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DECOMPOSING THE MARGINAL INTRA-INDUSTRY TRADE INDEX AS A MEASURE OF CHANGES IN TRADE PATTERNS AND ITS APPLICATION TO THE MENA COUNTRIES

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1. Introduction

In our two previous studies we investigated the change in the pattern of trade for Turkey (Erlat and Erlat (2006, 2008)). The first study, based on the work by Gagnon and Rose (1995), classified the sectors as surplus, balance and deficit sectors and constructed 3x3 contingency tables indicating whether sectors that, for example, showed a surplus at the beginning of the period remained surplus sectors at the end of the period or moved into the balance and deficit categories. This also enabled us (a) to test, if the beginning pattern is independent of the pattern at the end of the period and (b) construct histograms regarding the distribution of how long the sectors have been showing surpluses over the period.

The second study uses two measures of comparative advantage namely, the index of revealed comparative advantage (RCA) due to Balassa (1965) and the Lafay index (Lafay, 1992), as measures of specialization and investigates if the distribution of these measures applied to 3-digit SITC trade data evolve over time. We used Galtonian regressions, as in Laursen (2000), that involve regressing the cross-section of index values at the end of the period on the cross-section at the beginning of that period. The sign of the slope coefficient and its relation with the correlation coefficient provide us with the information as to how the pattern and degree of specialization of Turkish trade have evolved.

In this study, we use a new tool developed by recently by Bastos and Cabral (2007) that is based on decomposing the change in trade between two time periods into three components: (i) The change in inter-industry trade that contributes to a country's specialization at the beginning of the period; i.e., the increase in previous specialization, (ii) the change in inter-industry trade that does not contribute to the country's specialization at the beginning of the period; i.e., specialization shifts and (iii) the share of intra-industry trade in new trade; marginal intra-industry trade.

Bastos and Cabral (2007) apply this tool to 26 manufacturing industries in 20 OECD countries including Turkey. This, of course, will enable us to compare Turkey's trade performance with a different group of countries with different economic characteristics.

The plan of the paper is as follows. The next section contains a description of the methodology implemented in the paper. We describe the data in section 3 and present the empirical results in section 4. Section 5 contains our conclusions.

2. Methodology

The tool we shall use to investigate the dynamic pattern of trade is based on measuring the share of intra-industry trade in new trade; i.e., on measuring marginal intra-industry trade (MIIT). The most popular measure of MIIT is the one due to Brulhart (1994) and considers what is left over after the *inter-industry component* in new trade is accounted for. If $\Delta X_{it} = X_{it_1} - X_{it_0}$ and $\Delta M_{it} = M_{it_1} - M_{it_0}$, where X_{it} and M_{it} represent exports and imports of sector *i* at time *t*, respectively, and t_0 and t_1 represent the beginning and ending dates of the period over which the change in these trade flows are considered, then

$$MIIT_{it} = 1 - MINTER_{it} = 1 - \frac{|\Delta X_{it} - \Delta M_{it}|}{|\Delta X_{it}| + |\Delta M_{it}|} \tag{1}$$

where MINTER is marginal *inter*-industry trade. It is the changes in unmatched trade, given by MINTER that contains information about the dynamic pattern of trade beyond its movement towards or away from intra-industry trade.

Bastos and Cabral (2007) decompose MINTER into changes that increase a countries previous specialization and those that decrease a countries previous specialization. They denote the former change by IPS and the latter by SS, indicating specialization shifts. This decomposition is based on the following rule:

$$\begin{aligned} MINTER_{it} &= IPS_{it} \quad if \quad sign(\Delta X_{it} - \Delta M_{it}) = sign(X_{it_0} - M_{it_0}) \\ &= SS_{it} \quad if \quad sign(\Delta X_{it} - \Delta M_{it}) \neq sign(X_{it_0} - M_{it_0}) \end{aligned} \tag{2}$$

In other words, the change in inter-industry trade will be IPS if the relationship between exports and imports at the beginning of the period remains the same in new trade; otherwise it will indicate a specialization shift. This shift in specialization may be either because $\Delta X_{it} - \Delta M_{it} > 0$ while $X_{it_0} - M_{it_0} < 0$ or because $\Delta X_{it} - \Delta M_{it} < 0$ while $X_{it_0} - M_{it_0} > 0$. Note that this does not necessarily imply that $X_{it_1} - M_{it_1} > 0$ ($X_{it_1} - M_{it_1} < 0$) will take place when $\Delta X_{it} - \Delta M_{it} > 0$ ($\Delta X_{it} - \Delta M_{it} < 0$) but that $X_{it_1} - M_{it_1} > X_{it_0} - M_{it_0}$ ($X_{it_1} - M_{it_1} < X_{it_0} - M_{it_0}$).

