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Estimating the Import Demand Function for Paper and Paperboard Products in Iran

Abschätzung der Importbedarfsfunktion für Papier und Pappprodukte im Iran

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Key words: Import demand, paper and paperboard, Ordinary Least Square, Iran

Schlagworte: Importbedarf, Papier und Pappe, Methode der kleinsten Quadrate, Iran

Abstract

This study investigated the factors that affect the import demand for paper and paperboard products in Iran. Data used in the time series analysis covered 1989-2013 periods. Double-log linear function was applied to analyze the import model, and the coefficients were evaluated using the ordinary least squares method. The import demand for paper and paperboard including: writing and printing paper, newsprint, and corrugated board were specified as functions of relative price variable, gross domestic product, Iran's petroleum export income, Iranian Rial-US dollar exchange rate, domestic production for each of the studied products, and the import quantity in the previous year (the first lagged). The results indicate that the demand for all of the studied products are own-price and income-elastic, and the writing and printing paper compared to newsprint and corrugated board is more sensitive to price and GDP changes. The adverse impact of relative price of the mentioned products on their

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import demand is in accordance with the import demand theory. The exported petroleum income could not influence the import demand of writing and printing paper and corrugated board, but in case of newsprint, a positive relationship between these two variables was observed. The demand for import of the all mentioned products is affected by exchange rate fluctuation. The domestic production quantities of the paper and paperboard products imposed an adverse impact on the import demand of these products. For all the studied commodities in this paper, the import variable with the first lagged quantity had an adverse impact on the current demand of their import.

Kurzfassung

Diese Studie untersuchte die Faktoren, die Einfluss auf den Importbedarf für Papier- und Pappprodukte im Iran haben. Die Daten der Zeitreihen umfassten die Jahre 1989 bis 2013. Zur Analyse des Importmodells wurde eine doppelt-logarithmische Funktion angewandt und die Koeffizienten wurden mittels der Methode der kleinsten Quadrate geschätzt. Der Importbedarf beinhaltet: Schreib- und Druckpapier, Zeitungspapier und Wellpappe, welche als Funktionen der Relativ-Preis Variablen, des Bruttoinlandsprodukts, der Einnahmen Irans aus dem Rohölexport, des Rial-US-Dollar Wechselkurses, der Inlandsproduktion der untersuchten Waren und der Importmenge des vorherigen Jahres (verzögerte Reaktion) festgelegt wurden. Die Ergebnisse legen nahe, dass die Nachfrage aller untersuchten Produkte eigenpreis- und einkommenselastisch ist. Das Schreib- und Druckpapier verglichen mit Zeitungspapier und Wellpappe ist allerdings empfindlicher gegenüber Preis- und BIP-Veränderungen. Der negative Einfluss des relativen Preises der untersuchten Waren auf den Einfuhrbedarf steht in Übereinstimmung mit der Theorie des Importbedarfs. Die Einkünfte aus dem exportierten Rohöl hatten keinen Einfluss auf den Einfuhrbedarf von Schreib- und Druckpapier und Wellpappe, aber in Hinsicht auf Zeitungspapier konnte ein positiver Zusammenhang erkannt werden. Der Import aller Produkte wird von Wechselkursschwankungen beeinflusst und die Herstellungsmengen der Papierprodukte im Inland zeigen einen gegensätzlichen Einfluss auf den Einfuhrbedarf. Für alle in dieser Studie untersuchten Güter existiert ein negativer Zusammenhang der verzögerten Importvariablen zum aktuellen Importbedarf.

