Iranian Journal of Economic Studies
Vol. 2, No.1, Spring 2013, 49-71

The Synchronization of Business Cycles among Iran's Trade Partners

Ebrahim Rezaei*
The Center for Research and Development in Humanities, SAMT
Ebrahim.rezaei@gmail.com

Abstract

In recent years, investigating synchronization of business cycles among countries, after increasing integration of global economies, has been attracted more attention of policy makers and researchers. Perhaps an unknown origin of such similarities, as an open question, is the main reason of these interests. So, with regard to the mentioned question, the aim of this paper is to investigate some probably determinants of synchronization among Iran's main trade partners. Therefore, in the first step, in order to measure business cycles, some parametric and non-parametric techniques are used. Then, applying several criteria, the degree of synchronization is determined. After these two steps, employing IV-GLS and QR estimators, the relationship between business cycles and trade intensity index, as a possible channel of synchronization, has considered. The result shows that an increase in trade intensity index increases business cycle synchronization for all 21 sample countries. Also, this result remained almost unchanged when we divided sample into some subsamples. It is worthy to note that due to the endogeneity of independent variable, the gravity equation and Helpman theorem(1981) are employed. In these equations, some variables such as GDP, common borders and distance had significant effects on trade intensity and hence on business cycles.

Keywords: Synchronization, Business Cycles, Helpman Theorem, Iran's Trade Partners, IV-GLS and QR estimators.
JEL Classification: F14, F15, E32.

* Received: 29/9/2012 Accepted: 21/8/2013

1. Introduction

In recent decades, increasing global integration of economies on the one hand, and evolutions of modern macroeconomics with improving its instruments for analysis of economic challenges, on the other, have provided remarkable attitudes toward business cycle theory. In this extensive framework, several dimensions of cycles from statistical isolating to shocks sources, symmetric or asymmetric debates, compatibility, synchronization and shifting of business cycles are the most popular fields of research subjects. It is clear that all of them can be very important and may be very effective in policy making process. But what is crucial for us is the synchronization of business cycles among main trade partners of Iran.

However, with regard to the literature of the synchronization and co movement of business cycles it becomes clear that there are not clear definitions about these subjects. For the first time, burns and Mitchell (1946) had applied the concept of synchronization. According to them, business cycles are similar if turning points of reference cycles have taken place at the same time. In such a way that turning points are at through (or peak) point at the same time (Garnier, 2003). Also, other explanation has given by Harding and pagan (2002).

In addition, theoretically speaking, inflows of goods and services is a channel for shifting and synchronization of business cycles. In contrast of this statement, there are some other researches which show ambiguous effects of trade integration (inflows of goods and services) on business cycles synchronization. (Calderon et al, 2002). However based on most papers the interpretation of synchronization is "co-movement" or "common movements" of business cycles.

The next section of this paper will review the theoretical background. Then we introduce measuring methods of cycles. The forth section provides setting of the model and its estimating debate and finally the concluding remarks will be presented.

2. Theoretical background

In spite of the remarkable literature about the synchronization of business cycles, there are no definite and certain factors affecting the similarity of business cycles. (Alicia and Ruiz 2008) However, neither the theoretical background nor the empirical works present a certain answer to the direction or sign of potential channels by which trade or other factors may affect business cycles synchronization. Even though, it may be some typical case studies about this subject. Kose and Vei (2001), for example, suggest that, depending on the nature of the trade and kind of shocks, the extensive integration may lead to more or less synchronization of cycles. In other words, if there is an increase in intra-industry trade, then the business cycles of both economies will be more similar. In contrast, if two economies have an inter-industry trade, then there will be no evidence of synchronization in cycles.

However, it is possible to have some indirect channels affecting trade integration and thereby business cycle synchronization. For example, similarity of the production structure and fiscal and monetary policies can be some sort of these indirect channels.

Rose and Spiegel (2004) argue that the strong trade integration may increase financial integration, too. Because, the trade integration causes increases in FDI inflows as well as international borrowings. This, in turn, likely affects economic structure similarity.

According to Romberg (1968), goods and services trade is the main channel through which every change of economic activities in developed countries will be shifted to the developing countries. Actual or expected changes in the production of developed countries affect demand of intermediate goods that often import from developing countries. Due to the inelastic supply of these goods,- particularly in the short run- it's said that any quantity changes in demand will affect prices of raw materials.

In addition to the current account of balance of payments as a channel for transmission and shifting of synchronization, there is capital account of balance of payments which can be possibly the path of passing disturbances from one economy to another. (Romberg, 1968)

It is worth noting that the degree of synchronization can provide useful information on the necessity of pertinent macroeconomic policy to manage domestic macroeconomic environment against external shocks. Furthermore, high (low) similarity can be an agreeable (disagreeable) criterion to establish regional agreements.

Besides theoretical issues, there are some applied studies which are directly related to subject of our paper, i.e. the relationship between trade intensity and business cycles similarity: according to Garcia-Herrerob(2008) both of international trade and financial linkages have a significant relation with business cycles synchronization. Based on the result of this paper bilateral trade and financial flows can simultaneously lead to similar GDP's fluctuations. In other study, Rana (2007) has considered the effects of trade intensity on business cycles similarity in the east Asia. According to this research, depending on kind and nature of intra- industry shocks there will be different patterns of cycles among trade partners.

