دراسة حساسية الطلب على الإسكان
لتغير الرهن العقاري في الأردن

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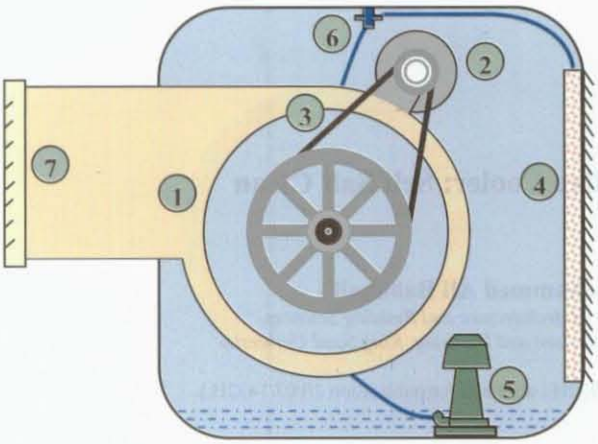
الكلمات المفتاحية: الإسكانات الجديدة، السوق، الأردن، الرهن العقاري.

ملخص البحث. ترتبط القدرة على تحمل تكاليف الإسكان في الدول النامية بالزيادة السكانية المرتفعة نسبياً بالمقارنة بالنمو الاقتصادي، حيث إن ملكية السكن في الأردن تعتبر صعبة نسبياً، ذلك أن تكلفة السكن أصبحت عالية خلال السنوات الماضية. كما أن التدابير التخطيطية الفعالة تتطلب فهماً دقيقاً لمحددات وسلوك الأسواق المعنية، وخاصة سوق الإسكان. تهدف هذه الدراسة إلى تطوير نموذج الطلب وبحث محددات الإسكان في الأسواق الجديدة في الأردن. كما ويسهم هذا النموذج في تحديد مدى فعالية المتغيرات المعنية من أجل المساعدة في وضع الخطط والسياسات الفعالة من أجل تلبية الاحتياجات المتزايدة للإسكان. ويستند النموذج على الأدلة التجريبية والأطر النظرية المعتمدة على طبيعة السوق المحلي، معتمداً على علاقات خطية وغير خطية لبيانات مستمدة من فترات زمنية متتالية. أظهرت الدراسة نتائج غير متوقعة، حيث إن المتغيرات السكانية والمتغيرات الاقتصادية لم تستطع تفسير الطلب على السكن بدلالة إحصائية مقبولة. وأن العامل المؤثر كان مرتبطاً بقطاع الرهن العقاري. كما وأن التطبيق مؤثر للغاية في السياسات الإسكانية للدولة ويتطلب ذلك اتخاذ إجراءات حاسمة للسياسة النقدية من أجل تحقيق أقصى قدر من الإنتاج، تهدف إلى تنفيذ البرامج الإسكانية الجديدة التي تساهم في تقديم المساعدة لبناء مساكن ملائمة للاحتياجات السكانية.



1. Centrifugal Fan
2. Electric Motor
3. Belt
4. Wetted Pad
5. Water Pump
6. Hose
7. Outlet Vent

Fig. 1. Evaporative cooler.

Fig. 2. The effect of the cumulated salt on the evaporative cooler (outside the cooler).

Fig. 3. The effect of the cumulated salt on the evaporative cooler (inside the cooler).

Previous Works

There are several attempts to improve the evaporative coolers performance and their efficiency, and to achieve the proper wetted pad media.

The basic principle of the evaporative cooling processes for human thermal comfort was studied, along with the mathematical development of the thermal exchanges (Camarago, Ebinuma and Cardoso, 2003).

In another study, a thermo economic analysis method based on first and second low of thermodynamic was applied to an evaporative cooling system coupled to an adsorption dehumidifier (Camarago, Ebinuma and Silveira, 2003).

On the other hand, a cross-flow direct evaporative cooler was investigated, in which the wet honeycomb paper constitutes the packing material and the results indicate that the performance can be improved by optimizing some operation parameters (Dai and Sumathy, 2002).

The performance characteristics of a pad evaporative cooling system in a broiler house in a Mediterranean climate was investigated. The results indicated that evaporative cooling systems can be recommended for sustainable poultry production in the Mediterranean region (Dagtekin, Karaca and Yildiz, 2009).

Three different natural fibers were examined as wetted medias. The study investigated their performance against the salt deposition. These three fibers were date palm fibers (stem), jute and luffa gourd. A commercial wetted pad was used to be a reference. The results came up with the jute having the least salt deposition followed by palm and luffa gourd fibers, while the commercial type had the highest salt deposition (Al-Sulaiman, 2002).

However, the most frequently deteriorating parts are the wetted pads which play very essential role in the cooling process. The most important factors affecting the efficiency of the wetted pad are the type of materials used in the pad, its thickness, surface area and the size of the perforation and the flow rate of air passing through the pad (Smmons and Lott, 1996).

In fact, the majority of the commercial wetted pads are wood based, where the salt deposition and mold forming usually clog their surfaces, declining the flow rate of air and decrease the performance of the evaporative cooler (Al-Sulaiman, 2002).

Due to the abhorrent implications of salt deposition, the salt accumulation needs to be controlled and minimized to maintain the wetted bad and the body of the cooler from damage, which will be discussed on this study.

Objective of the Study

The study aims to develop and enhance the efficiency of evaporative cooler performance by utilizing solar still, and to outline the impact of using such systems on the wetted pads media.

Significance of the Study

The importance of the study stems from the negative effect that salt deposition do in the evaporative cooling system. The effect of minimizing salt deposition is not restricted to the cooler performance, but it will save money by increasing the lifetime of the wetted pads and the metal enclosure, and reduce the numbers of maintenance.

By adapting solar water still, evaporative cooler will have the ability to minimize the salt buildup with no extra cost in electricity. The still is totally depend on solar radiation which is available most of the day and free of charge.

The Proposal System

The solar still and their accessories will be incorporated into the ordinary evaporative cooler, which can be installed over the roof of the cooler (Fig. 4).

The idea of this proposal is concentrated on the solar distillation still (Fig. 5). The mechanism of the solar still consists of two steps, evaporation and condensation. The sun's radiation heats water to the level of evaporation. As soon as water evaporates, water vapor is condensed on the inner surface of the glass cover for collection (Solanki, 2008).

The task of the proposed solar still is to draw the salty water from the base of the cooler and desalinate it by evaporating the water. The water vapor will be condensate and return back to the cooler's base. This operation removes impurities such as salts, dust particles and minerals as well as eliminates microbiological organisms. These wastes will remain on the base of the still and they can be removed easily from it at the time of changing the wetted pads.

