International Journal of Economic Sciences and Applied Research

Volume 3 Issue 2 December 2010

Print ISSN: 1791-5120 Online ISSN: 1791-3373

Volume 3 issue 2.indd 1 9/12/2010 10:13:27 πμ

Volume 3 issue 2.indd 2 9/12/2010 10:13:27 πμ

International Journal of Economic Sciences and Applied Research

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Another empirical look at the Kuznets curve

Rabindra Bhandari[1], Gyan Pradhan[2] and Mukti Upadhyay[3]

Abstract

This paper examines the functional relationships between income inequality, economic factors, institutions, and Kuznets' inverted-U hypothesis. A model that incorporates interactive as well as direct effects of several factors to capture their combined effect on inequality is developed. The model is estimated using two popular measures of inequality—the Gini coefficient, and the ratio of income shares in income distribution—using a panel data set for 57 countries from 1987 to 2006. The results provide support for Kuznets' hypothesis; however, the relationship between growth and inequality is conditioned by a host of economic and institutional factors.

Keywords: Kuznets curve, inequality, growth, Gini coefficient, income shares

JEL classification: O1, O40

1. Introduction

The relationship between inequality and economic development has continued to fascinate economists ever since Nobel Laureate Simon Kuznets (1955) suggested that such a relationship may take the form of an inverted-U. This hypothesis predicts that inequality first increases in the early stages of development, reaches a maximum at an intermediate level of income, and then declines as the country achieves a high level of per capita income. As a poor country embarks on growth, the process of industrialization leads to greater inequality as a result of a shift of labor force from low-productivity agriculture to sectors of higher productivity. If inequality between agriculture and the rest of the economy was more pronounced than that within each sector, then inequality would first rise as people moved out of agriculture and then fall as many of them found themselves in the new sector, or the economy reached a point where the factor movement was equalizing returns across sectors. The Kuznets hypothesis generated a great deal of interest, much of it driven by the concern that development hurts the poor.

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Empirical estimates of the hypothesis have continued to provide different results. Given the dearth of data for estimating income distribution at the time, Kuznets based his hypothesis on data for a few countries. Early tests of the hypothesis for England, Germany and the United States seemed to support Kuznets' proposition, but in a large number of later studies, a wide variety of results emerged with some challenging the hypothesis and others supporting it. Most of these studies used cross-sectional data while a few used time-series data. These earlier studies often suffered from serious problems with the quality and availability of the underlying data.

Estimates of the distribution of income or consumption provided by a World Bank project (Deininger and Squire, 1996) seemed to provide some general support for Kuznets' hypothesis when cross-section data were examined. For instance, Jha (1996) reports that despite problems with data comparability, the Kuznets hypothesis holds. Galor and Tsiddon (1996) use a general equilibrium model based on an endogenous mechanism and find that growth is accompanied by increasing inequality in the early stages of development, and declining inequality in later stages. Using a panel data set for 96 countries, Thornton (2001) also finds empirical support for the Kuznets hypothesis. Higgins and Williamson (2002) find that inequality follows an inverted-U as an economy's aggregate labor productivity rises and that inequality falls as population matures. Similarly, Lee (2006) finds support for the hypothesis in his examination of 14 European countries covering 1951-1992. Huang et al. (2007) also verify the Kuznets prediction for countries with mild income inequality but do not find such support for countries where inequality is either too high or too low. Chen (2008) examines the growth inequality nexus in 23 cities and counties in Taiwan from 1983 to 2006 and finds the existence of the inverted-U relationship.

Quite a few empirical studies refute the Kuznets hypothesis, however. For example, Fields (1991) finds that there is no tendency for income inequality in poor countries to increase (rather than decrease) and no tendency for income inequality in rich countries to decrease (rather than increase). Similarly, Ravallion and Chen (1997) in their study of 67 developing and transitional economies covering the 1981-94 period find that income distribution improved with economic growth as often as it worsened. And as the first users of the new dataset, Deininger and Squire (1998) found no support for the Kuznets hypothesis in the cross-country data on income and asset distribution.

Lundberg and Squire (2003) claim that growth and inequality move together, determined by a simultaneous process. To examine the effects of policy, focusing on one outcome but not the other will then lead to incomplete results and to those that are less relevant to policy. Francois and Rojas-Ramagosa (2004) develop a methodology to reduce the measurement error problems in the secondary data on inequality. Davis (2007) formulates a model of a dual economy where the formal sector leads economic growth through spillovers of human capital. If institutions erect barriers on the formal activity, growth suffers and inequality worsens as well. Since institutions can be very dissimilar across countries, the growth-inequality outcomes can also be different.

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2. Theoretical background, methodology and data

The relationship between inequality and growth is a long run one and is influenced by other economic and institutional factors. Income growth has an important effect on inequality but this effect can be accentuated or mitigated by other economic factors. How inequality is influenced in the long run thus also depends on factors such as the degree of economic freedom and competition, development of the financial sector, level of education, degree of economic openness, nature of tax regime and the extent of political freedom. It should be noted that many of these factors also affect growth and are in turn facilitated, if not induced, by economic growth, social development and government policies. Further, greater availability of some of these factors implies a high level of development of the formal sector as well.

This paper takes a traditional approach in that it assumes that income growth affects inequality as postulated by Kuznets, but remains consistent with the implications of the Davis model (2007) of income and inequality. It tests the impact of income in conjunction with the above mentioned factors on inequality. So we postulate the following model for the determination of inequality within country *i* in period *t*:

$$Ineq_{it} = F(Ineq_{i,t-1}, Y_{it}, Y_{it}^{2}, FinDev_{it}, Frdm_{it}, Open_{it}, FinAcc_{it}, LMob_{it}, Tax_{it}, Polit_{it}, Edu_{it}, IP_{it}) \quad (1)$$

Where

Ineq = income inequality index (Gini concentration ratio)

Y = level of real per capita income (purchasing power parity adjusted dollars, World Development Indicators 2008)

Frdm = degree of economic freedom (competitiveness) within the country (Freedom House data)

FinDev = degree of financial development (M2/GDP ratio; International Financial Statistics Yearbook, different years)

FinAcc = degree of freedom in private sector's access to credit (Monetary Survey Credit to the Private Sector; International Financial Statistics, different years)

LMob = degree of labor mobility (proxied by sectoral or agriculture-industry wage differential; not used in estimation for lack of data)

Open = degree of international openness

Tax = degree of use of anti-inequality policy (tax progressivity as measured by the ratio of highest marginal to average income tax rates)

Edu = level of education (average years of schooling in adult population)

Polit = degree of political freedom (democracy minus autocracy, University of Maryland Polity 6)

IP = income support policy (dummy variable for publicly provided social insurance, not used in estimation for lack of data).

The subscript *i* refers to country, and *t* for time period.

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Generally, a competitive economy is expected to adjust to exogenous economic changes including those in policy relatively quickly and thereby increase the possibility of broad based economic growth. Lack of competition is likely to accentuate sectoral and regional income differences leading to an increase in overall income disparity. A high degree of competitiveness in the economy requires that resources and information be allowed to flow freely between sectors. It also allows relatively free entry and exit and makes it harder for income disparity to be sustained for a long period of time.

Therefore, for the Kuznets curve to manifest in full force, greater economic freedom in financial and labor markets as well as in the overall economy is essential. Institutional barriers in labor market participation or access to capital could result in growth being inequality inducing, while no barriers will result in economic growth that alleviates inequality. Thus, a priori, one would expect that the closer a country's economy is to a competitive market, the more likely and rapidly it would show an inverted U-relationship between income and inequality. If one were to assume market imperfection either due to factor market rigidities or monopolistic practices in product markets, one would expect inequality to decline only slowly in the absence of strong government policies to reduce it.

Our paper uses the following regression equation for country i in period t. This is based on functional relationships, as discussed above, between inequality, economic factors, institutions, and the inverted-U hypothesis.

$$\begin{aligned} Ineq_{it} = {} & b_1 + b_2 \ln Y_{it} + (b_3 + b_5 FinDev_{it} + b_6 FinAcc_{it} + b_7 LMob \\ & + b_8 Frdm_{it} + b_9 Edu_i + b_{10} Open_{it}) \ln Y_{it}^{\,2} + b_{11} Ineq_{i,t-1} + b_{12} Tax_{it} + b_{13} Open_{it} \\ & + b_{14} FinDev_{it} + b_{15} FinAcc_{it} + b_{16} LMob_{it} + b_{17} Frdm_{it} + b_{18} Edu_{it} + b_{19} IP_{it} + e_{it} \end{aligned} \quad (2)$$

Equation (2) includes interactive as well as direct effects of several factors to capture their combined effect on inequality. For example, increasing the growth of money supply could be inflationary in a way that adversely affects inequality in favor of investors relative to savers. Increased money supply to the private sector can, however, help to improve access to credit, making national investment and growth more broad based and inequality-reducing as income grows. Similarly, open trade may affect inequality differently over time as a country's income grows. For instance, trade could serve as an engine of growth and over time it may reduce income inequality. In the short to medium run, however, trade may increase inequality as the domestic market adjusts to a new specialization regime initiated by trade. It may also affect income inequality depending upon how broadly the international trade occurs. The model can thus be used to test different hypotheses about the how these terms directly and indirectly interact to affect inequality.

One would expect *a priori* that the closer a country's economy is to a competitive market, the quicker one might observe an inverted-U relationship between income and inequality. In this sense, we would expect the sign of the coefficients of $(lnY)^2$ to be negative as would their interactive terms with other competition enhancing indicators. One would also

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expect the coefficients of such terms to have a negative sign. However, given the complex nature of interactions between these variables that makes it difficult to make theoretical predictions, we argue the signs of the associated coefficients should be determined with an empirical model. It is likely that they will have significant and positive coefficients and thereby mitigate the inequality dampening effect of growth. Theoretically, this could happen if they lead to 'narrow based' economic growth or they contribute to reduce competition in the market. In short, it is possible to observe positive or negative effects of income growth on inequality depending on the net effect of these different variables.

The paper estimates the model using two popular measures of inequality: (1) The Gini coefficient, and (2) the ratio of income shares of the top 10 to the bottom 10 percentiles of population in the income distribution. Purchasing power parity adjusted value of the real GDP per capita (at constant dollars) serves as our measure of income. Following a tradition in the economic development literature, we use the money supply (M2) to GDP ratio as a proxy for the level of financial development together with domestic private credit to GDP ratio as a measure of the degree of access to capital. In addition, the paper uses trade to GDP ratio as an indicator of the degree of openness. The model implicitly assumes that a higher degree of international openness is a reflection of competitiveness. In light of transnational firms and imperfect markets, such an assumption may not always be true and becomes an empirical question. Due to lack of data, we were unable to include measures of labor mobility and other policy variables that may have an impact on the level and change in inequality.

The data used in the model were compiled from *World Development Indicators CD-ROM 2007* and *WIDER* dataset. A panel data set was constructed for 57 countries extending over 20 years from 1987 to 2006. These countries include countries from all continents and as the study requires, with different levels of income. There are 16 Asian, 6 European, 16 Latin American, 3 North American, 2 Oceania, and 14 Sub Saharan Africa countries.

3. Estimation and results

The Gini Coefficient

In the estimated form of model (2) for the Gini measure of inequality, a few variables were dropped due to lack of data. A reduced specification based on the theoretical models (1) and (2) appears in below.

$$Ineq_{it} = b_1 + b_2 \ln Y_{it} + [b_3 + b_4 FinDev_{it} + b_5 DomCr_{it} + b_6 Open_{it}] \ln Y_{it}^{\,2} + b_7 Ineq_{i,t-1} + b_8 Open_{it} + b_9 FinDev_{it} + b_{10} DomCr_{it} + e_{it} \qquad (3)$$

In order to capture the effects of other country-specific variables that data cannot directly control for, we estimate equation (3) as a varying parameter model. The model was tested with the data for the appropriateness of a fixed-effects model against a

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random-parameter model using the Hausman specification test. The test overwhelmingly suggests the fixed-effects model is more appropriate for the data[1]. The results of the estimation yielded the following results:

$$\begin{aligned} Ineq_{it} = & -249.5 + 70.093 \ln Y_{it} - 4.269(\ln Y_{it})^2 + 0.191 Ineq_{it-1} - 0.401 Findev_{it} \\ & (-3.02)^{***} \quad (3.42)^{***} \quad (-3.35)^{***} \quad (1.93)^{*} \quad (-2.20)^{**} \\ & +0.004[(\ln Y_{it})^2 \times Findev_{it}] + 0.028 DomCr_{it} \\ & (1.71)^{*} \quad (0.55) \\ & +0.007[(\ln Y_{it})^2 \times DomCr_{it}] + 0.015 Open_{it} \\ & (0.24) \quad (0.59) \end{aligned} \tag{4}$$

$R^2 = 0.488 \quad no.obs. = 227, \quad no.cntrs. = 57$

Note: Figures in parentheses are the t-statistics.

*, **, and ***: significant at 10, 5, and 1 percent level respectively.

The overall model is significant at 5 percent level. The estimated results clearly suggest that Kuznets' inverted-U relationship holds between inequality as measured by the Gini-coefficient and income. This can be inferred from the statistically significant coefficient of the income variable *ln(Y)* which is positive and the coefficient of $ln(Y)^2$ which is negative[2].

The above regression also supports our hypothesis that financial development affects inequality both directly and indirectly. While the direct effect of *FinDev* (*M2/GDP*) is to reduce inequality directly, it also has an inequality increasing effect as indicated by the positive sign of the interaction term between $[ln(Y)]^2$ and *FinDev*. This effect may be due to increased wealth accumulation by the rich facilitated by the development of the financial market and through inflationary pressure within the economy due to faster monetary expansion that typically occurs during high income growth periods. Using a cleaner model that drops the insignificant variable domestic credit, its interaction with $[ln(Y)]^2$, and the trade-GDP ratio, we find that for a low income economy with a growing per capita income, when the *M2/GDP* ratio is 10 percent, the inequality reducing effect of income starts when per capita income reaches $4000[3]. This

[1] The Hausman chi-square ratio was 40.72 which is significant at 1 percent level and hence rejects the null of the difference between the fixed and random effects coefficients being not systematic.

[2] To see if the inclusion of a cubic term would give us a better specification of the model, we tested with $\ln Y^3$. Unfortunately, the inclusion of the cubic term caused the signs of the coefficients for lnY and $\ln Y^2$ to go in the opposite direction to most theoretical predictions, which made the results insensible. So we dropped the cubic term in the reported specification.

[3] This result is based on the following regression:

$$\begin{aligned} Ineq_t = & -223.92 + 63.92 \ln Y_t - 3.8 (\ln Y_t)^2 - 0.412 FinDev_t + 0.00466[(\ln Y_t)^2 * FinDev_t] + 0.205 Ineq_{t-1} \\ & (3.51) \quad (-3.48) \quad (-2.38) \quad (2.11) \quad (2.11) \end{aligned}$$

The coefficients of income and income squared are statistically significant at 1 percent and other coefficients are significant at 5 percent level.

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'critical level' of per capita income for inequality reduction increases to $6000 when broad money rises to our sample average of 42 percent of GDP. In contrast, for a high degree of financial development, such as 200 percent of GDP, the income per capita required to lower inequality needs to rise to $52,000 in our sample. Thus, we find the Kuznets hypothesis to imply that as *M2/GDP* ratio rises, so does the inequality reducing critical level of income, holding other factors constant. While higher *M2/GDP* may be conducive for decreasing inequality in the short run, over longer runs it exerts an adverse effect on inequality. We note that in light of such a finding it is not surprising that some empirical studies have found evidence contrary to Kuznets' hypothesis (Deininger and Squire, 1998; Fields, 1991; Ravallion and Chen, 1997). Domestic credit and openness to trade seem to have no effect on inequality as measured by the Gini coefficient.

The Kuznets Ratios

A second measure of inequality that is often used is the ratio of income percentages of the top 10 percent in the income distribution to the bottom 10 or 20 percent. Unlike the Gini coefficient, this measure compares how the richest are faring relative to the poorest when national income changes and hence may be more appealing for some purposes. These 'Kuznets ratios' do not always agree with the Gini coefficient, especially when the Lorenz curves drawn for different time periods intersect (see Fields, 1980; Ray, 1998). Within the same theoretical framework as described above, we estimate our inequality model using Kuznets ratios as a measure of income inequality.

In this case, the Hausman specification test supports the random-effects rather than the fixed-effects model for variation in the country-specific terms. The estimated model for the income share of the top 10 percent of population relative to the bottom 10 percent appears below.

$$\begin{aligned} Yshr_{it} = & -280.92 + 65.54 \ln Y_{it} - 3.75 [\ln Y_{it}]^2 - 0.0028 [(\ln Y_{it})^2 * FinDev_{it}] \\ & (-2.15)^{**} \quad (2.06)^{**} \quad (-1.91)^{*} \qquad (-3.1)^{***} \\ & +0.104[(\ln Y_{it})^2 \times DomCr_{it}] - 0.0126[(\ln Y_{it})^2 \times Open_{it}] + 0.112(Open_{it}) \\ & (2.88)^{***} \qquad\qquad (-1.56) \qquad\qquad (1.63)^{*} \end{aligned} \tag{5}$$

$R^2 = 0.160, \quad \text{No.obs.} = 204, \quad \text{No.cntries.} = 57, \quad \text{prob} > \chi^2 = 0.0022$

The numbers in parentheses are the z-statistics,

*, **, and *** indicate significance at 10, 5, and 1 percent respectively.

As shown by the regression, the data support complex relationships between income and inequality. In addition to income and its squares, financial development, domestic private credit, openness to international trade and their interaction with income show significant effects on inequality. Similar to many other cross sectional studies, and as in the case of the Gini coefficient above, the results support the inverted-U relationship. All the

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estimated coefficients except the coefficient of $[(\ln Yit)^2 * Open_{it}]$ are statistically significant at 10 percent level or better. The interaction between openness and squared income misses this significance slightly though it is still significant at 12 percent. The inverted-U relation can occur at a relatively early or later stage of development depending on the strength of other factors. For an economy with growing per capita income, and inequality measured by relative income shares, the financial development affects inequality only indirectly and it reduces inequality instead of raising it. When *M2/GDP* rises from a low level of 10 percent to the sample mean level of 43 percent, the critical per capita income needed to start inequality reduction falls from $2600 to $2200, *ceteris paribus*.

Openness to trade has a direct as well as indirect effect on inequality. The model suggests that greater openness can both accentuate and ameliorate income inequality. However, on balance, it reduces inequality. One may view these two effects as short run and long run effects of international trade on inequality. A simple simulation of the model using the average *M2/GDP* ratio (43 percent) and the average domestic private credit to GDP ratio (45 percent) in our data shows that an increase in openness from a low of 13.5 percent to the average of 62.6 percent would reduce the per capita income needed to achieve a turning point in inequality from $8000 to $2200, ceteris paribus. Overall, trade openness has an inequality-ameliorating effect over time in a growing economy but, consistent with some findings, it may initially accentuate inequality.

The results of the effect of private domestic credit are not as expected. It has been found that greater access to credit seems to increase inequality. It is possible that this variable does not serve as a good proxy for open access to finance, which would be the case if there is a monopoly hold on access to credit, either because of credit rationing under government directives or if the market is highly concentrated in a way that keeps interest rates high. We therefore find a higher rate of domestic credit to GDP ratio raising inequality in our panel. Exercises based on our results suggest that a rise in domestic credit from 10 percent to the sample average of 45 percent at the mean levels of openness and M2/GDP (62.5 and 43 percent respectively) increases the income that is needed to start inequality reduction from $1400 to $2200, *ceteris paribus*.

A similar regression using ratio of the share of the top 10 percent of income and the bottom 20 percent of the distribution as a measure of income inequality yields similar results. All the coefficients have identical signs and are similarly significant at the 5 percent level. In this case, the effect of openness as discussed above is statistically stronger. The positive relationship between trade and inequality in the short run and a negative one in the long run is now statistically significant at better than 10 percent significance level[4].

[4] The estimated regression with coefficients and z stat. (in parentheses) in this case is:

$$Yshare_{it} = \underset{(-2.34)}{-83.66} + \underset{(2.27)}{19.69}\ln Y_{it} - \underset{(-2.08)}{1.11}(\ln Y_{it})^2 - \underset{(-3.61)}{0.0008}[(\ln Y_{it})^2 * FinDev_{it}]$$
$$+ \underset{(3.22)}{0.0306}[(\ln Y_{it})^2 * DomCr_{it}] - \underset{(-1.93)}{0.0041}[(\ln Y_{it})^2 * Open_{it}] + \underset{(1.97)}{0.036}[Open_{it}]$$

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These findings are not very different from those of other studies (see Davis, 2007). They highlight some of the complexity involved in the estimation of the relationship between income and inequality. We note that our paper does not explicitly deal with the issue of a simultaneous process by which factors that affect inequality may also affect income. Yet, the paper sheds some light on the interaction among several important factors that have significant effects on inequality. The net effects are driven by the overall nature of the economy in which the degree of competition in goods and financial markets as well as international openness plays a prominent role.

Comparison of Gini and Income Shares

The results suggest that the worst scenario for inequality when measured by the Gini coefficient occurs with a high level of M2/GDP ratio. When relative income shares are used to measure inequality, the worst scenario occurs with income growth where domestic credit is high, international openness is low, and money supply is a small percentage of GDP.

With the same starting point of inequality for the two measures, we find that a combination of low *M2/GDP* ratio (10 percent), low outward orientation of the economy (10 percent), and high private sector credit to GDP ratio (75 percent) is a bad scenario for inequality based on the ratio of income shares. A possible good scenario is offered by a high *M2/GDP* ratio (70 percent), a high trade to GDP ratio (70 percent), and a low ratio of private domestic credit to GDP (10 percent). The 'critical level' of per capita income needed for the inequality alleviation effect is as high as $13,000 in the bad scenario compared to only $1300 under the good scenario described above. To reach such a level of per capita income takes about 46 years more with a compound annual growth of 5 percent and 77 years more with a growth rate of 3 percent. Between these two scenarios, there are numerous possible combinations of critical income levels and length of time for the Kuznets curve to manifest. Therefore, the inverted Kuznets curve is indeed a strong long term tendency that is influenced by many other institutional and economic factors.

4. Conclusion

The results lend support to Kuznets' inverted-U hypothesis, but this relationship is conditioned by a host of economic and institutional factors that affect growth and income directly or indirectly. The exact shape of the Kuznets curve is also influenced by how one measures inequality as well as by such factors as competitiveness, access to credit, state of financial development, and the extent of outward orientation of the economy. We find some surprising results from our interaction terms, particularly the effect of changes in financial deepening and how those changes influence the level of income that is required for inequality to change course.

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Acknowledgement

We are grateful for helpful comments from three anonymous referees. An earlier version of this paper was presented at the Midwest Economics Association in Chicago, USA, in March 2008.

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Appendix

Table: Countries included in the Sample

Country #	Country Name	Region	Income
1	Argentina	LAm	Middle
2	Australia	Oceania	High
3	Bangladesh	Asia	Low
4	Bolivia	LAm	Low
5	Botswana	SSA	Middle
6	Brazil	LAm	Middle
7	Bulgaria	Europe	Middle
8	Canada	NAm	High
9	Chile	LAm	Middle
10	China	Asia	Low
11	Colombia	LAm	Middle
12	Costa Rica	LAm	Middle
13	Cote d'Ivoire	SSA	Low
14	Dominican Rep.	LAm	Middle
15	Ecuador	LAm	Low
16	Egypt, Arab Rep.	SSA	Low
17	Ghana	SSA	Low
18	Honduras	LAm	Low
19	India	Asia	Low
20	Indonesia	Asia	Low
21	Iran, Islamic Rep.	Asia	Middle
22	Jamaica	LAm	Low
23	Japan	Asia	High
24	Jordan	Asia	Middle
25	Kenya	SSA	Low
26	Korea, Rep.	Asia	Middle
27	Lao PDR	Asia	Low
28	Lesotho	SSA	Low
29	Madagascar	SSA	Low
30	Malaysia	Asia	Middle
31	Mauritania	SSA	Low
32	Mexico	NAm	Middle
33	Morocco	SSA	Low
34	New Zealand	Oceania	High
35	Nicaragua	LAm	Low
36	Nigeria	SSA	Low

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37	Pakistan	Asia	Low
38	Panama	LAm	Middle
39	Paraguay	LAm	Middle
40	Peru	LAm	Middle
41	Philippines	Asia	Low
42	Poland	Europe	Middle
43	Romania	Europe	Middle
44	Russian Federation	Europe	Middle
45	Senegal	SSA	Low
46	South Africa	SSA	Middle
47	Sri Lanka	Asia	Low
48	Sweden	Europe	High
49	Thailand	Asia	Middle
50	Tunisia	SSA	Middle
51	Turkey	Europe	Middle
52	Turkmenistan	Asia	Middle
53	United States	NAm	High
54	Uruguay	LAm	Middle
55	Venezuela, RB	LAm	Middle
56	Vietnam	Asia	Low
57	Zimbabwe	SSA	Low

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International Journal of Economic Sciences and Applied Research 3 (2): 21-39

A Time-Varying Parameter Vector Autoregression Model for Forecasting Emerging Market Exchange Rates

Manish Kumar[1]

Abstract

In this study, a vector autoregression (VAR) model with time-varying parameters (TVP) to predict the daily Indian rupee (INR)/US dollar (USD) exchange rates for the Indian economy is developed. The method is based on characterization of the TVP as an optimal control problem. The methodology is a blend of the flexible least squares and Kalman filter techniques. The out-of-sample forecasting performance of the TVP-VAR model is evaluated against the simple VAR and ARIMA models, by employing a cross-validation process and metrics such as mean absolute error, root mean square error, and directional accuracy. Out-of-sample results in terms of conventional forecast evaluation statistics and directional accuracy show TVP-VAR model consistently outperforms the simple VAR and ARIMA models.

Keywords: Stock Prices, Exchange Rates, Bivariate Causality, Forecasting

JEL Classification: C22, C52, C53, F31, G10

1. Introduction

Various significant structural transformations between 1960 and early 1970s led to the dramatic end of the Breton-Woods system of pegged exchange rates. Numerous efforts to bring back the fixed exchange rate system proved futile and by March 1973, the regime of floating currencies began. Collapse of Breton-Woods and rapid expansion of global trading markets has altered the dynamics of foreign exchange market dramatically. This market is considered the largest and most liquid of the financial markets, with an estimated $1 trillion traded every day.

So, in such an environment where exchange rate fluctuates, policymakers strive to understand the exchange rate movements and their implications on interest rates and inflation. The interest rate is set on the basis of an overall assessment of the inflation outlook. Moreover, exchange rate movements affect consumer price inflation through

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various means. Therefore, fluctuation in the rates is considered a source of economic disturbance and helps determine future inflation.

Multinational companies (MNCs) thrive on most of their sales coming from overseas. And for this, they have to dabble with many tasks such as decisions on hedging, short-term financing, short-term investment, capital budgeting, earning assessment, and long-term financing. This makes MNCs vulnerable to exchange rate movements. Thus understanding the exchange rate movements can help MNCs take better decisions. Large volume and value of currencies transacted around the world have also led to speculation in these markets, as huge benefits are netted from the differences in exchange rates.

Moreover, post Breton-Woods, many countries including India resorted to managed floating exchange rate system. In this system, the central bank checks the free movement of exchange rates and intervenes in the market, as a buyer or seller of currencies to influence adverse market conditions or exchange rate movements. What is more, it is needless to say that policymakers need to have a thorough knowledge of currency movements.

As exchange rates are considered an important input in various decision-making processes, numerous significant contributions (Frankel, 1976; Meese and Rogoff, 1983a, 1983b; Alexander and Thomas, 1987; Wolff, 1987; Baillie and McMahon, 1989; Mussa, 1990; Gallant et al.,1991; Meese and Rogoff, 1991; Frankel and Rose, 1995) have been made theoretically and empirically to characterize and understand exchange rates. However, results of most studies (Meese and Rogoff, 1983a; 1983b; Alexander and Thomas, 1987; Somanath, 1986; Boothe and Glassman, 1987; Wolff, 1987; Wolff, 1988) suggest that econometric forecasting models of exchange rates failed to outperform the random walk model, in forecasting variations in exchange rates. These results also point out that the exchange rate is an asset price and is determined efficiently in the foreign exchange market.

Results of few studies (Woo, 1985; Schinasi and Swami, 1989; Kuan and Liu, 1995; Brooks, 1997; Gencay, 1999; Kumar and Thenmozhi, 2004, 2005; Hongxing et al., 2007; An-Pin Chen et al., 2008) contradict the earlier findings and show that their models outperform the naïve random walk, for certain time periods and currencies. These studies conclude that the presence of nonlinearity, volatility, chaos, nonstationarity, etc in the exchange rates was not handled properly in previous empirical models. This resulted in the random walk scoring over other models.

Most studies (Brooks, 1997; Panda and Narsimhan, 2003; Corte et al., 2007; Rime et al., 2007, An-Pin Chen et al., 2008 etc.) on exchange rate forecasting have either used macroeconomic variables such as inflation rates, money supplies, interest rates, trade balance, and crude oil price; or technical indicators such as past returns of exchange rates, short- and long-term moving averages etc as an input variables to the forecasting models.

Moreover, studies (Lisi and Schiavo, 1999; Qi and Wu, 2003; Kumar and Thenmozhi, 2003, 2004 and 2005; Chen and Leung, 2004; Cao et al., 2005; Hongxing et al., 2007; An-Pin Chen et al., 2008; Carriero et al., 2009) in the domain of exchange rate forecasting have used a wide range of linear and nonlinear models such as autoregressive models, ARIMA, linear regression, VAR, ARCH/GARCH, artificial neural networks

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(ANN), and support vector machines (SVM). Earlier studies also used a wide range of statistical metrics such as root mean square error (RMSE), mean absolute error (MAE), mean absolute percentage error (MAPE), and Theil's coefficient—to evaluate the performance of forecast.

During the last decade, the use of various nonlinear models such as ANN and SVM in forecasting various financial time series has considerably been increased. However, having a forecasting model which is consistent with economic theory and also forecast well is very appealing. So, in this study, we use the VAR time series approach to forecast the daily exchange rates of INR vs. USD. We select INR/USD rates because India is the world's sixteenth largest foreign market, in terms of daily turnover ($34 billion in 2007). India's contribution to global foreign market turnover has grown to 0.9% in 2008, a three-fold jump from just 0.3% in 2004. It also recorded the second-highest growth in the daily average foreign exchange market turnover after China. In 2006–07, India's annual gross foreign exchange market turnover grew to $6.5 trillion from $1.4 trillion, six years earlier. In August and October 2008, the Security and Exchange Board of India (SEBI) permitted National Stock Exchange (NSE), Bombay Stock Exchange (BSE) and Multi Commodity Exchange of India (MCX) to set up a currency derivative segment as well, where only currency futures (INR/USD) contracts are traded. Total turnover in this segment increased to $19.52 billion in March 2009 from $3.38 billion in October 2008. Open interest in the segment also grew 96% to 4, 51,819 contracts in March 2009 from 2, 30,257 contracts in October 2008.

