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Trade Relationship between Libya and its Major Trading Partners

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ABSTRACT

This paper analyses the trade relationship between Libya and its major trading partners using a simultaneous-equations model. The model is estimated using the 2SLS method of estimation.

The analysis emphasizes the role played by the interaction of international trade and the degree of feedback. The hypothesis tested in this paper is that an increase in Libyan's exports to a major trading partner contributes to growth in Libyan GDP. The increase in Libyan income expands its imports from its major trading partners. This in turn contributed to growth in the income of the trade partners.

The level of Libyan imports from its major trading partners does not seem to have any significant effect on the level of the GDP of its major trading partners except Greece, Turkey and Tunisia.

JEL: *E19, F10, F12, F13*

1. INTRODUCTION

The Libyan economy is a developing small oil-producing economy that depends heavily on international trade. This dependence suggests the existence of an interaction between the Libyan economy and the rest of the world. This interaction could be observed in two different ways. First, an increase in Libyan exports will increase its income, which in turn causes imports to rise. The increase in Libyan imports will raise the income of the exporters to Libya, which in turn results in an increase in their imports from Libya. On the other hand, the rise in oil prices will result in an increase in oil revenue. However, this rise in oil prices increase the cost of production in importing countries which may result in a lower growth in their income and hence their imports from oil-producing countries.

This paper will test the export-led growth model within the framework of international trade interdependence. Thus, the structure and performance of trade between Libya and its ten major trading partners (Italy, Germany, Spain, Turkey, France, Switzerland, Tunisia, Greece, UK and China) during the period 1975-2005 will be analyzed.

The literature on feedback effects of foreign trade has intensified during the past two decades (Metwally and Tamaschke, 1980; Salvatore, 1983; Metwally 1988; Lee, 1989; Tamascke, 1990; Esfahani, 1991; Metwally and Vadlamudi 1992; Sprout and Weaver, 1993; Metwally, 1993; Perdikis and Asseery, 1994 and Metwally and Tamaschke 2001).

The paper is divided into five sections. After this introduction, section two examines the magnitude of trade between Libya and it major trading partners. Section three develops a simultaneous equations model to test the interaction of international trade and the degree of feedback between Libya and its major trading partners. Section four gives the regression results of the simultaneous equations model for ten trading partners. Finally, the main conclusions are summarized in section five.

2. THE MAGNITUDE OF TRADE BETWEEN LIBYA AND IT MAJOR TRADING PARTNERS

Libya trades mostly with the industrialized countries. More than 50 per cent of Libyan imports are supplied by industrialized countries. Libya imports over two-thirds of its supplies from Italy and Germany. In addition, Libya exports almost 50 per cent of its total exports to these two countries.

The data in Table 1 suggest that Italy is the largest trade partner with Libya. More than one-third of Libyan exports during the last five years were directed to Italy and more than one-quarter of Libyan imports during the same period were obtained from Italy. The second largest trade-partner with Libya is Germany. Libyan exports to Germany over the last five years were more than 14 per cent of Libyan total exports and Libyan imports from Germany were more approximately 10 per cent of Libyan total imports during that period.

The data in Table 1 also suggest that a large proportion of Libyan exports (more than 11 per cent) had been directed to Spain over the last five years. On the other hand, Libyan imports from Spain were less than 2 per cent of total Libyan imports during that period. An opposite trade relationship seems to hold in Libyan trade with UK. Libyan trade with France and Greece seem to be equal for both exports and imports.

Table 1
Libyan Trade with its Major Trading Partners (Average 2000-2005)

Country	*Value of Libyan Exports (US million dollars)*	*% of total Libyan Exports*	*Value of Libyan Exports (US million dollars)*	*% of total Libyan Imports*
Italy	5614	34.33	1602	24.27
Germany	2307	14.11	650	9.85
Spain	1835	11.22	127	1.92
Turkey	985	6.02	233	3.53
France	800	4.89	308	4.66
Switzerland	503	3.08	114	1.73
Tunisia	322	1.97	340	5.14
Greece	288	1.76	116	1.76
UK	286	1.75	373	5.66
China	145	0.89	158	2.40
Total	13085	80.02	4021	60.92

Sources: IMF, *International Financial Yearbook*, Various issues, Washington DC.
IMF, Direction of Trade Statistics Yearbook, Various issues, Washington, DC.
Libya; Statistical Abstracts, various issues.

Libyan trade with China, Tunisia and Turkey is quite significant. This trade averaged approximately 2.2 billion US dollars during the period 2000-2005. Libyan total trade with Turkey is much higher than its trade with Tunisia and China. Less than 1 per cent of Libyan exports were directed to China.

3. SIMULTANEOUS-EQUATIONS MODEL

To study the relationship between the Libyan economy and its major trading partners, a simultaneous equations model similar to that developed by Metwally in his study of the interdependence of trade and economic development in Asian economies (1993) will be utilized to test the feedback effects.

The following simultaneous relationships, known as structural equations, have been developed to test for feedback effects in the trade relationship between the Libya and its main trading partners.

Structural Equations:

$$Y_{L,t} = \alpha_0 + \alpha_1 X_{L-\textbf{partner}\,i,t} + \alpha_2 X_{L0,t} + \alpha_3 Y_{L,t-1} + e_{1t}$$

$$X_{L\,\textbf{partner}\,i,t} = \beta_0 + \beta_1 P_{oil,t} + \beta_2 Y_{\textbf{partner}\,i,t} + e_{2t}$$

$$Y_{\textbf{partner}\,i,t} = \gamma_0 + \gamma_1 X_{\textbf{partner}\,i0,t} + \gamma_2 M_{L,\textbf{partner}\,i,t} + Y_{\textbf{partner}\,i,t-1} + e_{3t}$$

$$M_{L-\textbf{partner}\,i,t} = \delta_0 + \delta_1 U_{L,t} + \delta_2 M_{L-\textbf{partner}\,i,t-1} + e_{4t}$$

Endogenous Variables:

$U_{L,t}$ = Libyan GDP in period t

$X_{L-\textbf{partner}\,i,t}$ = Libyan exports to the ith trading partner in Period t

$Y_{\textbf{partner}\,i,t}$ = GDP of the ith partner in period t

$M_{L-\textbf{partner}\,i,t}$ = Libyan imports from the ith trading partner in Period t

Predetermined (Exogenous) Variables:

$X_{L0,t}$ = Libyan exports to countries other the ith partner in period t

$Y_{L,t-1}$ = Libyan GDP in period $t-1$

$P_{oil,t}$ = *Oil prices in period t*

$X_{\textbf{partner}\,i0,t}$ = Exports of the ith trading partner to countries other than Libya in period t

$M_{L\text{-}\textbf{partner}\,i,t-1}$ = Libyan imports from the ith trading partner in period $t-1$

$Y_{\textbf{partner}\,i,t-1}$ = GDP of the ith partner in period $t-1$.