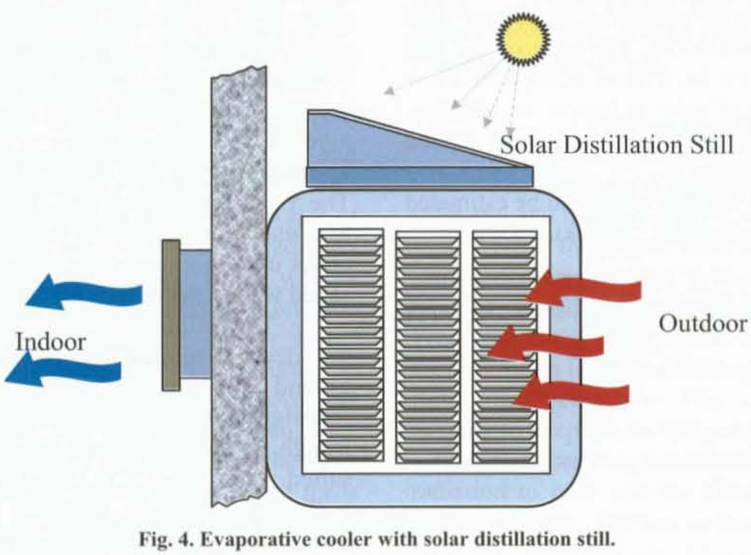


Fig. 4. Evaporative cooler with solar distillation still.

The base also radiates energy back to the glass cover in the form of a long wave (infra-red region), but this radiation has no ability to pass through the glass and reflected back into the still. This operation traps the solar energy inside the still (the greenhouse effects). The heated water vapor evaporates from the basin and condenses on the inner surfaces of the glass cover, which is at a lower temperature because it is in contact with the ambient air. In this process, the salts and microbes and other particles that were in the cooler water are left behind and accumulated in the bottom of the base.

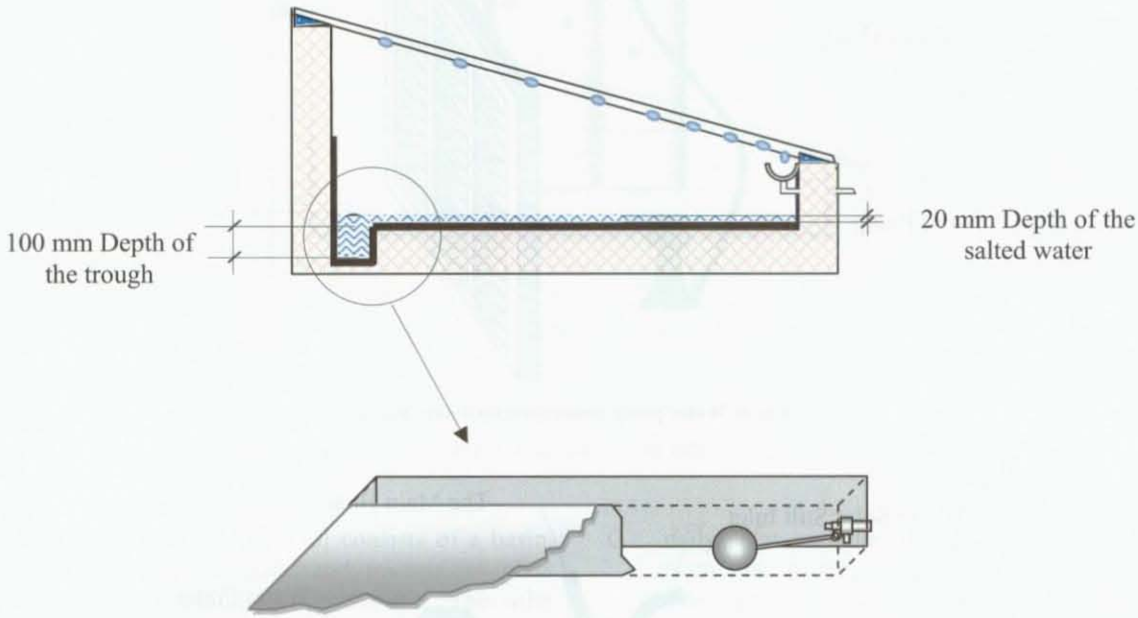


Fig. 8. The salted water trough with floating valve.

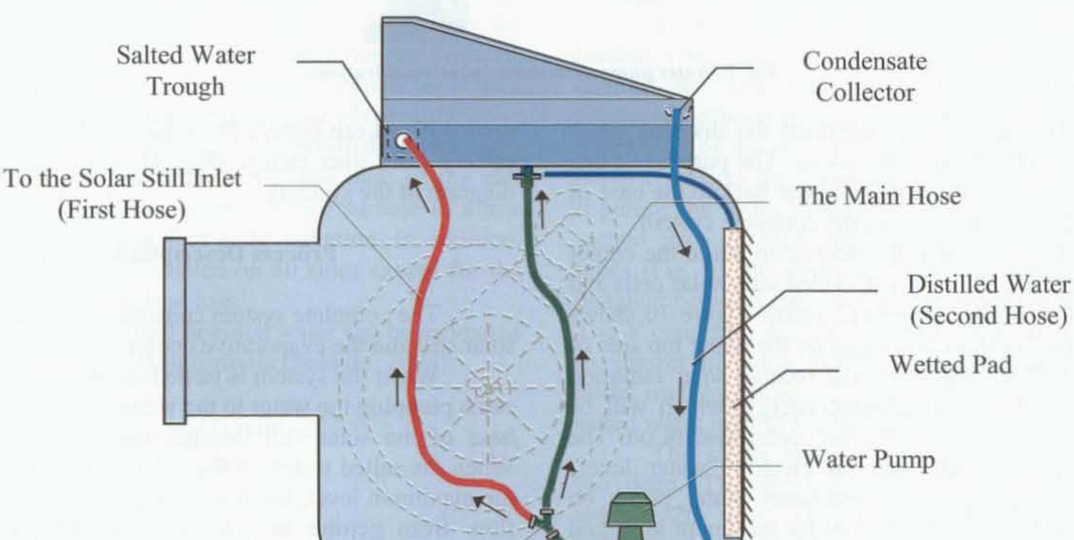


Fig. 9. The complete system.