In short, based on literature review, it seems that the empirical research is the appropriate way to understand the relationship between trade increasing and cycles similarity among trade partners of each region in the world. So, this paper aims to reveal any possible similar patterns of cycles due to trade intensity among Iran and its trade partners.

3. Business Cycles Measurement

3.1. Data

Different sources of data are a clear reason for differences in the results of business cycle studies. In the business cycle literature, GDP and industrial production series are two well known sources to produce cyclical, seasonal and monthly data. Also, sometimes components of GDP, for example consumption and investment, are taken to account instead of whole GDP. So, in order to measure business cycles we have both GDP and industrial production series.

However, according to some studies,(for example Cotis and Coppel, 2005) focusing on GDP series is the single available option to consider

business cycle synchronization. Because industrial production consists only(perhaps less than) 20 percent of GDP in most economies on the one hand, and has much more fluctuations rather than whole GDP on the other, so it can not be a appropriate representative of an economy. Therefore, we get GDP series of sample economies to calculate the business cycles synchronization index.

Our sample consists 21 countries and annual data for the 1960-2007 period. All countries are trade partners of Iran. It should be noted that, in the sample, export flows from country i to j are not necessarily equal to import flows of country j from country i. So, in this case, our bilateral trade index is based on reported data by each country.

The bilateral data are collected from International Monetary Fund's Direction of Trade Data set, while nominal and real GDP data are taken from World Bank's World Development Indicators. All countries and variables are introduced in Table 1.

Table 1: Countries and variables

Countries	Variables
Group 1: Oil- producing countries: Iran, Saudi Arabia, Kuwait, Oman, Qatar, Venezuela, Bahrain and United Arab Emirates. Group 2: Selected middle east countries (Turkey and Pakistan) along with oil-producing countries. Group 3: Selected southern and eastern Asian Countries: Malaysia, Indonesia, Philippine, South Korea, Hong Kong, India and Singapore. Group 4: Selected South Latin American Countries: Argentina, Brazil, Peru and Mexico.	1) GDP in national currencies are taken from WDI and GDP in US dollars are taken from IFS and PWT. 2) Trade flows between Countries for the 1960-2000 period are collected from Feenstra data Base (http://www.nber.org/papers/w11040) and for the 2001 -2007 are taken from WDI. 3) Data for other Gravity model variables have several sources such as net webs, PWT and so on.

Note: Because of estimating issues we just included main trade partners of Iran.

3.2. Debate on the Classical and Modern Definitions of Business Cycle

The classical business cycle has been defined as an absolute recovery or

recession of economic activity by Burns and Mitchell (1946). But more recently, most studies have been emphasizing on deviation of economic path from its long run trend. (such as Jacub et al, 2008; Garcia, 2008; Ranna, 2008)

However, both above definitions have been compared by Harding and Pagan (2003, 2005). According their view, applying the classical business cycles index is appropriate than modern one. Because, the classical business cycles definition, due to lack of trend debate, are less abstractive and subjective. In addition, policy makers are mostly interested in understanding recession than merely downward deviation from trend.

Since the mentioned subject has considerable importance in business cycles literature, this study uses both methods at the rest of the paper. So, we first introduce detrending methods and then we present studying cycles without detrending.

Some well known detrending techniques which have been employing in the literature are,

1) The first difference. 2) The Hodrick -Prescott's nonparametric filter. 3) The Baxter – King's nonparametric filter. 4) The Christiano-Fitzgerald random walk band pass filter 5) The supply side structural model and 6) other statistical methods.

However, the important point related to the outcomes of above techniques is the legion differences in the statistical properties of obtained series. This undesirable feature of detrending methods, as a serious challenge in the literature of business cycles, pointed out by Canova (1998). Due to this drawback in the detrending Issue, almost all researches often use more than one technique for robustness purpose.[1]

3.3. Measures of Synchronization

3.3.1. The Concordance index

The concordance index is the ratio of time which two partners are in the same phase of business cycle. This index varies from 0 to 1. When the value closes to 1 there will be a high degree of synchronization between

the business cycles of two countries, while movement toward zero denotes no synchronization. In order to build the concordance index, a large number of studies used Harding and Pagan (2002) methodology. (Sometimes after minor modifications) They suggest the following measure for synchronization:

$$C_{ij} = \frac{1}{T}[\sum_{t=1}^{T}(s_{it} \times s_{jt}) + \sum_{t=1}^{T}(1-s_{it})(1-s_{jt})] \quad (1)$$

Where C_{ij} is the synchronization between i and j countries. s_t is the phase of cycle which will be zero when the economy is in the recession and one in the recovery case. In fact, s_t as an unobservable binary process can be obtained by parametric or nonparametric approaches. Markov-switching process and the Bry- Boschan algorithm are respectively parametric and nonparametric methods to obtain s_t. We use the Bry- Boschan algorithm, in this study, to calculate s_t.

3.3.1.1. The Bry- Boschan Algorithm

Since 1971 the Bry-Boschan(BB) algorithm, as likely a well known nonparametric method, has been applying to detect the turning point(s) of economic activity. This algorithm determines locally maximum and minimum points of time series during a given period. In fact, determinating locally maximum and minimum points is the main advantage of this algorithm. In addition, including new observation(s) has no effect on previous turning points.