Since dealing with sector level results may become tedious, we need to aggregate them. Our aggregation will be at both the country level and in terms of sector groupings. Thus, letting

(3) $$k_{ijt} = \frac{|\Delta X_{it}| + |\Delta M_{it}|}{\sum_{i=1}^{N_j} |\Delta X_{it}| + |\Delta M_{it}|}$$

where *j* indicates either country level or sector group aggregation, we obtain

(4) $$IPS_{jt} = \sum_{i=1}^{N_j} k_{ijt} IPS_{it}, \quad SS_{jt} = \sum_{i=1}^{N_j} k_{ijt} SS_{it}, \quad MIIT_{jt} = \sum_{i=1}^{N_j} k_{ijt} MIIT_{it}$$

Note that $IPS_{jt} + SS_{jt} + MIIT_{jt} = 1$.

3. The Data

The main source of the data is the United Nations COMTRADE database. We have considered SITC 3 digit classified import and export data measured in $US and found that series exist for different periods for the MENA countries. First of all, the earliest data for which observations exist in 1988 and only for Israel, Kuwait and Oman. The latest date is 2001 and is found for Bahrain, Israel, Jordan, Oman, Qatar and Saudi Arabia. Secondly, there are countries like Iraq, Djibouti for which no data exist and countries like Iran, Libya, Syria, Yemen for which data exists for very short periods like four or two years. We, unfortunately, left these countries out of consideration. Hence, the set of MENA countries that we have obtained empirical results consist of Algeria, Bahrain, Egypt, Israel, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Tunisia, Turkey and the United Arab Emirates (UAE).

The empirical results are presented for overall trade and five technologically determined subgroups as was done in our previous work (see, e.g., Erlat and Erlat, 2008). The subgroups are

Raw Material Intensive Goods ***(RMIG)*****:** SITC 0, 2 (ex.26), 3 (ex.35), 4, 56

Labour Intensive Goods ***(LIG)*** **:** SITC 26, 6 (ex.62, 67, 68), 8 (ex.87, 88)

Capital Intensive Goods ***(CIG)*****:** SITC 1, 35, 53, 55, 62, 67, 68, 78

Easy-to-Imitate Research Intensive Goods ***(EIRG)*****:** SITC 51, 52, 54, 58, 59, 75, 76

Difficult-to-Imitate Research Intensive Goods ***(DIRG)*****:** SITC 57, 7 (ex.75, 76, 78), 87, 88

The details for these subgroups are given in the Appendix.

4. Empirical Results

We shall present our empirical results in two tables. Table 1 has the results of applying our tools to the full data available for all the countries. Hence, they will correspond to various periods with differing beginning and ending dates. In Table 2 we have results corresponding to a period that is common to the majority of the countries in the set being consider

The results for ***overall trade*** from Table 1 indicate that Kuwait, Qatar, Egypt, Jordan, Israel, Turkey and the UAE have the most dynamic trade patterns for the periods their performances are considered. Turkey and Israel enter this group because they have low IPS values. Their SS values are even lower but their MIIT values are high (in fact, MIIT is higher than IPS for Israel), indicating that new trade has not lead to a specialization shift in inter-industry trade but to an increase in matched trade. Tunisia and Morocco show a similar performance with somewhat higher IPS values and much lower SS values.

The country that exhibits the most dynamic trade pattern is Kuwait with a much larger value for SS than both IPS and MIIT. Kuwait is followed by Qatar and by Egypt where, for the latter country, the share of intra-industry trade in new trade is about the same as the rate of specialization shift in inter-industry trade.

The least dynamic trade pattern is observed for Algeria, Saudi Arabia, Bahrain and Oman, all of which exhibit IPS values greater than 80 % and SS values less than 10%.

Turning to the results for ***raw-material intensive goods***, the dynamism in trade patterns continue for Kuwait and Qatar with high SS and low IPS values, and almost non-existent movement in MIIT. Turkey continues exhibiting relatively high MIIT values (compared to SS values) and is joined by Tunisia, Egypt and Morocco. Egypt also has a comparable SS value. Saudi Arabia, Algeria, Bahrain and Oman continue exhibiting static trade patterns for RMIG.

The picture seems to change when we move on to the other subgroups where manufacturing industries start making up the majority of the sectors.