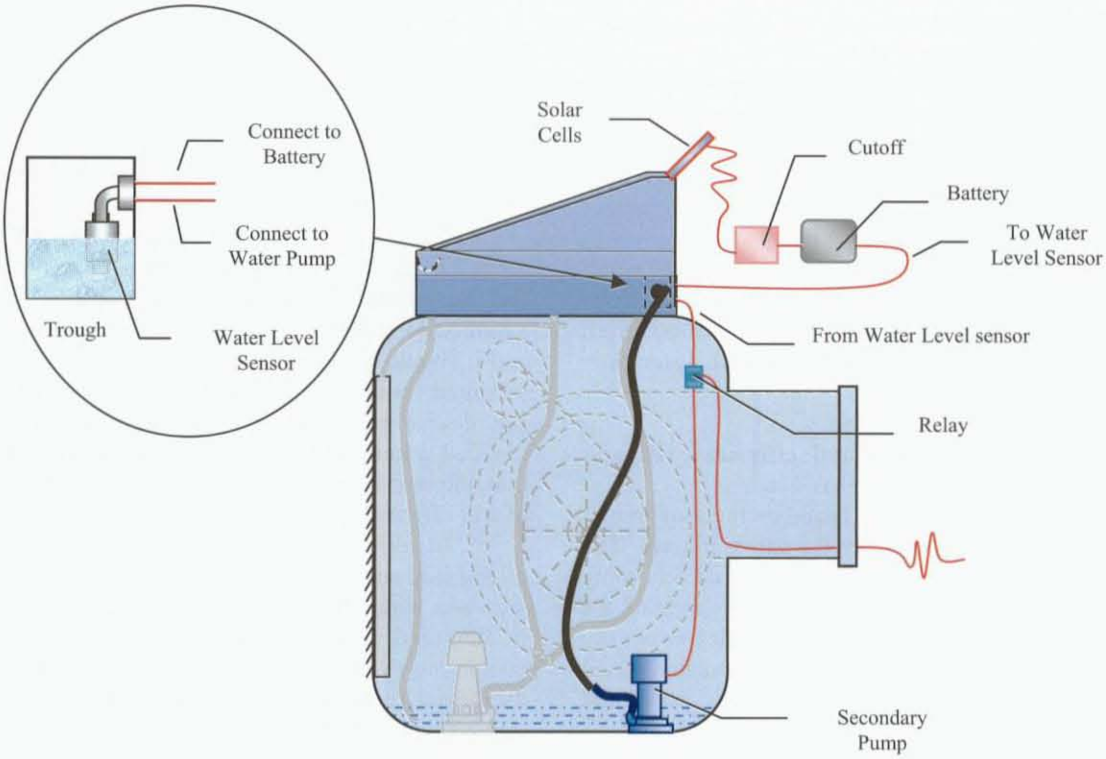


Fig. 10. The solar cells system.

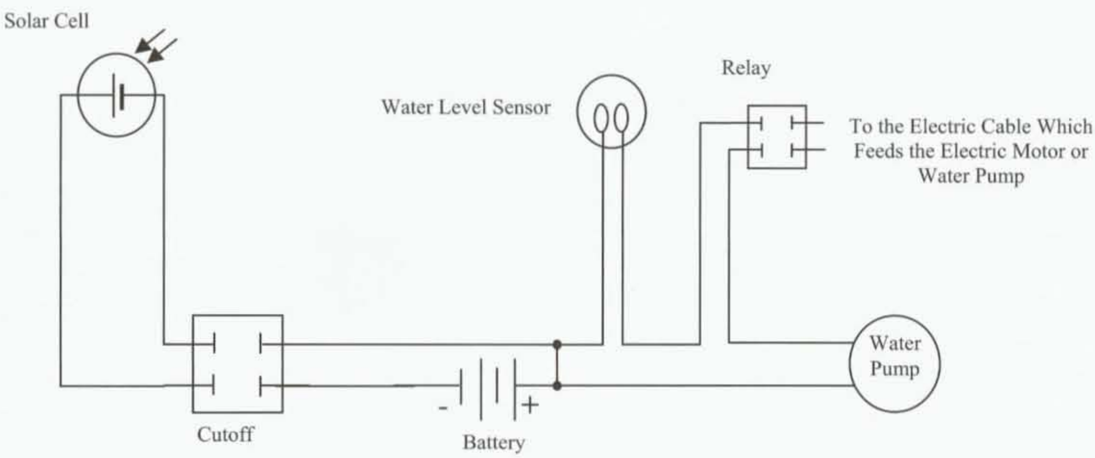


Fig. 11. Circuit diagram of the system.

Condensed water drips down the inclined glass cover to the collector "trough", and then returns back to the sink of the cooler.

When the level of salted water goes down, due to the evaporation mechanism, the floating valve turns on, letting the water running in to recharge the base again with water.

The operation continues as long as the cooler is "on", and the salted water moves from the sink of the cooler to the solar still and returns back as distilled water. After sundown, the still will continue to produce distillate until the water temperature cools down.

When the cooler is turned off, the relay of the solar cells system goes on and connects the secondary water pump with the solar system. The secondary water pump pumps the salted water to the trough until the certain level where the water level sensor disconnects the power from the pump.

The system keeps on producing distillate water until the salted water in its base dries or its temperature goes down, or the battery run out from energy. Figure 12 shows the diagram of water flow process.

Predicted system output and efficiency (Riyadh city as an example)

The size of the still is based on the roof area of the evaporative cooler, where the still is placed. The areas of the evaporative coolers are varied according to their power size. According to the sizes of the available cooler in the Saudi market, table1 shows the distilled water output which can be calculated based on the daily solar radiation in Riyadh city during the summer session (Figure 13) by using Formula (1).

In Table 1, the first four columns from left represent the coolers specification, where the fourth column indicates the roof area, in square meters, of the coolers. The rest of the columns (from Column 5 to Column 10) indicate the total output-distilled water per day (liter/day) during the summer session, from May up to October.

Table 1 shows that the distilled water output is ranged between 2 to 12.3 liters per day, according to the size of the cooler, where the still efficiency is assumed to be 60%. This indicates a good potential and it should be noted that withdrawing certain liters of salted water from the cooler base will reduce the salt degree in its water, and returning it back as distilled water will reduce it more again. In addition, this output can be increased by increasing the degree of still efficiency.

In addition, Fig. 14 indicates that the amount of distilled water output is proportional with the still area and with solar radiation. Thus, this can be seen in June and July where the solar radiation is high comparing to the other months. From the other side, the output increases when we move from the small size coolers to the bigger ones.