1. Introduction

Iran is a sparsely forested country with about 4.5% forest cover and 4.5% other wooded land. The area of natural forest in Iran is approximately 12.4 million hectares, and approximately 1.9 million hectares are commercial forests called Iranian Caspian, Hyrcanian, or Northern forests. Forest industries in Iran produce sawn-wood, wood-based panels, as well as pulp and paper from hardwood species. Almost six million cubic meter of wood is annually consumed in Iran. Of this, around two million cubic meter of wood is produced from natural forests that are located in north of Iran (Hyrcanian forests); almost two million cubic meter of wood is derived from domestic plantation, and about two million cubic meter of wood is imported (Mohammadi Limaei et al., 2011). Other domestic sources for fibrous raw materials for large scale pulp and paper industries in Iran such as waste papers and agricultural residues due to the extensive utilization agricultural residues for cattle feed and the presence of many very small scale paperboard producers are limited. Therefore, the shortage of these materials for pulp and paper production is a serious problem. On the other hand, the establishment of new forest products mills is not among priorities of industrial development of the country which represents this industrial section, and due to the lack of suitable raw material and consequently undesirable investment in fiber deficient regions, it has not been able to satisfy the growing domestic demands. Therefore a considerable volume of paper products was supplied through imports. Namaki et al. (2014) estimated that in 2012 only14.8% of the total consumption was supplied via domestic production for writing and printing paper, and the rest was satisfied through imports. A similar situation exists For other forest products such as wood furniture. For example, the researchers found that in less than 11 years, Iran, once an exporter, transformed to an importer of furniture, there are several reasons, e.g. more competitiveness price, modern look, finer textile and so on(Fathollahzadeh ,et al. 2009). Limitations of domestic wood suppliers, low quality, and high of domestic produced paper products in comparison with foreign products can be considered as the main problems of the paper industry in Iran. In a similar finding, Saberi (1995) showed that the domestic to imported products prices' ratios of forest products in Iran are the most important factors in imports. Thus, it seems that importing has been a key factor in fulfillment of the growing domestic demands, and therefore studying the country's demand for forest products' imports and monitoring its evaluation over time, are important issues that merit careful examination. This kind of analysis could be useful for the industry as well as the policy makers to improve the existing industries and encourage the establishment of new facilities, due to they will able to identify the market and macroeconomic effective factors on demand for imports of the each studied paper products. Considering the importance of such a survey and the vast volume of forest products trade on international scale, it is necessary to provide a better understanding of the forces driving the demand for paper products' import in general.

Li et al. (2002) concluded that U.S paper and paperboard imported products are substitutes for China's domestic produced products. Gan (2004) demonstrated that

China's accession to WTO (World Trade Organization) significantly increases its imports of forest products and reduces its domestic market prices of lumber and wood products as well as pulp, paper, and related products.

In the case of the forest products industry, many researchers found that the variables (e.g., domestic and imported prices, exchange rate and income growth are important explanatory variables perceived to be demand driving (Buongiorno et al., 1988; Baek, 2007, Baek andYin, 2006; Kim, 2004; Kim et al., 2003; Tajdini et al., 2011). Buongiorno et al. (1988) examined the impact of changes the exchange rate and U.S. domestic lumber price on U.S. lumber imports from Canada using the standard Granger Causality test, and expressed that while U.S. price of softwood lumber has a dominant and effective force on lumber imports from Canada, the exchange rate exerts negligible effect on imports. Baek (2007) investigated the dynamic relationships between macroeconomic variables (i.e., exchange rate and U.S. income) and U.S.-Canada trade in forest products including softwood lumber using an autoregressive distributed lag (ARDL) model; he concluded that the income growth is a more powerful factor than the exchange rate. Tajdini, et al. (2011) in a similar research on the imports of wood-based panels in Iran showed that the petroleum export income variable of Iran has a positive impact on the demand for imports of veneer, but cannot influence imports' demand of particleboard and plywood. The demand for all the mentioned products' import is affected by exchange rate variations and import variable with the first lagged. The domestic production quantities of plywood and veneer have an adverse impact on demand for the import of these products. However, for particleboard, the out-dated production structure of domestic manufacturing facilities causes the inefficiency of locally produced particleboards to affect the demand for import. For the studied commodities, Mohammadi Limaei, et al. (2012) found that there is a significant relation 5% between wood imports as a dependent variable and population, GDP, and the amount of domestic wood production as independent variables. Kim et al. (2003) estimated the impacts of currency value change on the forest products import quantities using Korean data. The results by Granger causality test showed that currency value change affected softwood import quantities in Korea. Arabatzis and Klonaris (2009) analyzed the Greek aggregate import demand for unprocessed wood (such as logs), processed wood (such as sawn lumber), veneer, and wood manufactured parts during the period 1969 to 2001 using the linear approximation of quadratic AIDS model. The results indicated that the imports of unprocessed wood, veneer, and wood manufactured parts are price-elastic. In contrast to processed wood imports, unprocessed wood, veneer, and wood manufactured parts' imports are found to be expenditure-elastic while unprocessed wood is found to be an inferior good. Substitution possibilities are found to be significant between veneer and other wood imports and between processed wood and unprocessed wood.

In this study, it was aimed to determine the factors affecting import demand for paper and paperboard products in Iran during the period, 1989-2013 and to apply OLS Model. The method of least squares has some very attractive statistical proper-

ties that have made it one of the most powerful and popular methods of regression analysis. These estimators are unbiased and have minimum variance, in short, they are BLUE[1] (Gujarati, 2004).This research emphasizes the implication of including delayed (lagged) quantity dependent variables in market modeling.