Table 1																		
Components of Trade Change in MENA Countries (Various Periods) (%)																		
	Overall Trade			**RMIG**			**LIG**			**CIG**			**EIRG**			**DIRG**		
	IPS	**SS**	**MIIT**	**IPS**	**SS**	**MIIT**	**IPS**	**SS**	**MIIT**	**IPS**	**SS**	**MIIT**	**IPS**	**SS**	**MIIT**	**IPS**	**SS**	**MIIT**
Algeria (92-05)	93.99	5.31	0.70	97.5	2.08	0.41	31.05	27.95	41.02	20.16	15.18	64.66	65.58	15.50	18.92	57.37	4.62	38.01
Bahrain (94-05)	85.73	7.39	6.87	94.27	2.31	3.43	26.73	45.63	27.64	63.52	11.14	25.34	27.13	60.44	10.43	47.21	41.39	11.40
Egypt (94-04)	46.02	30.33	23.64	55.88	21.49	22.63	27.25	50.87	21.87	27.89	57.91	14.21	60.48	22.40	17.12	31.35	52.91	15.74
Israel (88-05)	38.14	17.36	44.50	75.44	16.12	8.44	33.19	17.17	49.64	60.57	3.77	35.66	30.49	18.05	57.40	37.64	8.12	54.24
Jordan (89-05)	49.86	22.74	27.39	75.53	9.27	14.20	22.57	48.68	28.75	49.77	19.07	31.16	39.21	17.73	43.06	50.90	13.07	36.03
Kuwait (88-01)	13.96	82.56	3.18	2.28	97.37	0.36	35.15	31.07	36.78	82.98	13.24	3.79	56.97	27.05	15.99	38.44	56.21	5.36
Morocco (93-04)	69.25	7.99	22.76	65.58	14.53	19.90	76.67	3.48	19.85	76.59	11.61	11.80	86.95	0.61	12.44	51.23	7.66	41.11
Oman (88-05)	80.74	7.94	11.31	90.92	2.02	7.06	45.60	11.65	42.75	77.92	5.09	16.99	70.49	2.24	27.27	66.50	13.27	20.23
Qatar (91-05)	61.82	34.96	3.22	59.68	40.10	0.22	86.41	4.79	8.80	78.64	12.04	9.33	76.40	17.93	5.67	87.92	2.71	9.37
S.Arabia (91-05)	89.10	3.53	7.37	98.07	0.32	1.62	34.70	37.97	27.33	70.95	2.87	26.19	75.74	3.47	20.79	62.68	15.17	22.15
Tunisia (90-04)	57.86	5.40	36.74	51.70	6.46	41.84	71.51	3.64	24.85	64.12	5.28	30.60	64.66	5.01	30.33	34.46	7.68	57.86
Turkey (88-05)	42.84	19.53	37.63	62.87	16.42	20.72	39.43	23.64	39.93	15.29	23.66	61.05	60.16	22.68	17.16	52.28	12.72	35.00
UAE (91-01)	49.50	20.00	30.50	69.83	24.90	5.27	27.57	16.40	56.03	20.31	31.27	48.43	18.85	20.33	60.82	52.50	6.11	41.40

For ***labour intensive goods*** we find that Jordan, Bahrain, Egypt with low IPS's and high SS's, and UAE with a low IPS and a high MIIT become the countries with the most dynamic trade patterns. Turkey is again in the group with high MIIT and is joined by UAE, Israel, Oman and Algeria. In fact Algeria now has an MIIT value greater than IPS. The least dynamic trade patterns are now encountered for Qatar, Morocco and Tunisia with high IPS and low SS and MIIT values.

In the case of ***capital-intensive goods*** the countries with the most dynamic trade patterns are Turkey, UAE, Egypt and Algeria with low IPS and high SS values. In the case of Turkey, Algeria and UAE the MIIT values are even higher than the SS values. Israel, Jordan and Tunisia also exhibit relatively high MIIT values. The countries with the least dynamic trade patterns are Kuwait, Morocco, Oman, Qatar and Saudi Arabia.

Turning to ***easy-to-imitate research intensive goods*** we find that the UAE, Bahrain, Israel and Jordan have low IPS values with Bahrain exhibiting a high SS value while the UAE, Israel and Jordan show high MIIT values. In fact, the UAE and Israel's share in new matched trade is above 50 %. Kuwait and Turkey also exhibit relatively high SS values. The least dynamic trade patterns are again found for Morocco, Oman and Saudi Arabia even though Oman and Saudi Arabia show some non-negligible movement in matched trade.

