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OPTIMIZING GEOGRAPHICAL DISTRIBUTION FOR SAUDI ARABIA EXPORTS OF DATE PALM

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Abstract

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This study aims at evaluating dates export trends, export stability index and level of exports' geographic concentration. Moreover, it examines the possibility of maximizing the returns of exporting dates.

A quantitative analysis was used to estimate the export trends in quantity, unit value and total value of exported dates during the period 1997-2011. The stability index for trade in dates during the same period was calculated. GINI Coefficient, as a concentration indicator, was calculated and linear programming algorithm was used to re-distribute the dates' exports between the selected countries. Secondary data, mainly from the Food and Agricultural Organization of the United Nations, was used in the analysis.

The results showed that all of the quantity exported, unit values and the value of exports from Saudi Arabia dates show increasing trend during the period (1997 - 2011).On the other hand, the results showed more stability of Saudi Arabia dates exports during the studied period.

Saudi Arabia dates were directed to many countries of the world, Yemen occupied the first place in import quantities (29.49 % of the total exports from Saudi Arabia), then comes Jordan in the second place and Pakistan ranked third. Turkey ranked fourth and India ranked fifth. The suggested Geographic re-distribution of Saudi Arabia dates exports ensured an increase of dates export earnings by about US$ 11.87 million annually(i.e. 18.45% of total exports).

Key words: date palm, Saudi Arabia, exports, stability

Abbreviations: FAO - Food and Agriculture Organization of the United Nations; GCC - Gulf Cooperation Council; KSA - Kingdom of Saudi Arabia; LP – Linear Programming Model; OLS - Ordinary Least Square; RCA - Revealed Comparative Advantage; RTA - Revealed Trade Advantage; SA - South Africa; TEI - Trade Entropy Index

Introduction

Date palm production and trade had witnessed a continuous increase at the global level. The total global production of date palm in 2010 was about 7.8 million tons; Egypt is leading this sector by producing about 1.4 million tons, and then comes Saudi Arabia producing about 1.08 million tons. On the trade part, the total global exports of dates in 2010 was around 836 thousand tons, out of which, the UAE exported about 28% of the global exports, then comes Iran (13%), Algeria (10%) and Kingdom of Saudi Arabia (KSA) (9%). (El-Habbab and Al-Mulhim, 2013).

Foreign trade play a main role in the national economy of the kingdom of Saudi Arabia, the value of exports of Saudi Arabia dates was about US$ 86.3 million in 2011.This value is not commensurate with the status and importance of dates in Saudi Agriculture, whether in terms of total production, cultivated area or the subsidy and importance of this sector by the government.

In general, exports of dates from Saudi Arabia are mainly directed to low income countries, at low prices, while small quantities were exported to high-income countries at higher prices. This necessitate a review of the geographical distribution of exports of Saudi Arabia dates to assure a greater share

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of Saudi dates in countries where high prices for dates prevail, i.e. to maximize the return on export of the same quantity exported.

This research aims at re-distribution of exports of Saudi Arabia's dates in different countries in order to get the highest possible value of the same quantity of exports to increase the export earnings of the Kingdom of dates, and to increase the contribution of agricultural exports in total exports.

The remainder of this paper is organized as follows: Section 2 presents a review of related literature. Section 3 describes the research methodology, while section 4 covers the theoretical background of the analysis. Section 5 presents the results and discussions, and the last section (Section 6) delineated the recommendations.

A recent study on the marketing of Saudi dates in the global markets grouped the importing countries into five groups with respect to dates' unit value (Al-Shareed et al., 2012).

A country market study of Saudi Arabia (Rensburg and Letswalo, 2010) examined the trade flows between South Africa (SA) and Saudi Arabia. The major objective of the study was to identify agricultural products that have the potential to be exported to Saudi Arabia. First, the study gave a historical background about Saudi Arabia, by looking at some the two countries facts, gave an economic overview and looked at the regional and international relations by Saudi Arabia. Then it examined the trade policy of Saudi Arabia, and looked at bilateral agreements between South Africa (SA) and Saudi Arabia and at total volume of trade between these two countries. A trade potential index (TPI) was drawn up,and it was noted that there are opportunities for deepening trade with Saudi Arabia. The "trade chilling" analysis was also conducted.