2. Materials and methods

2.1 Data

In this study, the time series data covering 1989-2013 periods were used to carry out the study. Iran's import demand for paper products including: writing and printing paper, newsprint, and corrugated board were specified as functions of relative price variable represented by the ratio as import price to domestic price, GDP, Iran's exported petroleum income, Iranian Rial-US dollar exchange rate, domestic production, and the import quantity in the previous year(the first lagged). Data of import and production quantities (expressed in MT) and import and domestic prices in rials were collected from the Islamic Republic of Iran's Customs Administration and the Ministry of Industry and Mines, respectively (IRIC, 2014; MIMI, 2014). The relative price is expressed in terms of a ratio between the import price and domestic price of any the studied products .All data related to the exported petroleum income, nominal exchange rate, and GDP were collected from Central Bank of the Islamic republic of Iran (2014), and the values were deflated based on 2004 (2004=100).

3. Methods of analysis

3.1 Unit root test

The term "stationary" is used to define a condition that must be assessed for time series analysis. A time series is said to be stationary if the mean and auto-covariance of the series do not depend on time. This means that the series does not have an upward or downward trend over time. Also, a non-stationary time series has a possibility of spurious regression. Therefore, we should check whether a series is stationary or not before using it in a model (Kim et al.2003).

Standard estimation procedures cannot be applied to the model that contains a non-stationary respondent variable or explanatory variables (Hamilton, 1994). The formal method of testing the stationary character of a series is the unit root test. To find out if any series is stationary, the regression was run on

$$y_t = c + \Sigma_{t=1} \alpha_i y_{t-1} + u_t \quad (1)$$

1 Best Linear Unbiased Estimator

y_t is the vector for import demand quantities of the studied products. Also, it was determined whether the absolute value of any αi was statistically equal to one on the basis of t statistics. The estimated coefficient was divided by its standard error to compute the statistics, and the results were referred to as the Dickey-Fuller table. If the absolute computed value exceeded the Dickey-Fuller absolute critical value, then the hypothesis that the given time series is non-stationary was rejected. On the other hand, if it is less than the absolute critical value, then the time series was found to be non-stationary. The test ran with a constant and a trend against the constant but not a trend. If the series was non-stationary, it was transformed by taking the first derivatives over one year. The above procedure was repeated until a stationary series was obtained. Delays (lags) of endogenous variables impose impacts on the mentioned products' import demand because the response of dependent variables to changes in independent variables may take several time periods. However, these delayed (lagged) quantity variables are mainly correlated with imported quantities. The demand for import of paper and paperboard products is estimated applying the ordinary least square method. The functional form of import demand equations is in the form of double logarithmic linear model which allows direct interpretation of estimated coefficients in terms of elasticity.

4. Autocorrelation

One of the assumptions of both simple and multiple regression analysis such as OLS is that the error terms are independent from one another. If this assumption does not hold, then we have the problem of "autocorrelation". In the presence of autocorrelation, the OLS estimation is unbiased and consistent but inefficient. In addition, the standard errors tend to be underestimated, overestimated, and too narrow confidence intervals. The most celebrated test for detecting serial correlation is that developed by statisticians Durbin and Watson (Gujarati, 2004). It is popularly known as Durbin–Watson d statistic (Gujarati, 2004). But, there are two restrictions in applying this approach. First, Durbin-Watson test can only investigate the first order autocorrelation and second, while the lagged values of dependent variables are used as explanatory variables in the model, this statistical approach is not suitable. Therefore, in this paper we use Breusch–Godfrey (BG) test. The test is more general than Durbin–Watson statistic (or Durbin's h statistic) which is only valid for non-stochastic regressors and for testing the possibility of a first-order autoregressive model (e.g. AR (1)) for the regression errors. The BG test has none of these restrictions and is statistically more powerful than Durbin's h statistic (Tajdini et al., 2012).

5. Multicollinearity

Multi collinearity is a case of the existence of a "perfect," or exact, linear relationship among some or all explanatory variables of a regression model. If the goal is to understand how the various X variables impact Y, and then multicollinearity is a big problem. Multicollinearity is a matter of degree, not a matter of presence or absence.