Finally, for ***difficult–to-imitate research intensive goods*** we find that Egypt, Tunisia and Israel have low IPS values but Egypt has a high SS value while Tunisia and Israel exhibit high MIIT values. Kuwait and Bahrain also show high SS values but their IPS values are not as low as the previous three countries. The UAE, Morocco, Algeria, Jordan and Turkey also show relatively high MIIT performances, but their IPS values are also relatively high. The least dynamic trade performances are again due to Qatar, Oman and Saudi Arabia.

Table 2 contains the results for the fixed period of 1994-2004. Starting with the ***overall trade*** results, we find that Kuwait, Bahrain and Egypt are again countries with low IPS's and they are now joined by Israel. Kuwait and Egypt exhibit high SS values while Bahrain and Israel show high MIIT values. Qatar and Jordan also have relatively high SS values while Turkey and Tunisia join the group with high shares in matched trade. The countries with the least dynamic patterns are Algeria, Saudi Arabia, Oman and Morocco. This latter picture is almost the same as the one we obtained from Table 1 except that Qatar is replaced by Morocco.

For ***RMIG***, Kuwait and Egypt again have low IPS and high SS values but Bahrain now replaces Qatar in this group but has a high MIIT value instead of a high SS value. Qatar

Table 2

Components of Trade Change in MENA Countries (1994-2004) (%)

	Overall Trade			RMIG			LIG			CIG			EIRG			DIRG		
	IPS	**SS**	**MIIT**	**IPS**	**SS**	**MIIT**	**IPS**	**SS**	**MIIT**	**IPS**	**SS**	**MIIT**	**IPS**	**SS**	**MIIT**	**IPS**	**SS**	**MIIT**
Algeria (94-04)	93.57	4.50	1.62	93.91	5.04	1.05	83.44	13.82	2.75	89.02	4.97	6.00	94.89	0.96	4.16	97.17	1.62	1.21
Bahrain (94-04)	25.73	14.86	59.41	17.46	12.54	69.99	49.32	27.21	23.48	55.76	13.35	30.90	43.18	43.58	13.24	57.77	24.30	17.93
Egypt (94-04)	46.02	30.33	23.64	55.88	21.49	22.63	27.25	50.87	21.87	27.89	57.91	14.21	60.48	22.40	17.12	31.35	52.91	15.74
Israel (94-04)	35.77	15.19	49.04	83.81	8.76	7.43	29.89	6.86	63.26	38.43	22.75	38.82	38.19	11.21	50.60	17.20	32.64	50.17
Jordan (94-04)	57.93	23.12	24.95	80.18	5.86	13.96	30.98	49.94	19.08	52.12	12.63	35.26	34.49	20.92	44.59	53.95	9.06	37.04
Kuwait (94-01)	16.96	78.80	4.24	3.98	95.39	0.65	43.01	45.06	11.93	75.03	18.20	6.76	59.89	37.09	3,02	20.39	63.04	16.57
Morocco (94-04)	70.38	7.23	22.40	71.44	10.63	17.92	77.54	3.24	19.22	68.83	21.77	9.40	85.54	0.28	14.19	51.30	3.55	45.15
Oman (94-04)	71.92	14.74	13.35	72.85	17.12	10.04	49.09	27.46	23.45	74.05	10.36	15.59	62.81	6.59	30.61	79.26	4.96	15.78
Qatar (94-04)	63.24	33.45	3.31	58.39	41.29	0.32	62.45	17.27	20.19	75.31	3.16	21.53	53.13	38.97	7.90	85.46	7.79	6.75
S.Arabia (94-04))	87.37	3.31	9.32	97.27	0.72	2.01	41.80	29.49	28.71	67.37	1.58	31.05	70.67	5.45	23.88	60.23	11.78	27.99
Tunisia (94-04)	55.98	7.91	36.11	55.44	4.60	39.96	69.24	6.56	24.20	63.99	5.74	30.27	66.45	8.49	24.56	30.92	13.65	55.42
Turkey (94-04)	53.68	5.32	41.00	69.28	11.16	19.50	52.74	8.13	39.13	30.19	2.39	67.40	79.40	2.67	17.93	58.36	2.80	38.84

also has a high SS value and Tunisia a high MIIT value. The least dynamic trade patterns are observed for Saudi Arabia, Algeria, Israel and Jordan. Israel and Jordan now replace Bahrain and Oman.

In the case of ***LIG*****,** again Jordan and Egypt have low IPS's and high SS's but now Israel replaces Bahrain in this group and but exhibits high MIIT values instead. Kuwait also has high SS values, while Turkey and Saudi Arabia show high MIIT values. The countries with the least dynamic trade are now Algeria and Morocco.