The BB algorithm imposes three conditions on turning point:

1) According BB, a given series is in its peak (trough) position if at time t its value be greater (smaller) than $t+1$ and $t+2$. For the peak and trough points we have the following conditions:

$$\begin{aligned} &\Delta y_t \succ 0 \text{ and } \Delta y_{t+1} \prec 0 \text{ and } \Delta y_{t+2} \prec 0 \quad \Rightarrow \text{for Peak} \\ &\Delta y_t \prec 0 \text{ and } \Delta y_{t+1} \succ 0 \text{ and } \Delta y_{t+2} \succ 0 \quad \Rightarrow \text{for Trough} \end{aligned} \quad (2)$$

These conditions insure that the turning point (peak) is locally

maximum with respect to previous and two next periods. Its vice- versa interpretation is true for trough case.

2) The algorithm insures that each peak point appears after trough point or vise-versa. If a turning point comes after another same point then algorithm takes the greatest (or smallest) of them as a turning point.

3) The algorithm sets some sort of rules to determine duration and amplitude of cycles. These rules don't allow a temporary growth in the recession and/or a temporary decline in the recovery phases are regarded as turning points.

Table 2 represents turning points of sample countries GDP during 1970 to 2007 based on the BB algorithm. Due to implementing of above conditions, it eliminated some beginning and ending observations of sample, automatically.

Table 2: Turning points of all countries GDP

Countries	Peaks	Troughs	Countries	Peaks	Troughs
Argentina	1974, 1977, 1980,1984, 1987, 1994, 1998, 2000, 2005.	1976, 1978, 1982, 1985 1990, 1995, 1999, 2002.	Singapore	1984, 1997, 2000, 2005.	1985, 1998, 2001.
Brazil	1980,1982,1987, 1989,1991,1997, 2002.	1981, 1983, 1988,1990 1992, 1998, 2003.	Saudi Arabia	1976, 1984, 1989, 1997, 2005.	1977, 1983, 1986,1992, 1998.
Peru	1977, 1982, 1987, 1991, 1997, 2000, 2005.	1978,1983, 1990,1992 1998,2001.	Kuwait	1976, 1979, 1984, 1987, 1989, 1991, 1995, 1998, 2000, 2005.	1975, 1977, 1982,1985, 1988, 1990, 1992, 1996, 1999,2001.
Mexico	1981, 1985, 1994, 2000, 2005.	1983, 1986, 1995, 2001.	Oman	1976, 1986, 1989, 1998, 2001, 2005.	1973, 1978, 1987,1990, 1999, 2004.
Venezuela	1974,1981,1984, 2005.	1975,1983, 1986.	Qatar	1980,1983, 1989,1989, 1991,1996,	1982,1985, 1990,1992,1 997,2000.

Countries	Peaks	Troughs	Countries	Peaks	Troughs
				1999,2005.	
Malaysia	1974,1984,1997, 2000,2005.	1975,1985, 1998,2001.	Bahrain	1980,1984, 1993.	1982,1988, 1994.
Indonesia	1981,1997,2005.	1982,1998.	UAE	1973,1977, 1981,1984, 1987,1990, 1992,2001, 2005.	1974,1978, 1983,1986, 1988, 1991, 1993,2002.
Philippine	1983,1990,1997, 2005.	1985,1991, 1998.	Turkey	1981,1991, 1995,1996, 2001,2003.	1983,1992, 1994,1997, 2002, 2004.
South Korea	1975,1997,2005.	1980, 1998.	Pakistan	1992, 1996, 2005.	1993, 1997.
Hong Kong	1974,1984,1997, 2000,2005.	1975,1985, 1998,2001.	Iran	1976,1987, 1992,2003.	1981,1988, 1994.
India	1973,1975,1978, 1990,2005.	1974,1976, 1979,1991.			

Source: Author Calculations.

3.4. Business Cycles Correlations

In this section, we use cyclical series to calculate simple correlation coefficient. As we already discussed, three detrending techniques, BK, HP and CF filters have been used to produce cyclical series of every given GDP. After deriving these series we applied Fischer's Z-transformation to modify distribution of data. This transformation causes residual terms of regression approaches to normal distribution form:

$$\rho_t = \frac{1}{2} Ln(\frac{1+\rho}{1-\rho}) \qquad (3)$$

Where ρ is pearson correlation coffecient between two cyclical series. In terms of Figure1, in principal two represented series are taken from CF filter. But there is no Z-transformation on the series which have leptokurtic form while the other one with mesokurtic form has all features of normal distribution.