In presence of multicollinearity the ordinary least squares estimators are imprecisely estimated .Multicollinearity is problematic because it can increase the variance of the regression coefficients, making them unstable and difficult to interpret.. If multicollinearity is perfect, the regression coefficients of the X variables are indeterminate and their standard errors are infinite. If multicollinearity is less than perfect, the regression coefficients, although determinate, possess large standard errors (in relation to the coefficients themselves), which means the coefficients cannot be estimated with great precision or accuracy.In statistics, the variance inflation factor (VIF) quantifies the severity of multicollinearity in an ordinary least squares regression analysis. It provides an index that measures how much the variance (the square of the estimates) of an estimated regression coefficient is increased because of collinearity. VIF shows how the variance of an estimator is inflated by the presence of multicollinearity.

6. The theoretical model

The functional model is expressed in general form as:

$$IM_t = f(R_t, GDP_t, OI_t, ER_t, Qt, IM_{t-1}, U_t) \quad (2)$$

A commonly used form of regression model is the double logarithmic-linear model as in equations 3 and 4 (Greene, 2000; Gujarati, 2004):

$$ln\, y_t = ln\, \alpha + \Sigma\, ß_t\, ln x_t + u \quad (3)$$

$$ln\, y_{it} = \alpha 1 + \alpha 2\, ln\, x_{i1} + \alpha 3 ln\, x_{i2} + \ldots ++ \alpha k\, ln\, x_{ik} + u_{it} \quad (4)$$

One important feature of the double-log linear model which has made it popular in applied work is that the slope coefficient αi measures the elasticity of y with respect to x_i that is the percentage change in y for the given (small) percentage change in x_i (Judge, 1996; Gujarati, 2004).

This model includes three logarithmic equations for the import demand of writing and printing paper, newsprint, and corrugated board (i= 1, 2, 3), respectively.

$$ln\, IM_{1t} = \alpha\, 1 + \alpha\, 2 lnR_{1t} + \alpha\, 3 lnGDP_t + \alpha\, 4 lnOI_t + \alpha\, 5 lnER_t + \alpha\, 6 lnQ_{1t} + \alpha\, 7 lnIM_{1t-1} + u_{1t} \quad (5)$$

$$ln\, IM_{2t} = \alpha\, 8 + \alpha\, 9 lnR_{2t} + \alpha\, 10 lnGDP_t + \alpha\, 11 lnOI_t + \alpha\, 12 lnER_t + \alpha\, 13 lnQ_{2t} + \alpha\, 14 lnIM_{2t-1} + u_{2t} \quad (6)$$

$$ln\, IM_{3t} = \alpha\, 15 + \alpha\, 16 lnR_t + \alpha\, 17 lnGDP_t + \alpha\, 18 lnOI_t + \alpha\, 19 lnER_t + \alpha\, 20 lnQ_{3t} + \alpha\, 21 lnIM_{3t-1} + u_{3t} \quad (7)$$

$$\alpha_2 < 0, \alpha_3 > 0, , \alpha_4 > 0, \alpha_5 < 0, \alpha_6 < 0, , \alpha_7 > 0$$

$\alpha_9 < 0 , \alpha_{10} > 0 , , \alpha_{11} > 0 , \alpha_{12} < 0 , \alpha_{13} < 0 , , \alpha_{14} > 0$

$\alpha_{16} < 0 , \alpha_{17} > 0 , , \alpha_{18} > 0 , \alpha_{19} < 0 , \alpha_{20} < 0 , , \alpha_{21} > 0$

Table 1: Definitions of model variables for import demand of paper and paper products

Variable name	Variable definition
IM_{it}	The quantity of import demand for *i* product during *t* year (MT)
R_{it}	The relative price for ***i*** product during *t* year
GDP_t	The gross domestic product during *t* year (billion Rials)
OI_t	Iran's petroleum export income (billion Rials)
ER_t	Iranian Rial-US dollar exchange rate in Iran during *t* year (Rial/US$)
Q_{it}	The quantity of domestic production for *i* product during ***t*** year (MT)
IM_{it-1}	The quantity of the first lagged import for *i* product during ***t*** year (MT)
i=1, 2, 3	1=Writing and printing paper 2=Newsprint 3=Corrugated board

7. Results

The results of Augmented Dickey Fuller tests are summarized in Table 2. As the results indicate some of the variables are Non-stationary at 5% level, but after the first and second differentiation, the data turn to be stationary. Therefore, the variables are designated as I(0), the integrated of order 0; as I(1), the integrated of order 1; as I(2) , or the integrated of order 2, and then they are introduced to the model. The import demand function for paper and paperboard products was estimated by Ordinary Least Squares (OLS). In this approach, we assumed that the demand for each of the imported products is an endogenous variable. Tables 9,10, and 11 summarize the estimated coefficients of the empirical import demand models, but Tables 3, 4, and 5 reveal the results of applying Breusch-Godfrey test to investigate the autocorrelation in the errors in a regression model. The null hypothesis states that there is no serial correlation of any order between the residual errors.