Turkey and Egypt are again the countries with low IPS's for ***CIG*****,** with Egypt also showing a high SS value while Turkey again shows a considerably high MIIT rate. Israel shows a performance similar to Turkey in joining these two countries with dynamic trade patterns. Morocco also has a relatively high SS value while Jordan, Saudi Arabia, Bahrain and Tunisia have relatively high shares in new matched trade. On the other hand, Algeria, Kuwait, Oman and Qatar exhibit the least dynamic trade patterns. Algeria appears to have replaced Morocco in the list obtained from Table 1.

In the case of ***EIRG*****,** Israel and Jordan have low IPS's and high MIIT values. The countries with high SS values are Bahrain, Qatar and Kuwait. Oman also shows a high rate of MIIT. The least dynamic trade patterns are found for Algeria, Morocco, Saudi Arabia and Turkey.

Last of all, in the case of ***DIRG***, the countries with the low IPS and high SS values are Israel, Kuwait, and Egypt. Tunisia has a low IPS value and a high MIIT value. Israel also has a high MIIT rate as do Morocco, Turkey and Jordan. The least dynamic trade performance is shown by Algeria, Oman and Qatar. Oman and Qatar were in this list based on the results from Table 1 but Algeria now replaces Saudi Arabia. Algeria appears to be the country with the least dynamic trade pattern for both overall trade and the subgroups.

5. Conclusions

1. IPS appears to be dominant component in new trade for the majority of countries when overall trade is considered. There are two exceptions to this from both Tables: Israel and Kuwait. For Israel the dominant component is MIIT in both cases while for Kuwait the dominant component is SS. A third exception is found in Table 2 where the common period 1994-2004 is considered, namely Bahrain. MIIT is dominant when the period becomes

1994-2005. Turkey appears to have a more dynamic trade pattern in both cases but the part of new trade not accounted for by IPS is dominated by MIIT.

2. When we turn to subgroups we find that Egypt appears to be the country with a dynamic trade pattern in almost all groups. The only exception appears to be EIRG. Bahrain exhibits dynamic trade patterns in LIG and EIRG while Israel appears in both research – intensive goods categories with emphasis on MIIT. Turkey appears to show a dynamic trade pattern in CIG, together with Egypt, but the extra-IPS new trade results in a high SS for Egypt while it goes into MIIT for Turkey.

3. The countries with the least dynamic trade patterns based on the results from both Tables, are Algeria, Saudi Arabia, Qatar, Morocco, and Oman for both overall trade and most of the subgroups. Turkey appears to show the least dynamism in trade where EIRG is concerned.

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Appendix

Raw Material Intensive Goods

SITC 0 Food and Live Animals
SITC 2 Crude Material, Inedible, Except Fuels (excluding 26)
SITC 3 Mineral Fuels, Lubricants and Related Materials (excluding 35)
SITC 4 Animal and Vegetable Oils, Fats and Waxes
SITC 56 Fertilizers (Other Than Those of Group 272)

Labour-Intensive Goods

SITC 26 Textile Fibers (Other Than Wool Tops and Other Combed Wool) and Their Wastes (Not Manufactured Into Yarn or Fabric)
SITC 6 Manufactured Goods Classified Chiefly by Material (excluding 62, 67, 68)
SITC 8 Miscellaneous Manufactured Articles (excluding 88, 87)

Capital-Intensive Goods

SITC 1 Beverages and Tobacco
SITC 35 Electric Current
SITC 53 Dyeing, Tanning and Colouring Materials
SITC 55 Essential Oils and Resinoids and Perfume Materials; Toilet, Polishing and Cleansing Preparations
SITC 62 Rubber Manufactures, n.e.s.
SITC 67 Iron and Steel
SITC 68 Non-Ferrous Metals
SITC 78 Road Vehicles (Including Air-Cushion Vehicles)

Easy-to-Imitate Research-Intensive Goods

SITC 51 Organic Chemicals
SITC 52 Inorganic Chemicals
SITC 54 Medicinal and Pharmaceutical Products
SITC 58 Plastics in Non-Primary Forms
SITC 59 Chemical Materials and Products, n.e.s.
SITC 75 Office Machines and Automatic Data-Processing Machines
SITC 76 Telecommunications and Sound-Recording and Reproducing Apparatus and Equipment

Difficult-to-Imitate Research-Intensive Goods

SITC 57 Plastics in Primary Forms
SITC 7 Machinery and Transport Equipment (excluding 75, 76, 78)
SITC 87 Professional, Scientific and Controlling Instruments and Apparatus, n.e.s.
SITC 88 Photographic Apparatus, Equipment and Supplies and Optical Goods, n.e.s.; Watches and Clocks