The first equation tests the relationship between Libyan income of and its exports to its major trading partners. It is assumed that Libyan income depends on these exports. It is also assumed that there is a partial adjustment mechanism in the income-export relationship. The lagged dependent variable gives the equation a dynamic character, allowing for partial adjustment (or lagged effects) following a Koyck geometrically declining weight scheme (Ramanathan, 1992, Griffiths, Hill and Judge, 1993, Johnston and Dinardo, 1997, Green, 2000 and).

The second equation examines the relationship between Libyan exports to each partner and the level of the partner's GDP. It is expected that the growth in the partner's economy, would result in an increase in its imports from Libya. It is also assumed that Libyan exports depend on the price of oil. It is expected that an increase in oil prices leads to an increase in the export proceeds of the Libyan economy, given the quantities exported.

The third equation examines the interaction between the Libyan economy and its major trading partners. It is assumed that the level of GDP of each trading partner depends on its exports to Libya and to the rest of the world. This equation is also dynamic. If there is a significant feedback effect, we would expect the coefficients γ_2 to be statistically significant. For only then, would we be able to say that increasing imports from Libya, results in an increase in the GDP of its trading partner. (Metwally 1988, Tamaschke, 1990).

The forth Equation examines the relationship between GCC imports from Libya and GDP of the Libyan country within a process of a partial adjustment mechanism. Libyan imports from various trading partners are assumed to depend on Libyan income with a partial adjustment mechanism.

The above system is mathematically complete in that it contains as many equations as it has endogenous variables (Theil, 1970). Applying the order and rank conditions of identification to the four simultaneous equations, it can be verified (as shown in the Appendix) that both conditions hold and each equation is overidentified. It follows that The method of Two Stage Least Squares (2SLS) is appropriate to estimate the equations of the model.

The 2SLS results for the three equations of the model are presented in Tables 2 to 10. The data used for the estimations are for the period 1975 to 2005[1]. They were obtained from the IMF publications, World Bank reports, issues of the Libyan economy and the Statistical Abstracts of individual countries. The (adjusted) R^2 and F statistics of the fitted equations suggest that the model is a good fit. Also the estimated Durbin Watson (DW) and Durbin's h statistic support the view that the residuals about the fitted equations were independent (Maddala, 2000 and Murray, 2006).[2]

4. RESULTS OF THE SIMULTANEOUS-EQUATIONS MODEL

These results are given in Tables 2 to 10. The regression results for Italy are given in Table 2. These results suggest:

The regression results for Italy are given in Table 8-2. These results suggest:

(i) Libyan income is strongly influenced by Libyan oil exports to Italy and to the rest of the world. The "*t*" value of the coefficient of the variable "$X_{L-Italy,it}$", which represents Libyan exports to Italy, is significant at the 5 per cent level of significance. The short-run elasticity of Libyan income with respect to its exports to Italy is approximately 0.18, while the long-term elasticity is approximately 0.36. This suggests that an increase in Libyan exports to Italy by 10 per cent results in an increase in Libyan income by approximately 1.8 per cent in the short run and by 3.6 per cent in the long run. Inspection of the coefficient ($Y_{L,t-1}$) further suggests the existence of a significant spread effects.

(ii) The results of the second equation suggest that Libyan exports to Italy are strongly influenced by oil prices and the level of Italian GDP. The Italian income is a major

determinant of Libyan exports to that country. A rise in Italian income by US$1 results in an increase in Libyan exports to Italy by approximately US$ 0.0021. Oil prices have a slightly greater effect on Libyan exports to Italy than the Italian income.

(iii) The results of the Italian GDP function in equation 3 suggest the absence of feedback effects. This may be due to the fact that the value of Libyan imports from Italy is a very small proportion of total Italian exports.

(iv) The regression results in the forth equation suggest that Libyan imports from Italy are positively related to the Libyan GDP within a partial adjustment mechanism. The marginal propensity of Libyan imports from Italy is approximately .11 in the short-run and .15 in the long-run. This suggests that an increase in Libyan income by US$1 results in an increase in Libyan imports from Italy by 11 US Cents in the short-run and by approximately 15 US Cents in the long-run. The short-term elasticity of Libyan imports from Italy with respect to Libyan income is approximately 2.16, while its long-run counterpart is approximately 3.04. This suggests that an increase in Libyan income by 1% results in an increase in Libyan imports from Italy by approximately 2.2 per cent in the short-run and by 3% in the long run. The value of the coefficient of the variable $M_{L-UK\,i,\,t-1}$ (0.288) suggests that approximately 0.712 of the gap between the desired level of spending on imports from Italy and the actual level of spending will be closed in one period and the number of periods of adjustment is approximately a year and half.

