Exchange Rate Volatility's Effect on Algeria and its Major Trading Partners' Trade

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Abstract

The following study investigates the effects of exchange rate movements on trade performance in Algeria and its major trading partners between 1981 and 2012 on quarterly basis. To operate our research, we employed the aggregate and disaggregate models. Whereas the aggregate model aims to identify the effects of the real exchange rate, the Algerian economic growth GDP, the economic growth of Algeria's major trading partners and the exchange rate volatility on Algeria's export, import and trade balance, the disaggregate model seeks to analyse the effect between Algeria and each of its major trading partners. The results which come out from the aggregate model reveal that the real exchange rate changes has a large influence over export and import in contrast with the income growth changes and exchange rate volatilities, which have less influence. The findings of trade balance model show that only the exchange rate and the domestic income growth have significant impacts on Algeria's trade balance in the short-run. On the other hand, the disaggregate model results indicate that all the considered variables have less influence over trade volume with most partners in determining bilateral exports and imports. The results that may come out from our analysis prove that the movements of exchange rate has a little effect on the bilateral trade balance of Algeria as well as bilateral export, import   between the country each of its main trading partners.

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1   Introduction

Many researchers and scholars from a wide range of nationalities have been increasingly interested in the relationship between exchange rate movements and their influence on trade performance. This topic is currently one of the 'crucial topics' in the field of trade and finance. However, the focus of the existing studies on the developed countries and the lack of consensus among researchers about the impact of exchange rate volatility on the growth of international trade performance raise the question of whether or not the already found results could be applied to the developing countries such as Algeria.

It is worth noting that Algeria –among a large number of developing countries has witnessed a rapid economic growth in the recent decades; there is almost certainly more adopted short and long term plans for further development than many other developing countries. Still, very few studies have investigated the exchange rate volatility impacts on Algeria's trade performance, which makes further academic inquiry into this area necessary.

2   Literature Review

With the increase in research on trade performance, many empirical studies whose interests extend to this field have examined the relationship between exchange rate movements and trade performance. In the last decades, hundreds of research papers have considered the impact of exchange rate movement on trade flows from different perspectives. A review of analyses has shown that several approaches have been adopted and different results have been yielded. In their studies on trade balance, Isaac Bentum-Ennin (2008) and Bahmani-Oskooee (2001) established linkage between real depreciation and trade balance, their results support the existence of favorable long-term effects of real depreciation on trade balance. In an investigation on 46 middle income and emerging market countries between 1980 and 2005, Mark (2006) provided evidence that any country's trade balance depends significantly on the market structure of its exports. Conversely, the results obtained from Bahmani- Oskooee and Kovyaryalova's (2008) and Bahmani-Oskooe and Mitra's (2008) studies proved to be conflicting, their analyses of the impact of exchange rate uncertainty on trade flows with reference to commodity trade between two countries show that exchange rate uncertainty has rather more short-run effects than long-run effects.

According to the investigation conducted by Akhter and Hilton (1984) on the relationship between the exchange rate movement and bilateral trade, the exchange rate volatility has a negative impact on bilateral trade between West Germany and the United States. However, Gotur (1985) disapproved Akhter and Hilton's (1984) findings after he improved the sample period and the measures of exchange rate risks, which made his research compatible with the 1984 IMF study. The influence of exchange rate volatility on the real imports of the United Kingdom from Canada, Japan and New Zealand during the period lasting from 1980 to 2003 was examined by Choudhry (2008). His analysis indicates a significant effect of the exchange rate volatility on the real imports.

In contrast, several full-length studies proved the negative relationship between international trade and exchange rate volatility. For example, Olimov and Sirajiddinov (2008) found that exchange rate volatility has a negative impact on both the trade outflows and inflows of Uzbekistan. Similarly, the studies of Gagnon (1993), Chowdhury

(1993), Arize (1995, 1998) and Arize et al (2000) demonstrate that exchange rate volatility leads to a reduction in international trade flows. In another study conducted on four East Asian countries (Hong Kong, South Korea, Singapore, and Thailand) Baak, Mahmood, and Vixathep (2002) inferred that exchange rate volatility has negative impacts on exports in both the short and long-term Periods.

Further analyses, which have explored the relationship between the exchange rate and trade performance indicate a positive influence of exchange rate on international trade. Sercu and Vanhulle (1992) Sercu and Uppal (2003), Franke (1991), Viaene and deVries (1992), McKenzie and Brooks (1997), Doyle (2001), and Choudhry (2005) provided arguments that variability in an exchange rate can stimulate bilateral trade. By employing both theoretical and empirical models, they showed that trade might benefit from exchange rate volatility

From the above description and discussion of the existing literature on the issue of the relationship between exchange rate and trade performance, it is safe to argue that there is a non-determined relationship between international trade and the volatility exchange rate. Moreover, seldom have efforts been made to draw a linkage between exchange rate and trade performance in the developing countries .In this research paper, we shall try to avoid the pitfalls of previous studies on this issue by emphasizing the connectedness of Algeria's trade performance with exchange rate volatility, bilateral real exchange rate and the change in the country's income growth and that of its major trading partners.

3   The Evaluation of Algeria's Exchange Rate Behaviour

From 1974 to 1994, Algeria had a fixed exchange rate system that was determined by pegging the Algerian Dinar (DZD) to a basket of currencies, adjusted from time to time. Starting from 1994, in order to ensure the stability of the real effective exchange rate (REER), the Bank of Algeria adopted a managed floating exchange rate system of the Dinar against the currencies of the country's major trading partners, through daily fixing sessions that included six commercial banks. The adoption of a managed floating exchange rate system, however, had some effects; it had caused an account surplus and a gradual devaluation of the Dinar against its major trading currencies. The gradual exchange rate movements of the Algerian Dinar against the currencies of the country's major trading partners is shown in Appendix A, it depicts some volatility from 1981 to 1990. During the period lasting from 1991 to 2012, the Algerian authorities maintained a policy that resulted in a trend of depreciation in the DZD exchange rate. This depreciation policy was accompanied by a recovery of hydrocarbon prices and an increase in public expenditure. However, In spite of the Dinar depreciation, still some appreciation was recorded within the last two decades.