Moreover, India has attracted unprecedented foreign investment (touching a phenomenal $10 billion) and is poised to become a major hub in the Asian economy. With the growing interest and research on emerging markets, India remains in the focus due to its rapid growth and potential investor opportunities. Moreover, volatility in emerging markets seems to be higher than in the developed markets—often making prediction difficult. This background makes the study more worthwhile: whether the dynamic linkages between INR/USD and stock market indices in India can be deployed to build a superior and accurate forecasting model.

This specific study improves upon the existing studies in several ways. To develop a successful model, it is necessary to consider the structural change in data. For this, 'regime-switching' and 'time varying parameter' (TVP) are two popularly used techniques; The TVP approach is used in the study given. This approach is beneficial in the sense that it makes use of all available data points and retains the long-term relationship inherent in the old data points (Hongxing et al., 2007). The study characterizes the TVP of VAR model based on the optimal control theory as proposed by Rao (2000). This methodology is a blend of flexible least squares and Kalman filter technique. Rao (2000) estimated TVP for linear regression models without an intercept; however, this study extends Rao's approach. Our method updates the coefficient of the VAR model and its covariance matrices in each time unit. Thus, the model can also be called a Bayesian VAR model. There is also a comparison between the results of the time-varying VAR model given with those of a linear VAR and ARIMA models.

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Earlier literature used macroeconomic variables, technical indicators, etc to develop forecasting models; but not stock prices data. Several recent studies (Vygodina, 2006; Pan et al., 2007; Ai-Yee Ooi, 2009; Aydemir and Demirhan, 2009 etc.) have reported causality from stock prices to exchange rates. Their results support the goods market or portfolio approach. Many firms in India that are on the stock index, NSE's S&P CNX Nifty (thereafter, CNX) have American Depository Receipts (ADRs) or General Depository Receipts (GDRs) that are traded on the NYSE, NASDAQ or on non-American exchanges. Over the years, INR has gradually moved towards full convertibility. The two-way fungibility of ADRs/GDRs allowed by India's central bank, Reserve Bank of India (RBI) has also possibly enhanced the linkages between the stock and foreign exchange markets in India. So, the dynamic relations between a stock index and exchange rates are examined, using linear granger causality tests. In addition, there is also usage of unit root and cointegration tests to analyze the long-run equilibrium between the two variables. The study exploits the dynamic linkage between stock price and exchange rate, and uses the granger causality test results to select important inputs for forecasting INR/USD.

Most previous studies arbitrarily split the available data into training (in-sample) and test (out-of-sample) set for model construction and validation, respectively. Performance of the forecasting model is likely to vary with the variation in time. So, consistency and robustness of the several competing models on various test data should also be evaluated. So in our study, we employ a cross-validation methodology (in-sample and out-of-sample data sets) to investigate the performance of various forecasting models.

Besides, earlier studies measured the degree of accuracy and acceptability of forecasting models, by the estimate's deviations from the observed values; they have not considered turning-point forecast capability using sign and direction test. In this study, there is a rigorous evaluation of the performance of forecasting models using MAE, RMSE, and directional accuracy. Directional accuracy measures the degree to which the forecast correctly predicts the direction of change in the actual INR/USD exchange rate returns.

It is expected that the outcome of the study will help enhance the existing literature, and offer some meaningful insights for policy makers, MNCs, traders, and individuals. The paper is set out as follows. In Section 2, daily exchange rates and the concept of unit root tests, cointegration tests, linear granger causality, VAR, TVP-VAR framework and ARIMA models are described. In Section 3, the empirical results are presented. Finally, Section 4 concludes with some discussion on future research.

2. Data and Methodology

We examined the daily closing price of CNX and INR/USD, obtained from NSE and RBI Web sites, respectively. The time period used is from January 4, 1999 to August 31, 2009. The original series was transformed into a continuously compounded rate of return, computed as the first difference of the natural logarithm of CNX and INR/USD.

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2.1 Unit Root Tests

To test the unit roots (stationarity) in CNX and INR/USD exchange rates, Augmented Dickey and Fuller (ADF) and Kwiatkowski, Philips, Schmidt and Shin (KPSS) tests are used. An ADF is a test for a unit root in a time series sample. KPSS tests are used for testing a null hypothesis that an observable time series is stationary around a deterministic trend. KPSS type tests are intended to complement unit root tests, such as the Dickey–Fuller tests. Table 1, contains the results.

2.2 Engle and Granger Cointegration Test

To investigate the existence of long-run relationship between two variables (CNX and INR/USD), the methodology suggested by Engle and Granger (1987) is employed. We prefer to use this method over Johansen Cointegration test, as Engle and Granger test is simple and helps in having at most one cointegrating vector (because we are examining two variables).

In the first step, we examine the order of integration of each variable. Cointegration between CNX and INR/USD requires that both series should be non-stationary of the same order of integration. In the second step, we run the following cointegration regression:

$$\ln S_t = \gamma_0 + \gamma_1 \ln ER_t + \varepsilon_t \tag{1}$$

Where $\ln S_t$ and $\ln ER_t$ are logarithms of CNX and INR/USD, respectively.

The third step is to obtain the error terms and run the ADF and KPSS tests on them in order to examine whether error terms have unit root and are stationary or not. If the error series is stationary, then the null hypothesis of no-cointegrating vectors is rejected. Table 2, lists the results of Engle and Granger cointegration test.

2.3 Granger Causality Test

In literature, various tests of Granger causality have been proposed and used. These tests are mainly based on the context of VAR models. So we employ the VAR framework to examine the presence of linear Granger causality between CNX and INR/USD. Let V_t denote the vector of endogenous variables and p, the number of lags. Then the VAR model can be represented as:

$$V_t = \sum_{i=1}^{p} \Psi_i V_{t-s} + \varepsilon_t \tag{2}$$

Where $V_t=(V_{1t,\ldots,}V_{pt})$, the p x 1 vector of endogenous variables, Ψ_i the p x p coefficient matrices, and ε_t is a zero-mean vector of white-noise processes.

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A VAR model including CNX returns denoted as X and INR/USD returns as Y can be expressed as:

$$X_t = \alpha(p)X_t + \beta(p)Y_t + \varepsilon_{xy,t} \qquad t = 1,2,....,N \tag{3}$$

$$Y_t = \chi(p)X_t + \delta(p)Y_t + \varepsilon_{yx,t} \qquad t = 1,2,....,N \tag{4}$$

where $\alpha(p)$, $\beta(p)$, $\chi(p)$ and $\delta(p)$ are all polynomial in the lag operator with all roots outside the unit circle

The error terms are identically and independently distributed (i.i.d) with zero-mean and constant variance.

If cointegration exists between CNX and INR/USD series, then the Granger representation theorem states that there is a corresponding error correction model. This model for CNX and INR/USD series can be represented as:

$$X_t = \alpha(p)X_t + \beta(p)Y_t + \phi Z_{t-1} + \varepsilon_{xy,t} \qquad t = 1,2,....,N \tag{5}$$

$$Y_t = \chi(p)X_t + \delta(p)Y_t + \varphi Z_{t-1} + \varepsilon_{yx,t} \qquad t = 1,2,....,N \tag{6}$$

Where $Z = \ln S_t - \gamma_0 - \gamma_1 \ln ER_t$ are the residuals from the cointegration regression of the log levels and $\Delta\ln S_t$ and $\Delta\ln ER_t$ is the first log difference of CNX and INR/USD, respectively (or simple exchange rate and CNX returns). Optimal lag length is selected based on the Akaike Information Criteria (AIC).

Within the context of this VAR/VECM model, linear Granger causality restrictions can be defined as follows. If the null hypothesis that β's jointly equal zero is rejected, it is argued that INR/USD returns (Y) Granger-cause CNX returns (X). Similarly, if the null hypothesis that χ's jointly equal zero is rejected, CNX returns (X) Granger-cause exchange rate returns (Y). If both the null hypotheses are rejected, a bi-directional Granger causality, or a feedback relation, is said to exist between variables. Different test statistics have been proposed to test for linear Granger causality restrictions. To test for strict Granger causality for pairs of (X,Y) in this linear framework, Chi-Square statistics is used to determine whether lagged value of one time series has significant linear predictive power for the current value of another series. Table 3 lists the results.

2.4 ARIMA Model

Popularly known as Box-Jenkins (BJ) methodology, but technically known as Autoregressive Integrated Moving Average (ARIMA) model, it is of the following form:

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$$Y_t = a_0 + \sum_{i=1}^{p} \alpha_i Y_{t-i} + \sum_{i=0}^{q} \beta_i e_{t-i} + \xi_t \tag{7}$$

Where Y_t is INR/USD returns, ξ_t is an uncorrelated random error term with zero mean and constant variance, and a_0 is a constant term.

The correlogram, simply a plot of Autocorrelation Functions (ACFs) and Partial Autocorrelation Functions (PACFs) against the lag length, is used in identifying the significant ACFs and PACFs. Lags of ACFs and PACFs, whose probability is less than 5%, are significant and are identified. Possible models are developed from these plots for CNX returns series. The best model for forecasting is picked by considering information criteria such as AIC and Schwarz Bayesian Information Criterion (SBIC).

2.5 The VAR Methodology

In this study, a VAR model is employed to forecast the INR/USD returns. Given V_t the vector of variables (CNX (X_t) and INR/USD (Y_t) returns), the classical first-order bi-variate VAR model can be represented as:

$$V_t = \Psi V_{t-1} + \varepsilon_t \qquad t = 1,....N \tag{8}$$

where $V_t = (Y_t, X_t)'$, Ψ is a 2 x 2 coefficient matrix and ε_t is a zero-mean vector of white-noise processes, with positive definite contemporaneous covariance matrix Σ and zero covariance matrices at all other lags.

To estimate the parameters, our study uses the least squares method. Optimal lag length is selected using information criteria (AIC and SBIC).

Optimal one-period ahead forecast of V_t using the VAR model can be obtained using the below equation:

$$V_{t+1,t} = \Psi V_t \tag{9}$$

2.6 VAR Model with TVP

Traditional time series model with time-invariant coefficients cannot be used to examine the relationship among economic variables, as they alter with changes in economic policies. So time variation of these parameters should go hand in hand with policy changes.

Thus, several estimation methods (switching regression model (Quandt, 1958; Goldfled and Quandt, 1973), pure random coefficient model (Rao, 1965), adaptive and varying parameters model (Cooley and Prescott, 1973a; 1973b), Kalman filter model (Athan, 1974), flexible least squares (Kalaba and Tesfatsion, 1988), recursive model

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(Rao, 1991), optimal control model (Rao and Nachane, 1988) have been proposed in the literature to deal with the problem is estimating TVP models.

Rao (2000), proposed a methodology to estimate the TVP of a linear regression model without an intercept term. The methodology is based on the characterization of the TVP problem as a near-neighborhood search problem, with an explicit allowance for welfare loss considerations. This leads to an updating algorithm, capable of predicting the optimal values of TVP as well as their covariance matrices. This methodology is a blend of the flexible least squares and Kalman filter techniques.

In the present study, there is an attempt to extend Rao (2000), to estimate TVP of VAR model. As the method updates the VAR coefficients and their covariance matrices for every time period, it could be considered as a Bayesian method. As discussed in the earlier section, the classical linear first-order bivariate VAR model is represented as:

$$V_t = \Psi V_{t-1} + \varepsilon_t, \qquad t = 1,....N \tag{10}$$

In the optimal control theory, the TVP of VAR model using near-neighborhood search method can be represented as:

$$V_t^* = \Psi_t^* V_{t-1} \qquad t = 1,....N \tag{11}$$

A control problem comprises a cost function, which indeed is a function of state and control variables. The linear quadratic cost functional, which has to be minimized for the TVP VAR model, can be stated as:

$$W = \frac{1}{2}\sum_{t=1}^{N} Q_t (V_t^* - V_t)^2 + \frac{1}{2}\sum_{t=1}^{N} (\Psi_t^* - \Psi_{t-1}^*)' R_t (\Psi_t^* - \Psi_{t-1}^*) \tag{12}$$

Where V_t, V_t^* are states, Ψ_t^* is control, and t is the time. In the finite-horizon case, the matrices Q_t and R_t are positive semi-definite and positive definite, respectively. The solution of the optimal control problem may not be unique. Most often, the solutions of such problems is locally minimizing. However, the main advantage of the cost function is that the constraints Ψ_t^* lie within the neighborhood of Ψ_{t-1}^* (Rao, 2000).

Equation 12, can be solved using the method of Lagrange multipliers. It is converted into an equivalent cost function, using certain unspecified parameters known as Lagrange multipliers (λ_t). The new cost function called as Lagrange function can be defined as:

$$J = \frac{1}{2}\sum_{t=1}^{N} Q_t (V_t^* - V_t)^2 + \frac{1}{2}\sum_{t=1}^{N} (\Psi_t^* - \Psi_{t-1}^*)' R_t (\Psi_t^* - \Psi_{t-1}^*) - \sum_{t=1}^{N} \lambda_t (V_t^* - \Psi_t^* V_{t-1}) \tag{13}$$

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To obtain the solution of the new cost function, we take the partial derivative of J with respect to three variables V_t, Ψ_t^* and λ_t; and set the partial derivative to zero. We get:

$$\frac{\delta J}{\delta V_t^*} = Q_t(V_t^* - V_t) - \lambda_t = 0 \qquad (t = 1, ..., N) \tag{14}$$

$$\frac{\delta J}{\delta \Psi_t^*} = R_t(\Psi_t^* - \Psi_{t-1}^*) + V_{t-1}\lambda_t = 0 \qquad (t = 1, ..., N) \tag{15}$$

$$\frac{\delta J}{\delta \lambda_t} = -(V_t^* - \Psi_t^* V_{t-1}) = 0 \qquad (t = 1, ..., N) \tag{16}$$

Solving Equation 14 for λ_t gives:

$$\lambda_t = Q_t V_t^* - Q_t V_t \tag{17}$$

Solving for V_t^* using Equation 16, we get:

$$V_t^* = \Psi_t^* V_{t-1} \tag{18}$$

Substituting the value of V_t^* in Equation 17 yields:

$$\lambda_t = Q_t \Psi_t^* V_{t-1} - Q_t V_t \tag{19}$$

Substituting Equation 19, in Equation 15, results in:

$$\Psi_t^* = (R_t + V_{t-1} Q_t V_{t-1})^{-1} R_t \Psi_{t-1}^* + (R_t + V_{t-1} Q_t V_{t-1})^{-1} V_{t-1} Q_t V_t \tag{20}$$

At this point, we have all the variables in terms of Ψ_t^*
In Equation 20, if the variable $Q_t = 0$, then it becomes:

$$\Psi_t^* = \Psi_{t-1}^* \tag{21}$$

Equation 21, suggests that the coefficient of the VAR model is time-invariant.
However, in Equation 15, if we set $R_t = 0$, then it becomes:

$$V_{t-1}\lambda_t = 0 \tag{22}$$

From equation 19 and 22, we get:

$$V_{t-1} Q_t V_{t-1} \Psi_t^* = V_{t-1} Q_t V_t \tag{23}$$

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Equation 23, results in $V_{t-1}\Psi_t^* = V_t$. This suggests that the dependent variables of VAR model can be tracked. Moreover, the adaptive nature of control system is evident, if Equation 20 is transformed. To do this, let us assume that:

$$K_t = (R_t + V_{t-1}Q_tV_{t-1})^{-1}V_{t-1}Q \tag{24}$$

Using Equation 24, Equation 20, can be rewritten as:

$$(R_t + V_{t-1}Q_tV_{t-1})^{-1}[(R_t + V_{t-1}Q_tV_{t-1}) - V_{t-1}Q_tV_{t-1}] = I - K_tV_{t-1} \tag{25}$$

Substituting Equations 24 and 25, in Equation 20, we get:

$$\Psi_t^* = \Psi_{t-1}^* + K_t(V_t - \Psi_{t-1}^*V_{t-1}) \tag{26}$$

Where K_t is the correction factor

Equation 26, can be used to compute the Ψ_t^* from its previous estimate. Subsequently, Ψ_t^* can be used to compute the predicted state of V_t^*.

The above three methodologies have been used to forecast the daily returns of INR/USD.

2.7 Estimation and Prediction

Examining the robustness of the forecast models is an interesting topic as well as a meaningful trial. This helps access the forecast performance vis-à-vis different sample data sets. To investigate the performance of the competiting forecasting models, four validation sets are used. In the first set, daily data of CNX and INR/USD from January 4, 1999–December 31, 2006 is used. The data is divided into an estimation period (in-sample data) from January 4, 1999–December 31, 2005, and a forecast period (out-of-sample data), from January 1, 2006–December 31, 2006. In the second validation set, daily data is considered from January 4, 1999–December 31, 2007. There are estimations conducted over period from January 4, 1999–December 31, 2006 and data from January 1, 2007–December 31, 2007 is reserved for the forecasting exercise. The third validation set covers a daily period from January 4, 1999 – December 31, 2008. The data is divided into an estimation sample from January 4, 1999–December 31, 2007, and a forecast sample from January 1, 2008– December 31, 2008. In the last validation set, there is daily data from January 4, 1999–August 31, 2009. The data is divided into two periods: January 4, 1999–December 31, 2008, for model estimation and is classified as in-sample and a period from January 1, 2009–August 31, 2009 is reserved for out-of-sample forecasting and evaluation.

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3. Results

3.1 Unit Root Test

Results of ADF and KPSS tests for the two time series: CNX and INR/USD returns and for the entire time period are shown in Table 1.

Table 1: Unit Root Test

Variable	ADF Test	KPSS Test
	t-statistics	t-statistics
ln S_t (Log level)	-0.6553	5.3562
Δ lnS_t (First Diff)	-36.7465	0.0890
ln ER_t (Log Level)	-1.3609	0.7149
Δ lnER_t (First Diff)	-52.5394	0.1765

Source: Author estimation

Note: The critical values for ADF and KPSS test at 1 % level are -3.4327 and 0.739 respectively.

These results indicate that the log level of CNX and exchange rates series have a unit root. However, ADF and KPSS tests test on the first log order difference for the two series: Δln S_t and Δln ER_t; and this confirm the stationarity of the two series.

3.2 Engle and Granger Cointegration Test

After testing for the unit root in the two series, the two-step Engle and Granger cointegration test was applied to examine whether the logarithms of INR/USD exchange rate and CNX are cointegrated. Table 2, reports the results of the cointegration regression.

Table 2: Engle and Granger Cointegration Test

Cointegrating Regression			
Coefficient	**Coefficient Value**	**t-statistic**	**Probability**
γ_o	25.3729	40.3541	0.0000
γ_1	-4.6699	-28.2934	0.0000
Unit Root Test of Cointegrating Errors			
ADF Test		**KPSS Test**	
t-statistics	**Critical Value (1%)**	**t-statistics**	**Critical Value (1%)**
-0.5415	-3.4327	5.4933	0.739

Source: Author estimation

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To find out whether the variables are actually cointegrated, the cointegration error terms are tested for stationarity. ADF and KPSS test results clearly indicate that the error terms are nonstationary. So, the results suggest that there is no cointegrating vector and eventually no long-run relationship between exchange rate and stock indices for India. Hence, an error correction term need not be included in the Granger causality test equations. Findings of Engle and Granger Cointegration tests are consistent with the findings of previous studies for developed markets such as US, UK, and Japan as well as for Asian markets like India, Malaysia, and Pakistan.

3.4 Linear Granger Causality Test

The dynamic (causal) relationship between CNX and INR/USD returns is investigated using bi-variate VAR framework, without the error correction term. The appropriate lag length for VAR models is selected using SBIC. Granger causality test results are in Table 3.

Panel A of Table 3, reports the results of linear Granger causal test, while panel B reports the Granger causality results between volatility-filtered CNX and INR/USD returns.

Table 3: Linear Granger Causality Test

Null Hypothesis	Chi-Sq-Statistics	P-Value
Nifty Returns does not Granger cause INR/USD	8.2422	0.0162**
INR/USD does not Granger cause Nifty Returns	9.6352	0.0081*

Source: Author estimation

* Represent the relationship being significant at 1 %

** Represent the relationship being significant at 5 %

The optimal lag length is 2 which are selected based on the SBIC criteria.

The results reported in Panel A, indicate that both the null hypotheses 'Nifty Returns does not Granger-cause INR/USD returns' and 'INR/USD returns does not Granger-cause Nifty returns' are rejected. Chi-Square statistics are significant and provide strong evidence for the argument that there is a Bi-directional linear Granger causality between CNX and INR/USD returns.

In general, the results suggest that exchange rates do help explain changes in the stock index and vice versa. So, the results of our study do not support the 'Efficient Market Hypothesis' for the Indian market. Moreover, the findings strongly support the portfolio approach on the relationship between exchange rates and stock prices. Thus, we could use stock price as an initial attribute to forecast exchange rates and vice versa.

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3.5 ARIMA Model

Plots of ACFs and PACFs are used to identify the significant lag length. Various orders of ARIMA models are developed using ACF and PACF plots. Information criteria (AIC and SIC) help identify the best forecasting model (results available upon request). After considering all possible models and looking at AIC and value of each model, it was decided that ARIMA (2,1,1) is best model for forecasting daily returns of INR/USD series for the first validation set (January 1, 1999–December 31, 2006). Moreover, for the subsequent validation data sets, ARIMA (1,1,2) is the best. Further diagnostic tests are performed to check the model's adequacy.

We use a popular diagnostic test known as Breusch-Godfrey LM test to examine the presence of serial correlation in the residuals of the developed ARIMA model. This test helps examine the relationship between residuals and several of its lagged values at the same time. The null hypothesis is that 'there is no serial correlation'. If the predictability value is greater than 5%, then we accept the hypothesis (at 95% confidence levels); so there is no serial correlation in the series. The LM test for serial correlation of residuals suggests that the ARIMA (2,1,1) and ARIMA(1,1,2) models capture the entire serial correlation; and the residuals do not exhibit any serial correlation (results available upon request). It suggests that the residuals, estimated by the two ARIMA models, are purely random. So, another ARIMA model may not be searched (Gujrati, 1995).

3.6 VAR Model

This model generally uses equal lag length for all its variables. One of its drawbacks is that many parameters need to be estimated, some of which may be insignificant. This problem of over-parameterization, resulting in multicollinearity and a loss of degrees of freedom, leads to inefficient estimates and possibly large out-of-sample forecasting errors (Litterman, 1986; Spencer, 1993). One solution, often adopted, is simply to exclude the insignificant lags based on statistical tests. Another approach is to use a near VAR, which specifies an unequal number of lags for the different equations.

In our study, while examining the causality test in the VAR framework, we selected two lags of CNX and INR/USD, based on SBIC criteria. However, when the parameters in VAR model of Equation 3 are estimated, it was found that the second lag of CNX and INR/USD seems to be insignificant. So we excluded these lags from the VAR model and re-estimated the model, using ordinary least squares criteria. So the forecast is done using a bi-variate first-order VAR model.

3.7 TVP-VAR Model

This model has been used to forecast the daily returns of INR/USD. First, an initial coefficient of TVP-VAR model is chosen that minimizes the welfare loss function. Estimates of the simple VAR model based on the in-sample data are used as an initial

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coefficient of the model for every cross-validation data set. The near-neighborhood approach using grid search is then employed on the initial coefficient to identify the coefficient values that further minimizes the loss function. This new coefficient as identified by the grid search is used to estimate the consecutive sequence of the coefficient and the corresponding predictions of the INR/USD returns, for each validation set of the model.

Forecasting performance of various models and for the four out-of-sample periods are summarized in Table 4.

Table 4: Prediction Accuracy

Model	First Validation Test Set (January 1, 2006 –December 31, 2006)		
	Performance Metrics		
	MAE	RMSE	Directional Accuracy
TVP-VAR	0.002065	0.002982	54.48%
VAR	0.002074	0.002986	53.13%
ARIMA	0.002081	0.002987	52.30%
Second Validation Test Set (January 1, 2007–December 31, 2007)			
Model	Performance Metrics		
	MAE	RMSE	Directional Accuracy
TVP-VAR	0.002550	0.003856	59.91%
VAR	0.002552	0.003861	56.61%
ARIMA	0.002555	0.003864	54.95%
Third Validation Test Set (January 1, 2008–December 31, 2008)			
Model	Performance Metrics		
	MAE	RMSE	Directional Accuracy
TVP-VAR	0.004687	0.006841	56.06%
VAR	0.004705	0.006885	53.13%
ARIMA	0.004759	0.006897	49.70%
Fourth Validation Test Set (January 1, 2009–August 31, 2009)			
Model	Performance Metrics		
	MAE	RMSE	Directional Accuracy
TVP-VAR	0.004725	0.006466	56.96%
VAR	0.004772	0.006493	55.69%
ARIMA	0.004872	0.006673	48.10%

Source: Author estimation

The results display the out-of-sample results of the various forecasting models. For the INR/USD returns, we find that the TVP-VAR model yields better forecast (smaller RMSE and MAE) than the simple VAR and ARIMA models, for all the validation sets.

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Moreover, between VAR and ARIMA model, the VAR forecasts on the four out-of-sample data have smaller RMSE and MAE.

The TVP-VAR model also exhibits good market-timing ability as indicated by the results of directional accuracy. The directional accuracy of the model is 54–60% over the four test samples. This means the forecasts are comparatively better than the chances in tossing a coin. Compared to the ARIMA models, the simple VAR forecast have higher directional accuracy values.

As for the forecasting stability, two observations can be made from Table 4. First, the time series models (TVP-VAR) are robust across the cross-validation test and the results seem to be more stable. Second, no matter what method is used, there are no consistent patterns in MAE and RMSE across all out-of-sample periods. There is a difference in the values of various performance measures such as RMSE and MAE of TVP-VAR, VAR and ARIMA models for all out-of-sample periods. This result is expected since the structure of the exchange rate time series varies from one time period to the other. If in-sample and out-of-sample date generally increase or decrease or vice versa, then it is clear that no method can predict well particularly in the short run—leading to large variations in prediction. So, it may be concluded that the predictive accuracy of all models changes across time, for different forecasting horizons.

Overall, results suggest that the TVP-VAR model contains added information for INR/USD and strongly outperforms the other two models. They are consistent with our expectations that allowing TVP using optimal control theory enhances the model's forecasting performance.

4. Conclusion

A Bayesian VAR model was developed based on the optimal control theory, which updates the coefficient and their covariance matrices in each time period. Our TVP-VAR model helps forecast the daily returns of INR/USD. The results of the TVP-VAR model are compared with the simple VAR and a linear ARIMA model. A cross-validation scheme is employed to examine the robustness of the three models with regard to sampling variation in time series. Out-of-sample performances of the three models were evaluated along performance metrics like MAE, RMSE and Directional Accuracy. Results from the study indicate that the TVP-VAR model achieves high rate of accuracy, in terms of MAE, RMSE and Directional Accuracy for the four validation sets. The results in general supports the study of Carriero et al. (2009), Sarantis (2006), Kumar and Thenmozhi (2003, 2004 and 2005), and Chen and Leung (2004) etc. The forecast gains are due primarily to the time-variation of coefficients. Moreover, the results also suggest that, informational content of indicators like stock index can be exploited to improve the exchange rate forecasts. Thus, the results reject the efficient market hypothesis and lend support to the technical analysis.

The findings of the study would be of great interest to traders, MNC's, regulators and others. The better forecasting or understanding of the movements of exchange rate

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for the developing economy of Asia would help traders to devise more effective business and trading strategies and a proper decision on asset allocation. Moreover, based on the forecast, they can also take precautionary measure to reduce potential currency risk.

Corporate and MNC's can effectively use such models for their foreign exchange risk management plan/policy/programme. Such models would help them to reduce the volatility in profits after tax, cash flows, and to reduce the cost of capital and thus increase the value of the firm on one side of the pole and to reduce the risks faced by the management on the other side of the pole.

The TVP-VAR model would also help policy makers in India to intervene successfully and at the right time in the market in order to prevent overshooting and decisively break the momentum in currency movement. Thus, the policy makers can conduct a suitable monetary policy which will in turn achieve its desired objectives of price stability and higher economic activity. Moreover, the dynamic bi-directional causal relationship between exchange rates and stock index also suggests that, the SEBI and the central bank i.e. RBI in India should be very careful in conducting exchange rate policies or capital market polices as it may impact on the development of the financial markets.

The study can be extended by taking into account the set of potential macroeconomic input variables such as interest rates, consumer price index and industrial production, as well as technical indicators. Moreover, various trading strategies can be used to examine if trading profits can be obtained from the forecasting model used in the study. The other logical extension could be to combine the TVP-VAR model with some nonlinear models used in the financial time series literature.

Acknowledgement

The author would like to thank the anonymous referees for going through the manuscript patiently and critically and providing their constructive suggestions in improving it. The views expressed here are those of the author, and do not necessarily represent those of their employers.

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International Journal of Economic Sciences and Applied Research 3 (2): 41-56

A VAR Analysis of FDI and Wages: The Romania's Case

Mihai Ioan Mutascu[1] and Anne-Marie Fleischer[2]

Abstract

According to Lall (1997), the FDI are strongly interconnected with a series of variables, such as: economic conditions (markets, natural resources, competitiveness), host country policies (macro policies, private sector, trade and industry, FDI policies), as well as MNE strategy (risk perception, location, sourcing of products/inputs, integration transfer). Recent studies have shown that the relationship 'FDI-Wages' is significant and the two variables have one on one influence. More precisely, the low wages have the role to attract FDI and the high volume of FDI generates the increase of the wages on the destination's country labor market. Also, the FDI augmentations determine inequalities on the structure of the wages. The paper analyses the 'behavior' of the relationships between the volume of FDI and the level of wages, in Romania, using an unrestricted vector autoregressive model (Unrestricted VAR). Based on the impulse functions generated by the model, some principal conclusions have resulted:

(1) The impact of the FDI on the wages is not uniform during the year, depending usually on the FDI flow and also on the self-regulation way and reaction of the wages on the labor market;

(2) The impact of the wages on the FDI is temporally sinuous in short term. In this situation, the FDI flow does not depend entirely on the signals received by investors regarding the level of wages in the destination country.

Keywords: FDI, Wages, VAR, Analysis, Impulse function, Effects

JEL Classification: F16, F21, C50

1. Introduction

According to Lall (1997, p.18), the FDI (Foreign Direct Investment) is strongly interconnected with a series of variables, such as: economic conditions (markets, natural resources, competitiveness), host country policies (macro policies, private sector, trade

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and industry, FDI policies), as well as MNE strategy (risk perception, location, sourcing of products/inputs, integration transfer).