Table 2
Regression Results of the Simultaneous Equations Model of Libyan Trade with Italy

$U_{Libya,\,t}$	=	8485.8	+	1.144 $X_{L-\mathbf{Italy},\,t}$	+	0.236 $X_{Libya,\,t}$	+	0.480 $Y_{Libya,,t-1}$
		(3.003)		(2.625)*		(2.117)*		(3.725)**
		R^{-2} = .720		F = 25.8		$D.h$ = 1.030		
$X_{Libya-\mathbf{Italy}\,it}$	=	−304.5	+	96.4 $P_{oil,\,t}$	+	0.0021 $Y_{\mathbf{Italy},\,t}$		
		(–0.626)		(5.576)**		(5.313)**		
		R^{-2} = 0.704		F = 35.4		DW = 1.404		
$Y_{UK,\,t}$	=	64117.1	+	1.990 $X_{\mathbf{Italy},\,t}$	+	6.760 $M_{Libya-\mathbf{Italy},\,t}$	+	0.552 $Y_{\mathbf{Italy},\,t-1}$
		(1.114)		(3.553)**		(0.201)		(4.400)**
		R^{-2} = 0.929		F = 122.9		$D.\,h$ = 0.825		
$M_{Libya-\mathbf{Italy},\,t}$	=	−2092.0	+	.111 $U_{Libya,\,t}$	+	.288 $M_{Libya-\mathbf{Italy},\,t-1}$		
		(-3.492)		(4.856)**		(2.089)*		
		R^{-2} = 0.591		F = 21.9		$D.h$ = 0.968		

The regression results for Germany are given in Table 3. These results suggest:

(i) Libyan income is strongly influenced by Libyan oil exports to Germany and to the rest of the world. The "t" value of the coefficient of the variable "$X_{L-\mathbf{Germany},\,it}$", which represents Libyan exports to Germany, is significant at the 1 per cent level of

significance. The short-run elasticity of Libyan income with respect to its exports to Germany is approximately 0.21, while the long-term elasticity is approximately 0.30. This suggests that an increase in Libyan exports to Germany by 10 per cent results in an increase in Libyan income by approximately 2.1 per cent in the short run and by 3.0 per cent in the long run. Inspection of the coefficient ($Y_{L,\,t-1}$) further suggests the existence of a significant spread effects.

(ii) The results of the second equation suggest that Libyan exports to Germany are strongly influenced by oil prices and the level of Germany GDP. The Germany income is a major determinant of Libyan exports to that country. A rise in Germany income by US$1 results in an increase in Libyan exports to Germany by approximately US$ 0.0004. Oil prices have a greater effect on Libyan exports to Germany than Germany income.

(iii) The results of the Germany GDP function in equation 3 suggest the absence of feedback effects. This may be due to the fact that the value of Libyan imports from Germany is a very small proportion of Germany exports.

Table 3
Regression Results of the Simultaneous Equations Model of Libyan Trade with Germany

$U_{Libya,\,t}$	=	9753.6	+	5.369 $X_{L-Germany,\,t}$	+	0.177 $X_{Libya,\,t}$	+	0.249 $Y_{Libya,\,t-1}$
		(5.375)		(3.803)		(2.067)*		(2.233)*
		R^{-2} = .831		F = 48,6		$D.\,h$ = 1.083		
$X_{\text{Libya-Germany i t}}$	=	611.6	+	29.9 $P_{oil,\,t}$	+	0.0004 $Y_{Germany,\,t}$		
		(2..412)		(3.133)**		(2.593)*		
		R^{-2} = 0.427		F = 11.8		DW = 1.731		
$Y_{Germany,\,t}$	=	237083.0	+	1.476 $X_{Germany,\,t}$	+	95.7 $M_{Libya-Germany,\,t}$	+	0.413 $Y_{Germany,\,t-1}$
		(3.368)		(4.463)**		(1.448)		(3.778)**
		R^{-2} = 0.976		F = 401.5		$D.\,h$ = 1.644		
$M_{\text{Libya-Germany},\,t}$	=	−440.0	+	.009 $U_{Libya,\,t}$	+	.399 $M_{Libya-Germany\,K,\,t-1}$		
		(−1.986)		(3.618)**		(2.992)**		
		R^{-2} = 0.572		F = 20.4		$D.\,h$ = 1.607		

(iv) The regression results in the forth equation suggest that Libyan imports from Germany are positively related to the Libyan GDP within a partial adjustment mechanism. The marginal propensity of Libyan imports from Germany is approximately .009 in the short-run and .015in the long-run. This suggests that an increase in Libyan income by US$1 results in an increase in Libyan imports from the Germany by 1 US Cents in the short-run and by approximately 1.5 US Cents in the long-run. The short-term elasticity of Libyan imports from Germany with respect to Libyan income is approximately 0.4, while its long-run counterpart is approximately 0.6. This suggests that an increase in Libyan income by 1% results in an increase in Libyan imports from Germany by approximately 0.4 per cent in the short-run and by 0.6% in the long run. The value of

the coefficient of the variable $M_{L-\textbf{Germany}\, i, t-1}$ (0.399) suggests that approximately 0.601 of the gap between the desired level of spending on imports from Germany and the actual level of spending will be closed in one period and the number of periods of adjustment is approximately one and two-third year.

The regression results for Spain are given in Table 8-4. These results suggest:

(i) Libyan income is strongly influenced by Libyan oil exports to Spain and to the rest of the world. The "*t*" value of the coefficient of the variable "$X_{L-\textbf{Spain}, it}$", which represents Libyan exports to Spain, is significant at the 5 per cent level of significance. The short-run elasticity of Libyan income with respect to its exports to Spain is approximately 0.13, while the long-term elasticity is approximately 0.23. This suggests that an increase in Libyan exports to Spain by 10 per cent results in an increase in Libyan income by approximately 1.3 per cent in the short run and by 2.3 per cent in the long-run. Inspection of the coefficient ($Y_{L, t-1}$) further suggests the existence of a significant spread effects.