On December 12, 2012, the average buying and selling rates of the U.S. dollar was US$1=DZD78.21, equivalent to SDR1=DZD120.15. To sum up, the trend of depreciation in exchange rate led to significant changes in terms of trade regulations, the inflation differentials with trading partners and the increase of productivity gap vis-a-vis the trading partners.

4   Algeria's Trade Flows and the Country's Major Trading Partners

Due to its economic growth, Algeria succeeded to reserve a seat as a member of the United Nations, African Union and OPEC (Organization of Petroleum Exporting Countries). The fact that the country has the seventh-largest reserves of natural gas, the fourth-largest exports of natural gas, and the tenth-largest oil exports in the world reveals that the Algerian economy is largely dependent on the hydrocarbon sector and explains why the country's trade balance is frequently positive. To put that in numbers, in 2007, Algeria had an export product concentration ratio of 60.6 and a positive trade surplus, which was mainly due to Hydrocarbons, which formed 98% of total exports. As a result, from 1992 to 2012, Algeria's Trade Balance averaged US$6.57 billion, reaching an all-time high of US$34.06 billion in December 2006 and a record low of -US$2.34 Billion in June of 2009. In 2012, the country's imports totalled US$46.80 billion against US$47.24 billion in 2011, in front of the exports, which hit US$73.98 billion (2.96%of which were non-oil exports US$2.18 billion) against US$73.48 billion in 2011 and consequently the trade balance recorded a surplus of US$27.18 billion against US$26.24 in 2011 due to the increase in the oil prices and the slight decrease in the imports of consumer non-food materials. Concerning Algeria's main export partners in 2012, the United States comes first with (US$11.94bn), followed by Italy (US$11.67bn), Spain (US$7.57bn), France (US$6.60bn) and Canada (US$5.48bn), as for the country's main suppliers, France is ranked first with over US$6bn, then China (US$5.88bn), Italy (US$4.34bn), Spain (US$4.09bn) and Germany (US$2.57bn). (See Appendix B)

Algeria has a strong trading relationship with the United States. With a trade volume, going from US$3.3billion in 2002 to over US$22billion in 2008, Algeria is considered as the U.S' biggest trading partner in North Africa and its second-biggest trading partner in Africa and the Arabic world as a whole. Algeria also enjoys a good reciprocal trading relationship with the European Union, while the country is   ranked as the European Union's third largest energy supplier in 2011 with a value of US $ 36.18 billion, the European Union absorbs almost half of Algerian international trade. Its exports to Algeria are mostly machinery stuff, telecommunication equipment, agricultural products, iron, steel and chemicals. Algeria's main trading partners in the EU are France, Germany, Italy, UK, Spain and Netherlands.   Apart from the European Union and the United States, Algeria is a trading partner of Canada and Japan. In 2007, the Algerian exports to Canada reached US$5.1billion, while the Algerian imports from Canada did not pass US$505million.

5   Empirical Analysis

5.1 Methodology

Algeria's dependence on hydrocarbons in its exports, the high volumes of its imports and its managed floating exchange rate system are issues too tempting to conduct an empirical study which investigates the effects of exchange rate movements on bilateral trade flows between Algeria and its top 8 trading partners (Canada, France, Germany, Italy, Japan, Nether land, Spain, USA). It is also our intention in this paper to explore whether or not the exchange rate volatility have any significant impact on bilateral trade balance. To implement our analysis, we based our study on the aggregate and disaggregate trade data

between Algeria and its major trading partners by employing a panel regression model and in order to determine the order of integration, we used Augmented Dickey Fuller (ADF) test with and without trend.

Based on aggregate trade data for both export and import functions between Algeria and its major trading partners, we built the bellow regression model to examine the impact of exchange rate movements

$$\Delta TR_{t,\,i} = \beta_1 + \beta_2 \,\Delta RE_{t-1} + \beta_3 \,\Delta Y_t + \beta_4 \,Vol_t + \varepsilon_t \qquad (5.1)$$

Export	(+)	(+)	(-)
Import	(-)	(+)	(-)

Each of the variables in the above equation has its equivalent. Whereas ΔTR is the quarterly change in Algeria's aggregate export/import, ΔRE is the quarterly change of Algeria's real exchange rate; it depicts the depreciation of Algerian Dinar due to the increase in real exchange rate. ΔY, Vol, and ε_t stand for the quarterly change in real GDP growth of the importing country, the measure of exchange rate volatility of the real exchange rate, and the disturbance term respectively.

Concerning Algeria's export and import functions, we expect β_2 to be positive since real depreciation of Algerian Dinar is believed to raise Algeria's exports to its major trading partners, we also estimate β_2 to be negative in the import model since the depreciation of DZD lessens Algeria's imports from its trading partners. Since the increase in Algeria's trading partners' income is expected to raise their imports from Algeria, so β_3 must necessarily be positive in both Algerian exports and imports models, for β_4 is expected to be negative in case the Algerian exports and imports are deterred by exchange rate variability.

In order to explore the impact of exchange rate changes and other variables on Algeria's bilateral trade balance with its major partners, we developed the following trade balance regression model.

$$\Delta TB_{t,\,i} = \lambda_1 + \lambda_2 \,\Delta RE_{t-1} + \lambda_3 \,\Delta Y_{Alg,\,t} + \lambda_4 \,\Delta Y_t + \lambda_5 \,Vol_t + \varepsilon_t \qquad (5.2)$$

$$(+) \qquad (-) \qquad (+) \qquad (+/-)$$

The variables in the second equation are the same as in the first one except ΔTB and ΔY_{Alg}. Whereas ΔTB is the quarterly change in Algeria's bilateral trade balance (generally defined as the difference between the change in Algeria's total exports (ΔEX) to its trading partners and the change in Algeria's total imports (ΔIM) from its trading partners), ΔY_{Alg} is the quarterly change in domestic income.