A study on the competitiveness of Saudi Arabia date palm (El-Habbab and Al-Mulhim, 2013) found that the excess production of dates, low consumption and weak export activities and processing of Saudi dates, resulted in a large surplus of dates at about 400 thousand tons in 2010, this is expected to exceed 600 thousand tons by the year 2022. The surplus is considered as a waste of water resources as well as of the financial resources of the Kingdom. To evaluate the level of competitiveness of dates between the GCC countries, the study used three main measures: i.e. Revealed Comparative Advantage (RCA), Revealed Trade Advantage (RTA) and the Trade Entropy Index (TEI), for the period 2000-2009. All the results showed that the KSA had Revealed Comparative Advantage for Dates exports.

Materials and Methods

The research used descriptive and quantitative analysis as follows:

Evaluate trend equations for the quantities, unit values and total values of date's exports from Saudi Arabia using Ordinary Least Square (OLS) method.

Evaluate the export stability coefficients annually during the period 1997-2011.

Evaluate the GINI index for dates' exports from Saudi Arabia at the current situation and after the geographic redistribution of the exports.

Use linear programming model for maximizing the value of Saudi exported dates, while maintaining the same level of total exported quantities.

This research has relied on secondary data for the period (1997-2011), which is mainly published by the Food and Agriculture Organization of the United Nations (FAO).

Theoretical Background of the Analysis

Trend Equations

The linear trend equations was applied, i.e.

$Exp = a \pm bT + \mu$,

where: Exp: quantity, unit value and total value of dates exports from the KSA;
T: time in years (1997-20011);
μ: error term;
a, b are parameters to be estimated.

Coefficient of Stability (CS)

CS is used to measure the degree of fluctuation in the quantity, value and the unit value of exports. The ideal situation for the stability of exports is the case when the stability coefficient is equal to zero, and the higher the value of this parameter from zero, indicates greater instability in exports (Michaely, 1962). The stability coefficient is calculated through the following steps:

1 - Calculate the equation of the exports trend during the studied period.

2 - Calculate the estimated value of exports in each of the periods under study.

3 - Calculate the percentage of the deviations of actual values from the estimated values in each year as follows:

$$CS = \frac{EX - \overline{EX}}{\overline{EX}} * 100 ,$$

where: CS = Coefficient of Stabilitym, EX = actual value, $\overline{EX}$ = estimated values

Export Concentration Index: (GINI index)

GINI index measures the extent to which the distribution of geographic exports of certain exporting country among individual countries deviates from anequal distribution. A Lorenz

curve plots the cumulative percentages of exports received against the cumulative number of recipients, starting with the lowest importing country to the highest importing country from the exporting country (Saudi Arabia). The GINI index measures the area between the Lorenz curve and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under the equivalent line. Thus, a GINI index of zero represents perfect equality, while an index of 100 implies perfect inequality.

- Linear Programming Model (LP):

LP is a Mathematical technique used in computer modeling (simulation) to find the best possible solution in allocating limited resources to achieve a maximum profit or minimum cost. However, it is applicable only where all relationships are linear. The LP model for this study is:

$$\text{Maximize } Z = \sum_{i=1}^{15} Pi * Qi$$

s.t.

$$\sum_{i=1}^{16} Qi \leq bi$$

$$\sum_{i=1}^{15} Pi * Qi \text{ and } Qi \geq 0,$$

where: Z: the total return from dates exports from Saudi Arabia; P_i: Unit value (US$/ton) of exported dates from Saudi Arabia to Country I; Q_i: Quantity in tons of exported dates from Saudi Arabia to Country I; b_i : Maximum quantity of exported dates from Saudi Arabia to Country I; i: Number of importing countries (15 country)

Results and Discussions

The Evaluation of Saudi Arabia's Dates Exports

This section deals with the evolution of Saudi Arabia exports of dates in quantities, unit values and total values.

Export Trends of Dates from Saudi Arabia

From the data in Annex 1 and Figure 1, it is noticed that the amount of dates exports from Saudi Arabia fluctuated during the period (1997- 2011). It reached a minimum in 1998 (about 24 850 tons) representing 88.2% of the base year 1997, and a maximum in 2011 (about 77 800 tons) representing 307.4% of the base year. The quantity of exported dates from Saudi Arabia had increased during the study period by around 3490 tons annually, representing 8.05% of the average amount of Saudi Arabia's exports of dates during the study period. Linear trend equations were evaluated and proved to be significant at less than 0.01 levels (Table 1).