The results indicate that amount of the p-value of the Breusch-Godfrey statistic for each of the products is more than significant at the 5% level, therefore, the null hypothesis of no autocorrelation could not be rejected, and there is not any serial autocorrelation between the errors. The results of VIF to investigate multicollinearity for each of the explanatory variables are summarized in tables 6,7 and 8. Since VIFs are less than 5 and close to 1,therefore it is indicated that there aren't multicollinearity problem. The coefficients of variables in log form represent elasticity because the double -log linear functions were used in estimation. Since equations are expressed in terms of natural logs of the variables, estimates for the parameters result in direct elasticity (Uzunoz and Akcay, 2009). As, it is observed in the demand for import function of writing and printing paper, the coefficient of relative price for imported writing and printing paper (imported price-domestic price ratio) was estimated

Table 2: Augmented Dickey Fuller (ADF) test for the unit roots in individual time series

Variables	Trend & intercept (lag)		Intercept (lag)		Results
	ADF-statistics	Critical value*	ADF-Statistics	Critical value*	
$LnIM_{1t}$	-3.68(0)	-3.58			stationary
LnR_{1t}	-2.89(0)	-3.58	-0.88(0)	-2.97	Non-stationary
ΔLnR_{1t}	-5.47(0)	-3.59	-5.59(0)	-2.97	Stationary
LnQ_{1t}	-2.49(0)	-3.58	-0.73(0)	-2.97	Non-stationary
ΔLnQ_{1t}	-5.02(0)	-3.59	-5.08(0)	-2.97	Stationary
$LnIM_{2t}$	-4.61(0)	-3.59	-5.08(0)	-2.97	Stationary
LnR_{2t}	-2.89(0)	-3.58	-0.88(0)	-2.97	Non-stationary
ΔLnR_{2t}	-5.47(0)	-3.59	-5.59(0)	-2.97	Stationary
LnQ_{2t}	-3.18(0)	-3.58	-2.73(3)	-2.99	Non-stationary
ΔLnQ_{2t}	-7.11(0)	-3.59	-7.25(0)	-2.97	Stationary
$LnIM_{3t}$	-4.01(0)	-3.59			Stationary
LnR_{3t}	-3.54(0)	-3.58	-86(0)	-2.97	Non-stationary
ΔLnR_{3t}	-6.72(0)	-3.59	-6.83(0)	-2.97	Stationary
LnQ_{3t}	-4.29(0)	-3.59			Stationary
$LnOI_t$	-2.05(2)	-3.60	-2.78(1)	-2.97	Non-stationary
$\Delta LnOI_t$	-2.57(0)	-3.59	-1.17(0)	-2.97	Non-stationary
$\Delta(\Delta LnOI_t)$	-6.52(0)	-3.60	-6.58(0)	-2.98	Stationary
$LnGDP_t$	-3.21(3)	-3.61	-0.25(0)	-2.97	Non-stationary
$\Delta LnGDP_t$	-6.67(0)	-3.59	-6.12(0)	-2.97	Stationary
$LnER_t$	-2.94(0)	-3.58	-2.95(0)	-2.97	Non-stationary
$\Delta LnER_t$	-4.83(3)	-3.62	-5.04(1)	-2.98	

*indicates statistical significant at 5% level

-0.88 which is a significant value, indicating that whenever either the imported price or domestic price increases or decreases by 1%, the demand for import decreases by 0.88. The minus sign in the coefficient is in accordance with the demand theory, although, the domestic price is expected to have a negative sign, whereas the sign of the import price can be either positive or negative depending on whether imports substitute for or complement domestic products(Jonsson, 2012). The small magnitude of own-price elasticity is consistent with reports for other forest commodities. For instance, Turner and Buongiorno (2004) calculated the price elasticity for import demand of paper and paperboard applying different methods from -0.50 to -2.05. But, Li et al.(2002) estimated the import demand function for paper and paperboard in China using both OLS and 2SLS and discovered that import demand for paper and paperboard are price-inelastic. The coefficient of GDP was estimated 3.42 which is significant at 5%. The income elasticity shows that any one percent increase in real GDP leads to 3.42 percent increase in the import demand for printing and writing paper, and the positive sign of the coefficient was expected. Li et al. (2002) found that