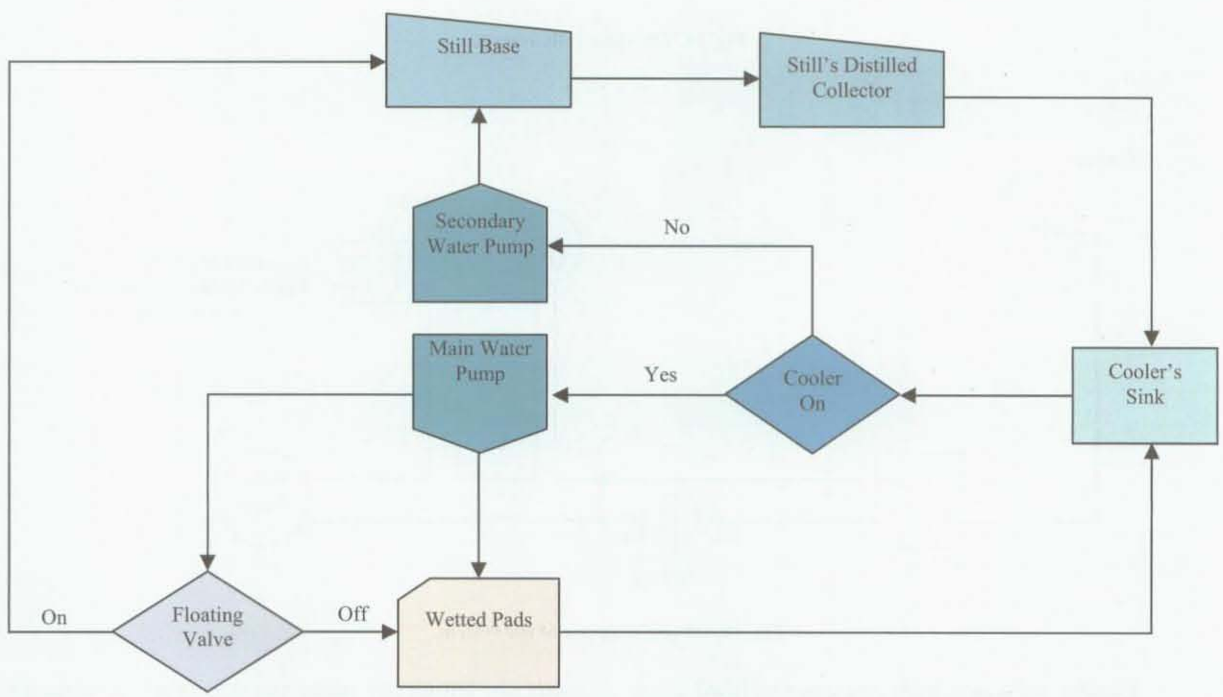


Fig. 12. Water flow process.

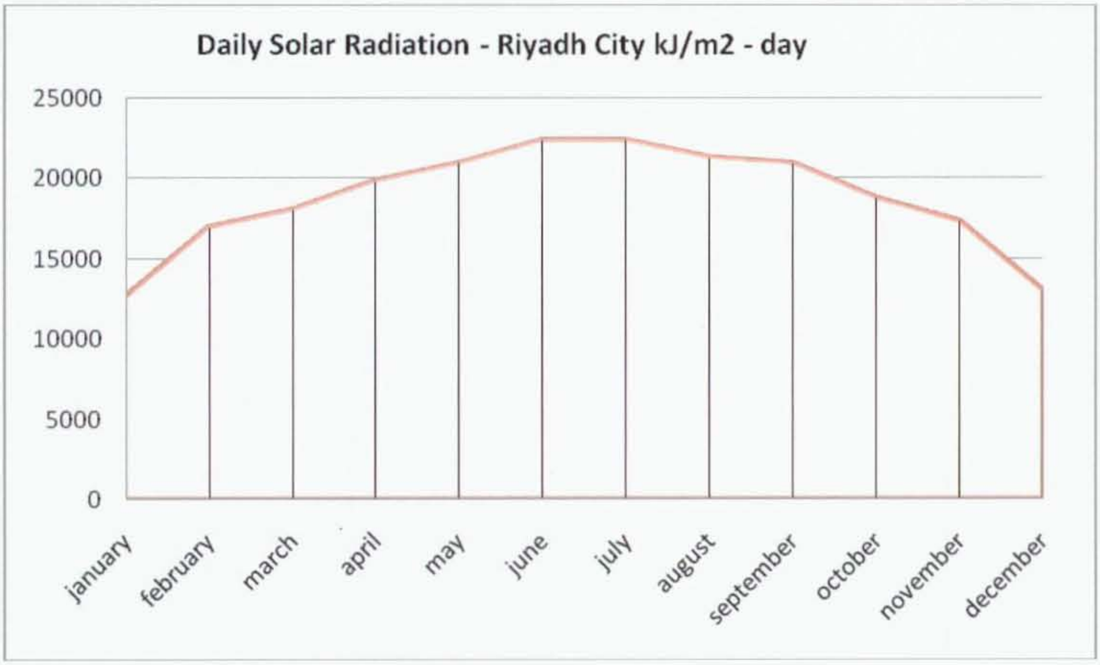


Fig. 13. Daily solar radiation in Riyadh city.

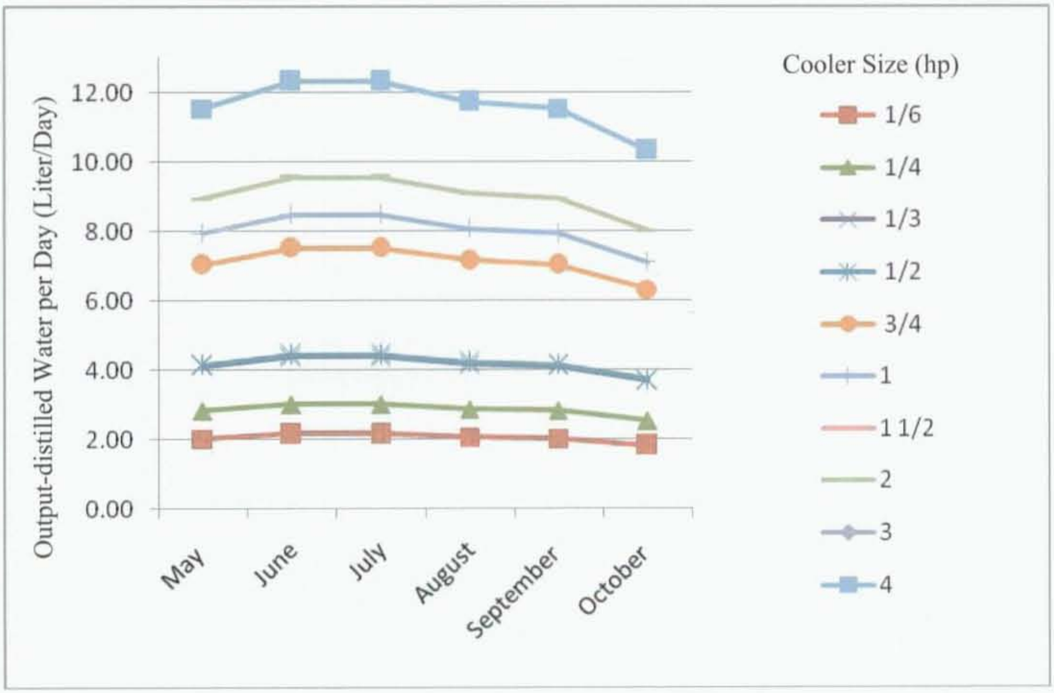


Fig. 14. Total output-distilled water per day (liter/day).