The competitiveness, one of the economic conditions, refers to labor availability, wages, skills, trainability, managerial technical skills, input access, infrastructure, supplier base, technology and financial support. In fact, the wages are an appreciable impact to the FDI, but over the time the skills and technical efficiency become more important.

Recent studies have shown that the relationship 'FDI-Wages' is significant and the two variables have one on one influence. In such conditions, we can identify two statements of the relationship between FDI and wages: (a) 'Wages first and FDI later', that means wages have the capacity to modify FDI; and (b) 'FDI first and wages later', that means FDI generates the changes in the level of wages.

Moreover, the field literature offers contradictory results about the sign of the relationship between FDI and wages. This could have the same sign, but also contrary, no matter which statement is considered ('Wages first and FDI later' or 'FDI first and wages later').

2. Theoretical fundaments

(a) In the first statement's case - 'Wages first and FDI later', Marr (1997, p. 6) argues that the decision to invest in low-income country has been heavily influenced by the prevailing low wage rate and the rapid growth in FDI has also been attributed primarily to the availability of low-cost labour. Moreover, in some countries when the cost of labor is relatively insignificant (when wage rates vary little from country to country), the skills of the labor force are expected to have an impact on decisions about FDI location.

For Holland and Pain (1998, p. 7), 'the cost of labor in the host country is a potentially major factor in the location decision, particularly for firms seeking to produce labor intensive products for export'. According to Resmini (1999, p. 15), 'the relevant presence of small investors and high percentage of foreign investments realized in the traditional sectors suggest that the endowment of labor force and its relative price may play a role in attracting FDI'.

On the contrary, Coughlin and Segev (1999, p. 12) reveal that 'higher wages should deter foreign investment. In concrete, since higher wages might be due to higher productivity, ideally employee productivity should be controlled for in the regression analysis. However, they confirm that the past studies of FDI have found somewhat conflicting results for the effect of wages, but this is likely due to some extent to the omission of a productivity variable'. The study of Rahmah and Ishak (2003, p. 1), shows that 'the labor market determinants differ between countries in terms of their role in FDI inflows'. The authors' results suggest that, with regard to labor market competitiveness, different countries may require different policy recommendations in order to attract FDI inflows into their countries.

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Amaro and Miles (2006, p. 3) consider that 'the opening of low wage nations to FDI has created much more competition for investment since the beginning of the 1990s'. Their analysis is made to determine the impact of both low wages and infrastructure as determinants of FDI. For Kyrkilis, Pantelidis and Delis (2008, p. 4), 'the labor cost and labor quality hold a prominent position in attracting FDI. Even though the empirical evidence is somewhat mixed, low wage costs prove that they have played a significant role in attracting FDI in developing countries, but the average wage was chosen as the approximation for labor cost with a negative relationship with FDI'.

(b) In the second statement's case - 'FDI first and Wages later', Aitken, Harrison and Lipsey (1995, p. 22), analyzing the relationships between wages and foreign direct investment in Mexico, Venezuela and the United States, find that 'higher levels of foreign direct investments are associated with higher wages'.

In the same spirit, Faggio (2003, p. 29), exploring the interaction between wages and foreign investment in Poland, Bulgaria and Romania, despite different economic conditions and levels of development, find that 'across all three countries higher levels of FDI are associated with higher manufacturing wages'. Almeida (2004, p. 18-19) considers that 'foreign firms have a more educated workforce and pay higher wages for all education groups even after accounting for sector and regional composition, as well as other firm and worker level characteristics usually not accounted for due to lack of data'.

On the contrary, the results of Vijaya and Kaltani (2007, p. 1) indicate that 'FDI Flows have a negative impact on overall wages in the manufacturing sector and this impact is stronger for female wages'. They argue that one possible explanation for such an impact may be a decrease in the bargaining power of labor due to new labor market arrangements in a global economy where capital is free to move across countries in search of more favorable conditions. Tomohara and Yokota (2007, p. 10), examining whether FDI inward is a source of wage inequality between skilled and unskilled labor in developing countries, show that the 'multinational companies tend to pay higher wages, even after controlling for factors such as industry and workers characteristics'.

Recent authors, such as Decreuse and Maarek (2008, p. 2), argue that 'FDI can have negative effects on the labor share of income, even though foreign firms pay higher wages than local firms and FDI benefit all the workers'. In the same time, Hale and Long (2008, p. 23) accept that 'the FDI presence in China is putting an upward pressure on wages of skilled workers through increased competition in the market for skilled labor, which are reflected in an increase in wages that private firms pay to their skilled workers and in a decline in quality of skilled labor in SOEs that appear to be constrained in terms of wages they can pay to their employees'.

Finally, we can note that the field literature offers contradictory results about the sign of the relationship between FDI and wages. Generally, it is considered that the low wages have the role to attract FDI and the high volume of FDI generates the increase of the wages on the destination's country labor market. Also, the FDI augmentations determine inequalities on the structure of the wages.

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According to the mentioned premise, all the theoretical elements presented allow us to formulate two theoretical working assumptions. The hypotheses are:

H_1: The statement 'Wages first and FDI later': The level of FDI is growing as the wages are decreasing.

H_2: The statement 'FDI first and Wages later': The level of wages is growing as the FDI is increasing.

In summary, the meanings of the hypothesis' work relations are:

Table 1: The 'sings' of the hypothesis' work relations

The statement	Variable and 'tendency sign'	Variable and 'tendency sign'
'Wages first and FDI later'	Wages + or –	FDI – or +
'FDI first and Wages later'	FDI + or –	Wages + or –

In this assumption approach, the first statement's case relives that the relationship between wages and FDI have contrary sign (if the wages increase, the FDI decreases and vice-versa) and the second statement's case consider that the connexion 'FDI-wages' have the same sign (if the FDI grows, the wages increase and vice-versa).

3. Methods and results

Because the relationship between the two variables 'Foreign Direct Investment - FDI' and 'Wages - W' has a double sense, based on theoretical working assumptions, for analysis of the 'binome' we consider a vector autoregression model (VAR). This model is commonly used for forecasting systems of interrelated time series and for analyzing the dynamic impact of random disturbances on the system of variables. Moreover, according to Gujarati (2004, p. 848), in vector autoregression models some variables are treated as endogenous and some as exogenous or predetermined (exogenous plus lagged endogenous).

In this case, the two considered variables - FDI and W - are treated as endogenous variables. Assuming that each of the two equations contains k lag values of FDI and W, for the t period, the VAR can be written:

$$FDI_t = \alpha + \sum_{j=1}^{k} \beta_j FDI_{t-j} + \sum_{j=1}^{k} \gamma_j W_{t-j} + u_{1t} \tag{1}$$

$$W_t = \alpha' + \sum_{j=1}^{k} \varphi_j FDI_{t-j} + \sum_{j=1}^{k} \mu_j W_{t-j} + u_{2t} \tag{2}$$

or, equivalently, in matrix form:

$$\begin{bmatrix} FDI_t \\ W_t \end{bmatrix} = \begin{bmatrix} \alpha \\ \alpha' \end{bmatrix} + \begin{bmatrix} \beta_1 \ \gamma_1 \\ \varphi_1 \ \mu_1 \end{bmatrix} \begin{bmatrix} FDI_{t-1} \\ W_{t-1} \end{bmatrix} + \ldots + \begin{bmatrix} \beta_k \ \gamma_k \\ \varphi_k \ \mu_k \end{bmatrix} \begin{bmatrix} FDI_{t-k} \\ W_{t-k} \end{bmatrix} + \begin{bmatrix} u_{1t} \\ u_{2t} \end{bmatrix} \tag{3}$$

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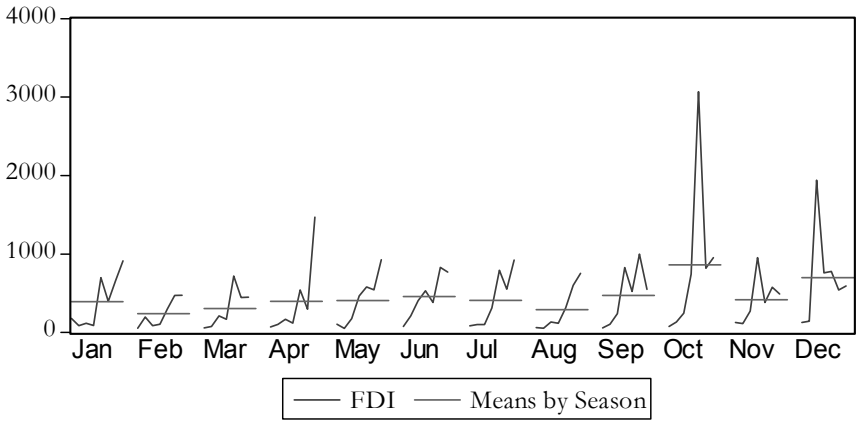
where α,α' are the intercept terms; β,γ,φ,μ are the coefficients of the endogen variables; and the u are the stochastic error terms.

The analysis data sets include the Foreign Investments Inflow in Romania (FDI) and the Net Average Wages (W), with monthly frequency, in nominal terms, in Romanian currency (Lei), communicated by The National Bank of Romania in its Monthly Bulletins, from January, 2002 to January, 2009 (85 observations).

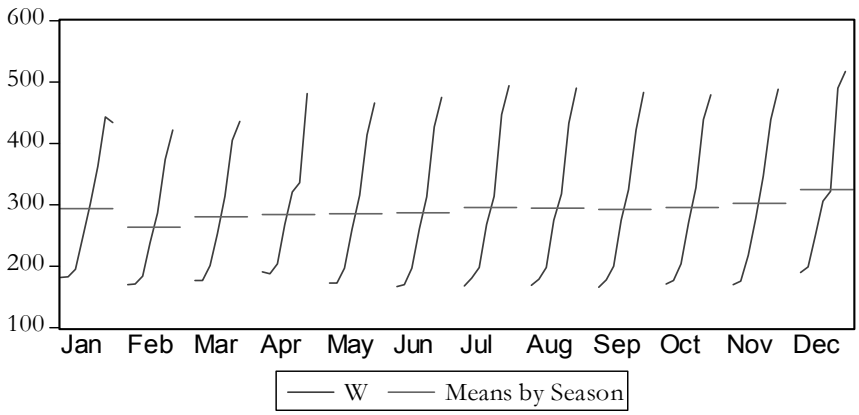
The principal steps of econometric analysis are: (a) variables' tests for seasonality components; (b) unit root tests of variables; (c) VAR and joint lag selection; (d) pairwise Granger Causality Tests; and (e) residuals' tests.

(a) Variables' tests for seasonality components use seasonal stacked line graphic methods. The graphic results are shown below:

Graph 1: FDI seasonal components



Graph 2: Wages seasonal components



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Both series reveal some seasonal components. In this situation, we have adjusted the series by X12 ARIMA additive method, used by United States Census Bureau. What is more, after adjustment, the variable FDI becomes FDISA and W becomes WSA.

(b) Unit root tests of variables are based on Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The results, shown in Appendix (Table 1-7), in both unit root tests, suggest that FDISA is I(0) and WSA is I(1).

(c) VAR and joint lags selection present the VAR constructions and the joint lags selection criteria.

The VAR construction's problem in our case is that one of series is stationary and another is non-stationary. We are working in levels, even if in the VAR methodologies all the variables should be stationary. The argument is that:

'The usual approach adopted by VAR aficionados is therefore to work in levels, even if some of these series are non-stationary. In this case, it is important to recognize the effect of unit roots on the distribution of estimators.' (Harvey, 1990, p. 83).

Also, Gujarati (1995, p. 749) affirms that transformations of the dates will not be easy if the model contains a mix of I(0) and I(1).

For selection of the *joint lags* we consider two tests: the VAR Lag Order Selection Criteria and the VAR Lag Exclusion Wald Tests.

(1) VAR Lag Order Selection Criteria illustrates (see Appendix, Table 8), for 5 theoretical lags, that the 4 of 5 criteria (LR, FPE, AIC and HQ, exception SC) recommend a joint lags 4 in the case of VAR 'FDISA-WSA'.

(2) VAR Lag Exclusion Wald Tests (see Appendix, Table 9), for 5 theoretical lags; confirm the results of the first criteria, in which the joint lags for considered VAR is 4.

In such conditions, for 4 joint lags, the 'Unrestricted VAR FDISA-WSA' may be written (see the estimates in Appendix, Table 10):

$$FDI_t = \alpha + \sum_{j=1}^{4} \beta_j FDI_{t-j} + \sum_{j=1}^{4} \gamma_j W_{t-j} + u_{1t} \tag{4}$$

$$W_t = \alpha' + \sum_{j=1}^{4} \varphi_j FDI_{t-j} + \sum_{j=1}^{4} \mu_j W_{t-j} + u_{2t} \tag{5}$$

(d) Pairwise Granger Causality Tests verifies how much of the current FDISA can be explained by past values of FDISA and whether adding lagged values of WSA can improve the explanation and vice-versa.

The Pairwise Granger Causality Tests, presented in Appendix, Table 11, for joint lags 4, suggests that we may reject the null hypothesis that 'FDISA does not Granger cause WSA' and 'WSA does not Granger cause FDISA'. In this context, the FDISA helps in the prediction of WSA (FDISA Granger causes WSA) and vice-versa (WSA Granger causes FDISA).

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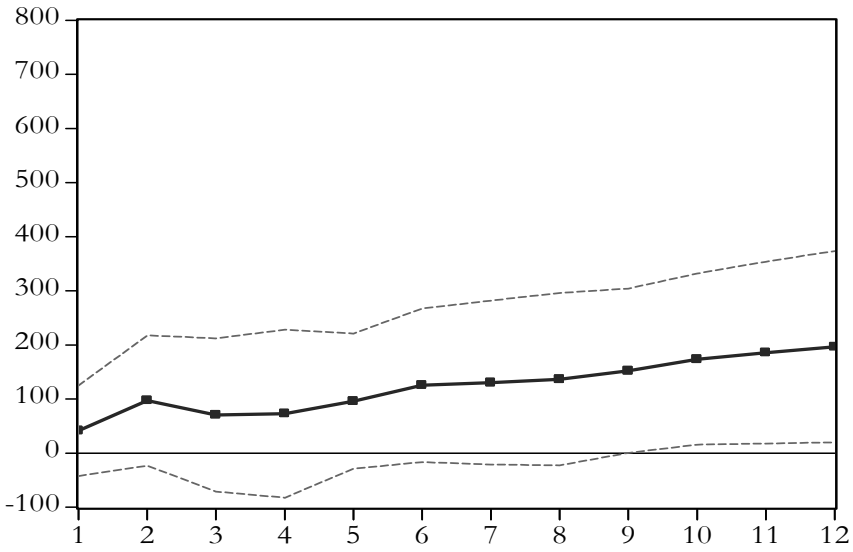
(e) Residuals tests are focused to VAR Residual Portmanteau Tests for Autocorrelations and VAR Residual Serial Correlation LM Tests. The results of the two tests are illustrated in Appendix, Tables 12 and 13. Both tests show that the null hypothesis of no serial autocorrelation in residuals cannot be rejected (at limit in Portmanteau's Tests).

In conclusion, the 'Unrestricted VAR FDISA-WSA' model may be considered representative to describe, in Romanian's case, the autoregressive connection between FDISA and WSA and vice-versa.

4. Conclusions

Based on the model, we can identify two impulse responses, because an impulse response function traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables FDISA and WSA. In this case, the accumulated responses of FDISA and WSA to Cholesky One S.D. Innovations ± 2 S.E., for 12 months, are illustrated in Graph 3 and 4.

Graph 3: Accumulated Response of FDISA to WSA



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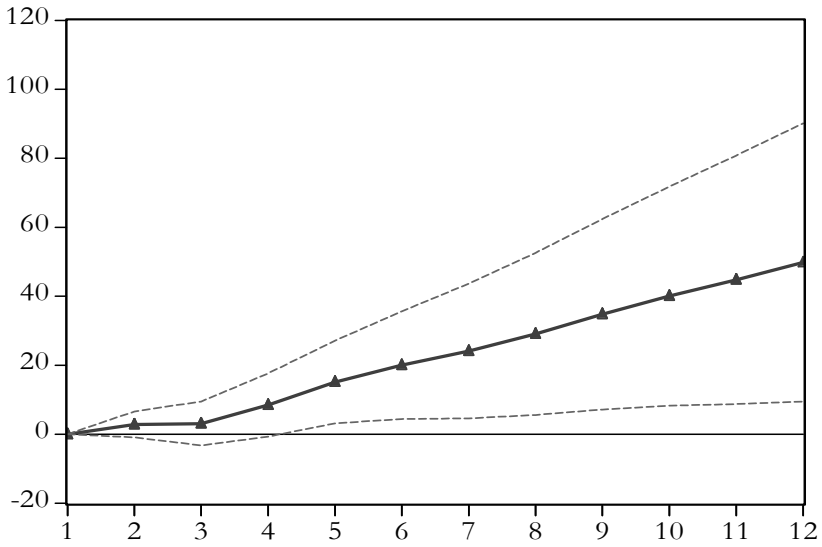
Graph 4: Accumulated Response of WSA to FDISA



In this context, in Romania's case, some principal conclusions have resulted:

- The impact of the wages on the FDI is temporally sinuous in short term. In this situation, the FDI flow does not depend entirely on the signals received by investors regarding the level of wages in the destination country;

- The impact of the FDI on the wages is not uniform during a year, depending usually by the FDI flow and also by the self-regulation way and reaction of the wages on the labor market.

(a) In the first statement's case - 'Wages first and FDI later', the results confirm our assumption hypothesis. In this case, the level of FDI is not growing as the wages are decreasing. The results infirm the conclusion of Marr (1997), Resmini (1999) and Kyrkilis, Pantelidis and Delis (2008), regarding the sign of 'wages-FDI' connection. In the same context, our results confirm the acquisition of Rahmah and Ishak (2003).

In Romania's case, a +1% sock in WSA, determines a low level of FDISA inflow in the first month, an abrupt growth in the next two and a 'flat increase' trend in the next 9 months. This means that the FDISA inflow has a high sensibility in very short-term (1 month). The growth of FDISA inflow reactions in short-term (more then 1 month) could be explicated by the increase in the levels of labour productivity and quality, according Coughlin and Segev (1999). More, if the percent of wages in total production costs is low, then the 'lent growth' reaction of FDISA under the impact of wages increase is explicable.

(b) In the second statement's case - 'FDI first and Wages later', the results confirm our assumption hypothesis. In this case, the level of WSA is growing as the FDISA are increasing. The results are in accord with the conclusions of Aitken, Harrison and Lipsey

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(1995), Faggio (2003), Hale and Long (2008), Decreuse and Maarek (2008) and Hale and Long (2008), but differ from the acquisitions of Tomohara and Yokota (2007) and, partially, Tomohara and Yokota (2007).

In the considered case, a +1% sock in FDISA, determines a low level of WSA in the first tree months and an 'accentuate increase' of WSA in the next 9 months. This fact is generated by the arguments that, on the one hand, a 'self-regulation' of the labor market at a labor force supply and demand level exists, and on the other hand, the competition in the market for skilled labor is increasing.

Also, the situations could be the result of competition in the labor market between multinational firms (Tomohara and Yokota, 2007), multinational firms and Romania's local firms (Decreuse and Maarek, 2008) or between private firms from Romania's local labor market (Hale and Long, 2008).

The effects of reaction function are most pronounced in the second statement's case, then in the first one. This means that the FDISA is more sensible to the WSA impact, then WSA to the FDISA. In the same time, the reaction of FDISA to WSA impulse has a high sensibility in very short-term (1 month) and depends on short-term by total production cost structures (the percentage of wages in total production cost is low) and labour productivity and quality.

On the contrary, the WSA response to FDISA impulse is the result of the competition in the skilled labor market between multinational firms and Romania's local firms and of 'self-regulation' of the labor market at a labor force supply and demand level.

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Appendix

Table 2: ADF 'unit root' test for FDISA - in level

Null Hypothesis: FDISA has a unit root Exogenous: Constant Lag Length: 1 (Automatic based on SIC, MAXLAG=11)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.969918	0.0025
Test critical values:	1% level	-3.511262	
	5% level	-2.896779	
	10% level	-2.585626	

Note: *MacKinnon (1996) one-sided p-values.

Table 3: PP 'unit root' test for FDISA - in level

Null Hypothesis: FDISA has a unit root Exogenous: Constant Bandwidth: 5 (Newey-West using Bartlett kernel)			
		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.382797	0.0000
Test critical values:	1% level	-3.510259	
	5% level	-2.896346	
	10% level	-2.585396	

Note: *MacKinnon (1996) one-sided p-values.

Table 4: ADF 'unit root' test for WSA - in level

Null Hypothesis: WSA has a unit root Exogenous: Constant Lag Length: 3 (Automatic based on SIC, MAXLAG=11)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.099655	0.9972
Test critical values:	1% level	-3.513344	
	5% level	-2.897678	
	10% level	-2.586103	

Note: *MacKinnon (1996) one-sided p-values.

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Table 5: ADF 'unit root' test for WSA - 1st difference

Null Hypothesis: D(WSA) has a unit root Exogenous: Constant Lag Length: 2 (Automatic based on SIC, MAXLAG=11)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.678852	0.0000
Test critical values:	1% level	-3.513344	
	5% level	-2.897678	
	10% level	-2.586103	

Note: *MacKinnon (1996) one-sided p-values.

Table 6: PP 'unit root' test for WSA - in level

Null Hypothesis: WSA has a unit root Exogenous: Constant Lag Length: 3 (Automatic based on SIC, MAXLAG=11)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.099655	0.9972
Test critical values:	1% level	-3.513344	
	5% level	-2.897678	
	10% level	-2.586103	

Note: *MacKinnon (1996) one-sided p-values.

Table 7: PP 'unit root' test for WSA - 1st difference

Null Hypothesis: D(WSA) has a unit root Exogenous: Constant Lag Length: 2 (Automatic based on SIC, MAXLAG=11)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.678852	0.0000
Test critical values:	1% level	-3.513344	
	5% level	-2.897678	
	10% level	-2.586103	

Note: *MacKinnon (1996) one-sided p-values.

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Table 8: VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: WSA FDISA
Exogenous variables: C
Included observations: 80

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1075.421	NA	1.71e+09	26.93553	26.99508	26.95940
1	-935.5100	269.3286	57200129	23.53775	23.71640*	23.60938
2	-928.0880	13.91625	52523572	23.45220	23.74995	23.57158
3	-923.5768	8.232889	51886250	23.43942	23.85628	23.60655
4	-913.7826	17.38479*	44934834*	23.29457*	23.83052	23.50945*
5	-912.6743	1.911832	48380586	23.36686	24.02191	23.62949

Note: * indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 9: VAR Lag Exclusion Wald Tests

VAR Lag Exclusion Wald Tests
Included observations: 80

Chi-squared test statistics for lag exclusion:
Numbers in [ ] are p-values

	WSA	FDISA	Joint
Lag 1	10.33481	2.094028	11.83395
	[0.005699]	[0.350984]	[0.018630]
Lag 2	1.757873	1.212232	3.320660
	[0.415224]	[0.545465]	[0.505666]
Lag 3	4.931144	0.786301	5.377916
	[0.084960]	[0.674927]	[0.250671]
Lag 4	18.19343	0.841669	18.74657
	[0.000112]	[0.656499]	[0.000881]
Lag 5	1.431584	0.452351	1.929203
	[0.488805]	[0.797578]	[0.748778]
df	2	2	4

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Table 10: 'Unrestricted Vector Autoregression FDISA-WSA' estimates

Vector Autoregression Estimates Included observations: 81 after adjustments Standard errors in ( ) & t-statistics in [ ]		
	WSA	FDISA
WSA(-1)	0.357944	3.655469
	(0.11807)	(2.82926)
	[3.03161]	[1.29203]
WSA(-2)	0.189000	-3.139787
	(0.12998)	(3.11467)
	[1.45405]	[-1.00806]
WSA(-3)	-0.013239	-0.588492
	(0.12507)	(2.99702)
	[-0.10585]	[-0.19636]
WSA(-4)	0.419550	1.880287
	(0.11429)	(2.73856)
	[3.67106]	[0.68660]
FDISA(-1)	0.007499	-0.043933
	(0.00495)	(0.11857)
	[1.51550]	[-0.37053]
FDISA(-2)	-0.001597	0.081528
	(0.00501)	(0.12010)
	[-0.31858]	[0.67883]
FDISA(-3)	0.011730	0.113941
	(0.00506)	(0.12125)
	[2.31813]	[0.93974]
FDISA(-4)	0.012569	-0.026554
	(0.00522)	(0.12505)
	[2.40850]	[-0.21235]
C	9.325167	-122.9193
	(5.36787)	(128.627)
	[1.73722]	[-0.95563]
R-squared	0.981987	0.307769
Adj. R-squared	0.979985	0.230854
Sum sq. resids	17990.63	10330126
S.E. equation	15.80727	378.7796
F-statistic	490.6316	4.001438
Log likelihood	-333.7619	-591.0571
Akaike AIC	8.463256	14.81623

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Schwarz SC	8.729306	15.08227
Mean dependent	297.4048	459.0141
S.D. dependent	111.7331	431.8991
Determinant resid covariance (dof adj.)		35422716
Determinant resid covariance		27988319
Log likelihood		-924.3336
Akaike information criterion		23.26750
Schwarz criterion		23.79960

Table 11: Pairwise Granger Causality Tests

Pairwise Granger Causality Tests
Date: 06/19/09 Time: 10:54
Sample: 2002M01 2009M01
Lags: 4

Null Hypothesis:	Obs	F-Statistic	Probability
FDISA does not Granger Cause WSA	81	3.70459	0.00847
WSA does not Granger Cause FDISA		2.48879	0.05075

Table 12: VAR Residual Portmanteau Tests for Autocorrelations

VAR Residual Portmanteau Tests for Autocorrelations
H0: no residual autocorrelations up to lag 4
Date: 06/19/09 Time: 11:36
Sample: 2002M01 2009M01
Included observations: 81

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	df
1	0.133313	NA*	0.134979	NA*	NA*
2	1.285452	NA*	1.316286	NA*	NA*
3	2.601136	NA*	2.682574	NA*	NA*
4	2.696371	NA*	2.782756	NA*	NA*
5	5.498544	0.2399	5.769283	0.2171	4

Note: *The test is valid only for lags larger than the VAR lag order.
df is degrees of freedom for (approximate) chi-square distribution

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Table 13: VAR Residual Serial Correlation LM Tests

VAR Residual Serial Correlation LM Tests H0: no serial correlation at lag order 4 Date: 06/19/09 Time: 11:43 Sample: 2002M01 2009M01 Included observations: 81		
Lags	LM-Stat	Prob
1	1.441893	0.8369
2	10.03376	0.0399
3	5.574192	0.2333
4	0.484115	0.9750
5	3.707082	0.4471

Note: Probs from chi-square with 4 df.

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Do Dividend Announcements Affect The Stock Prices in The Greek Stock Market?

Athanasios Vazakidis[1] and StergiosAthianos[2]

Abstract

This paper examines the reaction of the Athens Stock Exchange (ASE) to dividend announcements by a sample of firms listed at the FTSE/ATHEX 20 and FTSE/ATHEX Mid 40 for a fixed period 2004-2008. It also provides analytical information about the Greek Stock Market and the regulations underlying it, which have been taken into account in the present thesis. Moreover, previous studies of important academic scholars are presented and discussed, in order for the reader to attain the appropriate theoretical knowledge about the examined issue. Finally, significant abnormal activity is documented throughout the multiple event-windows that are employed and therefore, the null hypothesis, which supports the irrelevance theory as introduced by Miller and Modigliani (1961), is rejected.

Keywords: Dividend announcements, abnormal activity, signalling effect

JEL classification: G14, G30, G35

1. Introduction

During the last decades, there are numerous researchers that have been concerned in their papers with the impact of the dividend announcements on the stock prices. However, it is a matter of intense debate for the academics, the managers and the shareholders of many companies for several years. The theories that have been introduced by significant academics were essentially unable to terminate the above mentioned debate, as the empirical results of various studies, in the most important stock exchanges globally, concluded to different outcomes, supporting different theories.

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The main issue of the financial economists was the corporate dividend policy and how – if it affects the firm value and thus, the shareholders' wealth, as well as the existence of an optimal corporate dividend policy. Lintner (1956) is considered to be a pioneer in the research of the relevance between dividend policy and firm value. According to Lintner (1956), under the assumption that capital markets are 'imperfect', the firms' dividend policy plays a prominent role in managements' decision making and hence, in shareholders' wealth. He claimed that changes in corporate dividend policy may convey information to the market about company's current and future financial position; given that there are information asymmetries between managers and investors (the former have information advantage over the investors). Therefore, Lintner suggested that increases in the amount of dividends that companies distribute to their shareholders lead to a positive market reaction, while decreases in the amount of dividends lead to a negative reaction of the stock prices. Similar outcomes about the reaction of the market to changes in corporate dividend policy have been resulted from other important researchers as well (Walter, 1956; Gordon, 1959; Gordon, 1962). On the other hand, Miller and Modigliani (1961) postulated in their land-mark study the irrelevance between the dividend policy a firm adopts and the value of the firm. In particular, they argued that under the assumption that 'perfect' capital markets with perfect certainty, no taxes and transaction costs exist, dividend policy does not have any impact on the shareholders' wealth. Indeed, they suggested that managers can affect the firm value only by changing the firm's investment policy. Finally, a last group of researchers, the most important of which were Brennan (1970) and Brennan and Thakor (1990), declared that the corporate dividend policy is relevant as well as crucial to the value of a corporation. Nevertheless, this group of academics claimed that an increase in dividends has a negative effect on the stock prices due to the existence of taxation. According to Brennan and Thakor (1990), most of a company's shareholders prefer dividend payments when distributions are small, while they prefer tender offer stock repurchases when distributions are quite larger. The level of taxation seems to affect stock prices considerably in many stock exchanges all over the world.

The aim of the current paper is to investigate the reaction of the stock prices to the announcements of dividends by Greek listed companies. It applied the classical event study methodology used, in order to measure the abnormal returns of companies' stock prices that occurred during a fixed time period, before and after the day of the announcement (event day).

The current study adopts an approach similar to Balachandran's (1998), (same as used by Dasilas, 2007; Dasilas et al., 2008; Asimakopoulos et al., 2008) as it employs more than one event window, without however, exceeding in length 20 days before and after the event day. However, the results of this paper differ from the results of the above mentioned researchers.