In the context of the second model, the depreciation of the exchange rate raises exports, reduces imports and leads to improve the trade balance, which makes λ_2 positive. The same for λ_4, which is expected to be positive because an increase in foreign income might stimulate the country's exports leading to improvement of the trade balance. λ_3, on the other hand is believed to be negative due to the positive relationship between imports and domestic income. Since higher exchange rate volatility hampers both exports and imports, λ_5, remains unclear, which will harden the process of determining the kind of effect.

The previous studies helped to investigate the relationship between the exchange rate changes and trade flows on a wide rage. Yet, there are limits as well in this regard since most of the analyses are based mainly on aggregate trade data; which makes them suffer

from the aggregation bias. With this in mind the present study tries to make modest effort in this area, emphasizing not only on the effects of exchange rate changes on aggregate trade flows, but also on the effects of exchange rate changes on disaggregate trade flows (for every partner). The focus on bilateral disaggregate data set helps to identify partner-specific characteristics and also explains how and why the partners are affected by exchange rate volatility.

Based on equation (5.1) for both export and import functions and (5.2) for trade balance function, β_1 and λ_1 alternatively are assumed to be constant (common coefficients) over time (t), the slope coefficients are also expected to be constant for all partners in aggregated trade flows (common coefficients) but different in disaggregated trade flows (cross-section specific coefficients).

5.2 Data Source

To conduct our study, we arranged the data according to a quarterly time series lasting from 1981:1 to 2012:4. The time series data for Algeria and its major trading partners (Canada, France, Germany, Italy, Japan, Nether land, Spain, USA) are mainly obtained from the Central Bank reports; other data set is provided by the International Financial Statistics of the IMF (CD-ROM), the Direction of Trade Statistics of the IMF (CD-ROM) and the World Bank's World Development Indictors. The Data consists of observed values of aggregate and bilateral exports, aggregate and bilateral imports, real bilateral exchange rate and the real gross domestic product growth.

5.3 Empirical Results

5.3.1 Unit Root test

The results of (ADF) test presented in Appendix C show that most variables are non-stationary at level I. Consequently, to reach stationary, we differenced the data as a result all variables for the 8 countries and Algeria are significant at 1% level in the first differences

5.3.2 Aggregate Model

As mentioned above, we have used time series aggregate trade data in order to estimate the regression models represented in equations (5.1) and (5.2). The bellow tables (1 and 2) resume the results of our analysis. First, most of the coefficients in table 2, for both export/import models are statistically significant, they prove all the above expected signs, except for the real exchange rate changes which appear to have an opposite expected sign in the import model. Second, we can consider Algeria's imports as Giffen products and say that the income effect is verified in Algeria's economy case. The fact that the imports of Algeria increase whenever the exchange rate depreciates can give us an insight about the nature of the necessary products Algeria is importing: Algeria is still importing as much as it was before the national currency depreciates.

Despite the increase in foreign income, no significant change is recorded concerning Algeria' exports, this seems to be evident if we take into account the supply restriction imposed by the OPEC (Organization of the Petroleum Exportation Countries) and the huge gap between the economic sizes of Algeria and its major trading partners which leads Algeria's export to be less influenced by the major trading demand than Algeria's

import being influenced by its own demand. We also take into consideration the time adjustment for variables (the short run).

Table 2: Impact of Exchange Rate Movements on Algeria's Aggregate Exports and Imports

`	**Export Model**		**Import Model**	
ΔRE_{t-1}	7.337896**	ΔRE_{t-1}	9.874282***
	(3.095566)		(2.038778)
ΔY_t	0.000178	$\Delta Y_{Alg,t}$	2.331707**
	(0.004361)		(1.028114)
Vol_t	-0.718145**	Vol_t	-5.075711
	(0.291438)		(3.106942)
Constant	15.53199***	Constant	-18.05447***
	(3.947631)		(1.65427)
Adjusted R^2	0.788469	Adjusted R^2	0.693411
Observations	912	Observations	912

Note: Standard errors are given in parenthesis.
 ***, ** and * indicate the significance of coefficients at 1%, 5% and 10% respectively

Our findings in table 2 tend to be identical with the results of previous works on the impact of exchange rate volatility on trade. From one hand, they suggest that in case of export model, the exchange rate volatility has a negative and significant effect; the negative volatility term indicates that if variability in exchange rate increases, risk adverse traders favour domestic market than the international one in the short run . On the other hand, although, the imports are negatively affected by exchange rate volatility, statistically this is proved to be insignificant because Algeria's imports are necessary goods that cannot be stopped or substituted by local products.

The third table resumes the results of the aggregate trade balance model (equation (5.2)). The overall results are consistent with the previous findings from the analysis of the export and import functions. We find that the exchange rate changes have significant effects on trade balance in the short run. Change in Algeria's income has a negative impact on trade balance, while change in Algeria's major trading partners income is statistically insignificant implying that the higher income in those countries doesn't improve the trade balance in the short run. Further, the results show that the exchange rate volatility is negatively related to trade balance even though, the effect is statistically insignificant.

Table 3: Impacts of Exchange Rate Movements on Algeria Trade Balance

Aggregate Trade Balance Model	
$\Delta\,RE_{t-1}$	1.858726**
	(0.847856)
$\Delta\,Y_t$	0.000846
	(0.004033)
$\Delta\,Y_{Alg,t}$	-0.191066***
	(0.041067)
Vol_t	-0.882871
	(0.966704)
Constant	-1.476205***
	(0.059449)
Adjusted R^2	0.240766
Observations	912

Note: Standard errors are given in parenthesis.
***, ** and * indicate the significance of coefficients at 1%, 5% and 10% respectively

5.3.3 Disaggregate Model

In the first part of our analysis, we dealt with the impact of exchange rate volatility on aggregate exports, imports and trade balance data. Our interest in the present section is to test the impact on disaggregate trade balance by having a close look to each partner.

The bellow tables (4,5 and 6) resume the results of bilateral export, import and the bilateral trade balance models to estimate the panel regression models in equations (5.1 and 5.2). The results indicate that the effects on Algeria's bilateral export, import and trade balance are not always highly significant and almost all the coefficients are compatible with the expectations but statistically are not all significant. In the case of export and import models the intercept is highly significant, but Adjusted R2 is not that highly significant. This is due to the short run measure we are working according to and the insufficient time for exports and imports to be adjusted, in addition to the intervention of the Algerian government in manipulating the exchange rate.