Table 4
Regression Results of the Simultaneous Equations Model of Libyan Trade with Spain

$U_{Libya, t}$	=	9613.	+	3.310 $X_{L-\textbf{Spain}\, t}$	+	0.226 $X_{Libya, t}$	+	0.439 $Y_{Libya, t-1}$
		(3.619)		(2.456)*		(2.140)*		(3.559)**
		$R^{-2} = .775$		$F = 30.7$		$D.\ h = 0.711$		
$X_{Libya-\textbf{Spain}\, i\, t}$	=	– 233.6	+	33.4 $P_{oil, t}$	+	0.0014 $Y_{\textbf{Spain}, t}$		
		(– 1.777)		(7.057)**		(7.092)**		
		$R^{-2} = 0.811$		$F = 63.1$		$DW = 1.848$		
$Y_{\textbf{Spain}, t}$	=	24883.1	+	1.581 $X_{\textbf{Spain}, t}$	+	544.5 $M_{Libya-\textbf{Spain}\, t}$	+	0.710 $Y_{\textbf{Spain}\, t-1}$
		(2.340)		(2.803)**		(1.414)		(6.858)**
		$R^{-2} = 0.932$		$F = 133.5$		$D.\ h = 1.001$		
$M_{Libya-\textbf{Spain}\, t}$	=	– 124.7	+	.009 $U_{Libya, t}$	+	.183 $M_{Libya-\textbf{Spain}\, t-1}$		
		(– 1.145)		(2.577)**		(0.914)**		
		$R^{-2} = 0.171$		$F = 3.994$		$D.\ h = 1.442$		

(ii) The results of the second equation suggest that the amount of Libyan exports to Spain is strongly influenced by oil prices and the level of Spanish GDP. The Spanish income is a major determinant of Libyan exports to that country. A rise in Spanish income by US$1 results in an increase in Libyan exports to Spain by approximately US$ 0.0014. Oil prices seem to have an equivalent effect on Libyan exports to Spain as the Spanish income.

(iii) The results of the Spanish GDP function in equation 3 suggest the absence of feedback effects. This may be due to the fact that the value of Libyan imports from Spain is a very small proportion of Spanish exports.

(iv) The regression results in the forth equation suggest that Libyan imports from Spain are positively related to the Libyan GDP without a partial adjustment mechanism. The

marginal propensity of Libyan imports from Spain is approximately .01. This suggests that an increase in Libyan income by US$1 results in an increase in Libyan imports from the Spain by 1 US Cents. The elasticity of Libyan imports from Spain with respect to Libyan income is approximately 0.42 in Libyan income by 1% results in an increase in Libyan imports from Spain by approximately 0.4 per cent.

The regression results for Turkey are given in Table 5. These results suggest:

(i) Libyan income is strongly influenced by Libyan oil exports to Turkey and to the rest of the world. The "*t*" value of the coefficient of the variable "$X_{L-\textbf{Turkey}, t}$", which represents Libyan exports to Turkey, is significant at the 5 per cent level of significance. The short-run elasticity of Libyan income with respect to its exports to Turkey is approximately 0.101, while the long-term elasticity is approximately 0.203. This suggests that an increase in Libyan exports to Turkey by 10 per cent results in an increase in Libyan income by approximately 1 percent in the short run and by 2 per cent in the long run. Inspection of the coefficient ($Y_{L, t-1}$) further suggests the existence of a significant spread effects.

(ii) The results of the second equation suggest that Libyan exports to Turkey are strongly influenced by oil prices and the level of Turkish GDP. Turkey income is a major determinant of Libyan exports to that country. A rise in Turkish income by US$1 results in an increase in Libyan exports to Turkey by approximately US$ 0.017. Oil prices would seem to have less effect on Libyan exports to Turkey than Turkish income.

Table 5
Regression Results of the Simultaneous Equations Model of Libyan Trade with Turkey

$U_{Libya, t}$	=	7365.1	+	4.095 $X_{L-\textbf{Turkey}, t}$	+	0.285 $X_{Libya, t}$	+	0.548 $Y_{Libya, t-1}$
		(2. 950)		(2.186)*		(2.668)*		(5.094)**
		R^{-2} = .791		F = 32.9		$D.\ h$ = 1.102		
$X_{Libya-Turkeyi, t}$	=	−762.5	+	9.511 $P_{oil, t}$	+	0..017 $Y_{\textbf{Turkey}, t}$		
		(−5.985)		(3.054)**		(8.875)**		
		R^{-2} = 0.802		F = 59.6		DW = 1.772		
$Y_{\textbf{Turkey}, t}$	=	34304.6	+	1.037 $X_{Turkey, t}$	+	7.797 $M_{Libya-Turkey, t}$	+	0.238 $Y_{\textbf{Turkey}, t-1}$
		(6.789)		(6.444)**		(2.270)*		(2.138) *
		R^{-2} = 0.975		F = 334.1		$D.\ h$ = 0.979		
$M_{Libya-Turkey, t}$	=	−354.7	+	.015 $U_{Libya, t}$	+	.345 $M_{Libya-Turkey, t-1}$		
		(−2.463)		(2.730)		(6.867)		
		R^{-2} = 0.749		F = 44.3		$D.\ h$ = 1.232		

(iii) The coefficient of the variable $M_{Libya-Turkey, t}$ (which represents Libyan imports from Turkey) in the third equation, is statistically significant, which suggests that Libyan imports from Turkey had a significant and positive effect on the level of Turkish GDP. This significant impact suggests the presence of feedback effects.

(iv) The regression results in the forth equation suggest that Libyan imports from Turkey are positively related to the Libyan GDP within a partial adjustment mechanism. The marginal propensity of Libyan imports from Turkey is approximately .015 in the short-run and .023 in the long-run. This suggests that an increase in Libyan income by US$1 results in an increase in Libyan imports from the Turkey by 1.5 US Cents in the short-run and by approximately 2.3 US Cents in the long-run. The short-term elasticity of Libyan imports from Turkey with respect to Libyan income is approximately 1.915, while its long-run counterpart is approximately 4.181. This suggests that an increase in Libyan income by 1% results in an increase in Libyan imports from Turkey by approximately 2 per cent in the short-run and by 4% in the long run. The value of the coefficient of the variable $M_{L-\textbf{partner}\,i,\,t-1}$ (0.345) suggests that approximately 0.655 of the gap between the desired level of spending on imports from Turkey and the actual level of spending will be closed in one period and the number of periods of adjustment is approximately one and half years.