Export Trends in Prices (Unit Value) of Dates

The export unit values of the Kingdom of Saudi Arabia of dates fluctuated during the study period (1997-2011), it reached a minimum in 2001(586.4 US$/ ton) which represents 70.2% of the base year 1997. On the other hand, it reached its maximum in 2009 (1131.2 US$/ ton) representing 135.5% of the base year (Annex 1 and Figure 2). The unit values trend during the study period showed a slight increase on average (about 31.1 US$/ tons annually), this increase was significant at 0.01% level (Table 1).

Export Trend for Values of Dates

The export values of the Kingdom of Saudi Arabia of dates followed the same patterns as quantities and unit values, it

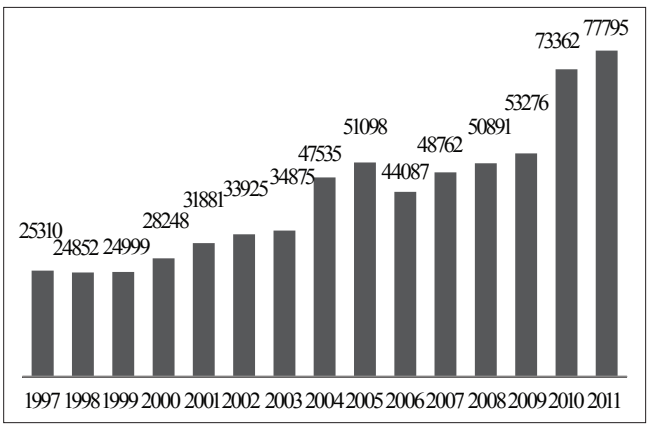

Fig. 1. Quantity of Dates Exports from Saudi Arabia (1977-2011)

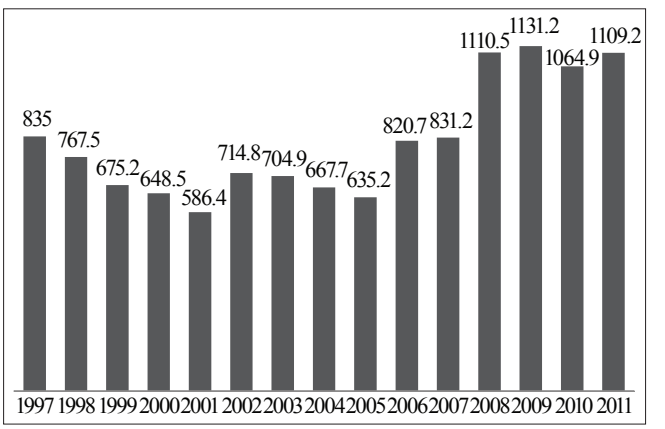

Fig. 2. Unit Values of Dates Exports from Saudi Arabia during 1997-2011, US$/ton

fluctuated during the study period (1997 - 2011), it reached a minimum in 1999 (16.88 million US$/ ton) which represents 79.9% of the base year 1997. It reached its maximum in 2011 (86.29 million US$/ ton) representing 408.3% from the base year (Annex 1 and Figure 3). The trend of export values of dates during the study period showed a continuous increase (about 4.56 million US$ annually), this increase was significant at 0.01% level (Table 1).

Degree of Stability of the Saudi Arabia's Dates Exports during the Period (1997- 2011)

Saudi Arabia's export quantities, unit values, and total values of dates were moving towards stability during the period (1997-2011). The value of stability coefficients were 9.43, 10.87 and 15.25 for the export quantity, unit values of and total values respectively. This indicates that the dates' exports of Saudi Arabia have a competitive advantage in the global markets.

Export Concentration Index (GINI index)

Figure 4 shows that the deviation of Lorenz curve from the equity curve is relatively high, the number of main importing countries of dates from Saudi Arabia was 15, and other countries are grouped in one figure (other countries). The GINI Coefficient of concentration was calculated as 74, this indicates that the level of geographic trade concentration is low.

Geographic Distribution of Saudi Arabia Dates Exports during the Period (2007-2011)

The exports of Saudi Arabia of dates are spread between more than 15 main countries in the world. Yemen occupies the first place with an average quantity of about 17.9 thousand tons during 2007-2011, at a value of about US$ 9.496 million. Jordan comes in the second place with an average exported quantity of about 4161.2 tons at a value of US$ 5.86 million, with an average unit value of US$ 1408.7 per ton.

The lowest importing country of Saudi Arabian dates, as an average of 2007-2011 was Italy (9.2 tons) (Annex 2 and Figure 5).