The rest of the paper is organized as follows. Section 2 presents the most important theories that have been developed. In section 3 data and methodology are presented, as

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well as the research design of the present event study. Section 4 demonstrates extensively the empirical findings of the study. Finally, section 5 concludes.

2. The informational content of dividends and their signals to capital markets

In this part of the study it is worth discussing about the various information conveyed by dividends to market participants, the so-called 'information content hypothesis', as well as the dividend 'signalling effect', which are extensively cited in the financial literature. Modigliani and Miller (1961), in an attempt to bring together the irrelevance proposition of their 'ideal' world with the dividend policy, under circumstances of uncertainty, introduced the informational content of dividends. They suggested that dividends provide useful information about managers' views of company's future profitability prospects. However, they also stated that a change in the dividend policy is only the 'handle' for a change on the stock prices and not its cause.

Taking into consideration the valuable inside information about firms' future plans possessed by managers, dividend announcements became as one of the various mechanisms that managers incorporate, in order to signal information to market participants. According to the above, another significant mechanism is the earnings figures. However, dividends offer more dubious information than earnings, as their distribution is in managers' discretion and can be quite effortlessly manipulated by them.

Numerous researchers suggested that dividends convey a substantial amount of information to markets, when changes in dividend policies are observed. Definitely, the majority of them concerning with this issue conclude that dividend changes convey information to market participants, sometimes beyond the information that has already been available by earnings figures. Nevertheless, the main dispute between the academic scholars is whether market participants comprehend the dividend signals and accordingly adjust their portfolios. As noticed above, the group of rightists assumes a positive relationship between changes in dividends and investors' reaction, while leftists take for granted that investors have a negative reaction to dividend changes, and finally, the middle of the roaders presume no relevance between them.

2.1. Evidence of the Signalling Effect from different capital markets globally

In this part of the study it is considered worthy of examining the empirical findings of different researches, which investigate the dividend signalling hypothesis.

DeAngelo et al. (2000) tested the dividend signalling hypothesis in the case of special dividends paid by 942 NYSE firms. They stated that the majority of the firms on the US market used to pay special dividends quite often, but nowadays they rarely distribute this type of dividends. They indicated that special dividends are paid by the companies as predictably as the regular dividend payments, in a way that is difficult to distinguish the difference between them. In addition, they provided empirical evidence

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that in spite of the general decline in the distribution of special dividends by NYSE companies, very large firms keep on paying specials on a regular basis. They finally suggested that the overall effacement of special dividends was not the result of the increased share repurchases, as they can not serve as signaling devices.

Nevertheless, there are studies concerning the US market that have challenged the informational content of dividend announcements. Christie (1994) identified all the reduction and omission announcements of dividends for a sample of firms listed on the New York Stock Exchange (NYSE) and on the American Stock Exchange (AMEX) for a period between 1967 and 1985. He provided evidence that future dividends have completely no significant relation to market reaction. Therefore, although studies which support the informational content hypothesis are by far more than the challengers, the dividend signaling effect on the US market remains an elusive issue.

Even though the largest firms in the world are listed on the US capital markets, European capital markets, especially those in the UK, stimulated the interest of many important academic scholars. According to Balachandran (1998), the UK capital market has at least two basic differences compared with the respective ones in the USA. Firstly, firms listed in the UK market usually pay dividends more frequently than the US companies, and more particularly they usually pay twice per year. Secondly, the tax treatment for companies listed in the UK market differs from the corresponding treatment on the US markets. Balachandran (1998) stated that 'although the US has a traditional taxation system, the UK has an imputation system'.

Lonie et al. (1996) were from the first economists who attempted to investigate the dividend signaling phenomenon in a European capital market, using UK data from a sample of listed companies on the London Stock Exchange. They stated that in capital markets with information asymmetries, the market participants try to explain correctly the managers' announcements of dividends and earnings, in order to make beneficial choices. Their results indicated that both dividends and earnings announcements affect the share prices. However, they found that earnings announcements have a more significant impact on them than dividend announcements.

On the other hand, Abeyratna (1996) implied that the simultaneous announcements of earnings and dividends are possible to interact with one another. The possibility is even greater in the UK capital markets, where it is a general practice for firms to announce dividends and earnings on the same day of the economic year. Therefore, the simultaneous signals of earnings and dividends may cause confusion to market participants and will probably make it quite complex for them to decode the conveyed information.

In addition, Balachandran (1998) scrutinized the dividend reductions in accordance with the interim effect in the UK capital market. He provided empirical evidence that the effect of dividend reductions on the firm value is quite significant around the announcement date and leads to value declines. However, the reductions of interim dividends have a more considerable impact on shareholders' wealth than the reductions on final dividends. According to the same author, the usual stability of interim dividends

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and the managers' reluctance to change them, compared to the final dividends, are the main reasons for the market's negative response.

Despite their limited size in terms of market capitalization and number of listed firms, the capital markets of Greece and Cyprus have stimulated the interest of several prominent financial researchers. In particular, numerous researchers have examined the stock market response to changes in corporate dividend policy by firms listed in those markets.

Beginning with the capital market of Cyprus, Travlos et al. (2001) investigated the stock price reaction to announcements of cash dividend changes in the environment of an emerging European market. In general, Travlos et al. (2001) believe that firms operating in emerging markets have to adopt a payout policy based on the special characteristics of the corresponding market, such as the market microstructures and the tax treatment of the Cyprus-listed firms. The results of their study demonstrated the existence of considerably positive abnormal returns associated with the announcements of changes in the payout policy, results which are conterminous with the information signalling hypothesis.

As it was mentioned in section 2 of the current thesis, the Greek stock market is considered a medium-sized one; however, it seems to be quite attractive to potential investors and an ideal case of study, as it allows examining the market response to dividend announcements without considering the effects of double taxation. Thereafter, the most essential studies concerning the Greek capital market will be presented, in order for the reader to have a more complete view about the Greek market as well as its reaction to dividend announcements.

One of the first attempts to examine the dividend signaling hypothesis in the Greek stock market was made by Papaioannou et al. (2000). It was a study that analyzed the stock price response to dividend announcements for a sample of firms listed on the Athens Stock Exchange. Their sample consisted of stocks traded on the main segment of the ASE for a period between 1981 and 1994. Their empirical findings seemed to be consistent with Modigliani and Miller's irrelevance theory, as no significant abnormal return was observed, as a result of the change in firms' corporate payout policy, neither on the announcement nor on the ex-dividend day.

In addition, Asimakopoulos et al. (2007) explored the same hypothesis in the ASE using a sample of listed firms, which distributed the lowest amount of dividend required or above the lowest required amount. Their outcomes suggest that when the listed companies in the ASE declared publicly the distribution of higher dividends than the compulsory amount and when this increase was regarded by the market participants as an unexpected one, then there was a negative stock price reaction. Consequently, Asimakopoulos et al. (2007) implied that increases in dividends that considered as unexpected changes in dividend policy convey 'bad news' to the market. However, the signaling effect does not apply to firms that pay only the minimum required amount for dividends. Therefore, the results of their study are consistent with the irrelevance theory about dividend policy.

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Furthermore, Dasilas (2007) and Dasilas et al. (2008) examined the stock market reaction on both final and interim dividend announcements in the Greek stock market. Nevertheless, their findings are diametrically different form the results of Asimakopoulos et al. (2007), as they found that positive changes in dividend policy, and hence increases in the distributed amount of dividends, have a positive impact on the stock prices, while decreases in the payout ratio lead to significantly opposite results in the stock prices.

In conclusion, empirical findings supporting the three different theories of dividend policy have been observed by the researchers in their studies concerning the Athens Stock Exchange. The next sections of the current thesis will present the classical event study methodology that has been employed, as well as its empirical findings.

3. Data and Methodology

The sample is consisted of 60 companies, listed in the Athens Stock Exchange (ASE). More particularly, the firms negotiate on the FTSE/ATHEX 20 Index and the FTSE/ATHEX 40 Index. FTSE/ATHEX 20 is an index comprised of the 20 largest blue chip companies in the ASE, in terms of total capitalization, while FTSE/ATHEX 40 is an index which consists of the next 40 listed companies that are classified as medium capitalization companies on the ASE. The event study period will be from the 1st of January 2004 until the 31st of December 2008 and secondary data are used (daily closing stock prices and announced dividends from 2004 to 2008), in an attempt to test the dividend signalling hypothesis on the Greek capital market.

3.1. Hypothesis Development

In order to shed some light on the continual debate of the dividend signaling effect, the current study attempts to examine whether the dividend announcements by the listed firms on the ASE convey information to the marketplace that can be evaluated by the investors and cause abnormal activity to the stock prices. Therefore, the current study aims to investigate the impact of the dividend announcements on the value of the selected firms, taking into account the special unique characteristics of the Greek stock market.

As a result, the null hypothesis that is tested by the current event study is the following:

H_0: Dividend announcements do not convey new information to the marketplace and should bear no effect on the firm value.

i.e. No abnormal returns in the stock prices

In case of accepting the above null hypothesis, it means that there is no significant abnormal activity by the stock prices during the examined period and thus, the irrelevance theory introduced by Miller and Modigliani (1961) stands true. Alternatively, in case of rejecting the null hypothesis, it means that statistically significant abnormal activity –

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positive or negative – has been observed in the firms' stock prices during the same period and hence, either the conservative rightists' or the radical leftists' theory stands true.

3.2. Constructing the Event Study Window

Before constructing the proper event window, it is worth determining the event day of the analysis. It seems usual in many studies the event day to be called as day 0. According to Papaioannou et al. (2000), in Greece there are five important dates during the economic years related with cash dividends: (a) the meeting of the board of directors, where it recommends the dividend payment and invites the shareholders for another meeting, (b) the public declaration of the shareholders' meeting, (c) the day of the dividend announcement, (d) the day of the shareholders' meeting and, (e) the ex-dividend date. Consequently, it has to be clear that in the current study it is defined as 'day 0' the day that the amount of the distributed dividend is publicly announced by the general assembly of the firm (Travlos et al., 2001; Dasilas, 2007).

Moreover, the determination of the congruent event window length is a subject that occupied the mind of several researchers. In the current study, the event occurs at a distinctly identified time, and thus the start of the event period can be determined easily (Krivin et al., 2003). The attention should be focused on how much time the market needs to completely incorporate the new information in the stock prices. Krivin et al., (2003) suggested in their study three possible approaches of an appropriate event window length: (a) a fixed time period, (b) an *ad hoc* approach and, (c) an approach that depends on how quickly the market fully incorporates the available information on the security prices.

Gurgul et al. (2003) used in their study a rather short event window, compared with those in other event studies. In particular, Gurgul et al. (2003) attempted to examine the impact of corporate dividend announcements in the Austrian security prices by incorporating an event window which comprised five trading days – two days before (-2), two days after (+2) and the event day (0).

An even shorter event window was used by Lonie et al. (1996) in an attempt to scrutinize the UK market response to dividend announcements and identify any abnormal share activity. Namely, they used a three-day event window – one day before and one after the dividend declaration day.

Furthermore, the majority of the researchers make use of 41-day event window – 20 days before and 20 days after the announcement day (Dasilas, 2007; Dasilas et al., 2008; Asimakopoulos et al., 2008). The above researchers believe that this event window is the most appropriate, in order for the stock prices to capture all the available information conveyed by the dividend announcements.

Finally, it is a common practice for the most recent researchers the use of more than one event window in their studies. Travlos et al. 2001 employed a symmetrical event window of 31 days – 15 days before and 15 days after the event day (0). In addition,

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Balachandran (1998) used multiple event windows, the larger of which did not exceed 20 days before and 20 days after the announcement day.

The current study adopts an approach similar to Balachandran's (1998), as it employs more than one event window, without however, exceeding in length 20 days before and after the event day. Therefore, the event window of the present thesis is 41 days (-20 days, +20 days) as it is defined day '0' the day of the dividend announcement.

3.3. Raw Return Measures

In order to estimate the stock price reaction to corporate dividend announcements, the current event study employs the use of logarithmic returns. According to literature, log-returns are usually preferred in the event studies than the discrete returns, as they can relate correctly returns over long time intervals.

Therefore, the raw returns ($R_{i,t}$) of the stock prices are calculated as follows:

$$R_{i,t} = \ln(P_{i,t}) - \ln(P_{i,t-1}),$$

where, $P_{i,t}$ denotes the daily closing price of the stock *i* on day *t* and $P_{i,t-1}$ is the daily closing price of the same stock on the previous day (*t-1*).

3.4. Abnormal Return Measures

Having calculated the actual logarithmic returns of every stock of the sample, the classical event study methodology 'necessitates' the measurement of the abnormal – excess returns. By saying abnormal return, researchers mean the percentage difference between the actual share return, which derives from the occurrence of the particular event – dividend declaration, and the normal return, which is expected by the investors to be received in the absence of the particular event (Dasilas, 2007).

Thus, the abnormal return can be estimated using the following equation:

$$AR_{i,t} = R_{i,t} - E(R_{i,t}),$$

where, $AR_{i,t}$ is the abnormal return on stock *i* on day *t* and $E(R_{i,t})$is the expected return on stock *i* on day *t.*

The expected return of each stock $E(R_{i,t})$, presented bellow:

$$E(R_{i,t}) = R_{i,t} - R_{m,t}$$

where, $E(R_{m,t})$indicates the market portfolio return on day *t.*

Numerous researchers both in the Greek and in other capital markets have used the market model as a standard event study technique in their papers (Travlos et al., 2001; Capstaff et al., 2004; Asimakopoulos et al., 2007; Dasilas, 2007; Dasilas et al., 2008).

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Finally, as it was mentioned above, the current paper uses multiple event windows, in order to estimate the cumulative abnormal returns (CARs) of the stock prices of the sample. The 15 event windows that have been used are the following:

(-20, +20), (-20, -1), (-20, 0), (+1, +20), (-10, +10), (-10, -1), (-10, 0), (+1, +10), (-5, +5), (-5, -1), (-5, 0), (+1, +5), (-1, +1), (-1, 0), (0, +1).

4. Empirical Results

In Table 1 we present the companies listed on the FTSE/ATHEX 20 Index of the Athens Stock Exchange, the market-adjusted model have been used to estimate the abnormal returns on the stock prices for the examined period of 2004.

Table 1: Average daily abnormal returns of the firms listed on the FTSE/ATHEX 20 Index for the whole event window in 2004

Market-Adjusted Model

Days	ARs%	t-Statistic
-20	-0,621**	-2,07
-17	+0,680**	2,2
-8	+0,658*	1,7
-6	+0,797**	2,03
0	0,406	0,8
1	-1,284**	-2,41
14	-0,576**	-2,14

Note: * 10% of significance, ** 5% of significance, *** 1% of significance

More specifically, throughout the days which precede the dividend announcements (-20, -1) there is an abnormal activity on the stock prices, however it seems to be statistically insignificant, except for the following days: t=-20, t=-17, t=-6, where the abnormal returns (-0.621%), (+0.6796) and (+0.7972) respectively are statistically significant at the 5% level, and on the day t=-8 (0.6577%), which is statistically significant at the 10% level of significance. Moreover, on the event day there is a positive, while statistically insignificant abnormal return of (0.406%). Finally, there is a negative trend on the stock returns until the fifth day after the announcement t=+5, but only on the first day t=+1 the abnormal return is statistically significant (-1.284%) at the 5% level.

Similarly, during the event window before the event day (-20, -1), for the year 2005, there is a fluctuation of the stock returns without the existence of statistically significant abnormal returns, apart from the fifteenth day t=-15 before the announcement, where the abnormal return (0.696%) is significant at the 5% level. In alignment with 2004, on the event day there is a positive, though statistical insignificant abnormal activity. Moreover, there is a negative reaction of the market following the announcement day, especially on the days t=+1, t=+8, t=+11, where the abnormal returns (-1.139%),

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(-0.843%) and (-0.789%) are statistically significant at the 5% level. Table 2, below, demonstrates the abnormal activity of the stock prices for the whole event window (-20, +20) for the year 2005.

Table 2: Average daily abnormal returns of the firms listed on the FTSE/ATHEX 20 Index for the whole event window in 2005

Market-Adjusted Model

Days	ARs%	t-Statistic
-15	+0,696**	2,12
0	0,311	0,32
1	-1,139**	-2,4
8	-0,843**	-2,16
11	-0,789**	-2,18

Note: * 10% of significance, ** 5% of significance, *** 1% of significance

In contrast to the preceding years, in 2006 the market does not seem to experience so much significant abnormal activity, as only on a day before t=-5 and on a day after the event day t=+2 there are significant abnormal returns on the 5% significance level. On the other hand, during the prior-announcement and the post-announcement period as well as on the event day the stock prices fluctuate at statistically insignificant levels. Table 3 below shows the abnormal activity of the stock prices for the whole event window (-20, +20) for the year 2006.

Table 3: Average daily abnormal returns of the firms listed on the FTSE/ATHEX 20 Index for the whole event window in 2006

Market-Adjusted Model

Days	ARs%	t-Statistic
-5	+0,907**	2,36
0	0,185	0,44
2	-0,977**	-2,42

Note: * 10% of significance, ** 5% of significance, *** 1% of significance

In 2007, the market presents a quite similar tendency as in 2004 and in 2005. Namely, the 20 days before the dividend announcements the stock prices presented abnormal activity, which was however statistically insignificant, except for the second day before the announcement t=-2. In particular, on this day t=-2 the abnormal stock return was (+0.6729%), which is statistically significant at the 5% significance level. Similarly on the event day, the stock prices experience negative and statistically significant abnormal return at the 10% level. During the post-announcement period,

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although the negative slope of the stock returns dominates, only the second day after the announcement t=+2 there is a strong statistically significant negative abnormal return (-1.677%) at the 1% level. The following Table depicts the abnormal activity of the stock prices for the whole event window (-20, +20) throughout 2007.

Table 4: Average daily abnormal returns of the firms listed on the FTSE/ATHEX 20 Index for the whole event window in 2007

Market-Adjusted Model

Days	ARs%	t-Statistic
-13	-0,800***	-2,62
-2	+0,673**	2,5
0	-0,422*	-1,66
2	-1,677***	-3,92
3	-0,658*	-1,82

Note: * 10% of significance, ** 5% of significance, *** 1% of significance

Finally, the fifth and last year included in the current analysis is 2008. As one can notice on Table 5 below, the positive abnormal returns monopolize throughout this year both on the prior-announcement and on the post-announcement period. Nevertheless, the majority of these returns are not statistically significant. The only exceptions are on the day t=-6, where a very strong statistically significant abnormal return can be observed (+1.655%) at the 1% significance level, and on the days t=+2 and t=+19 where a negative abnormal return (-1.157%, -1.174%) can be observed, which is statistically significant at the 5% and 1% significance level.

Table 5: Average daily abnormal returns of the firms listed on the FTSE/ATHEX 20 Index for the whole event window in 2008

Market-Adjusted Model

Days	ARs%	t-Statistic
-16	-0,576*	-1,77
-6	+1,655***	4,08
0	-0,119	-0,19
2	-1,157**	-2,04
19	-1,174***	-3,49

Note: * 10% of significance, ** 5% of significance, *** 1% of significance

Having discussed explicitly the empirical findings of the companies negotiating on the FTSE/ATHEX 20 Index, this part of the chapter analyses the empirical results of the companies included in the rest of the selected sample, namely the empirical findings of the firms negotiating on the FTSE/ATHEX Mid 40.

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Beginning the analysis with 2004, there is a continual alteration of the abnormal returns' signs throughout the prior-announcement period (-20, -1). However, only five abnormal returns seem to be statistically significant at an accepted level. On the first event-window day (t=-20) the market reacts negatively experiencing an abnormal return of -0.644%, which is statistically significant at the 5% level of significance. As the announcement day approaches the market gives the impression to respond positively t=-18 (+0.491%), t=-14 (+0.838%) and t=-3 (+0.424%), with the only exception the fifth day before the announcement (t=-5), where there is a negative market reaction (-0.455%). Both the positive and the negative abnormal returns are statistically significant at the 10% level of significance. On the other hand, on the event day (t=0) there is an abnormal return on the stock prices of about (-0.923%), which is statistically significant at the 10% significance level. The negative reaction of the market continues for at least six days, where very strong negative abnormal returns can be noticed, t=+1 (-1.316%), t=+6 (-0.696%), which are statistically significant at a 1% level, and t=+2 (-0.911%), which is statistically significant at the 5% level. Table 6 below gives a picture of the average daily abnormal activity analysed above.

Table 6: Average daily abnormal returns of the firms listed on the FTSE/ATHEX Mid 40 Index for the whole event window in 2004

Market-Adjusted Model

Days	ARs%	t-Statistic
-20	-0,644**	-2,3
-18	+0,491*	1,74
-14	+0,839*	1,78
-5	-0,456*	-1,7
-3	+0,424*	1,68
0	-0,923*	-1,86
1	-1,317***	-4,24
2	-0,911**	-2,07
6	-0,697***	-2,6

Note: * 10% of significance, ** 5% of significance, *** 1% of significance

There is a similar market reaction throughout 2005 as well, as there are negative abnormal returns around the event day. Namely, on the days t=-14, t=-5 and t=-1 the abnormal returns were (-0.540%), (-0.431%) and (-0.604%) correspondingly. The negative slope continues to exist around the event day with statistically strong negative abnormal returns. Specifically, on the event day (t=0) the abnormal return is -1.521%, which is statistically significant at the 1% significance level. Moreover, the subsequent day (t=+1) the abnormal return appears decreased (-1.046%) and statistically significant

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at the 1% significance level. It can be clearly stated that the dividend announcements conveyed negative news to the market place and this can be reflected on the stock prices' behaviour. The next Table illustrates the above mentioned behaviour analytically.

Table 7: Average daily abnormal returns of the firms listed on the FTSE/ATHEX Mid 40 Index for the whole event window in 2005

Market-Adjusted Model

Days	ARs%	t-Statistic
-14	-0,540**	-2
-5	-0,431*	-1,85
-1	-0,604**	-2,08
0	-1,521***	-3,04
1	-1,046***	-2,62
6	+0,738**	2,43
18	+0,735**	2,24

Note: * 10% of significance, ** 5% of significance, *** 1% of significance

Contradicting with the preceding economic years, in 2006 there is not any statistically significant abnormal activity during the period before the announcements. On the event day there is a positive, while insignificant abnormal return. On the other hand, throughout the post announcement period, the market appears to respond in general positively to the announcements. Specifically, on the day t=+1 and on the day t=+7 the abnormal returns equals to +0.634% and +0.674% and they are statistically significant at the 5% level. However, a negative abnormal return of about -0.636% intervenes the above ones on the day t=+4, and is statistically significant at the 5% level of significance. Table 8 below depicts the abnormal returns and their statistical significance in 2006.

Table 8: Average daily abnormal returns of the firms listed on the FTSE/ATHEX Mid 40 Index for the whole event window in 2006

Market-Adjusted Model

Days	ARs%	t-Statistic
-13	-0,667**	-2,24
0	0,305	0,44
1	+0,634*	1,92
4	-0,636**	-2,14
7	+0,674*	1,74

Note: * 10% of significance, ** 5% of significance, *** 1% of significance

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Additionally, in 2007 during the event window statistically significant abnormal returns can be observed only on three days before and on two days after the event day. In particular, on the day t=-18 there is a positive abnormal return of about +0.923% which is statistically significant at the 5% level. Also, on the next day t=-17 the abnormal return appears increased at +1.687%, which is significant at the 1% level of significance, and finally on the day t=-2 the abnormal return equals to +0.897%, which is significant at the 5% level. It can be stated that market participants expect the dividend announcements to have a positive impact on the stock prices. However, throughout the post-announcement period the only statistically significant abnormal returns appear to have a negative sign. Namely, on the days t=+3, t=+19 and t=+20 the abnormal returns were -0.607%, -0.865% and 1.201%, which are statistically significant at 10%, 1% and 5% significance level, respectively. The table below reviews the average abnormal activity of the stock prices for the whole event window (-20, +20).

Table 9: Average daily abnormal returns of the firms listed on the FTSE/ATHEX Mid 40 Index for the whole event window in 2007

Market-Adjusted Model

Days	ARs%	t-Statistic
-18	+0,925**	2,39
-17	+1,688***	2,65
-11	+0,788**	1,96
-2	+0,897**	2,33
-1	0,079	0,23
0	-0,181	-0,71
3	-0,607*	-1,88
19	-0,865***	-3,62
20	-1,201**	-2,16

Note: * 10% of significance, ** 5% of significance, *** 1% of significance

Finally in 2008, the period before the event day (-20, -1) appears to have a quite strong positive abnormal activity for the stock prices, which increases near the event day. As a whole, five days in the prior-announcement period present positive statistically significant abnormal activity, t=-18 (+0.732%), which is significant at the 10% level, t=-11 (+0.662%), t=-7 (+0.878%), t=-4 (+0.591%), which are significant at the 5% level, and finally t=-3 (+0.648%), which is statistically significant at the 1% significance level. On the other hand, both on the event day and the post-event day period the majority of the abnormal returns appear to be negative. However, the negative abnormal returns both on the event day and the post-announcement period are not statistically significant at any

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accepted level. The table 10 below illustrates the average daily abnormal returns for the whole event window (-20, +20) in 2008.

Table 10: Average daily abnormal returns of the firms listed on the FTSE/ATHEX Mid 40 Index for the whole event window in 2008

Market-Adjusted Model

Days	ARs%	t-Statistic
-18	0,732*	1,77
-11	0,662**	2,07
-7	0,878**	2,41
-4	0,591**	2,02
-3	0,648***	2,91
0	-0,114	-0,33

Note: * 10% of significance, ** 5% of significance, *** 1% of significance

The Table and the graph below illustrate the average abnormal returns of the whole sample for all the examined years (2004-2008).

Table 11: Average daily abnormal returns of the whole sample of firms for the event window for the all the examined years (2004-2008)

Market-Adjusted Model

Days	ARs%	t-Statistic
-18	+0,386***	3,19
-17	+0,553***	3,08
-9	+0,236*	1,84
-2	+0,186*	1,67
0	-0,209	-1,16
2	-0,876***	-3,44
3	-0,286**	-2,34

Note: * 10% of significance, ** 5% of significance, *** 1% of significance

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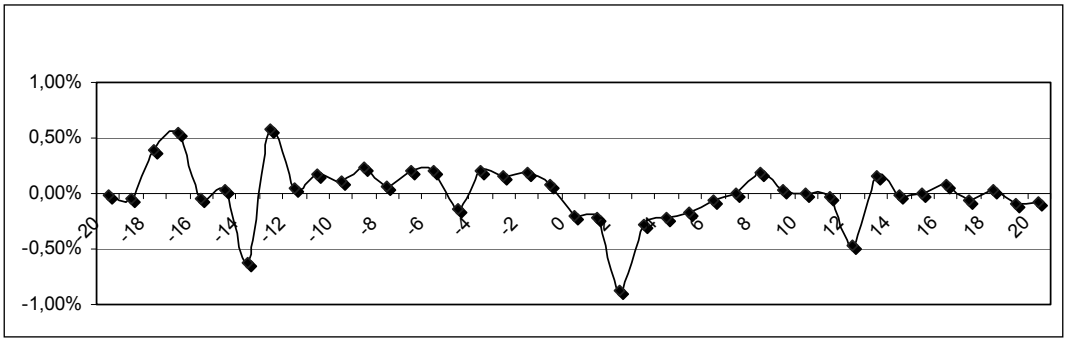
Graph 1: Average daily abnormal activity of the whole sample for all the examined years (2004 – 2008)



As one can observe from Table 11 and the above graph, the majority of the abnormal returns in the prior-announcement period appear to have a positive sign, although most of them move at statistically insignificant levels. However, on the day t=-17 the market reacts abnormally, having a return of about +0.553%, which is statistically significant at the 1% level. Additionally, on the days t=-9 and t=-2 the abnormal returns are +0.236% and +0.186% correspondingly, which are statistically significant at the 10% level of significance. As in the majority of the years that have been examined separately, on the event day there is a negative, while statistically insignificant abnormal return. At last, throughout the post-announcement period the market seems to react negatively with strong abnormal returns around the announcement day. Specifically, on the days t=+2 and t=+3 the abnormal returns -0.876% and -0.286% respectively, and thus, it can be clearly stated that the market has a general tendency to react negatively to dividend announcements.

As the reader can observe from the table below, the Cumulative Abnormal Returns (CARs) follow, in general, a similar trend as the abnormal returns.

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Table 12: Cumulative Abnormal Returns (CARs) of the whole sample of firms for the multiple selected event windows

	2004		2005		2006		2007		2008		2004-2008	
Event Windows	CAR%	t-statistic	CAR%	t-statistic	CAR%	t-statistic	CAR%	t-statistic	CAR%	t-statistic	CAR%	t-statistic
(-20,+20)	-1.603	-0.76	-1.882	-0.79	+1.606	0.95	-1.131	-0.21	+2.269	0.99	+0.002	0.00
(-20,-1)	+1.829	1.24	-0.517	-0.31	+1.617	1.38	+4.083	1.06	+4.163***	2.61	+2.340*	1.97
(-20,0)	+1.463	0.96	-1.289	-0.75	+1.871	1.55	+3.810	0.96	+4.103**	2.51	+2.130*	1.75
(+1,+20)	-3.066**	-2.07	-0.593	-0.35	-0.265	-0.23	-4.941	-1.28	-1.834	-1.15	-2.128*	-1.79
(-10,+10)	-2.136	-1.41	-2.634	-1.54	+2.155*	1.79	+1.081	0.27	+0.584	0.36	-0.532	-0.44
(-10,-1)	+1.103	1.05	-0.151	-0.13	+2.269***	2.73	+2.209	0.81	+2.103*	1.87	+1.303	1.55
(-10,0)	+0.737	0.67	-0.923	-0.74	+2.524***	2.89	+1.936	0.68	+2.043*	1.73	+1.094	1.24
(+1, +10)	-2.873***	-2.74	-1.711	-1.45	-0.369	-0.44	-0.856	-0.31	-1.459	-1.29	-1.626*	-1.94
(-5, +5)	-2.934***	-2.67	-2.835**	-2.29	+0.775	0.89	+0.161	0.06	-0.842	-0.71	-1.506*	-1.71
(-5, -1)	+0.147	0.20	-0.087	-0.10	+1.008*	1.71	+1.495	0.78	+0.658	0.83	+0.482	0.81
(-5, 0)	-0.219	-0.27	-0.859	-0.94	+1.262*	1.96	+1.222	0.58	+0.598	0.69	+0.272	0.42
(+1, +5)	-2.715***	-3.67	-1.976**	-2.36	-0.487	-0.83	-1.061	-0.55	-1.440*	-1.81	-1.779***	-3.00
(-1, +1)	-1.451**	-2.53	-2.108***	-3.26	+0.794*	1.74	+0.304	0.20	+0.402	0.65	-0.356	-0.77
(-1, 0)	-0.148	-0.32	-1.024*	-1.94	+0.302	0.81	-0.112	-0.09	+0.234	0.46	-0.130	-0.35
(0, +1)	-1.669***	-3.57	-1.856***	-3.51	+0.747**	2.01	+0.143	0.12	+0.109	0.22	-0.435	-1.16

Note: * 10% of significance
** 5% of significance
*** 1% of significance

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More specifically, it is quite obvious that the market reacts positively during the period before the dividend announcements, while throughout the first days of the post-announcement period strong negative abnormal returns are observed. More particularly, for the whole event window (-20, +20) the CAR seem to be marginally positive, but statistically insignificant. On the other hand, throughout the event windows that precede the announcement day, (-20, -1) and (-20, 0), there are positive and statistically significant cumulative abnormal returns. For example, for all the examined years simultaneously, the CARs are +2.340% and +2.130% for the above event windows respectively, which are statistically significant at the 10% level. In contrast, throughout the post announcement event windows, the sign of the CARs turns to be negative. Namely, for all the examined years simultaneously it equals to -2.128% and is statistically significant at the 10% level, as well. This is a result of the strong negative CAR that can be noticed in 2004 (-3.066%), which is statistically significant at the 5% significance level. However, the strongest negative abnormal returns appear to be just few days after the event day and particularly during the following event windows (+1, +5) and (0, +1). In 2004, an extremely statistically strong CAR, of about -2.715%, exists and it is significant at the 1% level. Moreover, in 2004 and 2005 there are statistically significant CARs in the short event window (0, +1), -1.669% and -1.856% correspondingly, which are statistically significant at the 1% level.