Table 1. Total output-distilled water per day (liter/day)

				Total Output-distilled Water per Day (Liter/Day) Efficiency = 60%					
				May	June	July	August	September	October
Size (hp)	L (m)	W (m)	Area m^2	(20880 KJ/m^2-day)	(22320 KJ/m^2-day)	(22320 KJ/m^2-day)	21240 KJ/m^2-day)	(20880 KJ/m^2-day)	(18720 KJ/m^2-day)
1/6	0.56	0.65	0.364	2.017784071	2.156941593	2.156941593	2.052573451	2.017784071	1.809047788
1/4	0.714	0.714	0.509796	2.825984198	3.02087966	3.02087966	2.874708064	2.825984198	2.533641005
1/3	0.86	0.86	0.7396	4.09987115	4.382620885	4.382620885	4.170558584	4.09987115	3.675746549
1/2	0.87	0.86	0.7482	4.147544071	4.433581593	4.433581593	4.219053451	4.147544071	3.718487788
3/4	0.9	1.41	1.269	7.034527434	7.519667257	7.519667257	7.155812389	7.034527434	6.306817699
1	0.9	1.59	1.431	7.932552212	8.479624779	8.479624779	8.069320354	7.932552212	7.111943363
1 1/2	1.04	1.55	1.612	8.935900885	9.552169912	9.552169912	9.089968142	8.935900885	8.011497345
2	1.04	1.55	1.612	8.935900885	9.552169912	9.552169912	9.089968142	8.935900885	8.011497345
3	1.04	2	2.08	11.53019469	12.32538053	12.32538053	11.72899115	11.53019469	10.33741593
4	1.04	2	2.08	11.53019469	12.32538053	12.32538053	11.72899115	11.53019469	10.33741593

Conclusion

A solar distillation still is incorporated with a centennial evaporative cooler. The solar still is designed to receive salted water from the cooler and return it back as distilled water. It is, also, provided with a solar cells system to save energy and to keep the still working on while the cooler is off.

An evaporative cooler does not need a major modification to be incorporated with the solar still; it needs only a minor adjustment which does not require an expert to do it.

The proposed system aims to eliminate the sediment (salt, dust, mold, microbes or any other particles) of the evaporative cooler by accumulating them in the base of the still, which can be cleaned and removed easily.

By eliminating the sediment, the life time of the centrifugal fan, electric motor, water pump, wetted pads and other supplements of the system will be extended due to the reduction of the corrosion's causes.

Finally, by adapting this system, eliminating the cooler's sediment is not restricted to economical aspects only, but it extends to cover health aspects, and create healthy environment.

References

Al-Sulaiman, F. *Evaluation of the Performance of Local Fibers in Evaporative Cooling: Engineering Conversion and Management*. Amsterdam: Elsevier, (2002).

Camargo, J.; Ebinuma, C. and Cardoso, S. "A Mathematical Model for Direct Evaporative Cooling Air Conditioning System." *Thermal Engineering*, Brazil, Vol. 4, (2003), 30-40.

Camargo, J.; Ebinuma, C. and Silveira, J. "Thermoeconomic Analysis of an Evaporative Desiccant Air Conditioning System." *Applied Thermal Engineering*, Vol. 23, (2003), 1537-2549.

Dagtekin, M.; Karaca, C. and Yildiz, Y. "Performance Characteristics of a Pad Evaporative Cooling System in a Broiler House in a Mediterranean Climate." *Biosystems Engineering*, Vol. 103, (2009), 100-104.

Dai, Y. and Sumathy, K. "Theoretical Study on a Cross-flow Direct Evaporative Cooler Using Honeycomb Paper as Packing Material." *Applied Thermal Engineering*, (2002), 1417-1430.

Krigger, J. and Dorsi, C. *Residential Energy: Cost Savings and Comfort for Existing Buildings*. 4th ed., Saturn Resource Management, (2004).

Smmons, J. D. and Lott, B. D. "Evaporative Cooling Performance Resulting from Changes in Water Temperature." *Applied Engineering in Agriculture*, Vol. 12, No. (4), (1996), 497-500.

Solanki, C. S. *Renewable Energy Technologies*. New Delhi: Prentice Hall of India, (2008).

macro demand model which is determined by a number of economic and demographic factors facilitating the formation of more effective housing policies in Jordan which could maximize productions and allocate investment in this sector efficiently.

Housing markets present an interesting field of research, and it has been the subject of a significant number of studies since Muth's pioneering work in 1960. Initial survey was done by Leeuw (1971), whereas Fulpen (1988) covers extensively theoretical and empirical studies on housing demand up to the 1980s. Donatos (1995) and Ge and Lam (2002) provide a significant number of housing studies in the last two decades. Malpezzi and Mayo's (1987) study is the only and most extensive literature survey on housing demand in developing countries. They argued that housing research in developing countries is limited to a small number of countries. Their work focused on the elasticity of demand and on the similarities in patterns of housing demand between the developed and developing countries. Johnson *et al.* (2004) worked on California housing market and found that 80% of changes in new housing constructions are explained by macroeconomic policies and demographic change. Fisher and Quayyum (2006) on the housing boom in the U.S. also found that demographic, incomes and regional structure of population account for about one-half of the increase in home ownership. Wilhelmsson (2008) investigated why housing prices differ between regions using incomes and cost of capitals as explanatory factors.

Recent literature on the mortgage market (Erbas and Nothaft, 2005, on their study of the Middle East and North Africa) argued that making affordable house mortgage loans available to a large cross-section of the population will serve the redistributive and growth-enhancing objectives of poverty reduction policies. Simulation based on U.S. experience provided some guide to the effect on economic growth of alleviating housing shortages by improving access to mortgage financing. Lau and Li (2006) used price-income ratio to measure housing affordability in the market. Yeung and Howes (2006) studied the role of housing provident funds in financing affordable housing in China. Bostic and Gabriel (2006) evaluated the effect of the mortgage purchase goals on home ownership in the U.S. and suggested the importance of ongoing federal policy in achieving housing objectives. Fair lending study by Apgar *et al.* (2007) examined how the structure of mortgage industry and uneven application of mortgage regulations combine to permit unfair mortgage pricing.