the income elasticity for the import demand of paper and paperboard products is 0.91 and 1.05, respectively, while Turner and Buongiorno (2004) indicated that such quantities for wood-based panels are from 0.47 to 3.09. The coefficient of exported petroleum income variable was not significant at 5%, so it is obvious that there is not any relation between this variable and the import demand for writing and printing paper in Iran. The other important variable affecting the import demand for writing and printing paper in Iran is the nominal exchange rate. The results show that the coefficient of this variable is estimated -6.18 which is significant at 5%, and it indicates that any 1% increase in the exchange rate in the country could decrease the import demand for writing and printing paper. The coefficient of domestically produced writing and printing paper was significant, indicating that this variable has a negative effect on the import demand. Thus, any 1% increase in the production volume decreases the demand for import by 0.56%. The results indicate that the import of this product is sensitive to changes in its production quantities. The coefficient of the first lagged quantity of import variable was estimated 0.23 which is a significant value and indicates that any increase in the import for writing and printing paper in the previous year increases the import demand quantity by 0.23%. The coefficient of determination (R2) was calculated 0.89 which indicates explanatory variables are responsible for 89% of the variation of the dependent variable. The coefficient of relative price for the import demand of newsprint is significant and indicates that any 1% increase or decrease in the imported or domestic price of newsprint causes the import demand of newsprint decrease by 0.39%; the negative sign of the coefficient was also expected. So, the newsprint compared to the writing and printing paper is less sensitive to price fluctuation. The income elasticity of demand for the imported newsprint was calculated 1.11, and thus any 1% increase in GDP increases import demand for the plywood by 1.11%. The coefficient of exported petroleum income was estimated 0.51 which is significant at 5%, and thus any 1% increase in the exported petroleum income increases the import demand for newsprint by 0.51%. The coefficient of nominal exchange rate is estimated - 3.75 and it is significant, so any 1% increase in the nominal exchange rate decreases the import demand of newsprint by 3.75%. The negative sign of coefficient was expected and reveals that any increase in the exchange parity between Rial and the foreign exchanges could decrease commodities' imports. The quantity of produced newsprint in the country has a negative effect on the demand for its import. Thus, any 1% increase in the production volume decreases the import demand of newsprint by 3.12%. The results indicate that the import of this product is very sensitive to changes in its production quantities. The coefficient of the first lagged quantity of newsprint import variable is estimated 0.43 and significant at 5%, which indicates that when the import quantity in the previous year increases by 1%, the current demand for the newsprint import increases by 0.43%. The coefficient of determination (R^2) was evaluated 0.81, indicating that explanatory variables will respond to 81% of the dependent variable variations.

The results of estimating the corrugated board import demand function are indica-

ted in Table 11. As it is observed, the coefficient of relative price of corrugated board (imported price-domestic price) is significant. Therefore, this product is price-elastic; however, it is less sensitive to fluctuation changes in price compared to the writing and printing paper and newsprint. This issue is related to the widespread demand of corrugated board imports. The coefficient of GDP variable is estimated 2.32 which is significant at 5%. Therefore, the corrugated board impact on economy is similar to the two mentioned products' sensitivity to income changes. The coefficient of exported petroleum income was estimated 0.25 which isn't significant at 5%. The coefficient of nominal exchange rate was estimated - 2.17 which is significant at 5%. Thus, any increase in this rate could decrease the import demand for the corrugated board by 2.17%. The coefficient of domestic produced corrugated board was significant and had a negative effect on the import demand of this product. Any 1% increase in the domestic production leads to 0.87% decrease in the import demand for the corrugated board. The coefficient of the first lagged quantity of import variable was estimated 0.11 which is significant at 5%, and it indicates that there is a positive relationship between the previous and current quantities of imported corrugated board. The coefficient of determination (R^2) was calculated 0.85 which indicates that the explanatory variables are responsible for 85% of the variation of the dependent variable.