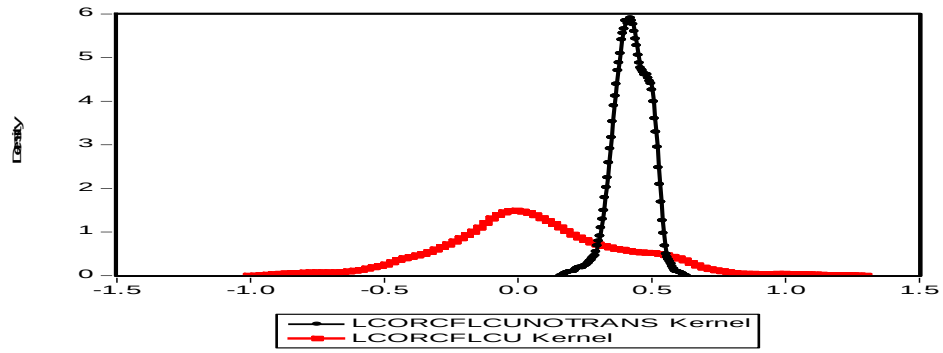

Figure 1. Z_ transformation

After Z-transformation, using BK, HP and CF filters, the average correlation of business cycles for all countries has presented in Table 3. Based on three filters, obtained values are 0.06, 0.093 and 0.057 respectively for BK, HP and CF. Having implied the positive correlation of cycles, these values indicate existence of synchronization among all countries. But this is not very clear sign and makes no plausible sense. So, we have concentrated on subsamples and other groups. According our findings, there is relatively high synchronization between the southern and eastern Asian countries and then among countries group 4. But based on correlation coefficient we have no evidence of synchronization among Middle East and oil- producing countries. So, we will use other measure (the Harding- Pagan Index) of synchronization to find out the degree of indices accuracy.

Table 3. Statistical properties of business cycles correlation based on several filters

Filter name	All sample	Group 1	Group 2	Group 3	Group 4
BK filter	0.06(0.26)	-0.37(0.24)	-0.038(0.23)	0.27(0.46)	0.22(0.2)
HP filter	0.093(0.27)	-0.005(0.26)	0.00(0.25)	0.40(0.21)	0.25(0.24)
CF filter	0.057(0.32)	0.034(0.27)	0.015(0.29)	0.44(0.34)	0.4(0.16)
Number of observations	420	30	56	42	20

Source: Author Calculations. Values inside parenthesis show standard deviation.

Note: The reported values aren't the result of using group data for sample countries but after bilateral calculation for all countries in sample and sub samples, similar to other studies in literature, we reported the average of them.

3.5. Business Cycle Synchronization Analysis Based on Harding-Pagan Index

As we've already shown, the Harding-pagan index is able to determine the degree of business cycle similarity between two countries. This index uses BB algorithm to find out turning points of a complete cycle. We applied this measure to identify the degree of cycle synchronization between country i and j. Our results have been depicted at the Table 4. The similarity of business cycles between pair countries will be statistically significant if obtained value for Harding-Pagan index is above 0.58.

Table 4. Business cycles synchronization based on the Harding-Pagan Index[2]

	Iran	Bahrain	Kuwait	Oman	Saudi Arabia	UAE	Pakistan	Turkey	Indonesia	South Korea	Malaysia	Philippine
Iran	1											
Bahrain	0.5	1										
Kuwait	0.61*	0.63*	1									
Oman	0.56	0.35	0.54	1								
Saudi Arabia	0.43	0.58	0.45	0.38	1							
UAE	0.65*	0.42	0.48	0.58	0.67*	1						
Pakistan	0.43	0.42	0.42	0.38	0.55	0.52	1					
Turkey	0.68*	0.58	0.59*	0.48	0.5	0.52	0.41	1				
Indonesia	0.58	0.54	0.58	0.46	0.68*	0.70*	0.58	0.47	1			
South Korea	0.56	0.46	0.55	0.41	0.50	0.52	0.55	0.63*	0.68*	1		
Malaysia	0.59*	0.63*	0.53	0.41	0.58	0.67*	0.58	0.53	0.60*	0.53	1	
Philippine	0.54	0.50	0.47	0.36	0.68*	0.52	0.63*	0.63*	0.55	0.48	0.70*	1

Source: Author Calculations. *- indicates significant cases.

So far, we presented debates of theoretical relations and cycles measurement. Our next assessment involves trade intensity index calculation and econometric modeling which will be presented respectively.

4. The Trade Intensity Index[3]

In order to start econometric analysis we have to identify our prime independent variable, i.e. bilateral trade intensity. Following Calderon et al (2002) and Frankel and Rose (1998), we apply two measures to represent trade intensity between country i and j at time T ;

$$xm(i,j)_T^1 = \frac{1}{T}\sum_{t=1}^{T}\frac{f_{ijt}}{f_{it}+f_{jt}} \tag{4}$$

$$xm(i,j)_T^2 = \frac{1}{T}\sum_{t=1}^{T}\frac{f_{ijt}}{y_{it}+y_{jt}} \tag{5}$$

Where f_{ijt} indicates export of country i to j and import of i from j. f_i and f_j denote the aggregate trade of country i and j, respectively. (i.e. $f_i = x_i + m_i$). Left hand side term of equation (4) , $xm(i,j)_T^1$, is the ratio of trade between i and j to total trade flows of two countries. Also, $xm(i,j)_T^2$ in equation (5) is the ratio of trade flows between i and j to whole output of two partner economies.

5. Econometric Model

As we discussed in the theoretical background, the synchronization of business cycles can be affected by bilateral trade intensity's changes. So, in order to study this theory among main trade partners of Iran we first investigate the conditional correlation of trade intensity and business cycles similarity and then endogenity assumption of independent variable ($XM(i,j)$). Generally, equation (6) shows the relationship between two variables;

$$corr(y_{i,t}, y_{j,t}) = \mu + \gamma Ln(1 + XM(i,j)_t + u_{ij,t} \quad (6)$$

Where the sign of γ and its significance is our prime question. Table 5 shows the conditional correlation of the business cycle and the bilateral trade indices in several groups. We introduce two conditional variables in analysis: the ratio of country i production to the world GDP and the production structure which can be shown by $\sum_{K=1}^{N} \left| s_{ki} - s_{kj} \right|$ which s_{ki} and s_{kj} are the ratio of industry k in the whole GDP of country i and j. if the value of this index close to zero it can be led to a high degree of similarity in cycles.

