Print ISSN: 2008-448X
Online ISSN: 2538-3310
International Journal of Business and Development Studies
University of Sistan and Baluchestan
Homepage: https://ijbds.usb.ac.ir

Evaluating H-O-V Aproach in Iran's Trade Relations with its Partners

Faribasadat Aghili[1] **Seyed Komail Tayebi**[2]

[1]Ph.D. in Economics, Department of Economics, University of Isfahan, Iran
[2]Corresponding Author, Professor of International Economics, Department of Economics, University of Isfahan, Iran. Email: sk.tayebi@ase.ui.ac.ir

ARTICLE INFO

Article type:
Research

Article history
Received: 21.09.2021
Accepted: 25.12.2021

Keywords:
Heckscher-Ohlin-Vanek Theory, Trade Factor Content, Semiparametric Method.

JEL Classification:
C14, F14.

Abstract:
In this paper, trade relationship between Iran and its main trading partners based on Heckscher-Ohlin-Vanek (H-O-V) theory is studied in order to evaluate the development of trade relationship in export factor intensity framework. Considering several production factors such as labor, physical capital, knowledge capital, R&D expenditures, productivity and energy as countries export factor content from 1990 to 2020 is the innovation of the study.

Regarding the role of R&D expenditures in trade expansion, it seems there is an allocation gap of this resource between developed and developing countries in order to benefit from the identical distribution, while the empirical findings available in the trade literature implies also unpredictable impact of the R&D expenditure variable on trade flows. Therefore, the analysis of this variable effect on trade flows is not limited to a parametric relationship. Nevertheless, other factors such as labor and capital have distinct and parametric effects on trade relations, so that a semiparametric method has been applied to the model of Iran's export supply in relation with its trading partners. The empirical results showed that productivity, human capital, and knowledge capital, which are the main trade factor content, have the most impacts on Iran export flows and its trading partners. Additionally, the nonparametric part of the model implies that a higher percentage of R&D expenditures affects significantly Iran's export flows in a higher rate.

1.Introduction

Assesment of the production factor content of a country is an appropriate method that shows the comparative advantages of country in various products. However, the issue is that the experiences of successful countries in export development in recent years expose that factors such as R&D expenditures, human capital and knowledge capital can provide export boosting.

The relevant literature represents that the concept of comparative advantages depends on the factor content, and for the first time, Vanek (1968) explained the

Cite this article: F. Aghili and S. K. Tayebi (2021). Evaluating H-O-V Aproach in Iran's Trade Relationship with its Partners. *International Journal Of Business and Development Studies*, 13 (2), 193-207.
DOI: 10.22111/IJBDS.2021.6764.

concept of factor content as an effective method on countries' exports. Accordingly, factor endowments of a country in comparsion with those in other countries can determine factors abundant in the country, and the comparative advantage of the country is detected by considering the factor intensity of products (Feenstra, 2002).

Regarding global integrated markets in goods and services, determination of comparative advantages indicates the power of competitiveness of products in a country, so that determiniation of comparative advantages causes boosting the competitiveness power of countries in global markets.

Evaluating trade relationship seems to be necessary because economic development plans can be achieved by increasing various non-oil exportable goods and services to avoid a country to be as a single exporter. More specifically, competitive advantage of oil industry will vanish in the near future; therefore, the determination of comparative advantages is based on factor content with a variety of products.

Considering the role of comparative advantages in trade relationship between countries, the objective is to specify a trade model to explore the importance of trade factor contents for Iran's non-oil exports to its trading partners including China, UAI, Iraq, Turkey, South Korea, India, Japan, Russia and Germany uring 1990-2020. Hence, the purpose of this paper is also to study the comparative advantages of Iran in relation with its major trading partners, which employs the specified factor content in order to determinin the comparative advantage of goods and services. Accordingly, this paper examines the fact that to what extent Iran's trade relations with its selected partners is related to the assumptions of free trade in the context of the H-O-V approach. It is worthwhile to mention that a few studies have assessed of H-O-V theory in Iran's trade relations, and the role of factors such as human capital, knowledge capital, R&D expenditures and productivity as a set of production factors, which affects exportable goods and services.

In this study, Section 2 will present the theoretical background of trade comparative advantage. Section 3 reviews the previous studies to discuss the trade literature both in the world and Iran. Section 4 specifies the empirical model of H-O-V for Iran, and the model estimates are analyzed in section 5. Finally, Section 6 concludes the remarks.