8. Discussion and Conclusion

This research was carried out in order to study the factors such as relative price represented by the ratio as import price to domestic price, GDP, exported petroleum income, exchange rate and the amount of domestic production and the first lagged import affect import demand for the paper and paperboard products including the writing and printing paper, newsprint, and corrugated board using the available annual data for the period of 1989 to 2013 and OLS procedure. The strength of the applied system lies in its potential to handle the existence of interactions among variables and the robust results derived from the utilized data. Population growth and the change in the consumption and demand pattern have contributed to the steady increase in the consumption of various paper products in Iran (Namaki, et al. 2014). Such finding is in accordance with other results. Azizi and Faezipour (2006) indicated that population growth and per capita construction are the key factors to predict plywood consumption in Iran(Azizi and Faezipour,2006) This country is located in an arid and semi-arid region with limited coverage of forests and faces serious shortage of wood. Therefore, vast quantities of paper and paperboard requrements are supplied through imports (Namaki, et al. 2014). Chas-Amil and Buongiorno (2000) found that the price elasticity of import demand in the 15 European Union countries during the period of 1969-1992 is -0.5, -0.9, and -0.3 for newsprint, writing and printing paper, and "other paper and paperboard", respectively. Such findings are similar to the results of this study. Imports of the studied paper and paperboard products are own-price elastic and writing and printing paper in compared to newsprint and corrugated board is more sensitive to price changes. The results revealed that the demand for writing and printing paper import was the most sensitive to changes in

GDP. Chas-Amil and Buongiorno (2000) indicated that GDP elasticity for paper and paperboard in EU varied from 0.4 to 1.6 from 1969 to 1992; most of the change in demand within the European Union was traced to GDP growth, writing and printing paper being the most sensitive to it, with an elasticity of about unity. The negative price effects were small. This was in part because all the commodities were price inelastic. Therefore, the demand for import of paper and paperboard is much sensitive to GDP changes in Iran. Writing and printing paper and newsprint are primarily used for publication of magazines, catalogues and books (textbooks, notebooks and exercise-books). Therefore the growth in demand for this grade of paper is highly influential on overall economic situation, especially the performance of advertising. This indicates that these products are important and strategic commodities which impose substantial impact on economic, cultural, social development of any country. On the other hand, corrugated board is a main raw material in the packaging industries, therefore as household incomes increase, the demand for paper and paper products will rise. The adverse impact of relative price of the mentioned products on their import demand is in accordance with the import demand theory which states that the import for goods in any time has an adverse relation with the relative price. Therefore, any increase in the imported price or decrease in the domestic price of these goods diverts most consumers away from these products, and then the demand for import decreases. The exported petroleum income could not influence the import demand of writing and printing paper and corrugated board. Namaki et al. (2014) calculated that 86% of the total consumption of writing and printing paper is satisfied through imports. Writing and printing paper is an essential good, and its consumer prefers to buy it in any price; therefore, the petroleum price fluctuations do not affect the demand for import. In the case of corrugated board, due to the low import value in each year, regardless of fluctuations in the country's petroleum income, the balance of required quantity to satisfy the growing domestic demand is supplied through imports. For the newsprint, the positive relationship between these two variables is available. The demand for the import of all the mentioned products is affected by the exchange rate fluctuation. The adverse impact indicates that any change in the exchange rate could lead to change in the imported price. Therefore, as was discussed earlier, any increase in exchange parity between Rial and foreign currency could decrease the import demand of these products. So, along with establishment and development of the domestic producing industries of paper and paperboard products, Iran may use depreciation of the dollar as an effective tool for weakening import demand for imported products. The writing and printing paper in compared to the other two products are more sensitive to exchange rate changes. The domestic production quantities of the paper and paperboard products impose adverse impact on the demand for import of these products. The reason is clear; any increase in the production quantities of domestic production could raise their shares in the market, and consequently the demand for import decreases. For all the studied commodities in this paper, the import variable with the first lagged quantity has an adverse impact on the current demand for their import which indicates that any increase in the import of these products reduces their price in the domestic market, and therefore

producers are likely to continue the trend of reducing price in the following year. This decreases the supply and increases the import of studied products in the following year. The pivotal aim of this study is limited to the effects of macroeconomic and market variables on demand for imports of the mentioned products. This issue expresses that in order to control marketplace and thus keeping price of this product fixed, trend of variation for the effective factors should be carefully taken into consideration at national and international levels. For better understanding, however, all relevant factors such as population, production cost factors (e.g., labor and energy) need to be considered in the analysis. This issue should be addressed in future research.