All results, based on several filters, are summarized in Table 5. According to the result of data derived from BK filter (the second row) conditional variables have a positive and significant effect on the correlation of cycles except group 4. We recall that in addition to the bilateral trade, the production structure has a vital role in similarity of the first group's business cycles. Based on HP filter this significant relation takes place merely in whole sample and group 3.

Table 5: Conditional correlation between cycles and trade intensity

Filter name	sample	Group 1	Group 2	Group 3	Group 4
BK filter	0.15(0.04)	0.37(0.05)	0.31(0.02)	0.6(0.07)	0.6(0.09)
HP filter	0.19(0.05)	0.06(0.75)	0.006(0.97)	0.65(0.04)	0.36(0.28)
Observations	420	30	56	42	20

Source: Ibid.

But the main problem which we should resolve here is the endogenity of independent variable. To do this, following Frankel and Rose (1998) we regress the trade intensity on other explanatory variables.[4] In other words, we use two methods to resolve the problem. Firstly, we apply Helpman theorem (1987) and regress the trade intensity on the ratio of two countries output to the world GDP and dispersion

index. Secondly, we use the gravity model.

Examining of Helpman theorem needs following equation;

$$LN\left(\frac{X_{ij}+X_{ji}}{Y_i+Y_j}\right)=\alpha+\gamma LnS_{ij}+\beta Ln\left(Dispersion_{ij}\right) \quad (7)$$

$$\text{Where } S_i=\frac{GDP_i}{GDP_w},\ S_j=\frac{GDP_j}{GDP_w} \text{ and } S_{ij}=S_i+S_j. \quad (8)$$

$$\text{and } Disprsion=[1-(\frac{Y_i}{Y_i+Y_j})^2-(\frac{Y_j}{Y_i+Y_j})^2]. \quad (9)$$

If β is positive it results the specialized of countries in producing several goods. otherwise, there is no specialization. Equation (7) estimated by using OLS and IV-GLS methods. Since, in the presence of possibly heterocedasticity, the efficiency of GLS and GMM estimators are greater than OLS estimators.(Green, 2002 :216) So, we applied instrumental method to estimate the specified model.[5]

In terms of Table 6, an increase in dispersion index , raises the bilateral trade between country i and j. This result was remained unchanged after including S_{ij}. But an important point about dispersion index is its small value indicating that countries didn't reach to high specialization in producing different goods. Also in the second panel, our postestimation tests show "homocedasticity" and weakness of functional form specification.

Table 6. Examining of the Helpman Theorem

Variables	OLS	t-stat	Part-R^2	IV-GWLS	t-HCSE	Part-R^2
The First Panel: Excluding LnSij						
LN(Dispersion)	0.0005	2.41	0.014	0.0005	2.23	
Constant	0.0003	0.5	0.0006	0.0001	1.47	
R^2	0.02				0.02	
Hetero test	0.09				0.38	
The Second Panel: Including LnSij						

LN(Dispersion)	0.0006	2.25	0.012	0.0001	2.64	0.0017
LN(Sij)	0.0003	0.63	0.0005	0.0003	2.73	0.0018
Constant	0.000	0.93	0.000	0.0003	2.71	0.0017
R^2	0.02			0.04		
Hetero test(prob)				0.43		
RESET23 test				0.009		

Source: Ibid

As the second step and to complete functional form of previous equation, we applied gravity theory and specified our model as follows;

$$Ln(1+XM_{ij}) \cong XM(i,j) = \beta_0 + \beta_1 LnY_i + \beta_2 LnY_j + \beta_3 Lnd_{ij} + \beta_4 B_{ij} + \beta_5 LnREM_i + \beta_6 LnREM_j + Z'\gamma + \varepsilon_{ij} \quad (10)$$

This specification adjusts functional form of model and increases its accuracy. In equation (10) LnY_i and LnY_j are the logarithm of GDPs of country i and country j, respectively. Also, Lnd_{ij} is the distance of capital of country i from country j. B_{ij} is the common border, $LnREM_i$ is the remoteness index of country i which can be obtained from;

$$REM_i = \sum_{m \neq j} \left(\frac{Y_m}{Y_w}\right) d_{im} \quad (11)$$

In fact, equation (11) which applied by Stein and Weinhold(1998) and Calderon et al(2002) is the weighted average of distance of country i from its partners so that country j which comes in xm_{ij} pairs will be eliminated from this index. Finally, Z vector involves other variables such as; common language, area (larea), population, presence in special union and so on.

Table 7 shows the result of estimating. Signs of coefficients are almost consistent with our expectations so that variables such as production of countries and common border have a significant and positive effect on trade inflows while distance has a negative significant effect[6].

