	SELIC	-0.332603	0.13537	-1371.8	558.3243	-2.457	0.015242
	IPCA-HAB	-0.211297	0.112773	-126.76	67.6526	-1.87365	0.063079
		Beta	Standard Error Beta	B	Standard Error	t(141)	p-value
	Intercept			1903.76	536.0099	9.14864	0
Modelo 2	SBPE	0.313231	0.106024	0.12	0.0012	-2.95435	0.003673
	SELIC	-0.524616	0.106024	-1163.75	437.2883	-4.94811	0.000002

Source: Prepared by the authors

In Table 5 you can see the regression statistics for this research. Notes to the level of significance of 5%, 74.31% of the dependent variable is explained by the independent variables. In the same Table 5, to give credibility to the regression we performed the analysis of variance (ANOVA) to see if the regression was significant, so the F test could be viewed. With the p-value of 0.000011 found, the multiple linear regression model is appropriate and significant at the 5% significance level.

Considering the importance of the dependent variables in the study, the two are considered suitable for the estimated regression, obtaining a value of "F" of 12.40.

For the adjusted model to be reliable, the assumptions described in the chapter on methodology cannot be violated. The first assumption is that analyzed the waste have a mean of zero, resulting in the care of it, the other conditions can be seen in Table 6.

Table 5: Statistical multiple linear regression results

	Value	
Multiple R	0,75092	
Multiple R²	0,74670	
Adjusted R²	0,743107	
	F(3,13)	**p-level**
ANOVA	12,40181	0,00011

Source: Prepared by the authors

Table 6: Results of the assumptions of the suggested model

Assumptions	Test	Result (p-value)
Residue is homoscedastic?	- Breusch-Pagan	0.801118
The errors are independent?	- Durbin-Watson	0.011358
The residue following the normal distribution?	- Kolgomorov-Smirnov - Shapiro Wilk - Lilliefors	p>0.2 p>0.2 p=0.13234
Multicolinearity problems?	VIF	1.864
Residues have outliers?	Bonferroni correction	0.4677577

Source: Prepared by the authors

To test the variability of the residue the Breusch-Pagan test was applied finding a p-value of 0.801, therefore not rejecting the homoscedasticity hypothesis of residue. In relation to the test of independence, it appears that the residues are independent through the p-value found in the Durbin-Watson test of 0.0113. It also notes that the residues follow a normal distribution, proven by the three tests, with p-values found higher than the level of significance. Multicolinearity was diagnosed through the VIF, found for both variables was 1.864, thus indicating that there are no multicolinearity problems, because the VIF value found was lower than 10. Finally, we observed at measure 109 is a possible outlier, then we applied to the Bonferroni correction finding a p-value of 0.46, thus it follows that the measure is not an outlier because they do not reject the hypothesis that this observation is not an outlier.

Thus, the SBPE and SELIC variables were statistically significant in relation to the objective of this work, adding that significantly affected the p-value of t test partial regression to $\alpha = 0.05$, managing to explain 74.34% of sales of real estate in the city of São Paulo. In Table 4, knowing that the model is appropriate, justified by the tests, we can describe the multiple linear regression model, seen in Equation (2).

Marketed units = 1.903,76 + 0,0012 SBPE – 1.163,75SELIC   (2)

Interpreting the Equation 1, we have the SBPE rate is 0.0012, as we are working with the variable unit of R$ 10mi, 10 million increase in housing finance, will represent 0.0012 real estate's sold, ie for each 840 million offered represents one real estate sold. The SELIC rate,

represented as a percentage rate that has a model -1163.75 representing that every 1%, approximately 1164 real estates no longer be sold in São Paulo. Finally the intercept (linear coefficient) was equal to 1903.73, but as it is impossible in any year the incentive values to real estate credit, and Selic rate being zero, it is a plus factor in the equation, which makes it possible to verify that the limit of real estate sales for a month would be 1904 real estates.

The comparison with results of other related work is infeasible, since we didn't find scientific papers for the same purpose, others like Favero (2005), Ferraz (2011) and De Paula (2013) report that incentives to housing credit, in this work represented by SBPE, is the most relevant factor for the growth of the real estate market, contrary to the view exposed in this research, which explains that the variable with the highest rate (importance) to this equation is the Selic rate, with B (seen in Table 4) equal -0.52 against 0.31 of SBPE. Making, these authors articulate the real estate market is dependent on long-term financing sector leveraging market growth which is directly related to GDP. The credit period was extended from 30 to 35 year. This gave people new possibilities to afford their first house. Also the social housing program, called "My house, my life", would have an influence, but it couldn't beproved. This increasing financing sector is generating an intense economic movement in the country, what are mentioning by Cerqueira, Ribeiro and Martinez (2014), stating that the SELIC rate is capable of changing markets and influence in the population's purchasing power. Studies like this, factors that influence home sales will be increasingly substantial in order to assist in macroeconomic policies for the sector.

5.0 CONCLUSIONS

Based on the results, we found a model that explains that 74.34% of the number of marketed units of real estate in São Paulo. The model used two significantly correlated variables: the value of SBPE letter of credit and the value of the SELIC rate. This work was in its objectives from the beginning, rather than the development and application of a statistical tool. We developed a path for future vision that could be understood and followed by all entrepreneurs, investors and employees involved in the real estate market who desire to invest in the biggest real estate market of Brazil, the city of São Paulo.

Complementary to this, the use of data with a longer time period would cause that the model represents more reliably and the use of other macro-economic variables in a joint modeling. It is noteworthy that two important variables for this sector were left out of the analysis, the GDP of São Paulo and the FIPE index / ZAP period. This two variables are not used by not having monthly measurement and the second by only containing data from 2011. To explain this behavior, it suggests a causality test between the real estate sales series and the real estate developments.

Thus, we expected that through this research the possible future analysis on the real estate market in the state capital as well as in other state capitals that have important real estate markets, because these markets have the capacity to boost local development.

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