International literature finally provides empirical evidence on the housing market in two groups; the first group treats housing demand as a macro function using time-series data, while the second group analyzes it in terms of individual attributes of housing demand using cross-section data. In both cases, such empirical evidence is useful because it assists the process of specification of the demand function by identifying some basic factors, though their effect may differ in time and place.

2. Method

The demand matrix of households in the housing market is classified by their characteristics, preference and constraints. The market allocates housing units on the basis of the prices of those units and the number of households that are willing to pay for them. Allocation progresses to the stage where households obtain the housing units they prefer and can afford. This is the process of market clearing solutions in terms of demand, supply and prices. Total housing demand is generally determined by the total household's housing expenditure and public investment.

The level of the demand is, therefore, affected by a variety of complex economic, demographic and political factors.

2.1. Model formulation

The general function of housing demand can be formed as follows (Ge and Lam, 2002):

$$Qd = f(G, H, D, t) \qquad t = 1, 2, 3, \ldots\ldots \tag{1}$$

where Qd is the quantity demanded, G stands for macroeconomic variables such as; gross domestic product, interest rate, H represents housing related variables such as prices, income, etc., and D is related to demographic variables such as population, birth rates, households, etc. Following the formulation of linear regression model, Eq. (1) can be expressed as follows:

$$Qd = a_0 + a_1 G_t + a_2 H_t + a_3 D_t + \varepsilon_t \tag{2}$$

2.2. Data

The selection of the appropriate variables for the demand model of the Jordanian housing market is based on the empirical and conceptual framework, the nature of the case study market and limited by available data. The selected variables are divided into four categories; housing related, demographic, economic and monetary variables, shown in Table 1.

Table 1. The selected variables of the demand model; 1994-2005

Category	Variable Code	Variable Type	Measurement/Annual
Housing related	NHC LS	Dependant Explanatory	- Number of new housing units completed Ratio of small parcel subdivision to total subdivision
Demographic	NH	Explanatory	- Number of households
Economic	AP PY RPI	Explanatory Explanatory Explanatory	- Average Price of multiple housing units - Per capita National income - Retail Price index
Monetary	MV MD MS LVR	Explanatory Explanatory Explanatory Explanatory	- Amounts of mortgage advanced (money) - Dummy, expressing lending difficulties - Mortgage size - Loan-to-value ration

The sources of data used in the model emanate from official statistics provided mainly by the department of statistics of the Ministry of Planning (Jordan).

The annual aggregate time-series data covers the period 1994-2005. The time span estimate was constraint by data availability. The hypothetical demand model proposed to be estimated for the Jordanian housing market will take the basic formulation:

$$NHC = a_0 + a_1\, NH + a_2\, PY - a_3\, AP + a_4\, MV \ldots \quad (3)$$

These changes in the volume of new housing completions (NHC) are expected to be positively related to changes in the number of households (NH), per capita national income (PY), and the amount of mortgage money advanced for lending (MV). On the other hand, the volume of new housing completion should be negatively related to the price of housing variable (AP). Because of the nature of the study area and the characteristics of the housing unit as a necessity and investment good in the economy, it will not be surprising to expect different magnitudes of some variables of the model than that of other experiences, reflecting the exact behavior of the study area market.

Data for the main variables of the demand model plotted against the time span period reveals the existence of two main types of functional form (Fig. 1). Firstly, a linear positive form shown by the demographic NH, the per capita income (PY) and the retail price index (RPI) variables, and secondly a quadric form expressed by the volume of new housing completions (NHC), the price of multiple family housing units (AP) and the amount of mortgage money lend to the households (MV).

The form of the function of these variables postulate a first observation that these differences of data forms may lead to the question whether the visual assessment seen by the data functional form would produce different results than these expected by the hypothetical assessment?. Answer to such question will remain to be seen by the estimation results of the model, bearing in mind that not only the model variables have different functional form over the period of estimate, but also their values have increased differently, ranging from the lowest percentage of 25% for the dependent variable NHC, to the highest increase for the mortgage variable MV.

3. Estimation and Results

The procedure used to estimate the hypothetical demand model in Eq. (3) employs the necessary statistical tests such as the tests of significance t and F, and check for possible problems of multicollinearity among independent variables. The simple linear functional form was first used and later a log function was tested to see if the results improve by the application of better fit. To have an insight view on the results of the estimation process, different combinations of the explanatory variables entered the model in order to widen the scope of the results, in some cases and to avoid the inclusion of the variables that are producing statistical problems such as multicollinearity in other cases.

At first we examine the results more generally and then in the conclusion part we discuss the findings for each of the factors in the demand model including the mortgage variables. Table 2 summarizes the results showing the estimated coefficients, relationships (positive or negative) and statistical tests. Model 1 shows that about 83% of the variance in the dependent variable is explained by the variations in the basic explanatory variables of the hypothetical model namely; the demographic factor NH, the per capita income PY, the price of multiple family housing units AP, and the mortgage advanced variable MV. Surprisingly, significance tests (t) for most of these explanatory factors fail, except for the mortgage variable. The demographic factor is significantly successful, but has the wrong expected sign on its coefficient; negative sign instead of a positive one. In addition, possible multicollinearity problem may exist as a result of high correlation between the explanatory variables MV and AP.