Table 7. Gravity model

variables	Coefficients	Standard Deviation	HCSE	t-HCSE	t-prob	Part.R^2
LYI	7.4e-007	2.7e-007	3.7e-007	1.98	0.0483	0.0095
LYJ	6.5e-007	2.7e-007	3.1e-007	2.09	0.0369	0.0106
LDIJ	-3.6e-006	5.5e-007	1.7e-006	-2.13	0.0334	0.0110
B	3.1e-006	1.3e-006	1.5e-006	2.08	0.0379	0.0105
lremi	1.3e-006	6.8e-007	1.02e-006	1.30	0.1943	0.0041
lremj	1.06e-006	6.7e-007	6.1e-007	1.74	0.0826	0.0073
lareai	-4.5e-007	1.2e-007	2.03e-007	-2.20	0.0281	0.0117
lareaj	-3.1e-007	1.2e-007	1.7e-007	-1.83	0.0681	0.0081
Language	-2.6e-006	1.02e-006	2.4e-006	-1.07	0.2850	0.0028
Agreement	-3.8e-006	1.3e-006	2.1e-006	-1.79	0.0745	0.0078
Constant	-1.0e-005	1.4e-005	1.07e-005	-0.932	0.3521	0.0021
Sigma	5.10718e-006	RSS	1.0668081e-008			
R^2	0.221343	F(10,409) =	11.63 [0.000]**			
Adj.R^2	0.202305	log-likelihood	4527.26			
No. of Observations	420	No. of Parameters	11			
Mean(LXM)	1.82558e-006	se(LXM)	5.71825e-006			

Source: Ibid (Summarized from PcGive software)
HCSE: Heteroscedastic-consistent standard errors (HCSEs)

5.1. Heterocedasticity and Outliers tests

So far, we have assumed the business cycle synchronization as a linear function of the trade intensity and other control variables. But whatever is important in view of empirical studies is the presence of outlier observation(s) in regressors as well as regressand. These observations may really influence every estimator. Existence of such problem can be initially seen by scatter diagram of business cycles correlations and trade intensity (after conditioning on control variables). Figure 2, shows this relationship and suggests that in spite of appropriate concentration of observations, there are still some observations far away from bulk of data.

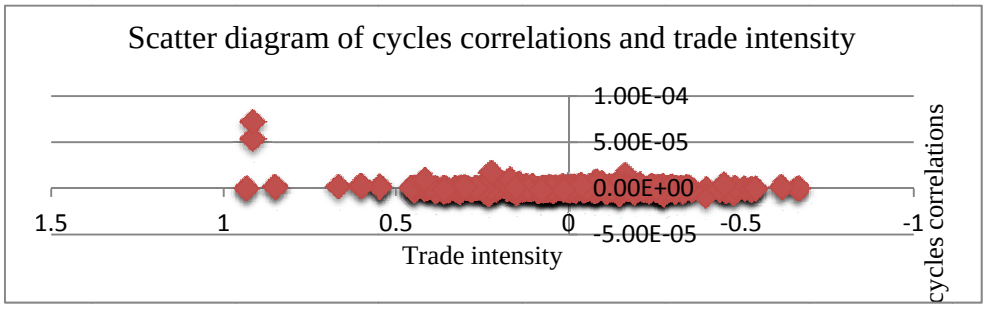

Figure 2. Scatter diagram

Therefore, using quantile regression we consider the relationship between business cycles synchronization and the bilateral trade intensity. Table 8 presents the result of this estimating. According to the coefficient sign, an increase in the bilateral trade increases business cycle synchronization and we cannot reject the equality of coefficients hypothesis during all quantiels. Figure 3, indicate that coefficients of quantiles(from q=0.3 to q=0.99) are equal with OLS coefficient and are inside of confidence intervals. This result implies that outliers' observations had no distortional effect on estimators.

Table 8. Estimating the bilateral trade coefficient using OLS and Quantile regression (a comparison)

variables	OLS	Q=0.25	Q=0.5	Q=0.75
Constant	0.039	-0.13	0.01	0.19
	(0.01)	(0.02)	(0.02)	(0.01)
LXM	16019	11171	1647	17721
	(2326)	(6905)	(5917)	(4707)
R^2	0.10	0.0082	0.0317	0.0637
Test.Equ.Cof. [q25=q50=q75]:lxm	Prob F=0.7528			

Source: Ibid

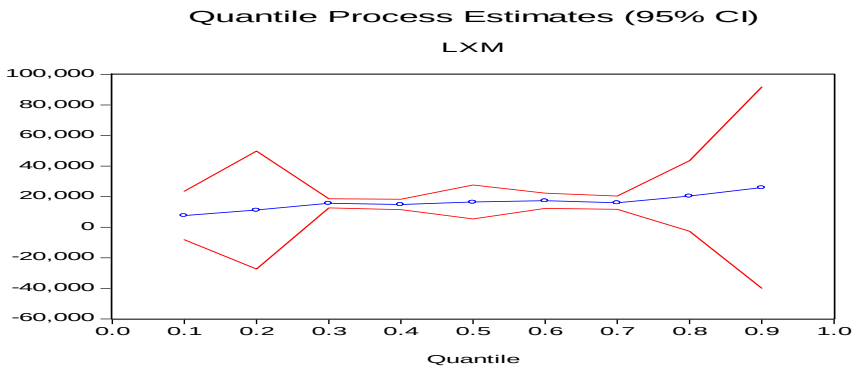

Figure 3. coefficients estimation during several quantiles

Also, we examined the influence of outlier observations on the outcome of equation (10). Our result shows that there are some significant differences in coefficients estimated by OLS, IV-GLS and quantile methods. Distance variable (Ld_{ij}), for example, has different values based on three methods which this case can be seen in Figure 4.