The regression results for France are given in Table 6. These results suggest:

(i) Libyan income is strongly influenced by Libyan oil exports to France and to the rest of the world. The "*t*" value of the coefficient of the variable "$X_{L-\textbf{France},\,t}$", which represents Libyan exports to France, is significant at the 5 per cent level of significance. The short-run elasticity of Libyan income with respect to its exports to France is approximately 0.16, while the long-term elasticity is approximately 0.238. This suggests that an increase in Libyan exports to France by 10 per cent results in an increase in Libyan income by approximately 1.6 per cent in the short run and by 2.4 per cent in the long run. Inspection of the coefficient ($Y_{L,\,t-1}$) further suggests the existence of a significant spread effects.

(ii) The results of the second equation suggest that Libyan exports to France are strongly influenced by oil prices and the level of France GDP. France income is a major determinant of Libyan exports to that country. A rise in France income by US$1 results in an increase in Libyan exports to France by approximately US$ 0.00037. Oil prices have a stronger effect on Libyan exports to France than the French income.

(iii) The results of the France GDP function in equation 3 suggest the absence of feedback effects. This may be due to the fact that the value of Libyan imports from France is a very small proportion of total French exports.

(iv) The regression results in the forth equation suggest that Libyan imports from France are positively related to the Libyan GDP within a partial adjustment mechanism. The marginal propensity of Libyan imports from France is approximately .01 in the short-run and .02 in the long-run. This suggests that an increase in Libyan income by US$1 results in an increase in Libyan imports from the France by 1 US Cents in the short-run and by approximately 2 US Cents in the long-run. The short-term elasticity of Libyan imports from France with respect to Libyan income is approximately 0.9, while its long-run counterpart is approximately 1.89. This suggests that an increase in Libyan income by 1% results in an increase in Libyan imports from France by approximately 0.9 per cent in the short-run and by 1.9% in the long run. The value of the coefficient of

the variable $M_{L-\textbf{France},i,t-1}$ (0.482) suggests that approximately 0.518 of the gap between the desired level of spending on imports from France and the actual level of spending will be closed in one period and the number of periods of adjustment is approximately 2 years.

Table 6
Regression Results of the Simultaneous Equations Model of Libyan Trade with France

$U_{Libya,t}$	=	11399.9	+	7.526 $X_{L-\textbf{France},t}$	+	0.232 $X_{Libya,t}$	+	0.341 $Y_{Libya,,t-1}$
		(3.853)		(2.490)*		(2.160)*		(2.362)*
				R^{-2} = .742 F = 28.8 $D.h$ = 0.986				
$X_{Libya-\textbf{France},it}$	=	– 254.03	+	19.8 $P_{oil,t}$	+	0.00037 $Y_{\textbf{France},t}$		
		(– 2.304)		(5.676)**		(4.928)**		
				R^{-2} = 0.667 F = 30.1 DW = 1.911				
$Y_{\textbf{France},t}$	=	116383.8	+	2.610 $X_{\textbf{France},t}$	+	58.8 $M_{Libya-\textbf{France},t}$	+	0.424 $Y_{\textbf{France},t-1}$
		(2.520)		(7.830)**		(0.435)		(5.073)**
				R^{-2} = 0.973 F = 346.9 $D.h$ = 1.254				
$M_{Libya-UK,t}$	=	– 147.9	+	.0109 $U_{Libya,t}$	+	.482 $M_{Libya-\textbf{France},t-1}$		
		(– 1.341)		(2.327)*		(3.036)**		
				R^{-2} = 0.591 F = 21.9 $D.h$ = 1.370				

The regression results for Switzerland are given in Table 7. These results suggest:

(i) Libyan income is not significantly affected by Libyan oil exports to Switzerland. It is strongly affected by Libyan exports to the rest of the world. The "t" value of the coefficient of the variable "$X_{L-Switzerland,t}$", which represents Libyan exports to Switzerland, is not statistically significant; even at the 10 per cent level of significance. This may be due to the fact that Libyan exports to Switzerland have been a very small proportion of Libyan total exports over the last two decades. However, inspection of the coefficient ($Y_{L,t-1}$) suggests the existence of a significant of a significant spread effects.

(ii) The results of the second equation suggest that Libyan exports to Switzerland are strongly influenced by oil prices and the level of Switzerland GDP. Switzerland income is a major determinant of Libyan exports to that country. A rise in Switzerland income by US$1 results in an increase in Libyan exports to Switzerland by approximately US$ 0.0012. Oil prices would seem to have less effect on Libyan exports to Switzerland than Switzerland income.

(iii) The results of Switzerland GDP function in equation 3 suggest the absence of feedback effects. This may be due to the fact that the value of Libyan imports from Switzerland is a very small proportion of total Switzerland exports.

(iv) The regression results in the forth equation suggest that Libyan imports from Switzerland are positively related to the Libyan GDP within a partial adjustment mechanism. The marginal propensity of Libyan imports from Switzerland is approximately .005 in the

short-run and .007 in the long-run. This suggests that an increase in Libyan income by US$1 results in an increase in Libyan imports from the Switzerland by 0.5 US Cents in the short-run and by approximately 0.7 US Cents in the long-run. The short-term elasticity of Libyan imports from Switzerland with respect to Libyan income is approximately 1.277, while its long-run counterpart is approximately 2.066. This suggests that an increase in Libyan income by 1% results in an increase in Libyan imports from Switzerland by approximately 1.3 per cent in the short-run and by approximately 2.1% in the long run. The value of the coefficient of the variable $M_{L\text{ - }\boldsymbol{Switzerland}\ i,\ t-1}$ (0.382) suggests that approximately 0.618 of the gap between the desired level of spending on imports from Switzerland and the actual level of spending will be closed in one period and the number of periods of adjustment is approximately 1.6 years.