The study assumed date varieties of the exported dates by the Kingdom of Saudi Arabia are homogeneity for all countries because detailed data on exported varieties to each country are not available. In addition, it is assumed that few quantities of high quality dates are exported to low income countries that could be redirected to other countries that can pay higher prices. Moreover, Saudi Arabia produces more

Table 1
The estimated equations of the time trends of exports of dates quantities, and value, and total values during 1997-2011

Variable	Constant	Slope	Average	Annual change, %	R^2	F value	t-value
Exports Quantities, tons	15461.6	**3491.4	43393	8.05	0.88	96.2	9.8
Unit Value, US$/ton	571.4	**31.1	820.2	3.79	0.53	14.45	3.8
Total Value, US$	1172.3	**4562.1	37669.3	12.1	0.82	60.7	7.8

Source: Calculated by the Researchers

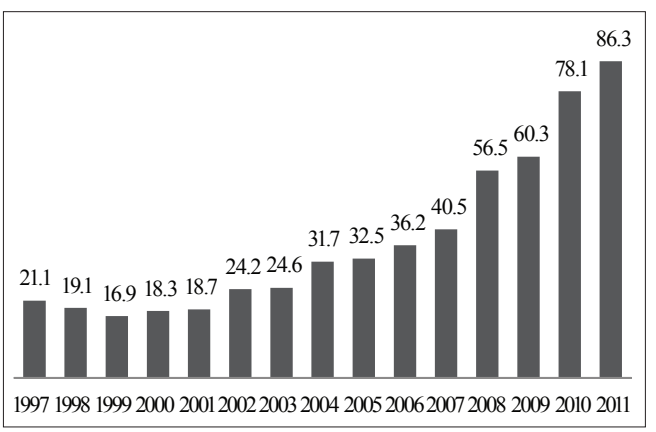

Fig. 3. Values of Dates Exports from Saudi Arabia during 1997-2011, Million US$

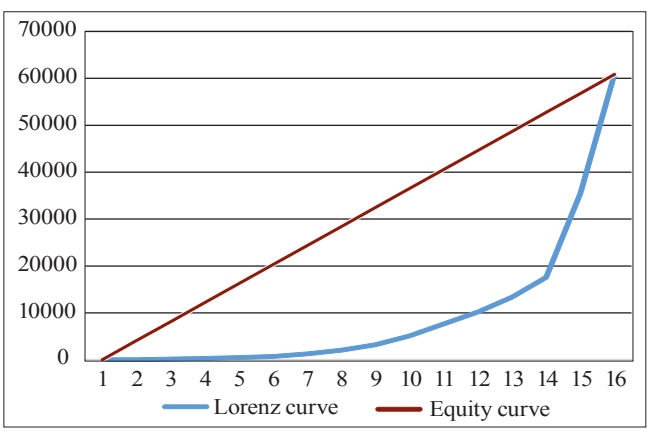

Fig. 4. Lorenz Curve for the Current Dates Exports from Saudi Arabia

than 400 varieties of dates due to prevailing different climates in the country; some of these dates are of high quality, which could be exported to high-income regions.

The Linear Programming Algorithm was implemented for redirecting dates exports from Saudi Arabia. It is assumed that Saudi Arabia can increase its export volume to the high income countries by 10% of the country's import capacity if its imports from Saudi Arabia share is less than 10% of its total dates imports, and increase it by 20% of the country's import capacity if its imports from Saudi Arabia share is more than 10% and less than 20% of its total dates imports. On the other hands, if the share of Saudi Arabia dates in a country is 40% or more, there will be no change in their imports.

The study showed that the annual exports of Saudi Arabia of dates, as an average of the period (2007-2011), amounted to 60.62 thousand tons at a value of about US$ 64.35 million, and the results of implementing the linear programming model (Annex 3) showed that KSA can export the same quantities at about US$ 76.22 million, which gain more from export earnings of dates for about US$ 11.87 million (around 15.6%)

According to the optimal solution, the Saudi Arabia dates exports will decrease in five countries, they are Yemen (US$ -2187 thousand and 3587 tons), Turkey (US$ -1434 and 1434 tons), Pakistan (US$ 300 thousand and 637 tons), India (US$ 295 thousand and 507 tons), and Sri Lanka (US$ 27 thousand and 24 tons). In addition, the un-identified other countries will decrease their imports by 1997 tons. Jordan and Indonesia imports of Saudi Arabian Dates will not change. The largest increase in dates imports will be in France (US$ 7196 Thousand and 2591 tons) and the lowest increase in imports is for Lebanon (US$ 975 thousand and 407 tons) (Figures 6 and 7).