Table 9: Estimating of Gravity model based on three methods.

variables	OLS	IV-GWLS	Q=0.25	Q=0.50	Q=0.75
Lremi	1.34e-06*	1.3e-006	-7.94e-08	-1.42e-07	1.13e-07
	(6.83e-07)	(1.02e-006)	(6.59e-08)	(1.01e-07)	(3.08e-07)
Lremj	1.12e-06	1.06e-006	-9.20e-09	-3.76e-08	2.39e-07
	(6.75e-07)	(6.1e-007)	(5.61e-08)	(1.11e-07)	(2.59e-07)
Lyi	7.68e-07*	7.4e-007*	3.60e-08	8.52e-08*	2.08e-07*
	(2.67e-07)	(3.7e-007)	(2.17e-08)	(4.05e-08)	(6.59e-08)
Lyj	6.68e-07*	6.5e-007*	2.20e-08	6.40e-08*	1.34e-07
	(2.67e-07)	(3.1e-007)	(2.28e-08)	(3.07e-08)	(9.07e-08)
Ldij	-3.50e-06*	-3.6e-006*	-2.47e-07*	-6.95e-07*	-1.59e-06*
	(5.53e-07)	(1.7e-006)	(9.33e-08)	(1.36e-07)	(2.85e-07)
Boredr	2.61e-06*	3.1e-006*	1.30e-06*	1.34e-06*	1.50e-06
	(1.20e-06)	(1.5e-006)	(5.16e-07)	(2.96e-07)	(1.29e-06)
Agreeme	-3.31e-06*	-3.8e-006	-3.72e-07	-6.31e-07*	-5.35e-07
nt	(1.22e-06)	(2.1e-006)	(2.13e-07)	(3.20e-07)	(1.09e-06)

variables	OLS	IV-GWLS	Q=0.25	Q=0.50	Q=0.75
Lareai	-4.52e-07*	-4.5e-007*	-2.46e-08*	-6.40e-08*	-1.66e-07*
	(1.18e-07)	(2.03e-007)	(1.14e-08)	(1.69e-08)	(6.41e-08)
Lareaj	-3.16e-07*	-3.1e-007	-1.61e-08	-4.00e-08*	-1.22e-07*
	(1.18e-07)	(1.7e-007)	(1.10e-08)	(1.99e-08)	(6.13e-08)
Language	-2.30e-06*	-2.6e-006	-1.02e-06	-6.38e-07	-1.00e-06
	(9.92e-07)	(2.4e-006)	(5.75e-07)	(3.70e-07)	(6.07e-07)
Constant	-.0000124	-1.0e-005	2.15e-06*	5.81e-06*	8.16e-06
	(.0000141)	(1.07e-005)	(1.03e-06)	(1.93e-06)	(4.84e-06)
R^2	0.2192	0.2213	0.0773	0.1638	0.2105

```
. test [q25=q50=q75] : lyi

 ( 1)  [q25]lyi - [q50]lyi = 0
 ( 2)  [q25]lyi - [q75]lyi = 0

       F(  2,   409) =    2.98
            Prob > F =    0.0519
5=q50=q75] : lyj

5]lyj - [q50]lyj = 0
5]lyj - [q75]lyj = 0

 2,   409) =    1.02
  Prob > F =    0.3597
```

*- implies significance level at 5 percent. Values inside parenthesis denote deviation standard.

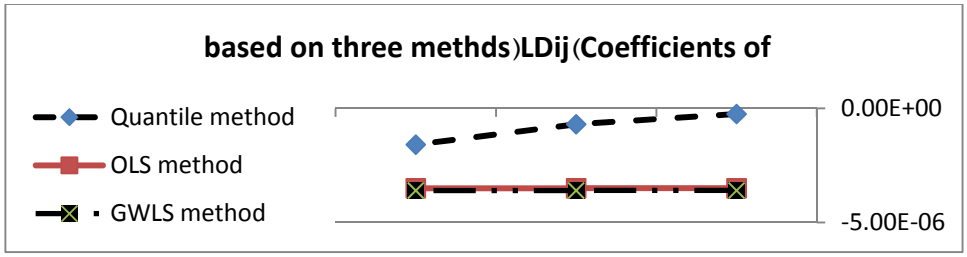

Figure 4. Coefficients of distance variable based on three methods. (a comparison)

However, other variables such as production of countries, common borders and area have similar effects in all methods. But our result in this section implies that the quantile regression is appropriate than other methods.

6. Conclusion

In this study, we discussed the possibility of business cycles synchronization among Iran's trade partners. Main findings of this study are;

1) For all countries in the sample the correlation of business cycles was positive.

2) Degree of correlation was relatively high for the southern and eastern Asian economies.

3) There is a remarkable correlation between business cycles of South-east Asian economies and oil-producing countries.

4) Based on the Harding-Pagan index, the synchronization of business cycles among Iran and some other countries such as Kuwait, UAE, Turkey and Malaysia were significant. In other words, there is a desirable opportunity to develop new agreements (or revise and reactivate old agreements) with these partners.

5) Conditional and unconditional correlation between business cycles and trade intensity index was positive and significant for sample economies.

6) Some variables such as GDP, common border, distance and area had significant effects on trade intensity.

7) According to our results, common language and to be a member of an economic agreement had no significant effects on the trade intensity.