Table 7
Regression Results of the Simultaneous Equations Model of Libyan Trade with Switzerland

$U_{Libya,\ t}$	=	6718.6	+	$4.608\ X_{L-\boldsymbol{Switzerland},\ t}$	+	$0.291\ X_{Libya,\ t}$	+	$0.612\ Y_{Libya,,t-1}$
		(2. 202)		(1.094)		(2.137)*		(5.120)**
		$R^{-2} = .681$		$F = 21.6$		$D.\ h = 1.321$		
$X_{Libya-\boldsymbol{Switzerland},\ i\ t}$	=	−202.1	+	$8.339\ P_{oil,\ t}$	+	$0.0012\ Y_{\boldsymbol{Switzerland},\ t}$		
		(– 5.985)		(3.817)**		(5.838)**		
		$R^{-2} = 0.676$		$F = 31.3$		$DW = 1.672$		
$Y_{\boldsymbol{Switzerland},\ t}$	=	10055.1	+	$1.660\ X_{\boldsymbol{Switzerland},\ t}$	+	$25.7\ M_{Libya-\boldsymbol{Switzerland},\ t}$	+	$0.486\ Y_{\boldsymbol{Switzerland}\ y,\ t-1}$
		(1.056)		(5.191)**		(0.221)		(4.841)**
		$R^{-2} = 0.973$		$F = 351.9$		$D.\ h = 0.713$		
$M_{Libya-\boldsymbol{Switzerland},\ t}$	=	−65.6	+	$.0046\ U_{Libya,\ t}$	+	$.382\ M_{Libya-\boldsymbol{Switzerland}\ ,\ t-1}$		
		(– 1.068)		(2.240)*		(2.202)*		
		$R^{-2} = 0.406$		$F = 14.8$		$D.\ h = 1.442$		

The regression results for Tunisia are given in Table 8. These results suggest:

(i) Libyan income is strongly influenced by Libyan oil exports to Tunisia and to the rest of the world. The "*t*" value of the coefficient of the variable "$X_{L-\boldsymbol{Tunisia},\ t}$", which represents Libyan exports to Tunisia, is significant at the 5 per cent level of significance. The short-run elasticity of Libyan income with respect to its exports to Tunisia is approximately 0.04, while the long-term elasticity is approximately 0.088. This suggests that an increase in Libyan exports to Tunisia by 10 per cent results in an increase in Libyan income by approximately 0.4 per cent in the short run and by 0.9 per cent in the long run. Inspection of the coefficient ($Y_{L,\ t-1}$) further suggests the existence of a significant spread effects.

(ii) The results of the second equation suggest that Libyan exports to Tunisia are strongly influenced by oil prices and the level of Tunisian GDP. Tunisian income is a major

determinant of Libyan exports to that country. A rise in Tunisian income by US$1 results in an increase in Libyan exports to Tunisia by approximately US$ 0.024. Oil prices would seem to have less effect on Libyan exports to Tunisia than Tunisian income.

(iii) The coefficient of the variable $M_{Libya-Tunisia,\,t}$ (which represents Libyan imports from Tunisia) in the third equation, is statistically significant, which suggests that Libyan imports from Tunisia had a significant and positive effect on the level of Tunisian GDP. This significant impact suggests the presence of feedback effects.

(iv) The regression results in the forth equation suggest that Libyan imports from Tunisia are positively related to the Libyan GDP within a partial adjustment mechanism. The marginal propensity of Libyan imports from Tunisia is approximately .007 in the short-run and .042 in the long-run. This suggests that an increase in Libyan income by US$1 results in an increase in Libyan imports from Tunisia by 0.7 US Cents in the short-run and by approximately 4.2 US Cents in the long-run. The short-term elasticity of Libyan imports from Tunisia with respect to Libyan income is approximately 1.188, while its long-run counterpart is approximately 7.11. This suggests that an increase in Libyan income by 1% results in an increase in Libyan imports from Tunisia by approximately 1.2 percent in the short-run and by 7% in the long run. The value of the coefficient of the variable $M_{Libya-Tunisia,\,t-1}$ (0.833) suggests that approximately 0.167 of the gap between the desired level of spending on imports from Tunisia and the actual level of spending will be closed in one period and the number of periods of adjustment is approximately 6 years.

Table 8
Regression Results of the Simultaneous Equations Model of Libyan Trade with Tunisia

$U_{Libya,\,t}$	=	7616.1	+	6.158 $X_{L-\mathbf{Tunisia},\,t}$	+	0.248 $X_{Libya,\,t}$	+	0.603 $Y_{Libya,\,t-1}$
		(2. 983)		(2.221)*		(2.372)*		(6.237)**
			R^{-2} = .767	F = 28.5	$D.\,h$ = 1.312			
$X_{Libya-Tunisia,\,t}$	=	−322.4	+	4.876 $P_{oil,\,t}$	+	0.024 $Y_{\mathbf{Tunisia},\,t}$		
		(−4.819)		(2.265) **		(7.942) **		
			R^{-2} = 0.706	F = 35.5	DW = 1.715			
$Y_{\mathbf{Tunisia},\,t}$	=	2420.8	+	0.477 $X_{Tunisia,\,t}$	+	12.983 $M_{Libya-Tunisia,\,t}$	+	0.606 $Y_{\mathbf{Tunisia},\,t-1}$
		(2.855)		(2.165)*		(2.243)*		(5.693)**
			R^{-2} = 0.945	F = 147.8	$D.\,h$ = 1.272			
$M_{Libya-Tunisia,\,t}$	=	−170.9	+	.0071 $U_{Libya,\,t}$	+	.833 $M_{Libya-Tunisia,\,t-1}$		
		(−2.362)		(2.846)*		(8.133)**		
			R^{-2} = 0.724	F = 39.3	$D.\,h$ = 0.932			

The regression results for Greece are given in Table 9. These results suggest:

(i) Libyan income is strongly influenced by Libyan oil exports to Greece and to the rest of the world. The "*t*" value of the coefficient of the variable "$X_{L-Greece\,i,\,t}$", which represents

Libyan exports to Greece, is significant at the 5 per cent level of significance. The short-run elasticity of Libyan income with respect to its exports to Greece is approximately 0.144, while the long-term elasticity is approximately 0.211. This suggests that an increase in Libyan exports to Greece by 10 per cent results in an increase in Libyan income by approximately 1.4 per cent in the short run and by 2.1 per cent in the long run. Inspection of the coefficient ($Y_{L,\,t-1}$) further suggests the existence of a significant spread effects.