Whereas the results presented in table 4 show that the depreciation of the Algerian currency against the country's major trading partners' currencies has positive impact on Algeria's exports and is significant at the 5% level with Canada, Italy, Nether land and USA, and at 10% with France, the results in Table 5 indicate that the real bilateral exchange rate changes carry two different signs; a negative sign as we expected with Germany at 1% and with Japan at 5% level which indicates that Algeria's exports from these countries are not necessary goods (alimentary goods) but luxury ones , and a positive sign with France (the main supplier of Algeria) and Spain but it is insignificant. The positive sign indicates that depreciation of the Algerian currency against the

above-mentioned countries' currencies does not discourage Algeria's imports from France and Spain in the short run. The results of the final table are consistent with our expectations; they indicate that the depreciation in the Dinar has a positive sign on Algeria's trade balance and all the coefficients of Algeria's major trading partners are statistically significant except for Germany and Japan, which are insignificant. These results also show that the bilateral exchange rate plays an important role in the trade between Algeria and its trading partners and the trade balance seems to benefit from the depreciation of the Algerian currency in the short run.

According to the results of table 4, we deduce that in the case of Algeria's bilateral export, the change in Algeria's major trading partners' income carries the expected positive sign and it is significant at 1% level with the US because it is the first importing country from Algeria, and at 5% level for both France and Spain and only 10% for Canada. An increase in Algeria's trading partner's income is expected to raise its imports from Algeria and consequently improves the bilateral trade balance that we notice in table 6 (positive sign). It is worth noting that even in the case of Algeria's bilateral import model, change in the domestic income growth carries an expected positive sign and the coefficient is highly significant at 1% level for France and Germany and at 5% level for Italy, Spain and insignificant for the rest partners as it is recorded in table 5. The increase in Algeria's income growth raises Algeria's imports from her major trading partners and this influences the trade balance negatively as we see in table 6 (the negative sign).

The results for exchange rate volatility in export, import and trade balance models always show a negative sign which means that the exchange rate volatility of Algeria's currency against the country's major trading partner's currencies has adverse effects on trade (discourages trade) in the short run, but it is significant only with few. In both the export and import models, the exchange rate volatility is significant with the first importer from Algeria (USA) at 1% level also with France (the first exporter to Algeria) at 5% level, and at 10% level with Germany and Japan. In the bilateral trade, it appears that any risk introduced by the exchange rate fluctuations has unfavourable effects and it is significant at 1% level with the USA, 5% level with Canada and at 10% level with France.

Table 4: Impact of Exchange Rate Movements on Algeria's Bilateral Export Model
(Panel Estimation)

variable	Constant	ΔRE t-1	Δ Y t	Volt
Canada	-28.15173 **	1.523885**	1.562399 *	-4.819564
	(11.17592)	(0.732336)	(0.872343)	(0.174567)
France	-28.15173 **	0.939478*	9.121617**	-2.162614
	(11.17592)	(0.481969)	(3.936222)	(3.133436)
Germany	-28.15173 **	4.705760	1.138565	0.597274
	(11.17592)	(49.94733)	(18.65689)	(1.102036)
Italy	-28.15173 **	1.119850**	2.015532	-0.936107
	(11.17592)	(0.477986)	(2.682561)	(1.102106)
Japan	-28.15173 **	2.255085	0.181986	3.622663
	(11.17592)	(0.501624)	(0.246359)	(5.256656)
Nether land	-28.15173 **	0.9446881**	7.551058	0.404889
	(11.17592)	(0.473255)	(7.797913)	(1.124586)
Spain	-28.15173 **	0.160307	1.138908**	-0.227415
	(11.17592)	(0.481705)	(0.474663)	(1.138535)
USA	-28.15173 **	1.320093**	1.166526***	-0.171635***
	(11.17592)	(0.648412)	(0.1481869)	((0.0443215)
Adjusted R2			0.595860	
Observation			920	
Number of partners			8	

Note: Standard errors are given in parenthesis.
***, ** and * indicate the significance of coefficients at 1%, 5% and 10% respectively

Table 5: Impact of Exchange Rate Movements on Algeria Bilateral Import Model (Panel Estimation)

variable	Constant	ΔRE t-1	Δ YAlg, t	Volt
Canada	9.882295***	-2.449663**	2.396653	-1.150739
	(0.475767)	(1.243344)	(2.651863)	(15.30903)
France	9.882295***	1.959508	2.340552***	-3.421752**
	(0.475767)	(1.694608)	(0.645526)	(1.527822)
Germany	9.882295***	-9.589301***	4.858871***	-8.404723*
	(0.475767)	(1.687957)	(0.875450)	(4.490550)
Italy	9.882295***	- 2.424214	5.911785**	-6.869546
	(0.475767)	(1.687957)	(2.675601)	(6.490550)
Japan	9.882295***	-2.881710**	3.035507	-8.747174*
	(0.475767)	(1.668534)	(2.578221)	(4.820873)
Nether land	9.882295***	-1.814683	0.329000	2.125987
	(0.475767)	(16.87957)	(2.675601)	(6.490550)
Spain	9.882295***	1.072796	6.362961**	2.189028
	(0.475767)	(0.787957)	(2.675601)	(1.490550)
USA	9.882295***	-7.474507	2.587694	-0.798194
	(0.475767)	(23.22722)	(2.595079)	(1.099345)
Adjusted R2	0.642650			
Observation	920			
Number of partners	8			

Note: Standard errors are given in parenthesis.
***, ** and * indicate the significance of coefficients at 1%, 5% and 10% respectively