In order to present the above results, the t-test has been applied in the current thesis. The above discussed outcomes undoubtedly reject the null hypothesis that supports the irrelevance theory proposed by Miller and Modigliani (1961), as abnormal returns were sighted both before and after the dividend announcements. Generally, the trend that has been followed by the abnormal returns is positive in the prior-announcement period and negative in the post-announcement period. Specifically for all the examined years simultaneously, in the event window (-20, -1) the CAR is +2.340% (statistically significant at the 10% level), while in the event window (+1, +20) the CAR is -2.128% (statistically significant at the 10% level).

Nevertheless, the results would be insufficient without mentioning two important limitations that have been taken into account throughout the analysis.

5. Conclusions

The relationship between the dividend policy and the value of the firm is an issue that has been arisen many decades ago and stimulated the interest of many economic researchers. However, it is also a matter of intense debate, as many theories have been developed in an attempt to shed some light on this troublesome issue. The aim of the current thesis was to examine the market reaction to dividend announcements by Greek listed companies on the indices FTSE/ATHEX 20 and FTSE/ATHEX Mid 40.

As it was mentioned in the second part of the study, the Greek stock market is characterized by some unique characteristics that other stock markets do not have, making it an ideal candidate for academic research. The absence of double taxation in the

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Greek stock market, in contrast with other stock markets in the USA and Europe, is a characteristic that may lead to different responses of the market participants to dividend announcements.

The empirical findings of the current thesis obviously reject the null hypothesis and challenge the irrelevance theory introduced by Miller and Modigliani (1961), as they indicate the existence of abnormal activity in the stock market both before and after the dividend announcements. In particular, they indicate positive market reaction during the prior-announcement period (statistically significant at the 10% level) and negative market reaction throughout the post-announcement period (statistically significant at the 10% level). On the other hand, on the event day, which is the day that the amount of dividends is officially announced by the firms, most of the abnormal returns that have been observed appear to be statistically insignificant at any accepted level. Therefore, it can be clearly stated that market participants expect the dividend announcements to have a positive impact on the stock prices, and they adapt their own portfolios according to their expectations. However, investors seem to interpret the news come from the dividend announcements, as ominous for the firms' future, and thus they react with a negative manner.

As it was mentioned in the last section of the literature review, there are numerous researches concerning the signaling effect on the Greek stock market. Nevertheless, none of them has the same outcomes with the present study. Initially, Papaioannou et al. (2000) did not observe any abnormal stock market activity around the dividend announcements by the firms including in their sample. Moreover, Asimakopoulos et al. (2007) stated that the signaling effect does not apply for firms that distribute only the minimum required amount as dividends, even for unexpected changes in their dividend policy. Therefore, the empirical findings of the above two mentioned studies are undoubtedly aligned with the irrelevance theory and are in clear contradiction with the results of the present research. Finally, Dasilas (2007) implied that there are no abnormal stock returns during the prior-announcement period, a fact that is clearly in contrast with the findings of the current paper, even if both studies support the signaling effect of dividends.

Thus, in spite of the restricted number of limitations, the current study through its empirical findings and based on previous relevant literature is an additional attempt to shed some light s of the most troublesome issues of the financial theory.

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The Renaissance of Word-of-Mouth Marketing: A 'New' Standard in Twenty-First Century Marketing Management?!

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Abstract

In this paper the importance of word of mouth for marketing management in the twenty-first century will be discussed. After a short introduction, there will be a focus on the demarcations and problems of traditional marketing. Then, in the third section, word of mouth (WOM) and word-of-mouth marketing (WOMM) as a 'new' standard in modern marketing are described. The fourth section broaches the importance of word of mouth and word-of-mouth marketing from the point of view of business and consumers, and then in the fifth section their importance for the Internet is considered. Finally, in section six evangelism marketing is discussed as the most effective form of word-of-mouth marketing. Section seven concludes the paper with a short summary. The paper focuses on scholarly articles and current research so as to keep theory as close as possible to reality.

Keywords: word of mouth, word-of-mouth marketing, evangelism marketing, social media, internet marketing

JEL Classification: M31, M37

1. Introduction

Communication between suppliers and consumers has been characterized over the centuries by an intense personal dialogue, from which a mutual trust arose with the aim of building long-term customer relationships (Schmidt, 2009; Oetting, 2006b). But since the

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advent of industrial mass production and mass media, and the transformation from a seller's to a buyer's market, marketing communication has fundamentally changed (Urchs and Körner, 2007; Oetting, 2006b).

In order to reach the large number of consumers eager to buy goods and possessing buying power, companies have focussed since the boom following World War II on a broad and rapid appeal addressed to the consumer through the mass media (Taylor, 1997; DeFleur and Dennis, 1996; DeFleur and Ball-Rokeach, 1989). Rather like the introduction of mass-produced goods, this developed a one-sided, uniform style of mass communication that functioned successfully for decades under contemporary conditions (Ramge, 2008; Oetting, 2007; Bruhn, 2005). At least since the 1990s, however, there has been an urgent need to adapt the existing communication model, for classical mass communication has become increasingly inefficient (Oetting, 2007; Urchs and Körner, 2007; Stevenson, 1994).

The present paper will discuss the development, importance and impact of word of mouth for marketing management in the twenty-first century. After a short introduction, the second section will focus on the demarcations and problems of traditional marketing. Then, in the third section, word of mouth (WOM) and word-of-mouth marketing (WOMM) are described as a 'new' standard in modern marketing. The fourth section broaches the importance of word of mouth and word-of-mouth marketing from the point of view of business and consumers, and then section five considers its importance for the Internet. Finally, section six discusses evangelism marketing as the most effective form of word-of-mouth marketing. Section seven concludes the paper with a short summary and future research. This paper is not intended to be a complete review, but rather a starting point for further discussion and investigation.

2. Demarcations of traditional marketing

The major change in the market that should be mentioned first is the ever increasing supply of communication channels. If there was still a fairly manageable number of media in the 1960s (TV, radio, magazine, newspaper), by the end of the 1990s the Internet and mobile communications had become two further media competing for the attention of the consumer (Markert, 2008; Röthlingshöfer, 2006). In addition, for years there has been an increasing fragmentation within the various communication channels (Rosen, 2009; Sankatsing, 2007). Since consumers' media addiction has not kept pace with this rise, however, the perception of communication and advertising messages within the individual channels has decreased dramatically (Egli and Gremaud, 2008). This development is also fostered by the fact that advertising messages are sent through communication channels that are now used by the corresponding target audiences to only a reduced extent. For example, advertising companies still use television as central medium of communication, whereas consumers – particularly the most sought-after target group between the ages of 14 and 49 – increasingly use the Internet (Egli and Gremaud, 2008; Urchs and Körner, 2007).

As a result, companies are faced by steadily growing mainstream media pressure, which frequently ends in consumers being inundated by a plethora of advertising.

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Sankatsing (2007) reports, that advertising spending worldwide currently exceeds € 350 billion per year. According to a study by the Private Institute for Marketing and Communication (IMK), consumers are now being bombarded daily by up to 6,000 promotional messages (Thinius, 2004). This concretely means that a consumer (subtracting eight hours for sleep) encounters a trademark (a brand name, slogan, logo or jingle), and thus directly or indirectly advertising of one form or another, approximately every ten seconds. This is a particularly critical finding in view of the fact that in the 1980s the surplus of information already stood at 98 per cent (Kroeber-Riel, 1987).

In addition to the growing range of communication channels and increasing mainstream media pressure, the homogenisation of the offered services in particular has had a negative impact on the existing communication model (Sankatsing, 2007). Thus, the consumer is confronted more and more by homogeneous standard products, which considerably complicates his buying decisions (Markert, 2008). Especially in markets where brand profiling through product differentiation or innovation is barely possible any longer, it often comes, according to Bruhn (2005), to intensely competitive advertising amongst individual providers with the aim of achieving unique communication proposition (UCP), and so obtaining strategic advantage.

Moreover, the increasing globalisation of products from abroad and the many no-name products that, along with traditional brands, have steadily expanded the range of products, foster the efficiency problem of classical marketing (Markert, 2008; Röthlinghöfer, 2006). A further factor is the increasing complexity of products and the resultant need for explanation. Neither the bewildering range of products nor the growing need for explanation can be satisfactorily dealt with by traditional marketing communication (Radic and Posselt, 2009; Heuer, 2008). As a result, traditional marketing messages are increasingly faced by credibility issues because of the commercial background and the frequently observed communication of faulty sales-related characteristics to the consumer (Egli and Gremaud, 2008; Markert, 2008; Kroeber-Riel and Weinberg, 2003). The commoditisation of products results in lower customer loyalty and so an increased propensity to switch products (Markert, 2008). Companies therefore labour under the constant necessity of acquiring new customers. The lack of customer dialogue and the below par customer relationship become clearly apparent for the first time under these new conditions. This in turn brings about a considerable increase of marketing communication and advertising pressure, resulting in a vicious circle of problems.

From this development we may infer that the classical sales approach has become more and more unpopular with consumers. They often feel harassed by the many advertising messages and read this flood of information either selectively or not at all. In addition, consumers no longer have the time or the interest to deal with the different messages and increasingly ignore them (Egli and Gremaud, 2008; Röthlinghöfer, 2006; Kroeber-Riel and Weinberg, 2003; Silverman 2001). In a countermove, they again give interpersonal communication a high priority and rely on their purchasing decisions more and more on recommendations from their social environment and from strangers on the

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Internet (Harris, 1999). In this way, word of mouth is experiencing a 'renaissance' (Spinner, 2009; Egli and Gremaud, 2008).

3. Word-of-mouth (WOM) and Word-of-mouth Marketing (WOMM)

Defining word of mouth (WOM) precisely, however, has proven difficult (Carl, 2006; Nyilasy, 2005). Arndt (1967, p. 291) defines it as 'face-to-face communication about a brand, product or service between people who are perceived as not having connections to a commercial entity'.

Some forty years later, the American Word of Mouth Marketing Association (WOMMA), founded in 2005, defined word of mouth (WOM) very generally as '[t]he act of consumers providing information to other consumers' (WOMMA, 2008).

Both definitions conceive of word of mouth (WOM) as natural (that is, non-commercial), inter-personal communication about brands, products or services that may be either positive or negative (WOMMA, 2008). In this sense, word of mouth marketing (WOMM) is seen as the type of marketing that specifically promotes natural inter-personal communication in the most diverse ways. WOMMA describes it as: 'Giving people a reason to talk about your products and services, and making it easier for that conversation to take place. It is the art and science of building active, mutually beneficial consumer-to-consumer and consumer-to-marketer communications' (WOMMA, 2008).

In this definition, word-of-mouth marketing (WOMM) becomes a generic term, including tactics such as so-called 'viral marketing' or 'buzz marketing' (Sernovitz, 2007). Word-of-mouth marketing (WOMM) is accordingly not about generating conversations between consumers (these exist already), but rather to encourage these conversations and to anchor them in the overall marketing strategy (WOMMA, 2008; Sernovitz, 2007; Oetting, 2005a). The focus on overall marketing is important because the theory of communication practice often speaks of marketing when it means only marketing communication and not the entire marketing mix (with product, price and place) (Kotler and Bliemel, 2006).

The difficulty of defining the terms 'word of mouth' (WOM) and 'word-of-mouth marketing' (WOMM) also stems from that the fact that researchers fail to distinguish between inter-personal communication itself, the strategy of facilitating this communication and its use for marketing, and the strategy of generating interpersonal communication (Oetting, 2005a). Plummer (2007), for example, introduces WOM (devoid of marketing) as a 'new advertising discipline' with the aim of generating conversations about brands, and so refers to both the discipline and the desired result.

While McCarthy's (1960) 'four P's' offer a good basic framework for understanding the all-encompassing nature of marketing, they lack one key ingredient that has been made apparent by the 'consumer revolution' – the consumer's involvement in the process. In the new reality that companies faces today, the consumer has seized control, audiences have been shattered into fragments and slices, product differences may last for only a few minutes rather than years, and the new ecosystem consists in millions and billions of unstructured one-to-one and peer-to-peer conversations. Companies therefore need to re-

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address the underlying models upon which marketing is based. James (2009) states the problem with the four Ps is that the first P is roughly ten times more important than the other three. And the Promotion part, which was never very important, has become very much less important now that the Internet provides instantaneous worldwide word of mouth. Fetherstonhaugh (2009) observes: 'We need a new framework. And a new tool kit. For starters, we need to throw away the Four Ps'. Furthermore, Navel (2009) says, that companies must add more P's to their marketing mix, such as People, Process, Physical presence, or – as word-of-mouth/social media representatives like to say – Participation.

Word of mouth (WOM) is not a new concept, but has for decades been considered a very important factor in the purchasing behaviour of consumers. For many years, however, companies and retailers have largely ignored it. Recently many companies have discovered its effectiveness by means of studies similar to those cited in the following literature review. This small and partial review of the literature on word-of-mouth communication will show the great development, importance and impact of this marketing method, which can help businesses effectively sell their products to customers.

The word-of-mouth field has been developed over forty years, with many research papers published in books, marketing-related and academic periodicals. Following the literature, we can identify three main periods of development of word-of-mouth communication: the mid-1960s, mid-1980s, and after the turn of the millennium.

Table 1: Most important research findings in the main periods of development of word-of-mouth communication

First author	Year	Subject of paper
Brooks	1957	Word-of-mouth advertising in selling new products
Dichter	1966	How word-of-mouth advertising works
Arndt	1967	Role of product-related conversations in the diffusion of a new product
Arndt	1968	Selective processes in word of mouth
Richins	1983	Negative word of mouth by disssatisfied consumers
Gumpert	1986	Interpersonal communication in a media world
Richins	1987	A multivariate analyses of responses to dissatisfaction
Berger	1988	Word-of-mouth reputations in auto insurance markets
Gremler	2001	Generating positive word-of-mouth communication trough customer-employee relationships
Bickart	2002	Expanding the scope of word of mouth: Consumer-to-consumer information on the internet
Wirtz	2002	The effects of Incentives, deal proneness, satisfaction and tie strength on word-of-mouth behaviour
Dellarocas	2003	The digitization of word of mouth: Promise and challenges of online feedback mechanisms
Godes	2004	Using online conversations to study word-of-mouth communication
Brown	2007	Word-of-mouth communication within online communities: conceptualizing the online social network

Source: Author´s illustration

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In the 1960s the focus of research was on the correlation of the phenomenon of word of mouth and advertising and innovation (Brooks, 1957). One of the first empirical studies of word-of-mouth influence in marketing was conducted by Arndt (1967). He was able to monitor the adoption of a new food product under test market conditions and assess the impact of word of mouth on short-term purchasing behaviour. One year before, Dichter (1966) conducted in-depth interviews with 255 consumers in 24 localities in the U.S. and explored aspects of consumer psychology with respect to word-of-mouth communication. He also applied his research findings to the product advertising.

Twenty years later, in the mid-1980s, the relationship between customer satisfaction and word of mouth was the main theme of research, with special focus on the correlation of dissatisfaction and negative word of mouth (Richins, 1983), as used, for example, in-depth interviews and open-ended questionnaire surveys to explore the correlation between possible reactions of consumers to unsatisfactory experiences and defined consumer variables for dissatisfaction reactions. In his pilot study, Richins found that 85 per cent of customers who were dissatisfied with a clothing item reported their dissatisfaction to an average of five others consumers. Richins´s (1987) replication study reported similar findings. He states that customers dissatisfied with a product spread negative word of mouth to eleven acquaintances, whereas satisfied customers may spread positive word of mouth to only three. And Berger (1988) found that the newly insured are willing to recommend their insurer and that these good 'word of mouth' recommendations offset the effect of poor recommendations.

In recent decades the Internet, by making it easier for individuals to share information, has been changing the way consumers share their positive and negative opinions. As Bickart and Schindler (2002) have argued, typical word-of-mouth communication consists of spoken words exchanged with one friend or relative in face-to-face-communication. By contrast, online word of mouth consists in the transmission of personal opinions and experiences through the written word. An advantage of this new kind of word-of-mouth communication – namely, the written word – is that people can seek information at home. Writing may also transmit the information in a more intact manner and make it appear more formal (Brown, Broderik and Lee, 2007). Furthermore, online communicators tend to be more willing to disclose personal information and to be more honest and forthcoming about their point of view (Roed, 2003). The new media technology has changed the form of classical interpersonal communication (sender – message – receiver) by introducing a new form of communicator, a forwarder or transmitter (Gumpert and Cathcart, 1986). After the turn of the millennium, many studies appeared on 'new', media based word of mouth; for example, Forbes, Kelley and Hoffman (2005), Godes and Mayzlin (2004), Xue and Phelps (2004), Dellarocas (2003), Wirtz and Chew (2002) and Gremler, Gwinner and Brown (2001).

The results of the these research papers indicate that word of mouth, both traditional and 'new' (online), is indeed a force that can influence the attitudes and predicted purchasing behaviour of consumers. Richins and Root-Shaffer (1988) claim that word of mouth has played a vital role in customers' buying decisions. It is therefore one of the most effective forms of communication in marketing management (File, Cermak

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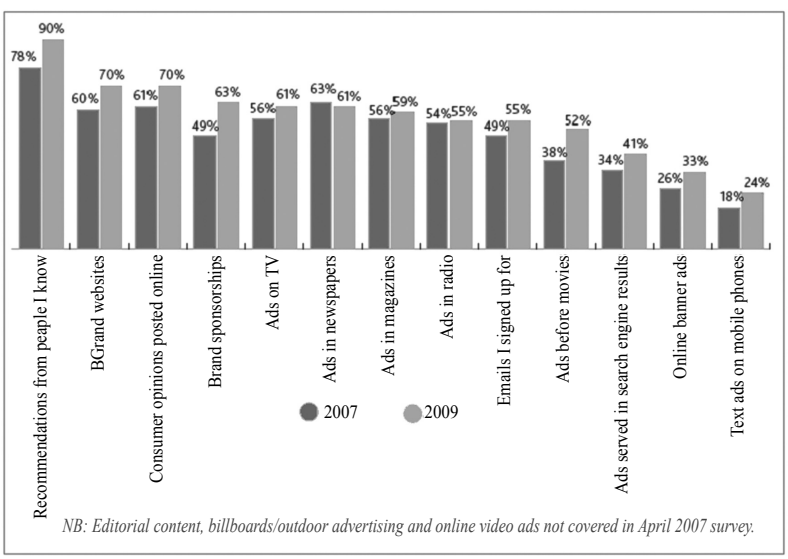
and Prince, 1994). Bill Bernbach, founder of the international advertising agency DDB Needham Worldwide and one of the most influential advertisers of the twentieth century, has been quoted as saying: 'Word of mouth is the best medium of all' (MacLeod, 2005). Later the equally renowned advertising genius David Ogilvy paraphrased this: 'The best advertising is word of mouth' (MacLeod, 2005).

4. Importance of word of mouth from business and consumer perspectives

Already in the late 1970s the growing importance of word of mouth in the realization of purchasing processes was empirically confirmed again and again. Thus, for example, for 67 per cent of the respondents in a study carried out by GfK Roper Consulting, recommendations from the social environment were the most important source of information, far ahead of TV-spots and print media, which were mentioned as a source of information by only 53 per cent and 47 per cent respectively (GfK Roper Consulting, 2006). Within the last thirty years the importance of word of mouth has increased substantially once again. According to an internet-based survey 'Trust, Value and Engagement in Advertising', repeatedly carried out by the market research institution Nielsen for the first time in 2007 and then in 2009, over 25,000 Internet users surveyed from 50 countries primarily trust in the recommendations of other consumers (90 per cent) and in consumer opinions published online (70 per cent). Traditional media such as newspapers (61 per cent), television (61 per cent) and radio (55 per cent) are mentioned, but they trail significantly behind inter-personal communication (The Nielsen Company, 2009).

Figure 1: Consumer trust in advertising by channel (trust somewhat/completely) 2007 vs. 2009



Source: The Nielsen Company, 2009, p. 2

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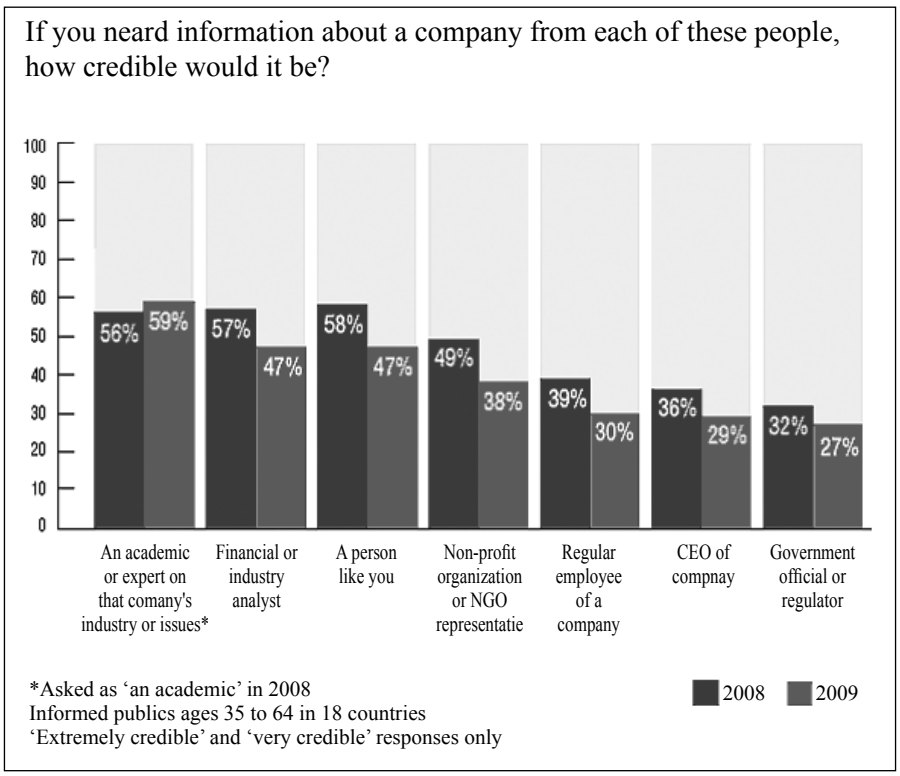
The results of the regularly conducted Edelmann Trust Barometer in 2009 also confirm that mass communication is losing its prominence as a source of information and trust. Thus 47 per cent of 3,400 respondents from 18 countries regard information about companies from a person similar to themselves as credible. Further, they classify the communication between friends and acquaintances to be by far more credible than company or product advertising (Edelman, 2009).

Figure 2: Trust in nearly every spokesperson down; academics, industry experts most credible



Source: Edelman, 2009, p. 13

Customer trust and satisfaction are determinants of positive word of mouth and customer loyalty. 'Customers continue to purchase those products with which they are satisfied and in telling others about particularly pleasing products, they may influence the brand perceptions of those with whom they communicate' (Richins, 1983, p. 68). More and more people nowadays based their attitudes forming in the emotional factor created by the word of mouth, so this could be a further factor of word of mouth increase (Yu and Dean, 2001).

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A key advantage of word of mouth in comparison to classical mass-marketing is individual consumer appeal and address. Instead of confronting the consumer with standardised and, for him, largely uninteresting advertising messages, passive or active recommendations are specifically tailored to the needs and interests of each recipient (Röthlingshöfer, 2008; Oetting, 2006b). This not only reduces the time the consumer needs to obtain necessary information, but also a reliable recommendation solves the problem of increasingly complex products and so the associated risk of making the wrong purchasing decision (Schüller, 2008; Marsden, Samson and Upton, 2005; Silverman, 2001).

Probably the most important characteristic of a recommendation, however, is its independence and credibility. Buying recommendations given by friends, family or acquaintances in particular appear to have more influence. The more positively the maker of the recommendation is rated, the more positively is his recommendation received (Röthlingshöfer, 2008).

Opinions published online concerning products, brands and companies are also increasingly gaining influence among consumers. Thus, the Allensbach Computer and Technology Analysis (ACTA) 2008 shows that 98 per cent of the approximately 40 million private Internet user regularly rely on the Internet for product search, primarily on price comparisons and information on the websites of the manufacturers and the valuation portals. Further, a total of 48 per cent of Internet users also consider the comments of other users and messages in forums in the process of deliberating a purchase, and these sources are assigned a much higher credibility than the websites of suppliers – again confirming the benefits of the word of mouth (ACTA, 2008).

5. Importance of the Internet for the word of mouth

The reason the Internet is so attractive and efficient for consumers, and consequently a vehicle for word of mouth, lies in the concept of the Internet itself. The Internet is characterized not only by a high degree of multimediality, but also by a high degree of interactivity, which especially in traditional marketing communication often exists to only a limited extent (Esch, Langner and Ullrich, 2009). 'Some of the medium's most significant characteristics are its 'always on', easy 24-hour access to the most updated information, its global coverage, an unlimited amount and source of information on products, brands or even competitors, its facilitating role in the ordering, customisation and payment for goods, and the medium's ability to target specific groups or individuals' (Sankatsing, 2007, p. 27). In particular, the development of Web 2.0, the so-called 'interactive Web' (Eck, 2007, p. 27), offers potential consumers numerous opportunities for obtaining information (for example, blogs, valuation portals, forums, communities) or participating actively in the word of mouth in the form of user-generated content (UCG) (Alby, 2008; Huber, 2008; Bauer, Große-Leege and Rösger, 2007). Not infrequently, fans of a product, brand or a company spend a great deal of time creating videos, photos or presentations on the Internet in order to show their appreciation for the item (Egli and

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Gremaud, 2008; Eck, 2007). In addition, there is a high range and rate of diffusion, achieved by the strong and far-reaching network, which is not possible within the framework of traditional mass marketing. Consequently, the Internet has contributed significantly to the fact that word-of-mouth advertising is now again playing such a decisive role in consumers' purchasing decisions (Brown, Broderik and Lee, 2007).

This is also confirmed by a ten-week study carried out in 2008 by the agency Komjuniti, which investigated approximately 1,400 consumers and three consumer brands. Four hundred (400) of the participants were active users of Internet brand communities; the remaining thousand (1,000) showed no affinity for social media and functioned accordingly as the control group. The results are clear and support the arguments already presented: social media activities produced in two out of three brands positive word-of-mouth effects and active members of the Internet community exchanged opinions about the relevant products with seventeen other people on average. By comparison, only two members of the control group spoke about the three brands advertised by traditional marketing methods. This word-of-mouth effect is also positively reflected by the sales: after traditional advertising showed a short-term higher impact during the first two weeks, from the third week on there was a 29 per cent increase in the sales of the products advertised through word of mouth, while only 5 per cent of the control group bought the products. The following weeks, too, showed a 14 per cent increase in sales based on recommendations, whereas the sales increase assisted by traditional advertising was a comparatively low 2 per cent.

Another key feature that became obvious during the study was that the customers' brand loyalty and willingness to repurchase was higher by 41 per cent in the case of consumers who had been acquired through word of mouth (Komjuniti, 2009). Given these advantages, it is understandable that, according to the study 'Tribalisation of Business 2009' carried out by the accountancy and consulting firm Deloitte, 94 per cent of the approximately 400 companies surveyed plan to invest more in social media in order to enter into a dialogue with customers, partners and employees (Deloitte, 2009). Only 6 per cent of all surveyed companies plan to reduce their investments in this regard.

Social Media and Web 2.0 activities are thus no longer only a matter of private leisure activity but widely recognized as an important factor in professional corporate communications (Huber, 2008). So far, however, leading German companies still have difficulties with implementing this concept. One survey conducted in 2009 by the communications agency PR-COM among the thirty internationally operating DAX–listed companies shows that the majority still do not quite know how to use the new communication possibilities. Of the 21 DAX-listed companies that participated in the study, 67 per cent are active in the area of social media on at least one platform. Thirty-three per cent of the companies surveyed are not present in social media, neither at German nor English-speaking platforms (PR-Com, 2009). In another study in 2010, PR-COM examined the web sites of 100 German IT and telecommunication companies that, based on the number of employees, belonged to the 150 biggest in this sector. The results of the study showed that precisely the IT industry, which sees itself as the vanguard of

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innovation, largely refuses to make use of the opportunities offered by Web 2.0. The study identified only eight German-language blogs. Nineteen companies had blogs in English, and three blogged in both languages (PR-Com, 2010).

In the long run, there is hardly a way around a presence on social media for most companies, as current studies conducted by eMarketer (2009) und CMO (2009) confirm. Three quarters of all Internet users are active in these media, talking on Twitter, Facebook or other blogs about companies and their products. Companies that are not present on social media run the risk of not being in the position either to build a positive reputation or to correct negative comments, which spread very rapidly in the real-time media of the Internet. In America, where Twitter and Facebook play a far greater role than in Germany, a study by the Exhibitor Media Group (2010) has shown that about two thirds of all companies are represented on Web 2.0. It is therefore not surprising that in a study carried out by Wittmann, Werner, Krabichler and Stahl (2008) 28 per cent of respondents said they had recognised the potential of social media and Web 2.0 too late. The respondents were 76 experts in the German financial services industry.