Policy-makers are very interested in industrial development and establishment of new pulp and paper plants, along with transfer of the Technology. The position of paper as the fastest growing category of forest products is often seen as being at risk due to a continuous fear of replacement by electronic solutions in the information sector. Replacement has not taken place and development of office technology has been more or less mutually beneficial for the producers of writing and printing paper. However, there are some indications of structural changes in the markets, the most well-known being the decline of newsprint consumption in the United States since 1987 (Hetemäki and Obersteiner 2001). In any case, the information sector is becoming more and more important for the paper industry, e.g., consumption of household paper is not likely to increase radically due to stagnating and even decreasing population. In Iran as earlier stated, there is shortage of raw material. It should also be noted that because of the volume of investment is also relatively high, there is little interest in private sector to participate in establishment of new plants. So maybe this is expected to increase Iran's dependence on imports of paper products in the future.

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Tables

Table 3: Breusch-Godfrey test to investigate first order the autocorrelation for writing and printing paper

0.25	P-value	1.227	F-statistic

Table 4: Breusch-Godfrey test to investigate the first order autocorrelation for newsprint

0.195	P-value	1.857	F-statistic

Table 5: Breusch-Godfrey test to investigate the first order autocorrelation for corrugated board

0.204	P-Value	1.623	F-statistic

Table 6: Collinearity test for import demand of writing and printing paper

Collinearity Statistics		Sig.	t	Coefficients		Variable
VIF*	Tolerance			Std. Error	C	
						C_t
1.21	0.824					LnR_{1t}
1.11	0.901					$LnGDP_t$
1.02	0.980					$LnOI_t$
1.06	0.946					$LnER_t$
1.01	0.992					$LnQ1_t$
1.13	0.885					$LnIM1_{t-1}$

* VIF is Variance Inflation Factor (VIF= 1/ Tolerance)

Table 7: Collinearity test for import demand of newsprint

Collinearity Statistics		Sig.	t	Coefficients		Variable
VIF*	Tolerance			Std. Error	C	
						C_t
1.00	0.996					$LnR2_t$
1.10	0.917					$LnGDP_t$
1.31	0.763					$LnOI_t$
1.00	1.000					$LnER_t$
1.08	0.924					LnQ_{2t}
1.40	0.712					$LnIM_{2t-1}$

* VIF is Variance Inflation Factor (VIF= 1/ Tolerance)

Table 8: Collinearity test for import demand of corrugated board

Collinearity Statistics		Sig.	t	Coefficients		Variable
VIF*	Tolerance			Std. Error	C	
						C_t
1.05	0.955					LnR_{3t}
1.12	0. 889					$LnGDP_t$
1.25	0.802					$LnOI_t$
1.44	0.694					$LnER_t$
1.03	0.973					LnQ_{3t}
1.19	0.839					$LnIM_{3t-1}$

* VIF is Variance Inflation Factor (VIF= 1/ Tolerance)

Table 9: Import demand function for writing and printing paper by OLS estimation (1989-2013)

Variable	Coefficients	Standard error	T-statistics
Import Demand function Ln IM_{3t} : Dependent variable			
C_t	-12.42*	8.35	-0.57
LnR_{3t}	-0.14*	-0.32	-0.82
$LnGDP_t$	2.32*	1.34	2.91
$LnOI_t$	0.25	1.71	0.44
$LnER_t$	-2.17*	1.25	-4.18
LnQ_{3t}	-0.87*	0.92	-7.19
$LnIM_{3t-1}$	0.11*	2.31	0.22
R^2=0.85			

Table 10: Import demand function for newsprint by OLS estimation (1989-2013)

Variable	Coefficients	Standard error	T-statistics
Import demand function Ln IM_{1t} : Dependent variable			
C_t	-24.15*	12.65	-5.23
LnR_{1t}	-0.88*	0.14	-3.69
$LnGDP_t$	3.42*	5.64	4.31
$LnOI_t$	0.85	1.92	0.87
$LnER_t$	-6.18*	7.05	-1.68
LnQ_{1t}	-0.56*	4.73	1.19
$LnIM_{1t-1}$	0.23*	1.24	2.55
R^2=0.89			

Table 11: Import demand function for corrugated board by OLS estimation (1989-2013)

Variable	Coefficients	Standard error	T-statistics
Import demand function Ln IM_{1t} : Dependent variable			
C_t	36.42	12.54	2.90
LnR_{1t}	-0.39*	23.73	-5.30
$LnGDP_t$	1.11*	9.14	-6.02
$LnOI_t$	0.51*	5.17	0.82
$LnER_t$	-3.75*	5.11	-5.84
LnQ_{1t}	-3.12*	12.36	-7.92
$LnIM_{1t-1}$	0.43*	25.49	3.08
R^2=0.81			