Table 6: Impacts of Exchange Rate Movements on Algeria's Bilateral Trade Balance

variable	Constant	ΔRE_{t-1}	ΔY_t	$\Delta Y_{Alg,t}$	Vol_t
Canada	-31.84168***	2.591614**	2.562944*	-0.013325	-4.433710**
	(11.84372)	(1.175898)	(1.496515)	(0.115055)	(1.946599)
France	-31.84168***	5.338771*	7.702755	-1.190128***	-5.031668*
	(11.84372)	(2.726817)	(7.020340)	(0.119012)	(3.027382)
Germany	-31.84168***	0.299603	-0.102865	-0.074008	-0.591024
	(11.84372)	(8.009926)	(3.056694)	(0.109590)	(1.782576)
Italy	-31.84168***	13.86839*	-0.632003	-0.458211***	-0.405504
	(11.84372)	(7.673306)	(4.500264)	(0.112202)	(1.781791)
Japan	-31.84168***	9.770243	0.3 12434	0.053307	7.405319
	(11.84372)	(11.42114)	(1.039821)	(0.106381)	(8.448542)
Nether land	-31.84168***	16.05000**	10.24983	-0.117722	0.415740
	(11.84372)	(7.608561)	(13.28040)	(0.113908)	(1.809137)
Spain	-31.84168***	9.997298*	7.703153	-0.252123**	-0.936549
	(11.84372)	(6.023899)	(9.138652)	(0.127967)	(1.827625)
USA	-31.84168***	12.68692***	1.973088***	-0.057208	-28.08340***
	(11.84372)	(4.034023)	(0.265213)	(0.121468)	(7.120764)

Adjusted R2	0. 673810
Observations	912
Number of partners	8

Note: Standard errors are given in parenthesis.
***, ** and * indicate the significance of coefficients at 1%, 5% and 10% respectively

6   Conclusion & Recommendation

Our research is an empirical study that has examined empirically the impact of exchange rate movements on the trade flows between Algeria and eight of its major trading partners both on aggregated and disaggregated trade flows. We used the real bilateral exchange rate change, income change and exchange rate volatility as our variables. Based on the aggregate model, a depreciation of the Algerian currency is proved to have a positive significant effect on Algeria's exports and imports, which can be explained by the theory of Marshall-Lerner of inelastic goods that aren't affected by the depreciation of Algerian Dinar. On the other hand, the exchange rate volatility has negative effects on exports and

Algeria's income growth triggers a higher demand for imports while the foreign income growth doesn't increase Algeria's trading partners' demands for Algerian products and this is mainly due to the difference in the relative importance of each trade partner to the other. We also noticed that the panel estimation results of the disaggregate model indicates that the exchange rate changes influence bilateral trade. The depreciation of the Algerian Dinar has positive effects on Algeria's exports to all its bilateral partners and negative effects on Algeria's bilateral imports from them except for France and Spain where the effects are positive. However, the bilateral exchange rate was not enough in explaining all the changes in the bilateral trade for Algeria. The bilateral estimation also shows that income changes in some major trading partners do affect trade, but not in the case of the aggregate model which makes the disaggregated bilateral trade data helpful in providing useful insights about Algerian trade. Concerning the exchange rate volatility, no clear effect was noticed except for USA, Canada and France, which witnessed an adverse relationship. Therefore, we are led to conclude that exchange rate movements do not have a large significant effect on Algeria's trade flows.

The volatility of Algerian currency against the country's major trading partner's currencies used in this study does not depict the reality of Algerian economy because of two reasons: the first reason is that Algeria's exports are dominated by hydrocarbons products and the exportation procedures are conducted either in US dollar or the euro in case of dealing with the euro zone. This means that the DZD is not directly involved in the international trade process. The second reason has to do with the purchasing power of Algeria, which is more vulnerable to USD movements rather than those of DZD. Actually, these two points reflect the importance of petrodollar in the Algerian economy. Therefore, the use of the American dollar or Euro as proxy of the currency movement seems to be more practical for further studies in this regard.

The Analysis provided in this study unveils the vulnerable structure of Algerian imports and exports , whereas the exports are largely composed of hydrocarbon products with no place for proliferated components and diversified markets, the Algerian imports are crucial and necessary products which reveals the high dependency of the country's economy on external supply. This trade balance structure needs to be revised and requires a separated analysis, which might lead to divert avenues of thought.