6. Customer evangelism as the most efficient form of word-of-mouth marketing

In the course of time, evangelism marketing has established itself as the most efficient form of marketing communication as a means of word-of-mouth marketing, says Ben McConnell. Along with Jackie Huba, McConnell is co-author of Creating Customer Evangelists, a book documenting how companies such as Southwest Airlines and Build-A-Bear Workshop have used evangelism to increase sales (McConnell and Huba, 2003). Whereas means such as buzz-marketing or viral-marketing primarily emphasize various actions, and promote word-of-mouth advertising (see sections three and four), evangelism marketing focuses completely on the product, the brand or the company to be promoted. The word 'evangelist' comes from the Greek word euangelos, meaning 'bringer of good news'. Evangelism marketing means creating a mission and brand experience that are so inspiring to consumers that they become committed to a company – and share their enthusiasm with others. What makes evangelism so powerful today is how it weds the oldest form of persuasion, word of mouth, with the newest, social networking and Web 2.0 (Fetherstonhaugh, 2009).

The aim of evangelism marketing is to tie the company, systematically and on a long-term basis, to the cycle consisting of positive word-of-mouth advertising, successful brand management, the emergence of a loyal customer relationship and the promoters developing from engagement with ambassadors of the company and the brand, and thereby to achieve a permanent acquisition of new customers and sales increase (Langner, 2007; Bone, 1995). Many people, including marketing-managers, believe Guy Kawasaki, the former chief evangelist of Apple Computer, to be the father of evangelism marketing and one of the key people responsible for marketing the Macintosh in 1984. In his books How to Drive Your Competition Crazy (1995) and The Art of the Start (2004), Kawasaki states that the driving force behind evangelism marketing is the fact that individuals

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simply want to make the world a better place. Evangelism, he says, is about selling your dream so that other people believe in it as much as you do. Those people, in turn, get even more people to believe – just as Jesus was an evangelist who recruited twelve more evangelists (Kawasaki, 2004; Kawasaki, 1995).

Evangelism marketing can be implemented only through the identification of a broad network of appropriate disseminators that are in a position to take a leading role in the active distribution of positive word of mouth. By targeted engagement of the selected disseminators, they can be trained as so-called 'customer evangelists' (McConnell and Huba, 2003). They are characterized, among other qualities, by loyalty, voluntary recommending and feedback, and consequently ensure a continuous reference program. If word of mouth is the skeleton, write McConnell and Huba (2003), then customer evangelism is the soul.

McConnell and Huba (2003) recommend six steps for creating customer evangelists:

1. Customer plus-delta: continuously gather customer feedback.
2. Napsterize knowledge: make it a point to share knowledge freely.
3. Build the buzz: expertly build intelligent word-of-mouth networks.
4. Create community: encourage communities of customers to meet and share.
5. Make bite-size chunks: devise specialized, smaller offerings to get customers to bite.
6. Create a cause: focus on making the world, or your industry, better.

The companies have to take into consideration three main factors as requirements for the successful recruitment of customer evangelist. The first factor is the obligatory need of a good and successful product, because only well-known products that are characterized by positive and unusual features or which cause emotional reactions among consumers are in fact recommended. For example, winning an award or having the position as market leader can have an advantageous effect because they provide additional arguments for recommendation (Schüller, 2008; McConnell and Huba, 2003). The second factor that conduces to training customer evangelists and that companies should therefore strive for (Schüller, 2008) is to be a strong brand, one that establishes not only an emotional relationship with consumers but also has a brand community. The third and last factor is the realisation of open, transparent and conversational corporate and marketing communications and integration of customers into the marketing processes so as to gain their trust and thus generate long-term recommendation marketing (Zunke, 2008; Schüller, 2008; Röthlingshöfer, 2006; Bone, 1995).

The importance of opinion leaders as customer evangelists is the reason that more and more companies, such as Sun Microsystems, have even created the overarching position of 'corporate evangelist' or 'chief evangelist' who focuses on trumpeting core values and vision. Corporate evangelists are people in the company who maintain close contact and intensive exchange with the biggest fans of the brand. As contact persons,

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they are available precisely to those people who already have a considerable interest in the company; they can continuously improve its reputation amongst hardcore fans because they provide the company with, so to speak, a human face and personality (Oetting, 2005b). Sun Microsystems is only one of the many companies, mainly in the technology sector, that have instituted such a position firmly in the corporate structure. Another company with a corporate evangelist is Google (Pethokoukis, 2005).

7. Conclusions

A key challenge for companies in the future is to procure authenticity, openness and credibility through individual customer dialogue (Stevenson, 1994). The modern communication mix can no longer be imagined without word-of-mouth marketing, which is now regarded as a decisive factor in the success of an enterprise (Schüller, 2008). Through tight integration into the corporate communications concept, word-of-mouth marketing can optimally develop its positive effect, providing companies with a long-term positive image and emotional customer loyalty while enabling the methodical recruitment of brand messages (Oetting, 2005a). Because of its methodical approach and long-term perspective, evangelism marketing is the most effective means of word-of-mouth marketing and will play a crucial role in companies' future marketing mix (Bone, 1995). This of course assumes that there is network of appropriate disseminators that are in a position to take a leading role in the active distribution of positive word of mouth.

Because of the rapid development of IT through the Internet, e-mail, cell phones, PDAs, text messaging and blogs, it has been suggested that future research should examine the influence of these new information technologies on word-of-mouth behaviour. Further research is needed to answer the following questions: What are the success factors of future word-of-mouth communication? Under which conditions do consumers recommend products and services to other consumers? Does word of mouth work equally well in all industries and with all products? To what extent do customers rely on electronic word of mouth? Does electronic word of mouth have the same effect on customers' buying decisions as does the traditional word-of-mouth method? And how valuable is online word of mouth?

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The Role of Savings in the Economic Development of the Republic of Azerbaijan

Nagi Bairamli[1] and Vassilis Kostoglou[2]

Abstract

This article aims to analyze the possibilities of the accumulation and mobilization of savings and their role in the economic development of the Republic of Azerbaijan. Currently, the national economic growth is mostly based on the resource components; crude oil, natural gas and oil products. For the development of the non-oil sector the mobilization of domestic savings into investments would prove very useful. Savings of people should be the most important investment resource for the development of the non-oil sector, as the foreign capital is mostly involved in production of natural resources like oil and gas. The mobilization of domestic savings is crucial for raising the economic growth and promoting development, as it is the private savings that affect the domestic investments significantly. The most of the savings are made when they are fully channeled into the productive investments. As a result, this will lead to the solution of problems of employment and economic growth.

Keywords: economic growth and development, savings, investments, financial institutions

JEL Classification: O16, O11, E44

1. Introduction

Over the last three years the economy of Azerbaijan is being developed at an accelerated pace, so that its growth rate has become one of the highest in the world. The speedy growth of the economy is due to the existence of huge oil reserves and the increased production of oil. This increase has accelerated a rapid growth of GDP as the oil sector accounted for over 50% during 2007 and 2008 (Economy, 2009).

Azerbaijan's integration into the World Economy has been intensified in recent years. More than forty-nine billion USD were invested into economy over the period 1995-2007, 70% of which were foreign investments. Eighty percent of foreign

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investments are foreign direct investments (FDI). Most of the FDI (about 90%) pertain to the oil sector.

It is therefore obvious that incomes from production and sales of oil make up a very significant part of GDP. For example, in 2007, mining and hydrocarbon industries accounted for well over 95% of the Azerbaijani economy, and oil and its products made about 98% of total export in the first half of 2009. Main export products of Azerbaijan are oil and oil products and the economy is not yet well diversified into manufacturing industries.

According to the new report of the International Monetary Fund (IMF) the economic growth in Azerbaijan will decrease due to the year by year reduction in oil production (IMF on Economic Growth of Azerbaijan, 2009). Growth of investments in Azerbaijan is stipulated by availability of vast reserves of oil. As a result, along with a decrease of oil the inflow of investment resources will decrease and the economic growth rate will be affected negatively.

Thus, it is vitally important for Azerbaijan on this development stage if the country receives vast amounts of income to develop the non-oil sector of the economy and launch production of goods having potential to provide the country with additional incomes. To solve the problem of the development it is very important to stimulate the real sector (agriculture and manufacturing) of the national economy. The sustainability of development of Azerbaijan will depend on its ability to invest in productive enterprises. Entrepreneurs organizing the production of goods which could compete with imported goods should be supported by all means.

Steady and long lasting growth can also be ensured on account of production of competitive goods and extensive use of new technologies. This requires an increase of investments into the real sector of the economy. The state support of direct investments could create favorable investment climate for provision of development of production of goods and services.

For the development of the production of competitive goods it is necessary to attract investments from domestic sources. The development of these investments into the Republic of Azerbaijan will contribute to an increase of the production potential of the country's economy. In the literature there is wide support to the idea of the positive influence of attraction of domestic savings on the level of investments and on the economic growth. The realization of the objective of a steady economic growth and development is a very hard task without mobilization of savings and investments.

In this paper we consider the role of savings in the economic development of Azerbaijan and the possibility of a stimulation of savings and their subsequent use in the development of investment projects. The importance of this topic is determined by the need of creation of appropriate conditions for subsequent development of the economy on account of domestic sources of financing, and not only on account of foreign sources. The remainder of the paper is organized as follows. Next section describes the situation with domestic savings and their importance in the economic growth. Section 3 gives an analysis of the main determinants of savings in Azerbaijan. The fourth section

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emphasizes the significance of transformation of savings into investments and the role of financial institutions. The paper's last section draws conclusions and suggests avenues for future work.

2. Situation of domestic savings in Azerbaijan

As it is known, in the long-run the level of investments in national economy closely correlates with the level of national savings. Population's savings are an integral part of the economic system and contribute to the future economic development. These savings can be the most important investment resource for the development of the real sector, because foreign capital is mostly invested in production of natural resources like oil and gas. It is of vital importance for the state to mobilize the savings of the people into the economy. The state will be less dependent on foreign investments and the domestic investments accumulated due to the savings will provide better stability of the country. This could contribute to the economic growth and development (Surina, 2007).

For maintaining a stable growth rate of the economy of Azerbaijan it will be necessary to increase the investments by means of domestic resources. Currently the ratio of savings attracted from population and the GDP in Azerbaijan equals to 5%, which is not considered to be an optimal level. It can also be seen (Table 1) that the saving/GDP ratio over the last years does not exceed 5%.

Table 1: Savings attracted from population (in thousands AZN)

	2003	2004	2005	2006	2007	2008
Savings attracted from population	251935	403127.6	494500	819500	1468400	1903700
of which:						
national currency	18986.2	30130.2	55800	250300	676400	1035600
foreign currency	232948.8	372997.4	438700	569200	792000	868100
GDP	7146500	8530200	12522500	18746200	28360500	38005738
Savings/GDP ratio	3.53	4.73	3.95	4.37	5.17	5.01

Source: State statistical committee of the Republic of Azerbaijan

Note: (1 Euro = 1.14 AZN) - Manat (code: AZN) is the currency of Azerbaijan

According to the estimations of the Standard & Poor's Ratings Services the level of the per capita deposits in Azerbaijan equals to $561. According to Table 2 per capita deposits in manats equals to 234 AZN and in foreign currency equals to 293 USD (numbers are calculated by dividing the total sums to the number of population which is equal to 8,238,672). This reflects to insufficiently strong market positions of the banking sector and to low level of well-being and savings (Standard & Poor's, 2008).

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Table 2: Deposits and savings by currencies (end of period)

Year	Total deposits	of which:			
		in manat		in foreign currency	
		demand deposits	time deposits	demand deposits	time deposits
2001	393	43.7	13.6	179.4	156.3
2002	451.4	59.7	11.8	171.6	208.3
2003	610.6	91.6	18.6	173.2	327.2
2004	1025.3	179.5	26.3	244.1	575.4
2005	1294.4	200.4	48.9	324.1	721
2006	2129.2	542.3	284.1	540.1	762.7
2007	3183.7	939.2	748.9	270.7	1224.9
2008	4348.5	999.3	936	208.9	2204.3

Source: National Bank of the Republic of Azerbaijan

It is common knowledge that the savings of the population are closely connected to their well-being and are the main source of investment resources. There is a general consensus on the positive role of investments in the acceleration of the economic growth and that a high level of saving leads to high level of investments. The largest share of financing for development has to come from domestic resources. The majority of the countries are more likely to finance most part of their investment out of national savings instead of using international capital movements (Obstfeld and Rogoff, 2000). The level of financing of the economic growth in the republic should be largely determined by the level of savings of population.

> 'The experience during a decade of economic transformation provides convincing evidence that the most successful transition economies have been those where the economic environment stimulated savings…' (Financing Growth and Development in the Transition Economies: The Role of Domestic Savings. 2000).

Today's savings are future investments. The situation with savings and investments in Azerbaijan is such that the ratio of investment to GDP is higher than the ratio of savings to GDP. Large investments in Azerbaijan are realized on account of the state financial resources, and not the private ones. The current role of savings of population in investment activities in Azerbaijan is not great. In developed countries savings of population attracted through the banking system and the capital markets are the most important sources of financing of economic growth. By conducting the necessary policies the government should create the required conditions for the growth of savings of population.

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3. The determinants of savings

The main determinants of savings analyzed in this section are fully relevant to the savings behaviour and derive from an extensive literature review, an indicative part of which is quoted below. The determinants included in the analysis are the income level and the expectations regarding future development, the taxation policy, the age structure of the population and the expected role of the financial institutions. The existence of some barriers is also discussed and taken into consideration.

The issue of the increase of savings is of great importance for maintaining the economic growth and development. Indeed, as Thirlwall argued:

> 'The growth of output of any economy depends on capital accumulation, and capital accumulation requires investment and an equivalent amount of savings to match it. Two of the most important issues in development economics, and for developing countries, are how to stimulate investment and how to bring about an increase in the level of savings to fund increased investment.' (Thirlwall, 2002)

Identifying the factors determining savings, as well as factors positively influencing attraction of investments is a major policy challenge for all countries (Xiaochuan, 2009). The main emphasis in the analysis below is given to the determinants of savings of people.

The income level is considered as the main determinant of savings, but this is not the only determinant affecting them. Other determinants are the level of interest rates and the age structure of population. As Metin states, there are several potential determinants of savings:

> 'Both theoretical and empirical work on savings, have consistently outlined the major potential determinants of savings that can be grouped loosely under the headings of government policy variables, financial variables, income and growth variables, demographic variables, uncertainty measures, and external variables.' (Metin et al., 2003, p. 1409).

The importance of identifying the determinants of savings is also emphasized in the Economic Survey of Europe:

> 'Understanding the motivation for saving (at the level of individuals and for the community as a whole) is not only of academic interest but also important in terms of its policy implications. Identifying the key determinants of saving may help policy makers to design policies to stimulate domestic savings and thus domestic investment.' (Economic Survey of Europe, 2001, p.177)

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3.1 Income level

As it is stated above incomes of people are considered as the main determinant of savings. According to state statistical data population's income is increasing. The per capita income of population increased by over 3 times within the last 5 years: from $641 USD to $2,000 USD. The average monthly wage in the country increased by about 4 times in this period and reached $252 USD. According to forecasts of the Ministry of Economic Development, these indicators will reach $4,500 USD and $657 USD in the next four years respectively.

According to these forecasts incomes of population made by government agencies in 2009 will increase by 22.5 % and will amount to 22.77 billion manats (Table 3). In 2009 the largest share of income of population will be formed due to entrepreneurial activities. Entrepreneurial income will amount to 11.3 billion manats which will make 49.6% of total incomes. The second largest share income will be due to wages and salaries. According to the forecasts wages and salaries will amount to 7.4 billion mantas, which is 32.8% of all incomes. According to the same forecast, expenditures will be equal to 18.1 billion manats, which is lower than revenues by 20.3%. The amount of savings according to the same forecasting will be equal to 4628 million manats (Khankishiyeva, 2009).

Table 3: Income and expenditures of population (million manat)

	2003	2004	2005	2006	2007	2008	2009 (forecast)
Income	5018.6	5738.1	6595.1	8063.6	10198.5	14305.6	22773.3
Primary income including:	3948.8	4600.3	5345.4	6394.2	8299.6	11852.1	18872
Wages and salaries	1262.1	1620.4	2122.3	2954.8	3364.5	4564.9	7470
Income from entre-preneurial activities	2683.6	2976.3	3217.9	3432.6	4874.1	7215.1	11300
Property income	3.1	3.6	5.2	6.8	61	72.1	102
Transfers	1069.8	1137.8	1249.7	1669.4	1898.9	2453.5	3901.3
Expenditures	4171.2	4793.8	5549.9	6508.7	8208.1	10819.5	18145
Final consumer expenditures	3740.2	4230	4697.7	5532.6	6873.1	9374.6	15825
Transfers	431	563.8	852.2	976.1	1335	1444.9	2320
Savings	847.4	944.3	1045.2	1554.9	1990.4	3486.1	4628.3

Source: State statistical committee of Republic of Azerbaijan

Note: (1 Euro = 1.14 AZN)

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Thus, it is forecasted that incomes of population will be higher in comparison with the previous year. The level of incomes directly influences the amount of savings, and also increases the propensity to save. Increase of incomes of households will lead to an increase of the investment potential of the Republic of Azerbaijan. Increase of the size of the income will be accompanied by even higher increase of savings. Savings of people as one of the indicators of living standard depend on the well-being of the population.

The expectations of people regarding the future economic situation are also an important factor because they can affect the current expenditures and savings. The study and the analysis of the determinants of savings will enable to forecast the tendencies in accumulation of financial resources by the population and will also help to develop an efficient mechanism of the transformation of savings into investments.

3.2 Taxation policy

Encouragement of the interest of population for the increase of savings can be realized also through the taxation. Several studies have shown that tax policy has a positive influence on the real sector and is an important tool not only for stabilization but also for promoting savings and capital (Peter and Peter, 2006, p. 36). As the most developed countries practise, tax stimulation of savings and relevant incentives for domestic investors should be actively used. It is well-advised to introduce the appropriate model of taxation based on benefits on incomes that people receive from investments. Indicative types of benefits are tax discount on installments of investment funds and special non-taxed savings accounts. Introduction of special banking accounts which would allow people to deposit some amounts of money without taxation of accrued interests within the first few years is one of methods of tax stimulation of increase of savings.

3.3 Age structure

Demographic variables are considered as important determinants of household savings. The population structure affects saving behavior of people.

> 'In the basic life-cycle model, the age distribution of households has an effect on the aggregate personal savings rate because the savings rates of individuals are assumed to vary with their age. An increase in the proportion of elderly households in the population is expected to reduce the aggregate savings rate because retired households are assumed to dissave, or at least save less than those of working age. Similarly, an increase in the proportion of the population that is of pre-working age is also expected to reduce the aggregate personal savings rate as parents spend a

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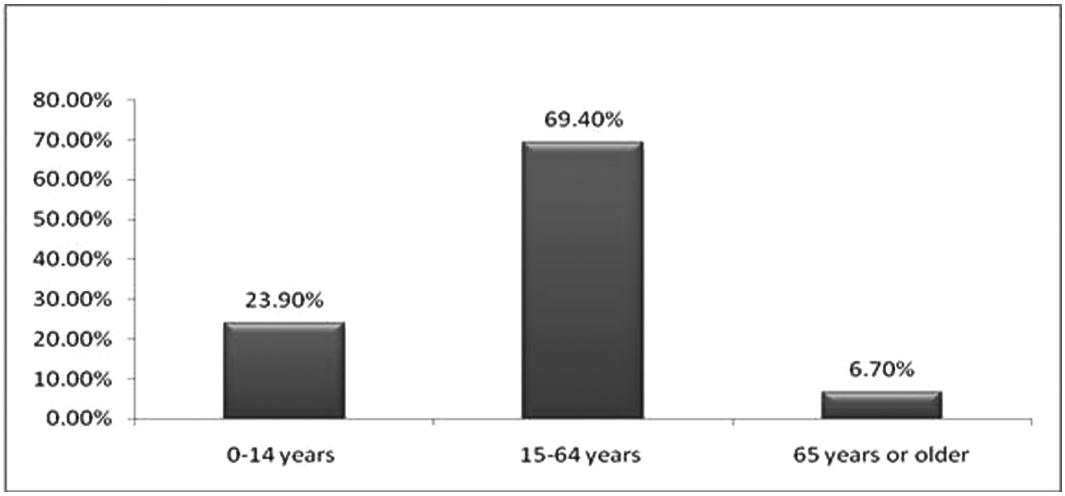
large proportion of their income on taking care of their children.' (Bérubé and Côté, 2000, p. 5).

According to the age structure of the population of Azerbaijan (see figure 1) 23.9% of population is 0-14 years old, 69.4% is 15-64 years old and 6.7% is 65 years or older. The median age of population equals to 27.7 years. According to the State Statistical Committee of Azerbaijan out of 8.6 million of people 5.8 million are at working age. 2.9 millions are in the category of 1-19 years old and 0.6 millions in the category of 65 and over.

Figure 1: Age structure of population



Source: State statistical committee of the Republic of Azerbaijan

The population factor for the development of the savings is favorable as the population is young and the majority of it is in working age and the number of the younger generation prevails the older one. Young, energetic and growing population predetermines the long-run economic growth. This factor increases the potential of the economy for growth and contributes to an increase of aggregate saving in the country.

3.4 The importance of financial institutions

The problem of transformation of savings into investments has a special significance for the development of the Republic of Azerbaijan. Redistribution of financial resources from those who own to those who need is essential for the economy. In order to transform savings into investments, savings should be attracted by financial institutions. The process of transformation of savings into investments can be carried out by financial markets and by financial intermediaries. Mobilization of savings of

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population by financial intermediaries is the most important type of relevant banking operations. Commercial banks play a key role in transformation of savings into investments. They attract savings of people and ensure the economic growth of the country.

Mobilization of savings of the population into the economy can be realized with the help of the banking system and other institutions of the financial sector. For the people, in order to deposit their savings in bank accounts, it is well-advised to apply more widely such mechanisms, as payment through banks for various kinds of services and goods and transfer of wages and salaries to current accounts of individuals. It is also necessary to use mechanisms of commercial banks for the realization of programs of stimulation of a consumer demand and acceleration of activity of non-bank organizations working with the savings of the people (Lopintsev, 2008).

The encouragement of transformation of savings of people into the investment should be carried out by the development of the system of insurances of individual investments. The use of insurance mechanisms for the transformation of savings into investments is of great practical importance. The amount of deposits insured by the state in Azerbaijan was equal to 8,000 AZN ($9,900 USD) until recently, but since May 2009 the amount equals to 30,000 AZN ($37,000 USD). The measures taken for the protection of the rights and legitimate interests of insured people increase the financial stability of the insurance organizations and confidence of people to the financial institutions.

The development of an institution of nonbanking financial intermediaries in Azerbaijan could also be a positive factor for the accumulation and the mobilization of savings of population. These institutions are indispensable suppliers of loan capital. Specialized nonbanking institutions unlike banks accumulate financial savings for sufficiently long periods and therefore can make long-term investments. The main forms of activities of these institutions are accumulation of savings of people, granting credits by means of issuing bonds, mobilization of capital and granting mortgage and consumer loans. Expansion of the nonbanking segment of the financial market by way of introducing new financial instruments will stir up investment activities of people. As we know, strong financial system promotes the transformation of savings into investments.

> 'Azerbaijan's financial system is not fully developed but is growing rapidly. Availability of long-term financial instruments remains limited, providing virtually no viable domestic savings options other than bank accounts. The market for state and corporate bonds remains small and illiquid.' (Index of Economic Freedom 2009).
>
> 'The private savings ratio tends to increase along with the development of the financial system.' (Koskela and Viren, 1983, page 117).

The development of securities markets in Azerbaijan can be useful for the transformation of savings into investments, as these markets are indispensable for the

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stability of financial markets. The development of stock exchanges is also conducive to an efficient transformation of savings into investments due to the fact that by trading securities stock exchanges large amounts of capitals can be accumulated which are also used for the development of productions. Weaknesses in the regulatory and supervisory framework, deficiencies in market architecture and infrastructure, insufficient development of equity markets are the main impediments of the development of capital markets in Azerbaijan (Project Information Document, 2008). The lack of investment interest of people in investment institutions is caused by the lack of development of the infrastructure of the securities market, its informational non-transparency, illiquidity of most securities, and lack of knowledge in investments issues. The regulation policy about the securities should first of all focus on the development of its investment potential, on the system of attraction of investment resources and on the attraction of private investments. Companies and enterprises in Azerbaijan should also work hard for the improvement of their corporate governance practices. Good corporate governance is pivotal for the integrity of corporations, financial institutions and markets, and essential to the health of economies and their stability (OECD Principles of Corporate Governance).

> 'Corporate governance has become an important topic in transition economies in recent years. Good corporate governance helps to increase share price and makes it easier to obtain capital. International investors are hesitant to lend money or buy shares in a corporation that does not subscribe to good corporate governance principles.' (McGee and Bose, 2008, p. 1).

However, the positive effects of the above important determinants to domestic savings will be active only if some side obstacles can be overcome. Barriers such as the current global unfavorable investment climate, the existing monopolism in some sectors, the emigration, as well as the corruption, a phenomenon noticed in most new countries formerly belonging to the Soviet Union have to be seriously considered and tackled. In our opinion, these barriers can be confronted only by a decisive intervention of the state. The most efficient tool would be a carefully prepared, protective legislative framework. It would be better if the voting of this framework was unanimous and the republic of Azerbaijan took every concern for its catholic application.

4. Conclusion

The objective of this article was to determine that the savings of population, if properly used, could be a significant factor in stimulating economic growth in Azerbaijan. Sustaining economic growth is important to ensure macroeconomic stability, develop strong financial institutions and fund the market in order to to provide accumulation and transformation of savings into investments. Strong financial institutions facilitate the flow

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of funds from savings to investments. Even if savings are high in the country without developed capital markets and financial intermediaries there will be no use as they could not be channeled into investments. On the other hand, insufficient development of the system of financial intermediaries lowers the rate of growth of the economy and can render the mobilization of savings inexpedient. The success of transformation of savings of people is determined by the degree of the development of financial intermediaries and the presence of attractive financial instruments.

Policy makers should focus on increasing the level of domestic private savings because the crucial problem for developing countries is the lack of investments which restricts economic growth. The savings of people serve as the basis of investment resources of the country and are essential for development and growth. Increase of the savings will lead to the capital accumulation which will eventually lead to the economic growth. High level of domestic savings will serve to the solution of the problems of unemployment, contribute to the development of entrepreneurship, and can therefore positively influence the rate of the economic development. Under a strong financial system the level of savings can be a reliable gauge of the economic development of the country. Besides, the saving rate along with inflation and unemployment can be considered as an indicator of the country's economic situation.

The estimation of volume of savings of population, the search for the ways of its use and the stimulation of investment activities of people should be the priority task for the government. The efficiency of measures will be productive only if the involvement of savings will favorably affect the well-being of people. In this case not only investment activities will be boosted but also the population's entrepreneurial potential, which will contribute to the increase of incomes and employment, as well as to the improvement of quality of life.

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International Journal of Economic Sciences and Applied Research 3 (2): 111-122

Modeling Labor Supply through Duality and the Slutsky Equation

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Abstract

In the present paper an analysis of the neo-classical optimization model with linear constraints is proposed. By introducing the dual problem it is shown that the solution to the maximization problem is also a solution to the minimization problem. The purely theoretical model proposes a universal equation, similar to the Slutsky equation as derived in the consumption theory. Another application is needed, different from the standard applications of the model found in economic literature. This application is based on the study of the change in optimality caused by the taxes on labor. The application focuses on how they impact the optimal decision in the choice between leisure and labor through the application of the classification derived on the basis of the Slutsky equation.

Keywords: labor optimization, duality, the Slutsky equation, tax rates

JEL classification: C61, C62, D11

1. Introduction

The model in the present paper elaborates the ideas as proposed by Ivanov (2005) and it differs from the traditional application of the optimization method, which solves for the maximum value of an *n*-argument function under a given constraint. The dual problem has been recently used by Menez and Wang (2005), who analyze the income and substitution effect under an increase in wage risk and uncertainty. Sedaghat (1996) provides a version of the Slutsky equation in a dynamic consumer's account model. In this paper, we propose an optimization model of labor supply by introducing the so called 'dual' problem and we find solutions for maximum and minimum. Aronsson (2004), Jones (1993), Sorensen (1999), and Werning (2007) treat the problem of optimal taxation and decision making in defining fiscal policies. Similar analysis are proposed by Bassetto

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(1999) and Chari (1994; 1999) who formulate the idea of optimality in taxation and its impact on business cycle management and in environments with heterogeneous agents.

There are few studies on tax avoidance and its effects on labor supply and general welfare like for example the ones we find in Agell (2004), Gruber (2002), Hausman (1983), and Kopczuk (2005). In our paper, by applying the Slutsky equation we propose a general classification of variables, analogous to the classification of goods based on income and price elasticity and we further use it in the labor supply model to interpret the influence of taxes on the changes in the choice between labor and leisure.

The paper is organized as follows: in Section 2 the purely theoretical optimization model is presented. By solving the maximization problem and its dual, a universal equation is derived based on the Slutsky equation in the consumption theory and an analogous classification of the variables which are arguments of the objective function is proposed. In Section 3 there are some comments on the representations of the model in labor supply decision-making. Section 4 includes an analysis taxes and their impact on the labor supply process. Section 5 summarizes the results and concludes.

2. The Model

We consider the function $\varphi(x)=\varphi(x_1, x_2, ..., x_n)$, defined in a convex and compact set $x \in X \subset R^n$, which is *continuous, monotonic, twice differentiable, quasi-concave and homogeneous of degree one* and this set is also characterized by local non-satiation.

For the purposes of this analysis we will consider the function $\varphi(x)$ as an objective function which we want to maximize under a certain linear constraint. In the *n*-dimensional case the model takes the following form:

$$\max_{x \geq 0} \varphi(x)$$
$$\text{s.t. } \langle a, x \rangle \leq b$$

where $x = (x_1, x_2, ..., x_n)$ is a vector of the arguments of the objective function, $a = (a_1, a_2, ..., a_n)$ is a vector of parameters, which are positive numbers and influence the constraint. The scalar $b \geq 0$ determines the value of the constraint.

We will assume that if the function $\varphi(x)$ is continuous, then $\varphi(x) \leq \varphi(x^*)$ for all $x \in X$, the constraint $\langle a, x \rangle \leq b$ belongs to a full and compact set and the vector a>0. Then, the vector x^* is an optimal vector consisting of the arguments of the function $\varphi(x)$. We will also assume that the vector x^* is a global maximum and is also a solution to the problem.

For the geometrical representation we shall discuss the two-dimensional case (Fig. 1).