2. Theoretical Discussion

Considering H-O theory, *Vanek (1986) showed that developing the two-factor model to multi-factor model could determine indeed the comparative advantages of countries in trading goods and services. In fact, t*he experiences of countries explain the relationship between economic growth and trade of a country is not enough through physical capital and labour, while there are additional factors that cause economic growth and increase trade *(*Maskus and Nioshika, 2009, Kiyota, 2013*)*. For example, human capital is considered as a qualitative

characteristic of human being and it is a kind of capital that provides the background of productivity improvement, production, income and welfare increasing. Knowledge capital is also a mass of knowledge, which is obtained through experiments and studies, and skills of inhabitants of a country to apply the knowledge (Amoroso, 2011, Kiyota, 2013, Do et al., 2016). It is believed that a complementary relationship between physical capital and knowledge could improve the productivity of physical capital (Zymek, 2015, Nioshika, 2013, Chen et al., 2012 and Rajabzadeh et al., 2015).

Hence, instead of a trade model based only on the difference in abundant production factors, Vanek (1986) develops the model, which can rely on the factor content. It means that to what extent factor contents influence exports and imports; or, how is the intensity of each production factor in tradable goods? In addition, enhancing H-O model by more than 2 countries, 2 goods and 2 production factors is another advantage of H-O-V model.

The H-O-V model includes a number of countries, i = 1, 2,…,C; a number of industries, j=1,…,N; and a number of inputs, k, l =1,.., M. We assume technology is fixed through countries, and that factor-price equalization (FPE) approach prevails in free trade. Additionally, we assume types of production function are homothetic through countries. We consider A=[ajk]', which is a (MxN) matrix denotes the amounts of labor, capital, land, and other primary factors that are required in each industry for one unit of production. Obviously, this matrix is applied to all countries. The rows measure a variety of production factors, k, l =1, 2, …, M, and the columns of the matrix stand for the different industries j=1, 2, …, N.

Next, Y^i denotes a (Nx1) vector of outputs in each industry for country i, and D_i stands for a (Nx1) vector of demand for each good, so that $T^i = Y^i - D^i$ is the vector of net exports of country i. The factor content of trade is then defined as $F^i \equiv AT^i$, which is an (Mx1) vector. To simplfy a HOV model, a framwork of the factor content of trade including labor and capital is defiend as follows:

$$\begin{pmatrix} F_l^i \\ F_k^i \end{pmatrix} \equiv AT^i \qquad (1)$$

where the purpose of HOV model is to connect the factor content of trade AT^i to the orginal endowments of country i.

There is the fact that a few studies have applied H-O-V model in Iran's international trade sector, a trade model, which is based on the H-O-V theory, is devoloped for Iran and its trading partners. Accordingly, production factors contain the factor content to explore comparative advantages of Iran and the trading partners. Based on the literature to explore the factor content, Nioshika (2013) refers to the role of knowledge capital to explain Japan comparative advantage, and Kiyota (2013) addresses the role of human capital and R&D expenditures in expanding exports.

It is believed that due to differences in R&D and productivity as the factors for improving technology in all economies and due to differences in knowledge capital, one can apply factor content icluding R&D expenditures and total factor productivity to study trade expansion in countries (Davis et al., 1997). R&D and productivity are the most basic factors of technology transfer, which their effect on economies will emerge when it is applied in production or commercialization. Generally, when R&D activities are managed truly during production process of goods and services, an economy reaches competitive situation. Therefore, the role of R&D and productivity are critical in determination of countries' comparative advantages (Nioshika, 2013, Sauré, 2017 and Doruk, 2015).
In the next section, we review the related literature to explore the relationship between foreign trade and the major factors arising from both studies which have been done in Iran and the other countries.

3. The Literature Review

Maskus and Nishioka (2006) showed that past empirical failures of the basic Heckscher-Ohlin-Vanek (H-O-V) model were related to its restrictive assumptions, particularly international technologies and factor price equalization. Using a dataset of 15 OECD countries, they found positive evidence on Trefler's idea, which focuses on H-O-V approach by introducing a simple Hicks-neutral (HN) factor-productivity adjustment, an approach that has applied to trade. Further, they found the ability of H-O-V fromework to explain North-South factor trade which depends both on relative factor abundance and productivity gaps.
Lai and Chun Zhu (2007) examined restrictions related to the factor content of bilateral trade to bilateral differences in technology and endowments. This differs from the Heckscher–Ohlin–Vanek theorem which compares the factor content of net trade with factor abundance. They used a unique dataset that covered 41 developed and developing countries with different endowments and technology. They found evidence supporting the factor content predictions, which perform well for trading partner pairs with larger endowment differences and for trade between capital-abundant countries.
Trefler and Chun Zhu (2010) showed that the recent decades witnessed ample research into the effect of technology differences on the factor content of trade. However, the literature has failed to oppose two fundamental issues. With international technology differences and trading intermediate inputs, there is no definition of the factor content of trade, which matched Vanek's factor content prediction. Trefler and Chun Zhu (2010) re-evaluated the performance of the prediction using the actual factor content definition and input–output tables for 41 countries. They found that the prediction performed well except for the presence of missing trade, is the ratio of the variances of the measured relative to the predicted factor content of trade (Fadinger, 2008).