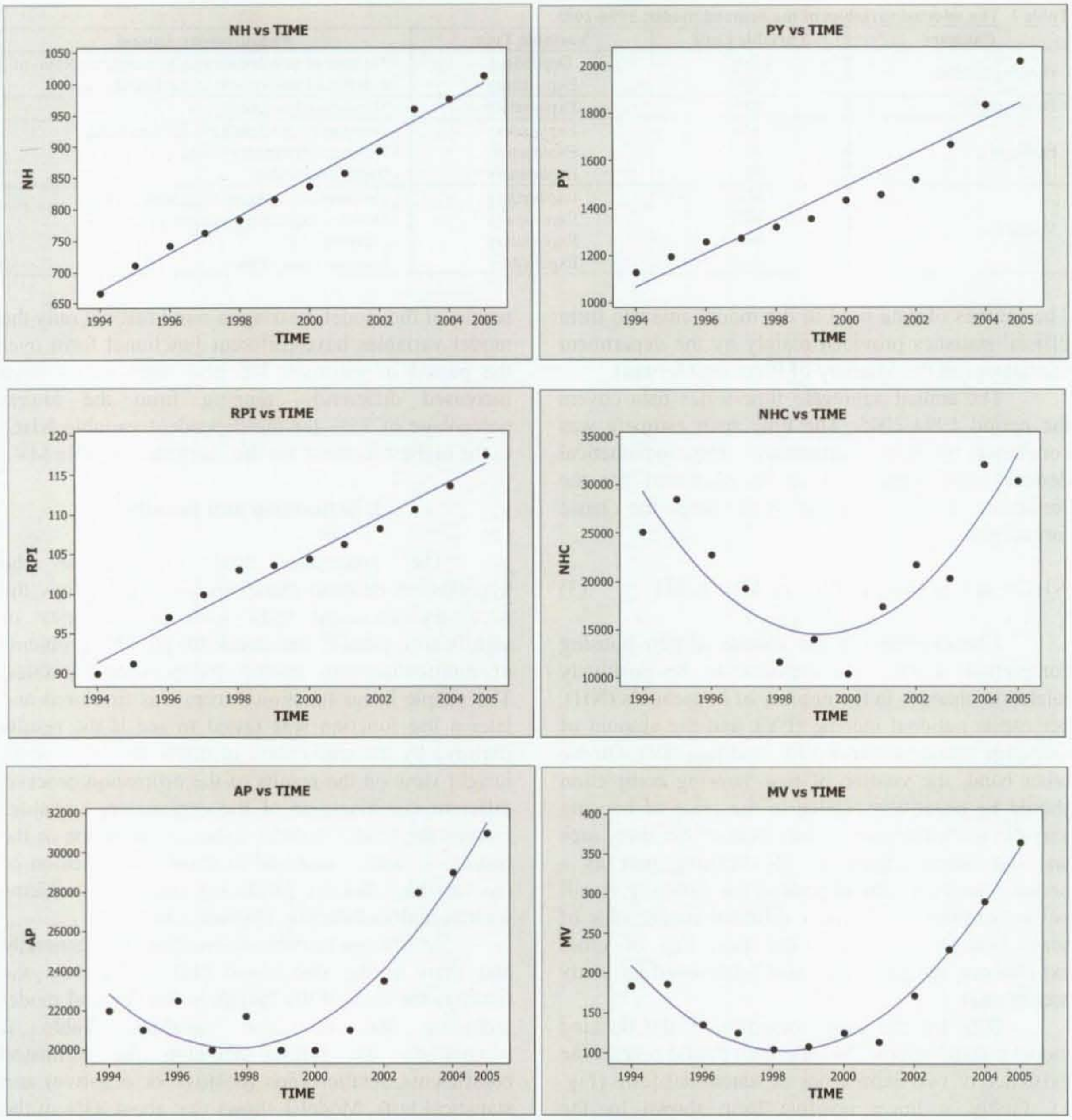


Fig. 1. The value of main variables of the demand model, 1994-2005.

Model 2 shows the results of estimating the hypothetical model having dropped the price variable AP to avoid problem of multicollinearity since this variable fails also in the significance test (t). The outcome is a little improvement, but still the demographic factor has the wrong sign, and the per capita income variable stays on the edge of below successful (t) test. Only the mortgage variable MV has a successful (t) value. Model 3 experimenting with the use of the demographic variable, the NH and the mortgage variable MV are only to make sure that NH is really insignificant in explaining the changes in the dependent variable. The demographic factor shows the same results when enters Model 4 with different variables, namely RPI and LS.

Model 4 indicates that the standard of living variable expressed by the retail price index RPI and the supply of affordable size of residential land cannot be accounted for as playing significant role in the demand function. Again, only the mortgage market variable MD is significant holding the expected sign; that difficulties and shortages of

Table 2. Summary results of the estimation of the demand for new housing in Jordan, 1994-2005. Dependent variable: NHC (Number of New Housing Completions)

Model	Explanation Variables	a	b	t	f	R^2	Elasticity
1	NH	30847.8	-45.6	-2.347	8.517	0.830	
	AP		-0.235	-0.223			
	PY		9.120	1.417			0.589
	MV		119.5	2.774			0.794
2	NH	29097.4	-47.6	-2.951	12.868	0.828	
	PY		8.745	1.500			
	MV		111.032	5.845			
3	NH	30671.8	-32.336	-2.421	15.957	0.780	
	MV		97.958	5.438			
4	NH	27363.4	-26.200	0.255	4.378	0.714	
	RPI		225.750	0.176			
	LS		-5873.2	-1.720			
	MD		-12590.3	-2.652			2.842
5	RPI	46968.4	-408.1	-2.676	17.753	0.793	1.058
	MV		92.696	5.912			
6	MV	17279.4	68.705	3.951	8.078	0.642	
	LVR		-21.807	-0.368			
7	MV	25891.5	114.857	5.284	17.404	0.795	
	PY		-17.352	-2.629			
8	MS	-3766.5	2.777	2.354	5.540	0.357	
9	MV	8775.2	69.303	4.187	17.535	0.637	
10	LVR	37946.1	-43.615	-0.472	0.223	0.022	

mortgage supply available to households are negatively correlated with the dependent variable.

Model 5 is statistically the best estimate of the demand so far. The two explanatory variables MV and RPI are statistically significant each with the expected sign. This model, although doesn't imply some standard demographic and economic variables, was able to explain about 80% of the demand variations. Experiments with other explanatory variables in Models 6 and 7 do not produce significant results, but still indicate the importance of the mortgage variable effect on the level of new housing demand. Finally, Models 8, 9 and 10 show the importance of different forms of the mortgage market variables in the demand function. Mortgage size MS of Model 8 is statistically significant, explaining about 35% of the variations demand. Introducing the loan to value variable LVR of Model 10 suggests that households don't really make their decisions to enter the housing market on the size of the mortgage relative to the cost of housing. Model 9 with the size of mortgage money lend to household variable MV alone explains more than 60% of the demand function. This mortgage variable, again is statistically significant, has the expected sign and explains a considerable portion of the demand value.

Before concluding the contribution of the variables of the demand function and analyzing their ultimate effect in the new housing market, attempts were made to use logarithm form (double log and semi-log functions) to estimate the hypothetical demand model. Table 3 summarizes the results which assert that no major changes have been produced by the logarithm functional forms supporting the earlier results of the linear form of the demand function.