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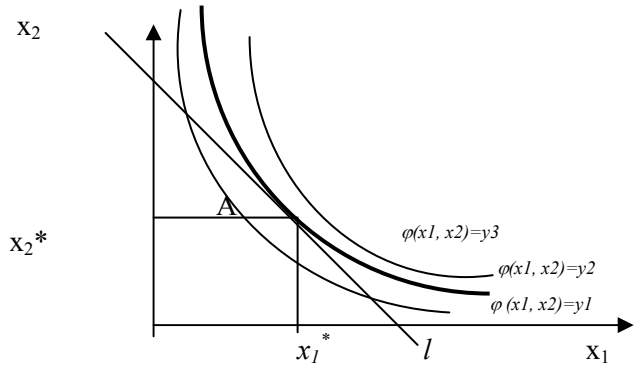
Figure 1: Optimization model



If we assume that the function $\varphi(x_1, x_2) = y$, where y is some number, for different values of x_1 and x_2 the objective function has one and the same value for y. On Figure 1 this function is presented by a family of curves, which correspond to changes in the value of y. These curves are defined in convex sets and they are continuous, quasi-concave, with a negative slope, they do not cross and hence they do not have a common point.

The second element of the model is a linear constraint, presented by the line $l : a_1x_1 + a_2x_2 = b$, where b is some constant. This line links a point from the horizontal axis with a point on the vertical axis and represents a geometrical area of points, each of which represents a different combination of the arguments of the function $\varphi(x)$, x_1 and x_2, their total value being equal to the constant b.

The aim with this model is to find the vector $x^* = (x_1^*, x_2^*)$, for which the function $\varphi(x_1, x_2)$ has a common point with the constraint and in this point it reaches its maximum value. We will prove that point A (x_1^*, x_2^*) in Figure 1, represented by the vector $x^* = (x_1^*, x_2^*)$, in which the curve is tangent to the constraint l, is a solution to the maximization problem.

For the purposes of our analysis we introduce the **value function** $v(a,b)$, which takes the following form:

$$v(a,b) = \max_{x \geq 0} \varphi(x) \quad \text{s.t. } \langle a, x \rangle \leq b \tag{1}$$

By using the first order condition, the solution to this problem is the vector $x^*(a,b)$ with coordinates $x^*_k = x^*_k(a, b)$, for $k = 1, 2, \ldots, n$.

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In the two-dimensional case, the vector $x^* = (x_1^*, x_2^*)$ defines the point of maximum and the function $x\ (a,\ b) = \begin{pmatrix} x_1(a,b) \\ x_2(a,b) \end{pmatrix}$ is a function that depends on the parameter a and the constraint $\langle a, x \rangle \leq b$ and determines the quantity from the fist and the second variable, which are x_1 and x_2, for obtaining a maximum value of $\varphi\ (x)$, i.e. is a solution to the problem.

As the value function $v\ (a,\ b)$ is monotonic with regard to b, then we can formulate the dual problem, i.e. for each level curve $\varphi(x) = y$ we can get the minimum value of $\langle a, x \rangle$, necessary for obtaining a certain level of y with a given parameter a.

For this purpose, we introduce the value function $g\ (a,\ y)$, which represents this relation and we formulate the problem for obtaining a minimum value of $\langle a, x \rangle$ under the constraint $\varphi(x) \geq y$, which takes the following form:

$$g(a, y) = \min_{x \geq 0} \langle a, x \rangle \qquad (2)$$
$$\text{s.t. } \varphi(x) \geq y$$

The function $h^*_k = h^*_k(a,\ y)$, for $k = 1, 2, \ldots, n$ is a solution to the problem. In the two-dimensional case the vector $h^* = (h_1^*, h_2^*)$ defines the point of minimum and the function $h\ (a,\ y) = \begin{pmatrix} h_1(a,y) \\ h_2(a,y) \end{pmatrix}$ is a function which depends on the parameter a and the value y of the function $\varphi\ (x)$ and determines the necessary quantity of the first and second variables, which are h_1^* and h_2^*, for obtaining a minimum value of $g(a,\ y)$, i.e. it is a solution to the problem.

The point of minimum coincides with the point of maximum, i.e. the solution to the two problems is one and the same vector. Hence, we can prove the following theorem:

Theorem 1

If the function $\varphi(x)$ is continuous and defined in a convex and compact set $x \in X$, characterized by local non-satiation, then the optimal vector x^*, which is a solution to the maximization problem for $\varphi(x)$ determines the optimal vector x^*, which is a solution to the minimization problem of $\langle a, x \rangle$. And vice versa, the optimal vector x^*, which is a solution to the problem for minimizing $\langle a, x \rangle$ determines the optimal vector x^*, which is a solution to the problem for maximizing $\varphi(x)$. This can be formulated with the following identities:

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$$v\,(a, b^*) = \max \varphi(x) = \varphi(x^*) = \varphi^*$$
$$\langle a, x \rangle \leq b^*$$

and

$$g\,(a, \varphi^*) = \min \langle a, x \rangle = \langle a, x^* \rangle = b^*$$
$$\varphi(x) \geq \varphi^*$$

Proof:

Let x^* be a vector for which the function $\varphi(x)$ has a maximum value and let $\varphi(x)=y$. We assume that there exists a vector x', at which the constraint b reaches its minimum value. Then, $\langle a, x' \rangle < \langle a, x^* \rangle$ and $\varphi(x') \geq y = \varphi(x^*)$. The local non-satiation property provides for the existence of a vector x'', close enough to x', i.e. for this vector the following inequalities are fulfilled:

$$\langle a, x'' \rangle < \langle a, x^* \rangle = b \tag{3}$$

and

$$\varphi(x'') > \varphi(x') > \varphi(x^*) \tag{4}$$

From (4) it follows that we can find a vector x'', in which the function $\varphi(x)$ has a greater value. This contradicts the assumption that x^* is a vector in which we have a minimum of the value of the constraint b.

The opposite is also true. Let x^* be a vector which minimizes $\langle a, x \rangle$. Then $\langle a, x \rangle = b > 0$. We will prove that x^* maximizes $\varphi(x)$. We assume that x^* is not a solution and let x' be the vector which maximizes $\varphi(x)$. Then $\varphi(x') > \varphi(x^*)$ and $\langle a, x' \rangle = b = \langle a, x^* \rangle$. As $\langle a, x^* \rangle > 0$ and $\varphi(x)$ is a continuous function, then there exists such a number $t \in [0, 1]$, that $\langle a, tx' \rangle = t\langle a, x' \rangle < \langle a, x^* \rangle = b$ and $\varphi(tx') > \varphi(x') > \varphi(x^*)$. Hence, we have obtained a new vector tx', at which the value of b is less and thus contradicts the assumption. Therefore, the vector x^* maximizes the function $\varphi(x)$. ♦

Based on the above theorem we derive the following identities:

$$g\,(a, v\,(a, b)) = b \text{ and } v\,(a, g(a, y)) = y \tag{5}$$

and

$$x(a, b) \equiv h\,(a, v(a, b)) \text{ and } h(a, y) \equiv x\,(a, g(a, y)) \tag{6}$$

From identity (5) and (6) and applying the chain rule we derive the following equation:

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$$\frac{\partial x_i(a^*,b^*)}{\partial a_j} = \frac{\partial h_i(a^*,y^*)}{\partial a_j} - x_j(a^*,b^*)\frac{\partial x_i(a^*,b^*)}{\partial b} \text{ for } i, j = 1, \ldots, n \quad (7)$$

In this equation, the derivative $\partial h_i / \partial a_j$ relates to substitution of the variables**,** which are arguments of the objective function, $x_j \times \partial x_i / \partial b$ expresses the effect of the constraint, and $\partial x_i / \partial a_j$ indicates the total effect when combining substitution and constraint. The substitution effect determines a line tangent to the curve of the function *φ(x)* and measures the impact on the h_i coordinate upon the increase in the a_j parameter in the problem for minimizing the value of *b*, and the effect of the constraint measures the impact on the x_i coordinate upon the increase in the value of the constraint in the problem for maximizing the value of the function *φ(x)*, multiplied by the x_j coordinate. The total effect $\partial x_i / \partial a_j$ determines the change of some variable, respectively ∂h_i or ∂x_i, against the change in a given parameter from the vector *a* which is found in the difference $\partial h_i / \partial a_j - x_j \times \partial x_i / \partial b$.

In the case when we have i=j, equation (7) takes the following form:

$$\frac{\partial x_j(a^*,b^*)}{\partial a_j} = \frac{\partial h_j(a^*,y^*)}{\partial a_j} - x_j(a^*,b^*)\frac{\partial x_j(a^*,b^*)}{\partial b} \quad (8)$$

From the properties of the function *h(a, y)* it follows that $\boldsymbol{\partial h_j/\partial a_j}$ has a negative sign and hence $\boldsymbol{\partial x_j/\partial a_j}$ also has a negative sign apart from the case when $\boldsymbol{\partial x_j/\partial b}$ has a negative sign, i.e. when the constraint effect is greater than the substitution effect.

Upon changes in the parameter Δa_i, for the change of the function *x* (*a*, *b*) we have:

$$\Delta x_i \equiv \frac{\partial x_i(a,b)}{\partial a_1}\Delta a_1 + \frac{\partial x_i(a,b)}{\partial a_2}\Delta a_2 + \ldots + \frac{\partial x_i(a,b)}{\partial a_n}\Delta a_n$$

Using equation (7) we obtain:

$$\partial x_i(a,b)\Delta a_j = \frac{\partial h_i(a,v(a,b))}{\partial a_j}\Delta a_j - \frac{\partial x_i(a,b)}{\partial a_j}\frac{x_j(a,b)}{\partial b}\Delta a_i \quad (9)$$

The value of the function *x*(*a*, *b*) changes with the change of the parameter that influences the constraint, which means that the optimal vector changes and moves to a higher level curve that defines a greater value of the function *φ(x)*, i.e. what we observe is the constraint effect.

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Depending on the changes in the value of the parameter *a* and the parameter *b,* the variables which comprise the optimal vector *x** can be classified as:

1. *normal variables* - variables for which at a fixed value of the parameter *a* the increase in the value of *b* leads to an increase in the value of the function *x (a, b),* i.e. $\frac{\partial x_j}{\partial b} > 0$. The value of the function *x(a, b)*, consisting of *normal* variables, decreases upon the increase in the value of the parameter *a*, and vice versa. Such variables we shall also refer to as *ordinary*.

2. In cases when upon the presence of two variables between which a choice is being made, with the increase in the constraint and at a fixed value of the parameter *a,* the value of one variable increases proportionately more than the value of the other variable, then we define the first variable as *luxurious* and the second variable as *necessary.* This result implies that the coefficient of proportionality for the necessary variable is less than the coefficient of proportionality for the luxurious variable.

3. However, if $\frac{\partial x_j}{\partial b} < 0$, then $\frac{\partial x_j}{\partial a_j}$ is determined by the negative substitution effect and the positive constraint effect. Hence, the derivative $\frac{\partial x_j}{\partial a_j}$ can be either positive or negative. If the constraint effect is greater than the substitution effect then:

$$\frac{\partial x_j}{\partial a_j} = \frac{\partial h_j}{\partial a_j} - \frac{\partial x_j}{\partial b} x_j(a,b) > 0,$$

which means that the value of the function *x (a, b)* for the variable *j* has increased with the increase in the value of the parameter *a* and $\frac{\partial x_j}{\partial a_j} > 0$.

Also the opposite is true – the value of *x (a, b)* for the variable *j* has decreased with the decrease in the value of the parameter *a.* This variable we can refer to as a *Giffen variable*. The Giffen variables are also *inferior variables* as for them it is true that $\frac{\partial x_j}{\partial b} < 0$, which means that with the increase in the constraint the value of *x (a, b)* also decreases.

4. If the constraint effect is less than the substitution effect then $\frac{\partial x_j}{\partial a_j} < 0$, which means that the variable is both *ordinary* and *inferior*. Inferior variable is that variable for which the value of the function *x(a, b)* decreases upon the increase in the value of the constraint *b*.

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5. Variables for which $\frac{\partial h_i}{\partial a_j} = \frac{\partial h_j}{\partial a_i} > 0$ are *substitutes,* and variables for which $\frac{\partial h_i}{\partial a_j} = \frac{\partial h_j}{\partial a_i} < 0$ are *complements*.

3. Applications of the model in the choice of labor supply

The dual problem and its solution have been discussed by Menezes and Wang (2005), who use the Slutsky equation in their analysis of the change in the optimal supply of labor under the conditions of wage uncertainty and risk. In their model $L, Y \geq 0$ are respectively the quantity of labor and income and they are arguments of the von Newman-Morgenstern utility function $u(L,Y)$, which is decreasing in L, increasing in Y, concave in (L, Y) and thrice continuously differentiable. The income of the consumer is defined with the equation: $Y = Y_0 + wL$, where Y_0 is his non-labor income and the price of labor w is a positive, random variable, or $w = \overline{w} + \beta z$. In this equation $\overline{w} = Ew$ is the expected wage rate, z is a neutral, random variable, and β is a positive vector, which can be used as a spreading risk parameter.

Menez and Wang provide another application of problem (1) when studying the maximization of the individual's labor supply function:

$$v(L, \overline{Y}, \beta) = \max_{0 \leq L \leq L_0} Eu(L, \overline{Y} + \beta z L) \quad (10)$$
$$\text{s.t. } Y = \overline{Y} + \beta z L$$

where $\overline{Y} = Y_0 + \overline{w}L$ is the expected level of income. The function $v(L, \overline{Y}, \beta)$, which they refer to as the „derived utility function' is the well-known indirect utility function.

Menezes and Wang further formulate the dual problem through the cost function:

$$I(\overline{w}, v^0, \beta) = \min_{0 \leq L \leq L_0} \overline{Y} - \overline{w}L \quad (11)$$
$$\text{s.t. } v(L, \overline{Y}, \beta) = v^o$$

The function $I(\overline{w}, v^0, \beta) \equiv \overline{Y}^C(\overline{w}, v^0, \beta) - \overline{w}L^C(\overline{w}, v^0, \beta)$ in their analysis is used to determine the minimum non-labor income, required for achieving expected utility level v^0.

Menezes and Wang claim that the supply of labor $L^U(\cdot)$ and the compensated supply $L^C(\cdot)$ coincide, when the non-labor income is represented with the equation $Y_0 = I(\overline{w}, v^0, \beta)$, which they determine with the identity $L^U(\overline{w}, I(\overline{w}, v^0, \beta), \beta) \equiv L^C(\overline{w}, v^0, \beta)$. The authors make this proposition solely on the

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basis of the solution of problems (10) and (11). In the context of our model, the proposed relation can be easily proven by applying Theorem 1 from Section 2.

Menezes and Wang further formulate the Slutsky equation:

$$\frac{\partial L^U(\cdot)}{\partial s} = \frac{\partial L^C(\cdot)}{\partial s} - \frac{\partial L^U(\cdot)}{\partial Y_0} \times \frac{\partial I(\cdot)}{\partial s} \tag{12}$$

where s is equal either to the parameter $\overline{w}$ or to β, $-\left[\partial L^U / \partial Y_0\right] \times \left[\partial I / \partial s\right]$ represents the income effect, $\partial L^C / \partial s$ is the substitution effect, and $\partial L^U / \partial s$ is the total effect. Considering the interaction of these two effects, Menezes and Wang (2005) prove that under conditions of wage uncertainty and risk, the income effect is positive (negative) depending on whether leisure is a normal (inferior) good. According to them, leisure is normal (inferior) good only when $\partial L^U / \partial Y_0 < 0 (> 0)$.

However, our model proves that the Slutsky equation can be applied in a more general analysis of the changes in the optimal labor choice. In the general analysis of changes in the optimal decision between labor and leisure, we can additionally extend the model of Menezes and Wang by applying the classification form Section 2. Thus, depending on the income and the substitution effects, leisure can be analyzed not only as *normal* or *inferior* good, but also as *ordinary, necessary, luxurious* or a *Giffen good*.

4. Influence of taxes on the optimal choice between labor and leisure

A standard Lindahl's optimization model will be analyzed, where there is an aggregate quantity of labor *L*, an aggregate quantity of leisure *d*, and *n* is the number of workers within a given community. It will further be assumed that labor income is constant and the community consists of equal income groups.

We shall apply problem (1) and thus formulate the utility maximization problem for the choice between leisure and labor, which takes the following form:

$$v(\tau, I) = \max_{L \geq 0, d \geq 0} u(L, d) \tag{13}$$
$$\text{s.t.} \quad \tau_1 L + \tau_2 d = I$$

where the objective function $u(L,d)$ is the utility function which represents the utility of the workers, L is the total aggregate quantity of labor, d is the total aggregate quantity of leisure, τ_2 is the value of leisure, τ_1 is the price of labor in the form of wages and salaries, and I is the total amount of the budget constraint or income. We assume that τ_2 is constant, i.e. we isolate any possible changes in the prices of the private goods found in the consumption bundle and also of those private goods which are outside it. Hence, the function $v(\tau, I)$ is the indirect utility function, which describes the preferences in the choice between labor and leisure. The solution to problem (23) is the Marshallean

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demand function $x^*(\tau, I)$, which describes the choice between private and local public goods.

Furthermore, by applying problem (2) we shall formulate the dual problem and continue the analysis by observing the expenditure minimization problem in the process of consumption of public and private goods, which takes the following form:

$$e(\tau,u) = \min_{L\geq 0, d\geq 0} \tau_1 L + \tau_2 d \quad \text{s.t.}\, u(L,d) \geq u \tag{14}$$

where the function $e(\tau,u)$ is the expenditure function. The solution to this problem is the Hicksian demand function $h^*(\tau,u)$, which represents the choice for public and private goods supplied in the community. By applying theorem 1 we derive the following equations:

$$v(\tau, I^*) = \max_{\tau_1 L+\tau_2 d\leq I^*} u(L,d) = u(L^*, d^*) = u^* \tag{15}$$

and

$$e(\tau, u^*) = \min_{u(L,d)\geq u^*} \tau_1 L + \tau_2 d = \tau_1 L^* + \tau_2 d^* = I^* \tag{16}$$

From (15) and (16), the following identities are valid:

$$e(\tau, v(\tau, I)) = I \text{ and } v(\tau, e(\tau, u)) = u \tag{17}$$

and

$$x(\tau, I) \equiv h(\tau, v(\tau, I)) \text{ and } h(\tau, u) \equiv x(\tau, e(\tau, u)) \tag{18}$$

If we fix the price for labor supply τ_1 as constant, then it is the value of the respective tax rates which influences the choice of a given individual within a community and determines the quantity of labor an leisure. The equilibrium theory suggests that with the increase in the value of taxes, labor becomes either inferior or a Giffen good and vice versa, with the decrease in the value the tax rates, leisure becomes Giffen or inferior good and labor either remains of the type before the change of the tax rate or it turns into normal and even in some cases luxury good.

The maximization problem takes the following form:

$$v\ (\psi, B) = \max_{L\geq 0, d\geq 0} u(L,d) \quad \text{s.t. } \psi_1 L + \psi_2 d = B \tag{19}$$

where the objective function $u(L,d)$ is the utility function, ψ_1 is the amount of taxes paid for labor supply and ψ_2 is the price of leisure, which is a constant variable, and B is the budget spent on the financing of taxes and leisure. Hence, the solution to problem (19)

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is the Marshallean demand function $x^*(\psi, B)$, which expresses the optimal choice of two types of goods.

We can now formulate the dual problem:

$$e(\psi,u) = \min_{L\geq 0, d\geq 0} \psi_1 L + \psi_2 d \qquad (20)$$
$$\text{s.t.} \quad u(L,d) \geq u$$

where the function $e(\psi,u)$ is the expenditure function and the solution is the Hicksian demand function $h^*(\psi,u)$, which is the vector of the choice between labor and leisure. Based on Theorem 1 and identities (5) and (6) it is obvious that $x^*(\psi,B) \equiv h^*(\psi,u)$.

Therefore, when $\psi_2 = 0$, the Slutsky equation (7) for model (19) takes the form:

$$\frac{\partial x_j(\psi,B)}{\partial \psi} = \frac{\partial x_j(\psi,B)}{\partial B} x_i(\psi,B) \qquad (21)$$

Depending on the decision of the government with regard to the amount of tax rates imposed on labor, as a good it can be classified as *normal* when the tax is equally distributed and hence the quantity of labor and leisure increases in the same proportion.

Then, from the Slutsky equation (7) and by applying the classification from the theoretical model in Section 2, labor and leisure can be classified as: *normal, ordinary, luxurious, inferior, Giffen goods, substitutes and complements.*

5. Conclusion

In this paper a theoretical optimization model was applied in order to analyse the choice between labor and leisure through the solution of a pair of problems – the maximization problem and the minimization problem. By introducing the dual problem and on the basis of our Theorem 1, it was proved that the solution to the maximization problem is also a solution to the minimization problem. In our theoretical model a universal equation was derived, similar to the familiar Slutsky equation from the consumption theory.

Further on, an application of the model in the choice of labor supply was commented, derived from existing economic literature, but the distinction that the Slutsky equation can be applied in a more general analysis of the changes in optimal labor choice was made clear. Our contribution to this application of the model is the claim that depending on the income and substitution effects, the arguments of the objective function (labor and leisure) can be classified using a general classification of the goods, i.e. they can be analyzed as *normal, ordinary, necessary, luxury, Giffen* or *inferior goods*.

To support these arguments, the influence of tax rates on the optimal choice between labor and leisure was analysed. Again, by applying the general theoretical

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model, it was demonstrated that both goods can be studied and classified following the classification from the theoretical model.

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International Journal of Economic Sciences and Applied Research 3 (2): 123-141

Responsiveness of Trade Flows to Changes in Exchange rate and Relative prices: Evidence from Nigeria

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Abstract

This paper examines the long-run and short-run impacts of exchange rate and price changes on trade flows in Nigeria using exports and imports functions. The bounds testing (ARDL) approach to cointegration is applied on a quarterly data from 1980Q1 to 2007Q4. The results indicate that in both the short-run and long-run Nigeria's trade flows are chiefly influenced by income- both domestic and foreign-, relative prices, nominal effective exchange rates and the stock of external reserves. The results also reveal that in the long-run, devaluation is more effective than relative prices in altering imports demand at both baseline and augmented models. The reverse is, however, the case for exports demand. Furthermore, the sum of the estimated price elasticities of export and import demand in Nigeria exceeds unity indicating that the Marshall-Lerner (ML) condition holds thus implying that a devalued naira might hold considerable promise as the panacea to rising trade deficits.

Keywords: Trade flows, Exchange rate, Relative prices, Autoregressive distributed lag

JEL classification: F13, F31, C32

1. Introduction

An increasingly integrated world economy has brought an admixture of both good and adverse consequences for developing countries. While international trade, especially in goods and services and capital, appears to have brightened prospects for economic growth and eventual development on the one hand, severe macroeconomic problems such as balance of payments disequilibrium, exchange rate misalignment and huge trade deficits seem to be counteracting factors on the other. From a theoretical standpoint,

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deficits resulting from trade with the rest of the world should be balanced by and equal (and opposite) amount of capital inflows. However, the global financial markets have tightened recently on account of the recession in the world economy. The foregoing coupled with the characteristic low level of financial sector in most developing countries suggests the existence of considerable difficulty in accessing the necessary offsetting capital flows when deficits arise. Hence, policymakers in these countries need to rely on the use of domestic policies- both commercial and devaluation- in order to manage the trade deficit and ensure some degree of balance within the economy.

Orcutt (1950) was the first to conjecture that trade flows of countries respond to relative price movements. This theoretical proposition, also pursued in Kreinin (1967), was however challenged by Houthakker and Magee (1969) on the grounds that the income effects neglected in the earlier studies could be equally as important[1]. Using a two-country model they showed that even with given production and prices, improvement or deterioration in the trade balance was driven largely by differences in income elasticities of their demand for imports (see, for example, Liu (1954), Junz and Rhomberg (1965), and Wilson and Takacs (1977) for further theoretical underpinnings on trade flows and relative price movement). Following this theoretical evolution, a large body of empirical literature has been developed in search of evidence on price and exchange rate impacts on trade flows among countries. These studies have used both the exchange rate and relative prices in order to investigate their combined or separate effects on trade flows.

Junz and Rhomberg (1973), in what is arguably the first empirical attempt, used data on trade flows, prices and exchange rates for thirteen industrial economies and concluded that trade flows respond in a similar fashion to changes in both prices and the exchange rate. Wilson and Takacs (1979), in contrast, employed data spanning 1957-1971 on a group of six industrial countries (Canada, France, Germany, Japan, United Kingdom and the U.S.A) in estimating export and import demand functions. They showed that trade flows were much more responsive to exchange rate variations than to price changes. Bahmani-Oskooee (1986) using data from 1971-1980[2] on a sample of seven developing countries arrives at a similar conclusion about trade flows. Although, unlike Wilson and Takacs (1979), his results show that import and export demand in these countries were more sensitive to relative prices than to exchange rate movements.

[1] In addition to this, the breakdown of the Bretton Woods system with the attendant emergence of floating exchange rate regimes altered thinking among professional economists as the possibility of reversals in the trade balance owing to foreign exchange fluctuations became an important factor in the analysis.

[2] It is noteworthy that the results from studies which used sample periods coinciding with the regime of fixed exchange rates should be interpreted with caution especially with respect to the estimated magnitude and speed of responses of trade flows to the two driving factors. See Bahmani-Oskooee (1986) and Tegene (1989) for further details on this issue.

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Recent developments in both time series econometrics and expanded computational possibilities have led to a re-examination of earlier findings in the empirical literature (see, for example, Bahmani-Oskooee and Niroomand, 1998; Tegene, 1991; Bahmani-Oskooee and Brooks, 1999). Along this line, Bahmani-Oskooee and Kara (2003) investigated trade flows in nine advanced economies using stationary data within a cointegration and error-correction modelling framework. The conclusion from their study that there appears to be differential impacts on trade flows of changes in both exchange rate and relative prices seems to reject Orcutt's original opinion. In a more recent companion paper, they obtain similar results using quarterly data on a sample of twelve developing countries over the periods of 1973 to 2002. They, therefore, concluded that 'it is clear that each country demonstrates different response path to changes in the relative prices and the exchange rate' (Bahmani-Oskooee, 2008).

The present paper, therefore, attempts to fill a gap in the empirical literature, on merchandise trade flows responsiveness to exchange rate and price changes, by providing evidence[3] specific to a developing country, Nigeria. The other innovative feature of this paper is that Nigeria-specific factors, such as the level of external reserves and internal upheavals which impact on import and export demand respectively and hence on trade flows, are explicitly modeled. We estimate relative price and exchange rate response patterns of trade flows using quarterly data over the 1980 -2007 period. The rest of the paper is organized as follows. Section 2 presents some stylized facts on the Nigerian economy as well as the trade models and the estimation procedure used. This is followed by the empirical results in section 3. Finally, a summary and conclusion of the study is presented in section 4.

2. Stylized Facts on Price, Exchange Rate and Trade Flows

Merchandise trade flows in Nigeria reflect the sequence of various policies employed over time. The problems of balance of payments in the 1960s prompted the application of trade policies in the 1970s. Consequently, as expected, volume of imports decreased due to increase in import prices, which was the outcome of high tariff rates on imported goods. Coupled with this was the use of administratively determined exchange rate to ensure cheap import of raw materials for local manufacturing industries; however, the problems persisted.

The unabated problems of balance of payments, the fall in price of crude oil and the attendant economic depression, herald the introduction of Structural Adjustment Programme (SAP) in 1986. As a result, trade and exchange rate policies were liberalized. Import restrictions were reduced and export prohibition abolished. Although, the tariff structure was modified in 1995, it nonetheless remained liberalized.

[3] Studies on specific countries in Sub-Saharan Africa are at best scant. Although, Adubi and Okunmadewa (1999) focused on the effect of price changes and exchange rate volatility on agricultural trade flows.

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Evidence shows that merchandise imports and exports fell considerably between 1980 and 1985. This was the period of economic recession and chronic balance of payments problems actuated by the oil price crash during the period. When the period prior to liberalization, 1980-1985, is compared to 1986-1991, the indicators of exchange rates decline over the period considered, indicating depreciation. In addition to that, the volumes of imports and exports have also increased. For example, data presented in Table 1 shows that the nominal effective exchange rate depreciated by about 81% while the exports and imports have increased by 536% and 284%, respectively for the same set of periods[4].

Table 1: Average Values and Change of some Selected Variables

PERIOD	***NEER***	***EX***	***IM***	***IMP***	***EXPR***	***CPI***
1980:1-1985:4	7846.24	10587763333	9.8E+09	452.77	128.23	2.21
1986:1-1991:4	1475.83	67362325000	3.77E+10	95.02	81.98	6.19
1992:1-1999:4	236.22	3.9838E+11	2.56E+11	87.82	100.37	57.30
2000:1-2007:2	78.68	4.06409E+12	1.77E+12	142.78	107.62	170.32
	Percentage change of selected variables (%)					
	NEER	*EX*	*IM*	*IMP*	*EXPR*	*CPI*
1980-1985:1986-1991	-81.19	536.23	284.71	-79.01	-36.07	179.80
1986-1991:1992-1999	-83.99	491.40	578.04	-7.58	22.44	824.38
1992-1999:2000-2007	-66.69	920.15	593.15	62.58	7.22	197.25

Source: Computed from IMF's IFS 2007 CD-ROM

It should be noted that the main driver of exports volume in Nigeria is the oil exports. The increase in oil prices leads to increase in its exports and accumulation of external reserve (see Figure 1). This in turn, increases the capacity of Nigeria's imports. Thus, an investigation of trade flows in Nigeria should consider the influence of the oil sector. The external reserve surged with the boom in international crude oil market, as clearly shown in Figure 1 and 2.

[4] Theoretically, exchange rate depreciation will lead to an increase in import prices, resulting into a fall in imports volume under the assumption that purchasing power parity. This is expected to correct the problems of balance of payments. However, the volume of trade flows has continued to increase in spite of the depreciation of exchange rate.