With regard to mentioned results, the economic agreement, as a powerful tool for integration, has not correctly been used yet. So, all countries have opportunity to ponder about its advantages. Also, we found a strong similarity between the southern and eastern Asian countries with the Middle East region, so in order to be away from consequences of several crises of Asian economies, establishing of some economic linkage with Latin America could be useful and acts as an alternative reliance. In addition, economies with the same structures have somewhat similar cycles, so they can use all of their unoccupied capacities.

Endnotes

1- On the whole, the literature of business cycles shows that using several de-trending methods will be very useful for robustness checks and sensitive analyses.

2. Other values of this index for Iran and other partners including Qatar, Venezuela, Hong Kong, India, Singapore, Argentina, Brazil, Peru and Mexico are, respectively, as follows: 0.52, 0.54, 0.43, 0.45, 0.5, 0.48, 0.53, 0.30 and 0.53. (all of them are statistically insignificant)

3. It is worth noting that there are some other factors potentially affecting business cycles synchronization but with regard to the subject of this paper which directly emphasizes on trade's role we just use trade intensity indices in our analysis. It should be pointed out that we deal with trade intensity as an endogenous variable and we specify main determinants of trade intensity before considering its effects on business cycles.

4- In fact, instead of regressing business cycle index on too many variables we only regress this index on trade intensity and then indirectly show that there are other variables affecting business cycles similarity by influencing trade intensity index. So, to do this, we use equations (7) and (10) which both of them have theoretical bases.

5- As noted before, applying two methods helps us to recognize relevant method of estimation and robustness checks. Although using IV_GLS method does not change signs of coefficients but it alleviates consequences of heteroscedasticity.

6. It is worthy to note that we performed similar estimating for other subsamples such as oil-producing and other countries which our results were almost similar.

References

Baum f. C. (2006). Time-series Filtering Techniques in STATA, Department of Economics, Boston College.

Baxter, M., King, R.G., (1999). Measuring Business Cycles: Approximate Band-Pass Filters for Economic Time Series. *The Review of Economics and Statistics* 81(4), 575-593.

Burns, A.F & Mitchell, W.C. (1946). Measuring Business Cycles, NY.NBER.

Calderón, C., & Chong, A., & Stein, E. 2002. Trade Intensity and Business Cycles Synchronization: Are Developing Countries any Different, Central Bank of Chile, WP195.

Canova.F. (1998). Detrending and Business Cycle Facts, *Journal of Monetary Economics* , 41(3), 475-512.

Chong-ll, C. (2001). An Impact of Economic Integration through Trade: On Business Cycles for 10 East Asian Countries, *Journal of Asian Economics*, 12(4),569-86.

Cogley.T & Nason.M (1995). Effects of the Hodrick-Prescott filter on Trend and difference Stationary Series: Implications for Business Cycles Research, *Journal of Economic Dynamics and Control* 19(1-2), 253-278.

Cotis ,J-P., & Coppel, J.(2005). Business Cycle Dynamics in OECD Countries: Evidence, Causes, and Policy Implications, OECD, Economics Department, Sydney, Australia.

Frankel, J.A. (2004). Real convergence and euro adoption in Central and Eastern Europe: Trade and Business Cycle Correlations as Endogenous Criteria for Joining EMU, John F. Kennedy School of Government Working Paper, No. RWP04-039.

Frankel, J.A. & Rose, A.K. (1998). The Endogeneity of the Optimum Currency Area Criteria, *Economic Journal*, 108(449), 1009-1025.

Frankel, J.A., Rose, A.K.(1997). Is EMU Justifiable ex post than ex ante?, *European Economic Review* 41(3-5), 753-760.

Garcia-Herrero A., & M.Ruiz, J. (2008). Do Trade and Financial Linkages foster Business Cycle Synchronization in a Small Economy,WP 0801,Bank of Spain.

Garnier, J. (2003). Has the Similarity of Business Cycles in Europe Increased with the Monetary Integration Process? , EUI Working paper ECO No. 2003/12

Green, W.H.(2002).”Econometrics Analysis”, Fifth Edition, Prentice Hall, NY University.

Harding, D. and Pagan, A. (2002). Dissecting the cycle: a Methodological Investigation, *Journal of Monetary Economics*,

49(2), 365-381.

Helbling,T. and Bayoumi, T. (2003). Are They All in the Same Boat? The 2000-2001 Growth Slowdown and the G-7 Business Cycle Linkages, IMF Working Papers 03/46.

Helpman, E.(1981). International Trade in the Presence of Product Differentiation, Economies of Scale, and Monopolistic Competition: a Chamberlin-Heckscher-Ohlin Approach. *Journal of International Economics*, 11(3),305-340.

Hodrick, R., and Prescott, E.C. (1997). Postwar U.S. Business Cycles: An Empirical Investigation, *Journal of Money*, Credit, and Banking, 29 (1), 1–16.

Rana, P. B. (2007). Trade Intensity and Business Cycle Synchronization The Case of East Asia, Asian Development Bank, WP, no10.

Romberg, R.R.(1968).Transmission of Business Fluctuations from Developed to Developing Countries, *IMF Staff Papers*, Vol15(1).

Stein , E. & Weinhold, D. (1998). Canadian – US Border Effects and the Gravity Equation Model of Trade, Washington, DC: Inter – American Development Bank. Mimeo.