The suggested geographic re-distribution of Saudi Arabia leads to a decrease in the GINI coefficient to 0.63 from 0.74. i.e. the concentration will increase.

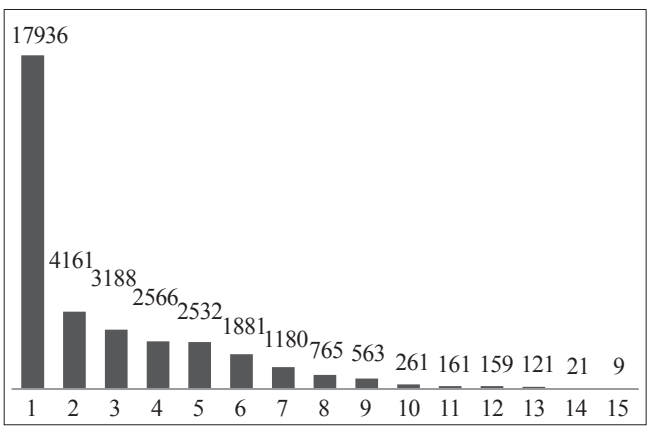

Fig. 5. Geographic Distribution of the Saudi Arabian Dates as an Average of 2007-2011

Recommendations

Direct exports of Saudi dates that have high specifications to countries that can pay higher prices such as United Kingdom, Germany, France and Canada. These quantities will be taken from the countries where the low prices of dates prevail.

Conduct field studies on foreign markets of Dates (United Kingdom, Germany, France, Canada) to provide market information about (volume of demand (quality, quality, varieties of date palm desired, the size of the packages and the competing countries in those markets)

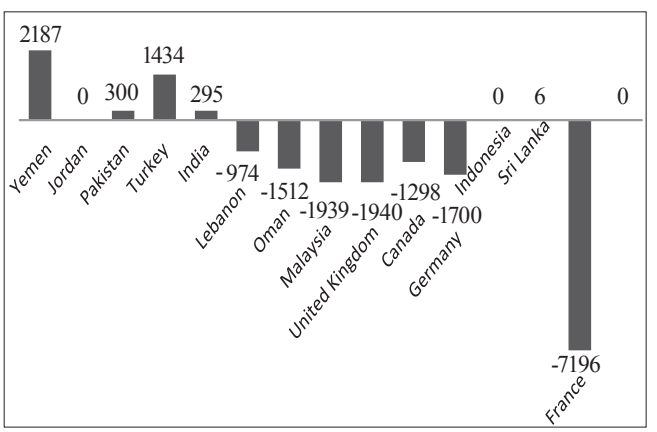

Fig. 6. Change in Value of Geographic Redistribution of Saudi Arabia Dates Exports, Thousand US$

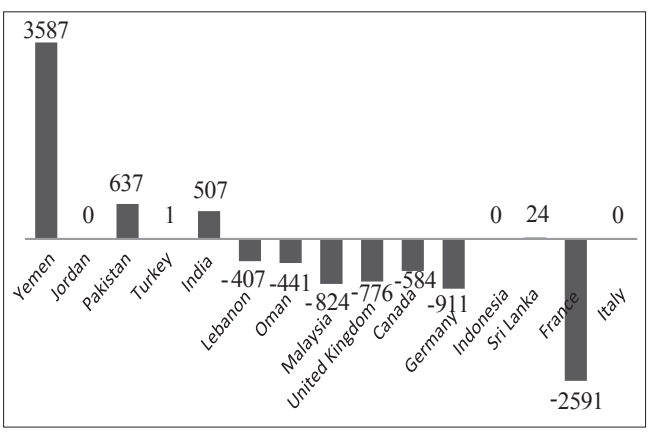

Fig. 7. Change in Geographic Quantity Redistribution of Saudi Arabia Dates Exports, Tons

Conduct promotion campaigns for the Saudi dates in European markets through exhibitions, festivals and seminars and utilization trying to benefit from the religious component of Saudi Arabian dates.

The Limitations of This Study

This study assumed the homogeneity of the varieties of exported dates by the Kingdom of Saudi Arabia to other countries due to the un-availability of detailed data on the exported varieties to each country. This limitation should be considered in the future research when detailed information on each important variety in the KSA is available.