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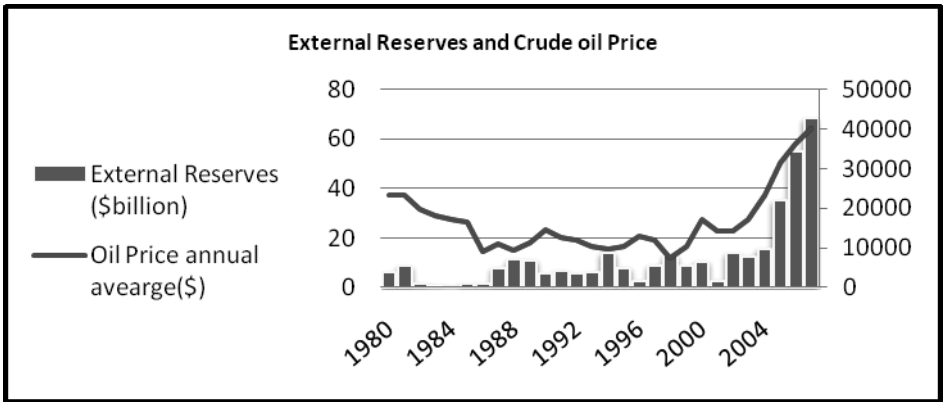
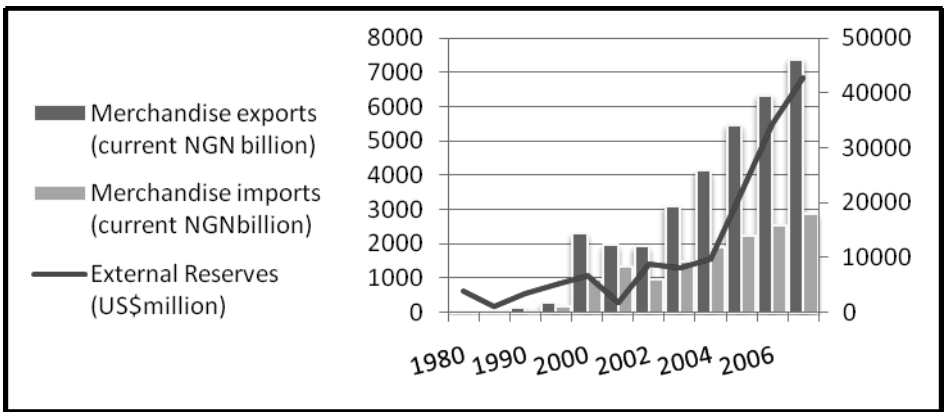
Figure 1: Nigeria External Reserve ($million) and Crude oil price ($US),1980-2007



Sources: (i) Central Bank of Nigeria Statistical Bulletin, Vol.18, 2007 issue.
(ii) http://www.nyse.tv/crude-oil-price-history.htm

Figure 2: Nigeria External Reserve ($million) and Trade Flows,1980-2007



Sources: (i) IMF's IFS 2007 CD-ROM
(ii) Central Bank of Nigeria Statistical Bulletin, Vol.18, 2007 issue.

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3. Methodology

3.1. Data Definition and Study Scope

With the aim of investigating the relative responsiveness of trade flows to changes in prices and exchange rate in Nigeria, this study employs the Nigerian quarterly which covers the period from 1980Q1 to 2007Q4. The variables employed in this study include the following: export, world income, domestic export price, world export price, nominal exchange rate (for export demand model); and import, domestic income, domestic price level, import price, nominal exchange rate and foreign reserves (for import demand model). All variables are sourced from International Financial Statistics[5] and expressed in their natural log form[6].

3.2. Model Specification

The export demand and import demand models employed in this study specifically represent the augmented version of Bahmani-Oskooee and Kara (2003). It should be recalled that the core of this study is to compare the benchmark models of both export and import demand with those of country specific using the case of Nigeria. This is, of course, not unconnected with the findings from different empirical studies on cross country analysis where the effects of changes in exchange rate and relative prices on trade flows in each country demonstrates different response path thus signaling the importance of country specific factors especially in the developing countries (see Bahmani-Oskooee and Kara, 2003; Bahmani-Oskooee and Kara, 2008). Therefore, the following country specific export demand and import demand models for the case of Nigeria are specified thus:

Export Demand Model

$$\ln ex_t = \alpha_0 + \alpha_1 \ln yw_t + \alpha_2 \ln\left[\frac{dep}{wep}\right]_t + \alpha_3 \ln ner_t + \alpha_4 dum + \mu_t \qquad (1)$$

$$\alpha_1 > 0; \alpha_2; < 0; \alpha_3 < 0; \alpha_4 < 0$$

where

ex_t = quarterly merchandise exports expressed in naira;

yw_t = index of world income;

$[dep/wep]_t$ = the relative price of domestic exports (*dep*) compared to that of the world (*wep*);

[5] See appendix for details on data definitions and measurement.

[6] The descriptive statistics for the variables employed in both models are presented in the appendix.

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ner_t = Nominal effective exchange rate;
dum = Dummy which represents the impact of domestic insurgency and conflicts especially in the oil producing regions in Nigeria. From 1980 to 1992, 0 is assigned to *dum* and from 1992 to 2007 we assigned 1[7]; and
u_t = Error term

Meanwhile, the impact of increase in the world income on Nigeria's export is hypothesized to be such that it induces exports. Therefore, an estimate of α_1 is expected to be positive. Again, given that an increase in the Nigeria's exports price relative to world price consequently leads to a decrease in the demand for Nigeria's exports. Thus, an estimate of α_2 is expected to be negative. It is also expected that an estimate of α_3 would be negative. The argument here is that with a fall in nominal effective exchange rate exports are anticipated to rise. Finally, the domestic conflicts in the oil producing regions in Nigeria are expected to be detrimental to oil production and therefore have a negative impact on oil export. Thus, an estimate of α_4 is expected to be negative.

Import demand Model

$$\ln im_t = \beta_0 + \beta_1 \ln yd_t + \beta_2 \ln\left[\frac{pm}{pd}\right]_t + \beta_3 \ln ner_t + \beta_4 \ln frs + \varepsilon_t$$
$$\beta_1 > 0; \beta_2; < 0; \beta_3 > 0; \beta_4 > 0 \qquad (2)$$

where
im_t = Quarterly merchandise imports expressed in naira;
yd_t = Quarterly domestic income expressed in naira;
$[pm/pd]_t$ = Relative prices of import (pm) compared to that of domestic goods (pd);
ner_t = Nominal effective exchange rate;
frs_t = Nigeria's foreign reserves; and
u_t = Error term

From the import demand model, the estimates of β_1, β_2, β_3 and β_4 are expected to be positive, negative, positive and positive respectively. In other words, while the propensity to import increases with increase in domestic income, relative price of import to domestic good, on the other hand, is expected to be negatively related to import demand. Furthermore, a decrease in nominal effective exchange rate dampens imports. Finally, the model postulates import demand as a positive function of foreign reserves.

Now, investigating the responsiveness of trade flows to changes in both relative price and nominal effective exchange rate entails thorough examination of dynamic adjustment nature of both export and import demand models specified above (Bahmani-Oskooee and Kara, 2008). Hence, this study shall employ the Unrestricted Error Correction Model (UECM) which follows the other of Autoregressive Distributed Lag

[7] The idea here is to capture the impact of domestic conflicts in the oil producing regions in Nigeria in our model.

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(ARDL) proposed by Pesaran et al. (2001). Pesaran et al. (2001), proposed a (ARDL) bounds testing approach to investigate the existence of cointegration relationship among variables. Compared to other cointegration procedures, such as Engle and Granger (1987) and Johansen and Juselius (1990), the bounds testing approach appears to have gained popularity in recent times due to the following reasons: Both long-and short run parameters of the specified model can be estimated simultaneously. Again, the approach is applicable irrespective of the order of integration whether the variables under consideration are purely I(0), purely I(1) or fractionally integrated.

ARDL Specification of Export Demand Model

$$\Delta \ln ex_t = \alpha_0 + \alpha_1 \ln ex_{t-1} + \alpha_2 \ln yw_{t-1} + \alpha_3 \ln\left[\frac{dep}{wep}\right]_{t-1} + \alpha_4 \ln ner_{t-1} + \alpha_{5i} dum$$
$$+ \sum_{i=1}^{p} \alpha_{6i} \Delta \ln ex_{t-i} + \sum_{i=1}^{q} \alpha_{7i} \Delta \ln yw_{t-i} + \sum_{i=1}^{r} \alpha_{8i} \Delta \ln\left[\frac{dep}{wep}\right]_{t-i} + \sum_{i=1}^{s} \alpha_{9i} \Delta \ln ner_{t-i} + \mu_t \quad (3)$$

ARDL Specification of Import Demand Model

$$\Delta \ln im_t = \beta_0 + \beta_1 \ln im_{t-1} + \beta_2 \ln yd_{t-1} + \beta_3 \ln\left[\frac{pm}{pd}\right]_{t-1} + \beta_4 \ln ner_{t-1}$$
$$+ \beta_5 \ln frs_{t-1} + \sum_{i=1}^{p} \beta_{6i} \Delta \ln im_{t-i} + \sum_{i=1}^{q} \beta_{7i} \Delta \ln yd_{t-i} + \sum_{i=1}^{r} \beta_{8i} \Delta \ln\left[\frac{pm}{pd}\right]_{t-i} \quad (4)$$
$$+ \sum_{i=1}^{s} \beta_{9i} \Delta \ln ner_{t-i} + \sum_{i=1}^{v} \beta_{10i} \Delta \ln frs_{t-1} + \varepsilon_t$$

The first step in the (ARDL) bounds testing procedures is to estimate equation (3) and (4) by Ordinary Least Square method and thus conduct an F-test for the joint significance of the coefficients of the lagged level of the variables with the aim of testing for the existence of long run relationship among the variables in both equations:
For equation (3):

Ho: $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$ against H_1: $\alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq 0$

For equation (4):

Ho: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$ against H_1: $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0$

Consequently, the computed F-statistic is then compared to the non-standard critical bounds values reported in Pesaran et al., (2001). If the computed F-statistic

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exceeds the critical upper bounds value, then the null hypothesis of no cointegration is rejected. If the computed F-statistic falls below the critical lower bounds value, then the null hypothesis of no cointegration is not rejected. But when the computed F-statistic falls between the critical lower and upper bounds values, then the knowledge of integration of the variables under consideration is required, or else, no conclusion can be reached about cointegration status.

4. Empirical Results

4.1. Unit Root Testing

Tables 2 and 3 present the results of Augmented Dickey Fuller and Phillip Perron unit root tests for both export demand and import demand models[8]. As indicated in both tables, almost all variables under consideration appear to be of I(1) variables. This is evidenced in their respective probability values. The maximum order of integration of the variables under consideration in both tables appear to be I(1). The result therefore, implies that the bounds testing approach is applicable in this study since none of the variables are integrated of higher order of stationarity than I(1).

Table 2: Unit Root Tests for Export Variables

	Augmented Dickey Fuller				**Phillip Perron**			
	With Constant		With Constant & Trend		With Constant		With Constant & Trend	
Variable	Level Prob.	FD Prob.	Level Prob.	FD Prob.	Level Prob.	FD Prob.	Level Prob.	FD Prob.
Exports	0.9661	0.0000	0.0274	0.0000	0.9506	0.0000	0.0545	0.0000
World Income	0.7995	0.0000	0.0803	0.0000	0.7735	0.0000	0.1465	0.0000
Relative Price	0.0132	0.0000	0.0529	0.0004	0.0292	0.0001	0.1276	0.0009
Exchange Rate	0.7313	0.0000	0.8365	0.0000	0.7499	0.0000	0.8724	0.0000

Note: FD signifies First Difference.

[8] The essence of testing for the stationarity properties of the variables under consideration is because the (ARDL) bounds testing approach to cointegration as proposed by Pesaran et al (2001) becomes applicable only in the presence of a I(0) or I(1) variables. Thus, the assumption of bounds testing will collapse in the presence of I(2) variables.

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Table 3: Unit Root Tests for Import Variables

	Augmented Dickey Fuller				Phillip Perron			
	With Constant		With Constant & Trend		With Constant		With Constant & Trend	
Variable	Level Prob.	FD Prob.	Level Prob.	FD Prob.	Level Prob.	FD Prob.	Level Prob.	FD Prob.
Imports	0.9616	0.0007	0.0628	0.0041	0.8983	0.0000	0.3702	0.0000
Domestic Income	0.9487	0.0133	0.6050	0.0121	0.9992	0.0001	0.0009	0.0006
Relative Price	0.8883	0.0000	0.2033	0.0000	0.9318	0.0000	0.4116	0.0000
Exchange Rate	0.7313	0.0000	0.8365	0.0000	0.7499	0.0000	0.8724	0.0000
Foreign Reserves	0.6667	0.0000	0.0446	0.0000	0.0354	0.0000	0.0824	0.0000

Note: FD signifies first difference

Table 4 depicts the results of the cointegration status of the models employed in this study. The results show that there are long run relationships in the models. For instance, both benchmark and augmented export models exhibit long run relationship when the vectors of variables are normalized on exports. A similar outcome is obtained in both import models. As clearly elucidated in Table 5, the long-run merchandise exports from Nigeria are largely driven by expansion or contraction in economic activity in trading partners. This view is supported by our finding that an increase of one percent in foreign income should lead to about 2 percent increase in Nigeria's exports to the rest of the world[9]. The results from both models- benchmark and augmented- are quantitatively and qualitatively similar. The nominal effective exchange rate (*neer*) carries the expected negative sign in both models. In theory, devaluation/depreciation of exchange rates is expected to result in a surge in export demand. The export elasticities of *neer* are -1.08 and -1.19 in the benchmark and augmented models, respectively. The policy implication here is that with a 10 percent depreciation in naira, exports in both models increase by about 10 and 12 percent respectively. This is as a result of the fact that with depreciation in naira, domestic export becomes relatively cheaper compared with world export leading to increased demand for Nigeria's exports.

[9] This is much in line with the findings of Agolli (2004) and Vika (2006) in the case of Albania, though their estimates of elasticity are in the 6-7 percent range.

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Table 4: Cointegration Test

Equation	F-Calculated	Lower Bound I(0)	Upper Bound I(1)	Outcome
Export	6.22	3.23	4.35	Cointegrated
Import (benchmark)	5.04	3.23	4.35	Cointegrated
Import (Augmented)	3.53	2.45	3.52	Cointegrated

Note: The asymptotic critical value bounds for both export and import models are obtained from Table C1 (iii) case III: Unrestricted intercept and no trend (Pesaran *et al*., 2001). For k = 3 and 4 (in the augmented import model) lower bound I(0) = 3.23 and upper bound I(1) = 4.35 at 5% significance level, while lower bound I(0) = 2.45 and upper bound I(1) = 3.52 at 10% significance level (for k =4). The lag structure was selected based on the Akaike Information Criterion; * Denotes the rejection of the null hypothesis at 1 (5%) significance level

Table 5: Long run Export Demand Model

	Benchmark Model			Country Augmented model		
Variables	**Coefficient**	**t-Statistic**	**Prob. Value**	**Coefficient**	**t-Statistic**	**Prob. Value**
lnyw	2.085813	3.169458	0.0020*	1.925479	2.889880	0.0047*
ln[dep/wep]	1.168849	5.356905	0.0000*	1.271752	5.520905	0.0000*
lnneer	-1.081470	-15.01823	0.0000*	-1.186380	-11.21629	0.0000*
dum	-------	-------	-------	-0.331054	-1.349717	0.1800
constant	23.47035	7.027008	0.0000*	25.02667	7.106792	0.0000*

Note: * represents 1 percent level of significance

However, against the received wisdom which posits that a rise in domestic export price relative to world export price should discourage exports, Nigeria's export price relative to world export price has a positive effect on exports. The result here seems counterintuitive. This stems from the fact that Nigeria's major export item is oil. Favourable price realisations in the global oil markets, ceteris paribus, should culminate in higher exports from Nigeria. Hence, Nigeria's export is seen to be quite elastic to relative price movements as revealed by elasticity estimates of 1.17 and 1.27 in our benchmark and augmented export models (see Table 5). These estimates comport with the 1.12 reported for Korea in Bahmani-Oskooee and Kara (2008). It is interesting to note that although our dummy for domestic conflicts in the augmented long-run model appears

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insignificant at the conventional levels, but has the expected negative sign. This implies that internal frictions[10] have a dampening effect on exports.

The short-run dynamics of the export demand models for Nigeria is presented in Table 6. Our results show that both the domestic conflicts dummy and the lagged relative export price are significant. Hence, internal upheavals seem to have a muffled effect on export in the short run. The estimate of exports price relative to world export price has the expected negative sign in the short-run. A 10 percent increase in the relative price results in about 7.3 and 7.1 percent reduction in exports in the benchmark and country augmented models in that order. The sign of the coefficient of the nominal effective exchange rate is the same as in the long-run models but the magnitude of the short-run coefficients are one-fifths lower, in absolute values, than the long-run estimates across models.

The error correction terms in both export models are negative and highly significant. This further strengthens the cointegration results obtained from the prior bounds testing (ARDL) procedure. Theoretically, the estimated coefficient of the error correction term should lie within an interval of zero and one. Thus, the larger the magnitude of this coefficient is, the faster the speed of adjustment toward the long-run equilibrium. In our models, any deviations from the static equilibrium are corrected at a rate of about 10 percent in each quarter.

Table 6: Parsimonious Export Demand Error Correction Model

	Benchmark Model			**Country Augmented model**		
Variables	**Coefficient**	**t-Statistic**	**Prob. Value**	**Coefficient**	**t-Statistic**	**Prob. Value**
Δln[ex(-1)]	0.230444	2.538837	0.0126	0.225275	2.497338	0.0141
Δln[dep/wep]	-0.735650	-2.384610	0.0189	-0.713092	-2.317840	0.0224
Δln[dep/wep(-1)]	0.412596	1.335338	0.1847	0.394005	1.278676	0.2039
Δln[neer]	-0.276308	-1.850233	0.0671***	-0.276099	-1.857209	0.0661***
dum	-------	-------	-------	-0.2011	-1.298173	0.23011
ecm(-1)	-0.096411	-2.726752	0.0075*	-0.102730	-2.903882	0.0045*
constant	0.030424	1.515940	0.1326	0.030679	1.535883	0.1276

Note*:* *(***) represents 1(10) percent level of significance respectively

[10] The crisis in the country's Niger Delta region with its attendant oil and gas production disruptions as well as civil unrests following the annulment of the June 12, 1993 presidential elections, in our view, are key among other factors that have precipitated internal chaos in Nigeria.

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Table 7: Long run Import Demand Model

	Benchmark Model			Country Augmented model		
Variables	**Coefficient**	**t-Statistic**	**Prob. Value**	**Coefficient**	**t-Statistic**	**Prob. Value**
yd	3.735911	11.43417	0.0000*	3.826748	7.353784	0.0000*
[pm/pd]	0.333477	3.535468	0.0006*	0.3156633	3.471611	0.0008*
neer	-0.929012	-6.784788	0.0000*	-0.884118	-6.853680	0.0000*
frs	-------	-------	-------	-0.286678	1.717724	0.0888***
frs(-1)	-------	--------	-------	0.308991	1.85566	0.0663***
constant	-65.48910	-7.372926	0.0000*	-68.24145	-5.105837	0.0000*

Note*:* * (***) represents 1 (10) percent level of significance.

In a similar fashion, Table 7 presents results of the long-run import demand models. Our elasticity estimates indicate that in the long-run the major determinants of Nigeria's import demand are domestic income, import price relative to domestic price level, the nominal effective exchange rate and foreign reserves. It is also pertinent to note that, in our augmented model, both foreign reserves and its one-period lag are significant at the conventional levels. An increase of 10 percent in real domestic income leads to a rise of about 38 percent in Nigeria's demand for foreign goods. This seems to be obvious on account of the important contribution of imports to offsetting domestic shortage of consumer durables as well as provision of inputs into production processes.

Table 8: Parsimonious Import Demand Error Correction Model

	Benchmark Model			Country Augmented model		
Variables	**Coefficient**	**t-Statistic**	**Prob. Value**	**Coefficient**	**t-Statistic**	**Prob. Value**
Δln[im(-1)]	0.293385	3.397198	0.0010*	0.327240	3.860055	0.0002*
Δln[yd]	0.794067	0.896212	0.3723	0.944616	1.220970	0.2249
Δln[pm/pd]	0.118866	1.134718	0.2592	0.138046	1.355144	0.1784
Δln[pm/pd(-3)]	0.178349	1.848182	0.0675***	0.192033	1.150352	0.2271
Δln[neer]	-0.389061	-3.863312	0.0002*	-0.349938	-3.583399	0.0005*
Δln[frs]	-------	-------	-------	-0.128542	-2.257945	0.0261**
ecm(-1)	-0.112640	-3.052779	0.0029*	-0.122900	-3.565835	0.0006*
constant	0.032348	1.999402	0.0483**	0.029606	2.012055	0.0469**

Note: *, ** and *** represent 1, 5 and 10 percent level of significance, respectively.

Digging further, Tables 7 and 8 show that import demand is inelastic to relative prices in both the long-run and the short-run. This pattern is repeated in the augmented

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model as evident from the elasticity values of 0.32 and 0.13 in the long- and short-run respectively[11]. This appears to be a reflection of low substitutability between domestically produced goods and imported ones. Much of consumer goods and productive inputs are imported owing to marked declines in manufacturing capacity utilization in Nigeria. Thus, even with a decline in local prices the demand for imports falls disproportionately as most imported goods do not have competitive domestic substitutes.

Effective exchange rate variations are found to have significant effect on Nigeria's demand for foreign goods. This elasticity is close to unity in both long-run models. A one-for-one response of import demand to the nominal effective exchange rate is, however, not supported by our models in the short-run. Thus, policymakers in Nigeria may have to consider exchange rate policies as a long-run fix to the problem of growth in foreign goods demand. In the short-run, imports will be indispensable in the Nigerian economy, against the background of genuine developmental needs. This creates a crucial role for alternative demand management policies of which fiscal and monetary policies have a pivotal role.

The results in Table 7 show that, in the long-run, the foreign reserves have a significant and a positive net impact on Nigeria's import demand. The short-run results in Table 8 reveal that foreign reserves are also significant in explaining Nigeria's import demand pattern although the elasticity, in absolute terms, is about one-half of the long-run coefficients. Also, the error correction term conforms to expectations as regard sign and significance. The magnitude of 0.12, in the augmented model, implies that following a divergence from equilibrium, nearly 12 percent of adjustment takes place in the current period[12]. In sum, merchandise import volume in Nigeria is related to domestic income, movements in relative consumer prices, foreign reserves, exchange rate fluctuations as well as corrections to disequilibrium.

We now turn to the Marshall-Lerner (ML) condition which states that currency devaluations can be effective if the sum of long-run price elasticities of import and export demand exceed unity in absolute value provided that the trade balance -which is assumed to be equal the current account balance- is zero initially. The results show that the corresponding trade flows price elasticities for Nigeria are 0.33 and 1.17, respectively. The sum is evidently greater than 1. The augmented model also supports the ML condition for Nigeria with an elasticity sum of about 1.60. This, from a policy perspective, could be a pointer to the effectiveness of naira devaluation as a tool for addressing problems of external trade deficits.

Having estimated the elasticity coefficients for export demand and import demand, this study proceeds to investigating the econometric reliability of these estimates by employing batteries of diagnostic statistics with the overall aim of making this study more

[11] The coefficient of relative import price is however insignificant in the short-run although its third period (in quarters) lag is correctly signed and statistically significant with coefficients of 0.17 and 0.19 in both parsimonious models in Table 8.

[12] This is in sharp contrast to the findings of Bahmani-Oskooee and Kara (2008). They reported estimates of 0.54, 0.55,0.61, and 0.76 for Isreal, Phillipines,Turkey, and Pakistan, respectively.

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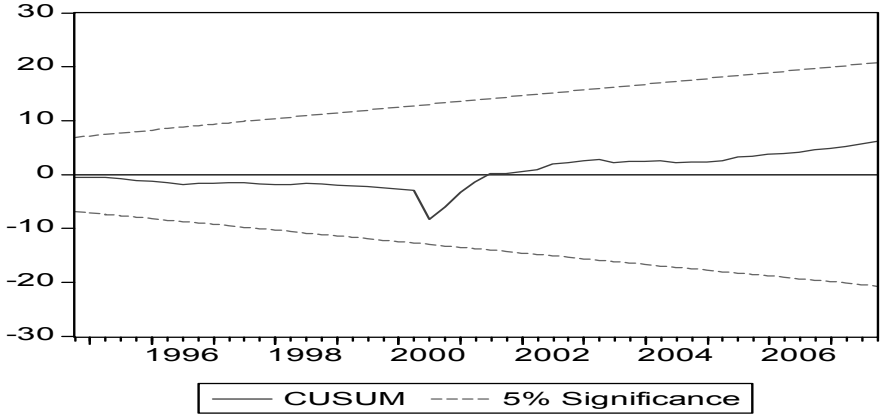
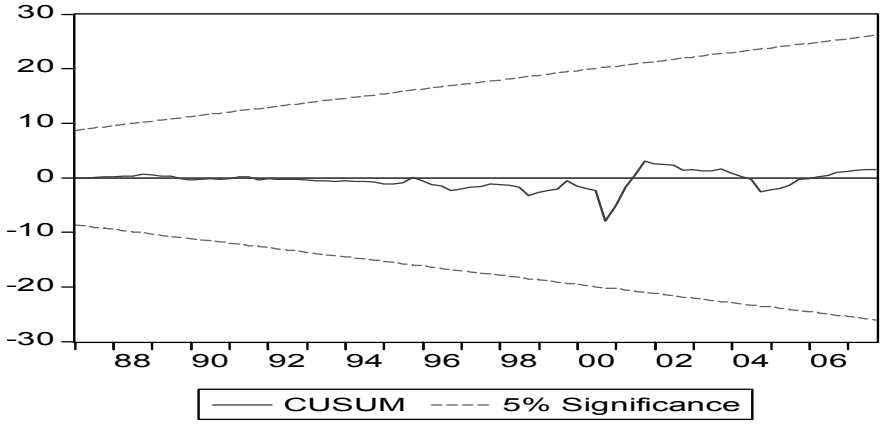
robust. As portrayed in Table 11, the following tests are conducted on both models: Residual normality, ARCH (LM) and White heteroscedasticity. Though the condition of normal distribution of residuals in export demand and import demand models appear not to be satisfied, however, both models pass the ARCH (LM) and white heteroscedasticity tests.

Graph 1 and Graph 2 depict the cumulative test which is based on the cumulative sum of the recursive residuals. The essence of this test is to find the parameter stability or consistency in both the export demand and import demand equations. The straight lines in the graphs represent critical bounds at 5% significance level. As evident from the graphs, it can be affirmed that the parameter estimates from both equations (export demand and import demand) display patterns of overall stability during the period covered.

Graph 1: Plot of Cumulative Sum of Recursive Residuals for the Export Equation



Graph 2: Plot of Cumulative Sum of Recursive Residuals for the Import Equation



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5. Conclusion and Summary

Most of the previous studies that examined the responsiveness of trade flows to changes in income, relative prices and the exchange rate have used non-stationary data (Bahmani-Oskooee and Kara, 2008) and have delved more into the cross-sectional dimensions of the issue. This paper fills the lacunae not only by providing evidence specific to Nigeria but also by augmenting the now standard model formulations in the literature via the inclusion of a dummy capturing the influence of domestic upheavals and the level of foreign reserves in the export and import demand models respectively. We find that in both the short- and long-run Nigeria's trade flows are chiefly influenced by income- both domestic and foreign-, relative prices, nominal effective exchange rates and the stock of external reserves. The results also reveal that in the long-run, devaluation is more effective than relative prices in altering imports demand at both baseline and augmented models. The reverse is however the case for export supply function. Augmenting the benchmark model, albeit interesting, did not change in any significant way the conclusions arising from our result. This goes to further buttress the need, expressed by Bahmani-Oskooee and Kara (2003; 2008), for an in-depth analysis of the responsiveness of trade flows to its key determinants on a country specific basis. Furthermore, the sum of the estimated price elasticities of export and import demand in Nigeria exceeds unity indicating that the ML condition holds thus implying that a devalued naira might hold considerable promise as the panacea to rising trade deficits.

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Appendix

Table 9: Export Demand Model-Variables Descriptive Statistics

	Export	Foreign Income	Relative Prices	Exchange Rate
Mean	26.04331	4.466880	-0.030717	6.202868
Median	26.10113	4.535600	-0.090371	5.736518
Maximum	29.68023	4.741901	0.902397	9.102079
Minimum	22.74714	3.938275	-0.540321	4.180522
Std. Dev.	2.252057	0.204170	0.288450	1.765019
Skewness	0.065658	-0.814900	1.311553	0.523902
Kurtosis	1.713012	2.656017	4.992025	1.815170
Jarque-Bera	7.810054	12.94801	50.62796	11.67468
Probability	0.020140	0.001543	0.000000	0.002917
Sum	2916.851	500.2906	-3.440252	694.7213
Sum Sq. Dev.	562.9653	4.627064	9.235586	345.7974
Observations	112	112	112	112

Table 10: Import Demand Model-Variables Descriptive Statistics

	Import	Domestic Income	Relative Price	Exchange Rate	Foreign Reserves
Mean	25.57286	25.75008	1.872713	6.202868	8.257291
Median	25.70328	25.75379	0.990425	5.736518	8.340845
Maximum	28.72159	26.35078	5.737651	9.102079	10.60357
Minimum	22.48730	25.29559	-0.569764	4.180522	6.241876
Std. Dev.	2.021629	0.289485	2.150181	1.765019	1.163757
Skewness	0.065333	0.253288	0.647392	0.523902	0.308949
Kurtosis	1.612350	2.119876	1.921212	1.815170	2.070638
Jarque-Bera	9.065678	4.812439	13.25451	11.67468	5.812392
Probability	0.010750	0.090155	0.001324	0.002917	0.054683
Sum	2864.160	2884.009	209.7439	694.7213	924.8166
Sum Sq.Dev.	453.6554	9.301980	513.1840	345.7974	150.3306
Observations	112	112	112	112	112

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Diagnostic tests

Table 11: Diagnostic Statistics Report

	EXPORT MODEL	IMPORT MODEL
Adj. R^2	0.93	0.96
F-Statistics	527 (0.0000)	794.66 (0.000)
Normality Test [χ^2_N]	9.1255(0.00)	12.88 (0.000)
ARCH (LM) [χ^2_{ARCH}]	1.39466 (0.15431)	1.170 (0.3193)
White Hetero. Test [χ^2_H]	2.375 (0.10769)	0.4619 (0.9893)

Table 12: Variable Definitions

Variables	Definition
Export	Merchandise export measured in local currency unit.
Export Price	Export quantum/quantity index (2000 = 100)
Import	Merchandise import measured in local currency unit
Import Price	Import quantum/quantity index (2000 = 100)
World Export Price	World export price index (2000 = 100)
Domestic Price	Consumer price index (2000 = 100)
World Income	Industrial production index from industrial countries (2000 =100)
Domestic Income	Real gross domestic product in local currency unit
Exchange Rates	Nominal effective exchange rate index (2000 = 100)
Foreign Reserves	Foreign reserves excluding gold
Dummy	Dummy which represents the impact of domestic conflicts especially in the oil producing regions in Nigeria. From 1980 to 1992, 0 is assigned to *dum* and from 1992 to 2007 we assigned 1.

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