(ii) The results of the second equation suggest that Libyan exports to Greece are influenced by oil prices and the level of Greece GDP. Greece income is a significant determinant of Libyan exports to that country. A rise in Greece income by US$1 results in an increase in Libyan exports to Greece by approximately US$ 0.003. Oil prices would seem to have greater effect on Libyan exports to Greece than Greece income.

(iii) The coefficient of the variable $M_{L,Greece\,i,\,t}$ (which represent Libyan imports from Greece) in the third equation, is statistically significant, which suggests that Libyan imports from Greece had a significant and positive effect on the level of Greece GDP. This significant impact suggests the presence of feedback effects.

Table 9
Regression Results of the Simultaneous Equations Model of Libyan Trade with Greece

$U_{Libya,\,t}$	=	12035.8	+	11.279 $X_{L-\mathbf{Greece},\,t}$	+	0.286 $X_{Libya,\,t}$	+	0.314 $Y_{Libya,\,t-1}$
		(3.642)		(3.321)**		(2.574)*		(2.156)*
		R^{-2} = .763		F = 27.8		$D.\,h$ = 0.992		
$X_{Libya-Greece,\,t}$	=	−42.6	+	9.292 $P_{oil,\,t}$	+	0.0037 $Y_{\mathbf{Greece},\,t}$		
		(−0.410)		(2.353) *		(2.182) **		
		R^{-2} = 0.337		F = 8.377		$D.W$ = 1.499		
$Y_{\mathbf{Greece},\,t}$	=	2542.7	+	2.314 $X_{Greece,\,t}$	+	73.135 $M_{Libya-Greece,\,t}$	+	0.574 $Y_{\mathbf{Greece},\,t-1}$
		(0.486)		(3.091)**		(2.876)**		(5.338)**
		R^{-2} = 0.850		F = 55.8		$D.\,h$ = 0.675		
$M_{Libya-Greece,\,t}$	=	−73.3	+	.0045 $U_{Libya,\,t}$	+	.686 $M_{Libya-Greece\,t-1}$		
		(−1.204)		(2.161)*		(3.244)**		
		R^{-2} = 0.327		F = 8.046		$D.\,h$ = 1.642		

(iv) The regression results in the forth equation suggest that Libyan imports from Greece are positively related to the Libyan GDP within a partial adjustment mechanism. The marginal propensity of Libyan imports from Greece is approximately .004 in the short-run and .014 in the long-run. This suggests that an increase in Libyan income by US$1 results in an increase in Libyan imports from Greece by 0.4 US Cents in the short-run and by approximately 1.4 US Cents in the long-run. The short-term elasticity of Libyan imports from Greece with respect to Libyan income is approximately 0.21, while its long-run counterpart is approximately 0.51 This suggests that an increase in Libyan

income by 10% results in an increase in Libyan imports from Greece by approximately 2% in the short-run and by 5.1% in the long run. The value of the coefficient of the variable $M_{L-Greece\,i,t-1}$ (0.686) suggests that approximately 0.314 of the gap between the desired level of spending on imports from Greece and the actual level of spending will be closed in one period and the number of periods of adjustment is approximately three years.

The regression results for UK are given in Table 10. These results suggest:

(i) Libyan income is not significantly affected by Libyan oil exports to UK. It is strongly affected by Libyan exports to the rest of the world. The "*t*" value of the coefficient of the variable "$X_{L\text{ - }\boldsymbol{UK},\,t}$", which represents Libyan exports to UK, is not statistically significant even at the 10 per cent level of significance. This may be due to the fact that Libyan exports to UK have been a very small proportion of Libyan total exports over the last two decades. However, inspection of the coefficient ($Y_{L,\,t-1}$) suggests the existence of a significant spread effects.

(ii) The results of the second equation suggest that the relatively small amount of Libyan exports to UK is strongly influenced by oil prices and the level of UK GDP. The UK income is a major determinant of Libyan exports to that country. A rise in UK income by US$1 results in an increase in Libyan exports to UK by approximately US$ 0.00013. Oil prices have less effect on Libyan exports to UK than the UK income.

(iii) The results of the UK GDP function in equation 3 suggest the absence of feedback effects. This may be due to the fact that the value of Libyan imports from UK is a very small proportion of UK exports.

Table 10
Regression Results of the Simultaneous Equations Model of Libyan Trade with UK

$U_{Libya,\,t}$	=	9304.6	+	17.0 $X_{L-\boldsymbol{UK},\,t}$	+	0.288 $X_{Libya,\,t}$	+	0.460 $Y_{Libya,\,t-1}$
		(2.560)		(1.741)		(2.192)*		(2.836)**
			R^{-2} = .676	F = 21.2	$D.\,h$ = 0.343			
$X_{Libya-UK,\,i\,t}$	=	−20.3	+	2.672 $P_{oil,\,t}$	+	0.00013 $Y_{\boldsymbol{UK},\,t}$		
		(−5.985)		(2.113)*		(6.110)**		
			R^{-2} = 0.711	F = 36.6	DW = 1.810			
$Y_{\boldsymbol{UK},\,t}$	=	−235785.2	+	3.366 $X_{UK,\,t}$	+	568.0 $M_{Libya-UK,\,t}$	+	0.413 $Y_{\boldsymbol{UK}\,t-1}$
		(−1.223)		(3.049)**		(1.039)		(2.181)*
			R^{-2} = 0.821	F = 45.5	$D.\,h$ = 1.241			
$M_{Libya-UK,\,t}$	=	−75.7	+	.0102 $U_{Libya,\,t}$	+	.426 $M_{Libya-UK,\,t-1}$		
		(−1.033)		(2.912)**		(3.036)**		
			R^{-2} = 0.669	F = 30.3	$D.\,h$ = 1.067			

(iv) The regression results in the forth equation suggest that Libyan imports from UK are positively related to the Libyan GDP within a partial adjustment mechanism. The

marginal propensity of Libyan imports from UK is approximately .01 in the short-run and .017 in the long-run. This suggests that an increase in Libyan income by US$1 results in an increase in Libyan imports from the UK by 1 US Cents in the short-run and by approximately 1.7 US Cents in the long-run. The short-term elasticity of Libyan imports from UK with respect to Libyan income is approximately 0.5, while its long-run counterpart is approximately 0.9. This suggests that an increase in Libyan income by 1% results in an increase in Libyan imports from UK by approximately 0.5 per cent in the short-run and by 1.2% in the long run. The value of the coefficient of the variable $M_{L-UK\,i,\,t-1}$ (0.426) suggests that approximately 0.574 of the gap between the desired level of spending on imports from UK and the actual level of spending will be closed in one period and the number of periods of adjustment is approximately 1.75 years.