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Appendices

Appendix A: Algeria's bilateral real exchange rate
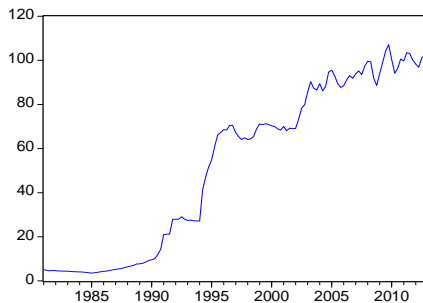
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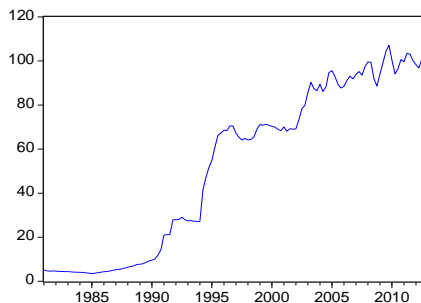
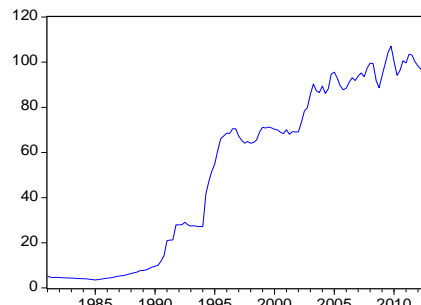Algeria_Germany real bilateral exchange rate
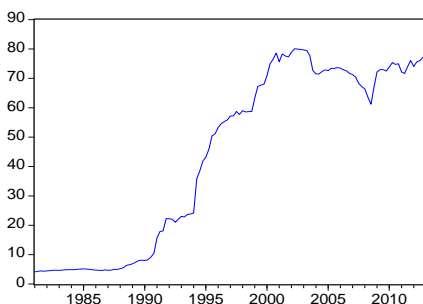
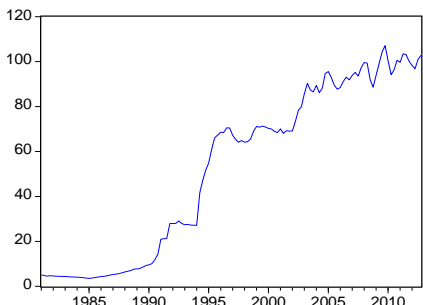
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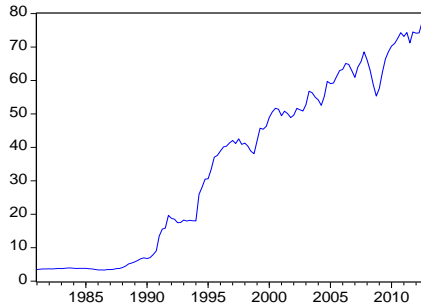
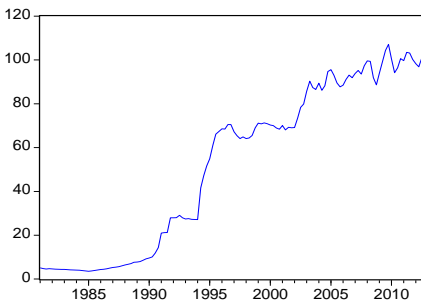Algeria_Canada real bilateral exchange rate
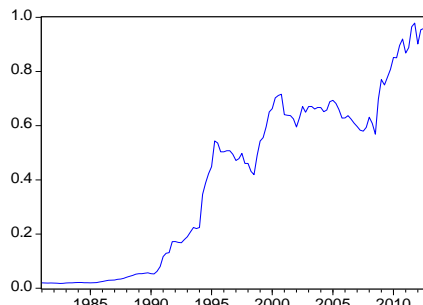
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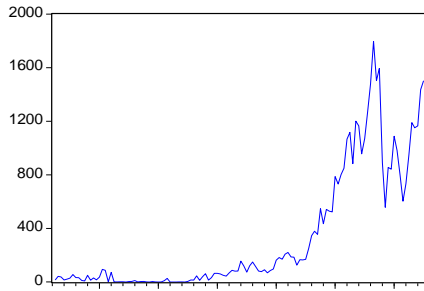Algeria_Netherland real bilateral exchange rate
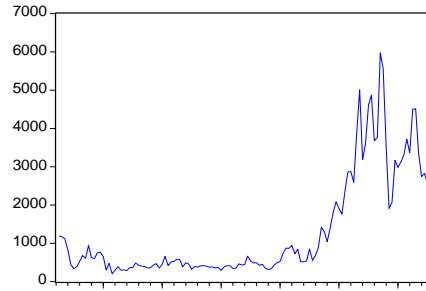

Algeria_Italy real bilateral exchange rate
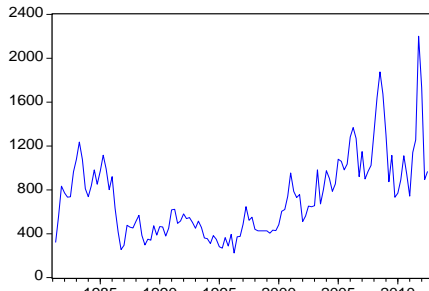

Algeria_Spain real bilateral exchange rate

Appendix B: Algeria's bilateral export

Algeria exports to canada

Algeria exports to USA

Algeria exoerts to France
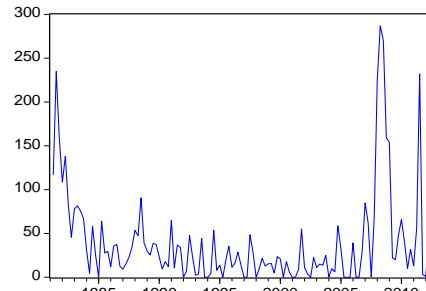
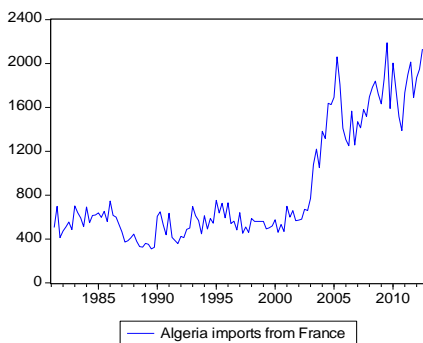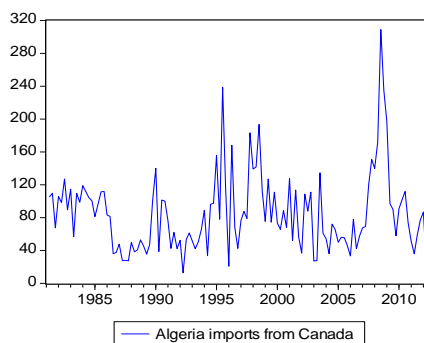Algeria exports to Japan
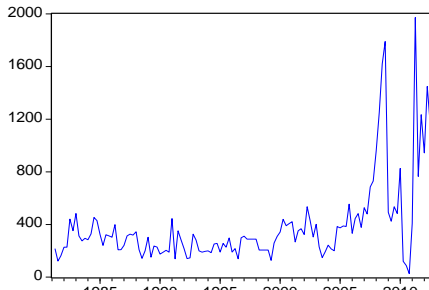
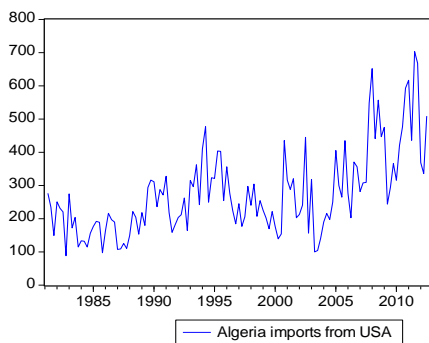Algeria exports to Netherland
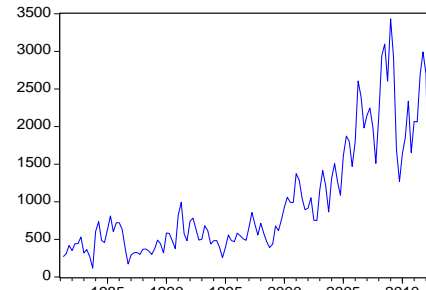
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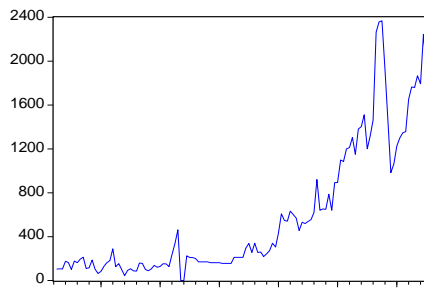
Algeria Exports to Spain
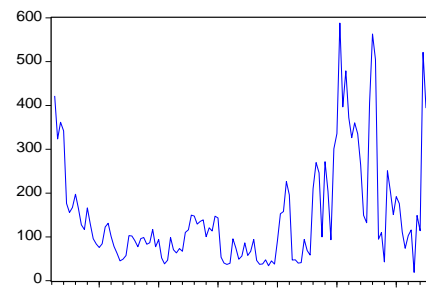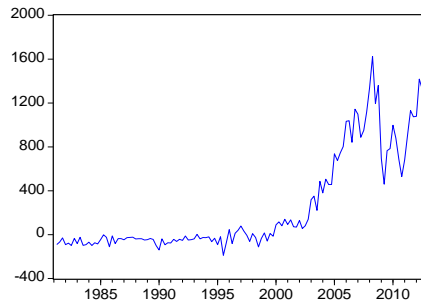
Algeria exports to Germany