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Annex 1
Dates Exports from Saudi Arabia during 1996-2011

Year	Quantity	Unit Value	Total Value	Index No. 1997=100	Thousand US$	Index No. 1997=100
	Tons	Index No. 1997=100	US$/ton			
1997	25310	100	835	100	21133	100
1998	24852	98.2	767.5	91.9	19073	90.3
1999	24999	98.8	675.2	80.9	16880	79.9
2000	28248	111.6	648.5	77.7	18320	86.7
2001	31881	126	586.4	70.2	18694	88.5
2002	33925	134	714.8	85.6	24248	114.7
2003	34875	137.8	704.9	84.4	24585	116.3
2004	47535	187.8	667.7	80	31739	150.2
2005	51098	201.9	635.2	76.1	32456	153.6
2006	44087	174.2	820.7	98.3	36183	171.2
2007	48762	192.7	831.2	99.5	40529	191.8
2008	50891	201.1	1110.5	133	56514	267.4
2009	53276	210.5	1131.2	135.5	60267	285.2
2010	73362	289.9	1064.9	127.5	78126	369.7
2011	77795	307.4	1109.2	132.8	86293	408.3
Average	43393		820.19		37669.33	

Source: FAOSTAT, 2013

Annex 2
Geographic Distribution of Saudi Arabian Dates Exports as an Average of the Period 2007-2011

Country	Quantity		Unit Value		Value	
	Tons	% of Total	US$/Ton	% of Total	Thousand Tons	% of Total
Yemen	17936	29.49	529.4	50.04	9496.2	14.76
Jordan	4161	6.84	1408.7	133.15	5861.8	9.11
Pakistan	3188	5.24	471	44.51	1501.6	2.33
Turkey	2566	4.22	857	81	2199.2	3.42
India	2532	4.16	581.2	54.94	1471.6	2.29
Lebanon	1881	3.09	2394.3	226.3	4503.6	7
Oman	1180	1.94	3425.6	323.78	4040.8	6.28
Malaysia	765	1.26	2353.2	222.42	1800.2	2.8
United Kingdom	563	0.93	2500	236.29	1408	2.19
Canada	261	0.43	2218.7	209.71	578.2	0.9
Germany	161	0.26	1864.3	176.21	299.4	0.47
Indonesia	159	0.26	792.5	74.9	126	0.2
Sri Lanka	121	0.2	220.8	20.87	26.8	0.04
France	21	0.03	2776.7	262.45	57.2	0.09
Italy	9	0.02	608.7	57.53	5.6	0.01
Other Countries	25314	41.62	1223.4	115.63	30969.6	48.13
Total	60818	100	1058	100	64345.8	100

Annex 3
Linear Programming Re-Distribution Results

Country	Total Imports	Current Situation				Optimal Solution				Value	Quantity
	Quantity	Quantity		Vale		Quantity		Value			
	Tons	Tons	% of Total	Thou-sand US$	% of Total	Tons	% of Total	Thou-sand US$	% of Total	Redistri-bution	Redistri-bution
Yemen	24948	17936	29.49	9496	14.76	14349	23.59	7309	9.96	2187	3587
Jordan	9172	4161	6.84	5862	9.11	4161	6.84	5862	7.69	0	0
Pakistan	11077	3188	5.24	1502	2.33	2551	4.19	1202	1.58	300	637
Turkey	12865	2566	4.22	2199	3.42	2565	4.22	765	2.88	1434	1
India	246490	2532	4.16	1472	2.29	2025	3.33	1177	1.54	295	507
Lebanon	9152	1881	3.09	4504	7	2288	3.76	5478	7.19	-974	-407
Oman	8106	1180	1.94	4041	6.28	1621	2.67	5553	7.29	-1512	-441
Malaysia	15892	765	1.26	1800	2.8	1589	2.61	3739	4.91	-1939	-824
United Kingdom	13393	563	0.93	1408	2.19	1339	2.2	3348	4.39	-1940	-776
Canada	8454	261	0.43	578	0.9	845	1.39	1876	2.46	-1298	-584
Germany	10724	161	0.26	299	0.47	1072	1.76	1999	2.62	-1700	-911
Indonesia	16604	159	0.26	126	0.2	159	0.26	126	0.17	0	0
Sri Lanka	5260	121	0.2	27	0.04	97	0.16	21	0.03	6	24
France	26115	21	0.03	57	0.09	2612	4.29	7253	9.52	-7196	-2591
Italy	7639	9	0.02	6	0.01	9	0.02	6	0.01	0	0
Other Countries		25314	41.62	30970	48.13	23535	38.7	30969	37.77		
Total		60818	100	64346	100	60818	100	76654	100		
Increase in Earnings											
Million US$								11.87			
%								15.6			