The regression results for China are given in Table 11. These results suggest:

(i) Libyan income is not significantly affected by Libyan oil exports to China. It is strongly affected by Libyan exports to the rest of the world. The "*t*" value of the coefficient of the variable "$X_{L-\mathbf{China},\,t}$", which represents Libyan exports to China, is not statistically significant even at the 10 per cent level of significance. This may be due to the fact that Libyan exports to china have been a very small proportion of Libyan total exports over the last two decades. However, inspection of the coefficient ($Y_{L,\,t-1}$) further suggests the existence of a significant spread effects.

(ii) The results of the second equation suggest that the relatively small amount of Libyan exports to China is strongly influenced by oil prices and the level of Chinese GDP. The Chinese income is a major determinant of Libyan exports to that country. A rise in Chinese income by US$1 results in an increase in Libyan exports to China by approximately US$ 0.0001. Oil prices would seem to have less effect on Libyan exports to China than the Chinese income.

(iii) The results of the Chinese GDP function in equation 3 suggest the absence of feedback effects. This may be due to the fact that the value of Libyan imports from China is a very small proportion of Chinese exports.

(iv) The regression results in the forth equation suggest that Libyan imports from China are positively related to the Libyan GDP within a partial adjustment mechanism. The marginal propensity of Libyan imports from China is approximately .0091 in the short-run and .0244 in the long-run. This suggests that an increase in Libyan income by US$1 results in an increase in Libyan imports from the China by 0.9 US Cents in the short-run and by approximately 2.4 US Cents in the long-run. The short-term elasticity of Libyan imports from China with respect to Libyan income is approximately 0.23, while its long-run counterpart is approximately 0.62. This suggests that an increase in Libyan income by 1% results in an increase in Libyan imports from China by approximately 0.2 per cent in the short-run and by 0.6 per cent in the long run. The value of the coefficient of the variable $M_{L-Chinese\,i,\,t-1}$ (0.628) suggests that approximately 0.372 of the gap between the desired level of spending on imports from China and the actual level of spending will be closed in one period and the number of periods of adjustment is approximately two and half years.

Table 11
Regression Results of the Simultaneous Equations Model of Libyan Trade with China

$U_{Libya,\,t} = 5930.4 + 3.147\,X_{L-China,\,t} + 0.399\,X_{Libya,\,t} + 0.634\,Y_{Libya,\,t-1}$
(1.751) (0.330) (2.314)* (5.093)**
$R^{-2} = .636 \quad F = 17.9 \quad D.\,h = 0.632$

$X_{Libya-China,\,i\,t} = -102.3 + 3.978\,P_{oil,\,t} + 0.00011\,_{China,\,t}$
(−5.985) (2.383)* (3.123)**
$R^{-2} = 0.458 \quad F = 13.3 \quad DW = 1.950$

$Y_{China,\,t} = 179501.2 + 2.157\,X_{China,\,t} + 575.6\,M_{Libya-China,\,t} + 0.359\,Y_{China\,t-1}$
(4.442) (5.777)** (1.014) (5.146)**
$R^{-2} = 0.975 \quad F = 164.71 \quad D.\,h = 1.090$

$M_{Libya-China,\,t} = -207.7 + .0091\,U_{Libya,\,t} + .628\,M_{Libya-China,\,t-1}$
(−2.061) (2.405)* (3.837)**
$R^{-2} = 0.529 \quad F = 17.9 \quad D.\,h = 0.777$

6. CONCLUSIONS

The main conclusions of this chapter may be summarized in the following:

1. Libyan exports to each member of its major trading partners had a significant positive effect on Libyan GDP. Only Libyan exports to China did not seem to have a significant effect on Libyan GDP. This may be due to the fact that these exports were too small and highly fluctuating.
2. The effects of lagged GDP on GDP are positive and significant in all cases which suggest the existence of a strong spread effects from the export sector to the rest of the economy.
3. The GDP of each major trading partner of Libya is a major determinant of Libyan exports to these partners.
4. The price of oil has a significant effect on Libyan export revenues from its major trading partners.
5. The GDP of the major trading partners is strongly influenced by their exports to countries other than Libya.
6. The level of Libyan imports from its major trading partners does not seem to have any significant effect on the level of GDP of its major trading partners except Greece, Tunisia and Turkey. In other words , it seems that a feedback effect exerts only in the trade relation between Libya, Greece, Tunisia and Turkey.
7. Libyan income has a strong impact on its imports from its trading partners. The short-run income elasticity was highest in the case of Italy (2.16) followed by Turkey (1.91) Tunisia (1.19) and France (0.9).

Notes

1. The data were estimated at constant prices with allowances for the real income effects of changes in the terms of trade; on this see Metwally and Tamaschke (1980) and Tamaschke (1990).

2. In the light of the comments in footnote 1, the values of R^2, *t*, *F*, *DW* and Durbin's *h*-statistics in Tables 3 and 4 are given for what they are worth. In addition to the test for serial correlation, inspection of the residuals about the fitted equations did not suggest any obvious violations of the homoscedasticity of error terms assumption. The equations were also analyzed for multicollinearity and these tests gave no undue cause for concern; this is further confirmed by a comparison of the *t*-statistics with the *F*-statistics of the fitted equations. For further discussion, including the robustness of Least Squares methods in the presence of minor violations of the error term assumptions (Davidson, 2000, Mittelhammer, Judge and Miller, 2000 and Patterson, 2000).

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