Appendix B: Algeria's bilateral import

Algeria imports from USA

Algeria imports from Canada

Algeria imports from France

Algeria imports from Japan

Algeria imports from Spain

Algeria imports from Germany

Algeria imports from Italy
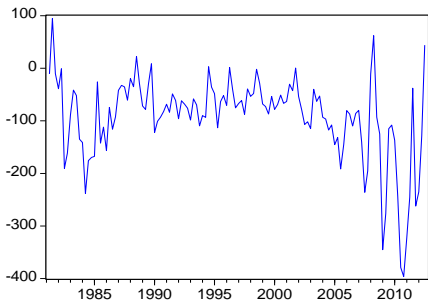
Algeria imports from Netherland
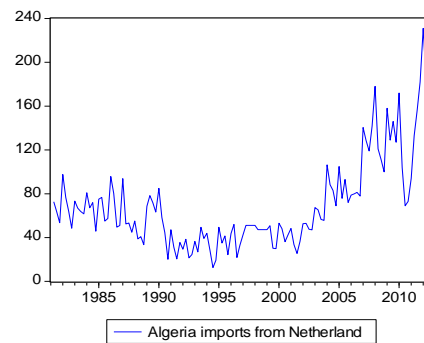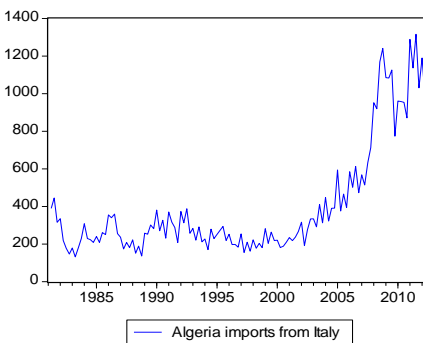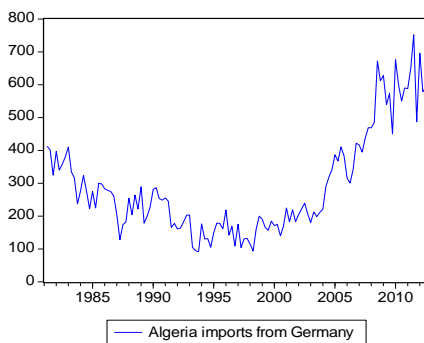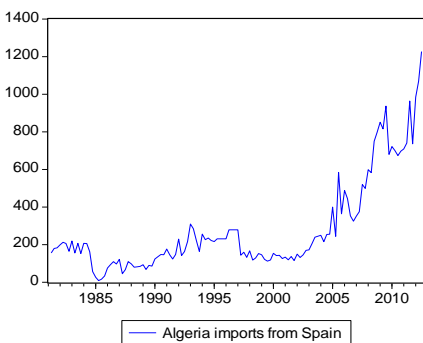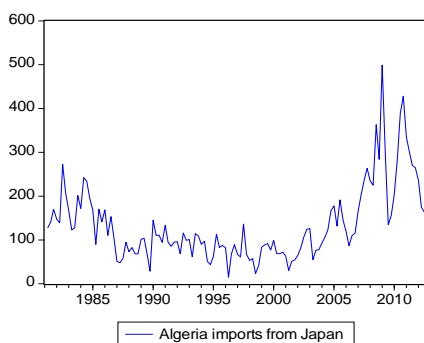
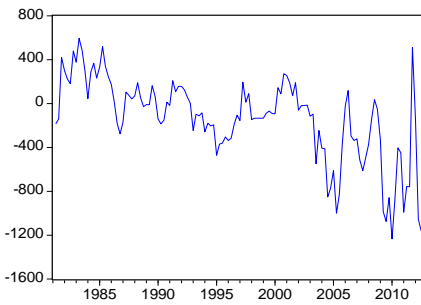## Appendix B: Algeria's bilateral trade balance
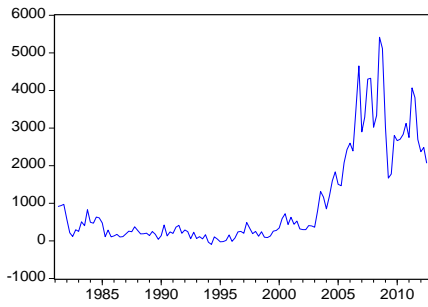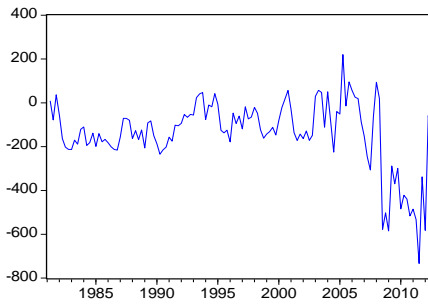