Table 3. Summary results of the estimation of the demand model is logarithm form, 1994-2005. Dependent variable: NHC

Model	Explanation Variables	a	b	t	f	R^2	Elasticity
1	Ln NH	16.762	-2.728	-0.360	4.367	0.714	2.085
	Ln AP		-0.108	-0.560			
	Ln PY		2.342	0.353			
	Ln MV		2.085	2.781			
2	NH	122065.9	-35517.4	-0.317	9.326	0.842	
	AP		3562.5	1.244			
	PY		-6730.3	0.069			
	MV		42475.1	3.830			

4. Conclusions

The conclusions will begin with the final assessment of each of the factors of the demand model and ends with a more general overview.

The demographic factor NH expressed by the number of households did not turn out to be a significant factor in the demand model for Jordan. Although it was statistically significant in most formulations, it had the wrong sign on its coefficient, suggesting little effect, if any, it had on the volume of new housing construction.

In a market where population growth is proceeding at high rates of 3.7% during the estimation period, this finding is unexpected. One explanation is that the housing market is affected more by the availability of mortgages to households than by mere household increase.

Changes in the price factor AP doesn't also play a significant role in the market during the estimate period. The coefficient of this variable was insignificant in the general model, while in some other formulations had a significant positive coefficient instead of a negative one as expected. This finding asserts the argument that housing in a developing country is still more a necessity good to some households to the extent that they don't drop out of the market by steady increase in prices, while for other households in the market, housing is considered as an investment good expecting prices to continue to increase in the future, as past observations show.

The income factor PY hasn't produced decisive result in the market. In the linear formulation (Table 2), its coefficient holds the right positive sign but it is significant only on the 0.10 significance level. One is more ready to accept its positive contribution is the market than the complete rejection. However, a better specification of the income variable in the future, when data permits, by using, for example, the real disposable income of households instead of the available per capita national income may produce more conclusive results. The elasticity of demand with respect to the model's income variable is 0.59 suggesting that household's income increase by 20% for example will make the demand increase by 12% only, while the remaining percent increase of will go for other expenditure and savings.

The mortgage market variable MV is certainly the most influential variable in determining the demand function of the Jordanian housing market during the estimation period 1994-2005. In contrary to most of other demographic and macroeconomic variables of the hypothetical demand model, it is always significant with the expected positive sign in all estimations whether in linear or log forms. This suggests that households rely heavily on getting mortgages from banks and institutions to fulfill their need for housing. The mortgage size variable MS is also an important determinant in the housing market suggesting that an increase in mortgage size encourage households to enter the housing market where as the loan to value LVR variable proved to be insignificant. Households seem to consider first the availability of the mortgage and encouraged by increasing the size of that mortgage, to make their demand for housing and not much by relating the size of the mortgage to the cost of housing.

The results of our demand model of Jordan as a whole suggest that the most influential factor in terms of statistical significance, size effect and consistent results, is the availability of mortgage MV variable and to a lesser degree the standard of living variable RPI. Both factors explain about 80% of the variance in the dependent variable, 60% of the variance is explained by the mortgage variable alone. The final conclusion asserts that the demand is highly sensitive to changes in the mortgage market and that these changes are related more to the availability and size of mortgages than to the relative mortgage size to the cost of housing LVR.

The implications of this result is important since a considerable proportion of future demand for new housing could be achieved within the state's monetary policy by facilitating and encouraging the private and public lending institutions. The elasticity of demand with respect to the mortgage advanced variables MV and mortgage difficulties MD range from about 0.8 to -2.8 indicating that demand for new housing is elastic with mortgage change. The new state housing program labeled "decent housing for decent living" which aims at providing more homes as a result of the large increase of land and housing costs in the last five years, should be aware of the fact that to implement such a program successfully special attention should be paid to the restructuring the conditions and terms of existing lending institutions to make them ready to participate in the housing market more strongly.

References

Apgar, W.; Bendimerad, A. and Essene, R. "Mortgage Market Channels and Fair Lending Analysis of HMDA Data." Joint Center for Housing Studies, working paper MM07-2, Harvard University, U.S., (2007).

Bostic, R. and Gabriel, S. "Do the GSEs Matter to Low-income Housing Market?: An Assessment of the Effect of the

GSE Loan Purchase Goals on California Housing Outcome." *Journal of Urban Economics*, Vol. 59, No. (3), (2006), 458-475.

De leeuw, F. "The Demand for Housing: A Review of Cross-section Evidence." *Review of Economics and Statistics*, Vol. 53, No. (1), (1971), 1-10.

Donatos, G. "A Quantitative Analysis of Investment in New Housing in Greece." *Urban Studies*, Vol. 32, No. (9), (1995), 1475-1487.

Erbas, S. and Northaft, F. "Mortgage Markets in Middle East and North African Countries, Market Development, Poverty Reduction and Growth." *Journal of Housing Economics*, Vol. 14, No. (3), (2005), 212-241.

Fisher, J. and Quayyum, S. "The Great Turn-of-the-century Housing Boom." *Economic Perspectives*, Vol. 30, No. (3), (2006), 29-44.

Fuplen, H. "A Comparison of the Development of Expenditure in Various OECD Countries during the Period 1964-1981." *Journal of Housing and the Built Environment*, Vol. 1, No. (1), (1986), 52-68.

Ge, X. and Lam, K. "Building a House Prices Forecasting Model in Hong Kong." *The Australian Journal of Construction Economics and Building*, Vol. 2, No. (2), (2002), 57-70.

Halicioglu, F. "The Demand for New Housing in Turkey: An Application of ARDL Model." *Global Business and Economic Review*, Vol. 9, No. (1), (2007), 62-74.

Hunaiti, H. "Housing Demand in Jordan: A Case-study." Population Studies Department, University of Jordan, Jordan, (1997).

Johnson, H.; Moller, R. and Darida, M. "In Short Supply?: Cycles and Trends in California Housing." Public Policy Institute of California, U.S., (2004).

Lau, K. and Li, S. "Commercial Housing Affordability in Beijing, 1992-2002." *Habitat International*, Vol. 30, No. (3), (2006), 614-627.

Malpezzi, S. "Economic Analysis of Housing Markets in Developing Countries." In: P. Cheshire and E. Mills (Eds.), *Handbook of Regional and Urban Economics*. Vol. 3, Ch. 44, Elsevier, (1999), pp. 1791-1864.

Malpezzi, S. and Mayo, S. "The Demand for Housing in Developing Countries." *Economic Development and Cultural Change*, Vol. 35, No. (4), (1987), 259-272.

Wilhelmsson, M. "Regional House Prices: An Application of Two-equation Model to the Swedish Housing Market." *International Journal of Housing Markets and Analysis*, Vol. 1, No. (1), (2008), 33-51.

Yeung, S. and Howes, R. "The Role of the Provident Fund in the Financing Affordable Housing Development in China." *Habitat International*, Vol. 30, No. (2), (2006), 343-356.