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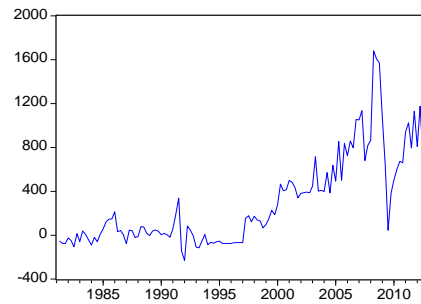
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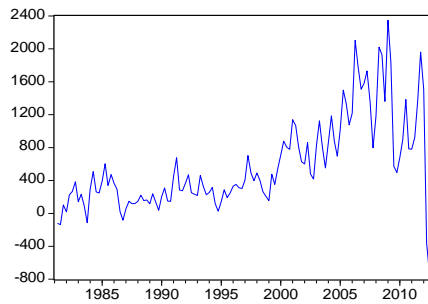
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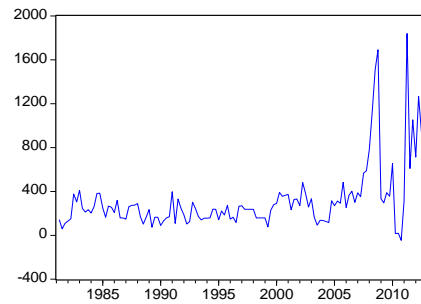
Algeria-France trade balance

Algeria-Germany trade balance

Algeria-Spain trade balance

Algeria- Italy trade balance

Algeria-Netherland trade balance

Appendix C

Table 1: Results of ADF tests applied to the level and first differences of variables

ADF statistics	Test Variables	level		First difference	
		No Trend	Trend	No Trend	Trend
Export	Exp can	-2.432479	-2.878945	-11.46383***	-11.54118***
	Exp Fr	-2.650972*	-2.729893	-10.57432***	-10.52347***
	Exp ger	-4.189315***	-4.655523***	-9.695134***	-9.746276***
	Exp it	0.901664	-0.920491	-7.394899***	-7.656304***
	Exp jap	-4.107636***	-4.075993***	-11.74353***	-11.77787***
	Exp neth	-3.583308***	-4.235968***	-8.128213***	-6.827048***
	Exp sp	0.793317	-1.046906	-7.704961***	-7.971693***
	Exp usa	-0.772080	-1.987129	-14.04779***	-14.08409***
Import	Imp can	-4.110511***	-4.205925***	-11.46417***	-11.41164***
	Imp fr	0.056499	-1.604578	-16.05359***	-16.21550***
	Imp ger	0.266233	-0.524278	-8.485237***	-9.268488***
	Imp it	2.017878	1.137872	-5.532658***	-6.132006***
	Imp jap	-3.916213***	-3.991571**	-14.19138***	-14.14055***
	Imp neth	-0.323182	0.109612	-5.553462***	-6.951906***
	Imp sp	-0.581030	-1.802673	-6.775218***	-18.04715***
	Imp usa	-3.563197***	-6.599825***	-11.10946***	-11.05671***
Trade Balance	TB can	-1.832792	-2.517993	-13.18901***	-13.19912***
	TB fr	-2.082236	-3.807076**	-10.92381***	-10.98011***
	TB ger	-2.285057	-2.218172	-10.07105***	-10.05964***
	TB it	-0.538194	-1.625408	-6.581107***	-6.475414***
	TB jap	-5.812793***	-5.920615***	-10.26631***	-10.21650***
	TB neth	-4.106273***	-4.691220***	-11.63564***	-11.58366***
	TB sp	-0.643551	-1.791269	-8.175700***	-8.150276***
	TB usa	-0.794221	-1.997960	-14.01730***	-14.06122***
Bilateral Exchange Rate	ER can	-0.018162	-2.917168	-7.530172***	-7.540342***
	ER fr	0.035888	-2.615301	-7.373328***	-7.391170***
	ER ger	0.035888	-2.615301	-7.373328***	-7.391170***
	ER it	0.035888	-2.615301	-7.373328***	-7.391170***
	ER jap	-0.451521	-2.504634	-4.542370***	-4.540252***
	ER neth	0.035888	-2.615301	-7.373328***	-7.391170***
	ER sp	0.035888	-2.615301	-7.373328***	-7.391170***
	ER usa	-0.685434	-1.044019	-7.709666***	-7.685186***
GDP	GDP Alg	-1.527524	-2.633743	-4.529470***	-4.459348***
	GDP can	1.056312	-1.511557	-7.058531***	-7.206994***
	GDP fr	-0.041413	-2.478966	-7.857617***	-7.824013***
	GDP ger	-1.776316	-1.776316	-8.388902***	-8.552141***
	GDP ita	-1.139219	-2.203690	-7.644537***	-7.675217***
	GDP jap	-2.768620*	0.495431	-3.082808**	-5.422575***
	GDP neth	0.674321	-2.052805	-11.50943***	-11.55302***
	GDP sp	0.128560	-2.351462	-3.440092**	-3.496004**
	GDP usa	1.536768	-1.709659	-5.732069***	-6.067287***
Volatility Exchange Rate	Vol can	9.772135***	5.978045***	-3.259156**	-7.292964***
	Vol fr	14.56781***	9.069743***	-10.25679***	-10.42499***
	Vol ger	14.56781***	9.069743***	-10.25679***	-10.42499***
	Vol ita	14.56781***	9.069743***	-10.25679***	-10.42499***
	Vol jap	-1.933232	-2.603891	-10.27102***	-10.24930***
	Vol neth	14.56781***	9.069743***	-10.25679***	-10.42499***
	Vol sp	14.56781***	9.069743***	-10.25679***	-10.42499***
	Vol usa	1.574008	0.504344	-9.799138***	-10.24930***

Note: ***, ** and * indicate the significance of coefficients at 1%, 5% and 10% respectivel