Amoroso et al. (2011) analyzed whether trade patterns of Mexico's comparative advantages in manufacturing follow productivity differentials, which rely on either the Ricardian hypothesis or related to the Heckscher–Ohlin hypothesis based on differences in factor endowments. The results suggested that Heckscher–Ohlin determinants tend to be more relevant than labor productivity differentials to explain changies in the export patterns between Mexico and its trading partners.

In addition, Kiyota (2013) showed that human capital is considered as one of the critical determinants of comparative advantage in Japan for the period 1980–2005. The results confirmed that although Japan is a net exporter of skill-intensive goods, the skill gap of net exports has been narrowing since the mid-1990s, mainly due to changes in the composition of trade. This implies that some OECD countries, including Japan, may have lost their comparative advantage in skill-intensive goods in recent years.

Nishioka (2013) examined the accumulation of physical capital versus knowledge (R&D) capital as a main factor of comparative advantages mostly in developed countries. Nishioka (2013) showed that these countries are abundant in R&D resources, and specialized in knowledge-intensive products of high-technology industries, which outsource labor-intensive goods to labor abundant developing countries.

Koebel et al. (2016) analyzed the determinants of the selected European countries' international trade of wood products, considering exports of woodworking products, pulp, paper and wooden furniture during 1995-2007. They developed the Heckscher-Ohlin-Vanek (HOV) framework in order to focus on the forest resource endowment as well as industrial performance factors. According to empirical investigations, the hypothesis was accepted to confirm the forest resource endowment that has a positive effect on net trade of two products (pulp and paper and furniture) rather than that of woodworking products. In addition, empirical results also showed the restrication of the HOV model to explain changes in international trade of wood products.

Taghavi et al. (2011) examined the Heckscher-Ohlin-Vanek (HOV) Model in Iran, and discussed Iran needs an appropriate model of factor content for production, to improve trade relations with its partners. Having used a HOV model and input-output (IO) framework, they evaluated the factor content of trade in different sectors in 1991-2001. Their results showed that factor content of trade in 67 percent of the activities in 28 sectors is negative while 33 percent of the activities for 13 sectors is positive.

Afshari and Moahed (2010) investigated H-O-S theory using an intra-industry trade of Iran by applying a dynamic panel approach, to explore the effects of product differentiation and human capital on trade relations between Iran and MENA member countries in the period of 1999-2007. To this purpose, they

applied a dynamic GMM method, through which the results showed that the comparative advantage of Iran's tradeable goods did not change significantly over the period.

According to the relevant literature in Iran, a paper by Taghavi et al. (2011) was the only study, which evaluated Iran's trade relations based on the H-O-V theory, while it was restricted to focus on a static version of the input-output table using data of labour, physical capital and energy in 1992 and 2002. However, studies for other countries showed that other factors such as knowledge capital and R&D expenditures play a dynamic role in creating trade advantages. Therefore, the innovation of this study is to assess trade relations betwen Iran and the selected trading partners based on the HOV theory by developing factor content through a semi-parametric analysis.

4. The Model

As discussed previously, a model specification of HOV theory is a novelty to fulfil the limited studies in Iran's trade patterns. The model diversifies factor content in which the effect of each factor will be examined on trade relations, and based on the factor intensity of products, the country comparative advantages will be determined appropriately.

Based on the issues discussed in the previous sections and applying Feder (1983) export supply function, a model is defined as follows:

$$EX_{it} = \beta_0 ER_{it} + \beta_1 P_{it} + \beta_2 FC_{it} + \beta_3 EF_{it} + \varepsilon_{it} \quad (2)$$

where *EX* denotes export supply, *ER* is exchange rate, *Pi* is the relative export price, *FC* stands for factor endowments and EF is productivity. Increases in exchange rate, the export price, components of factor content and productivity may cause increases in exports (Branson, 1989).

In this model, factor contents consist of labour, land and capital show natural endowments such as energy and capital, which includes infrastructures and production capacity. Besides the aufgmented model to a multi-factorial one, the productivity of production factors is also considered as a component of factor content. Moreover, a country with skilled labour can be specialized in producing hi-tech goods and services. An increasing rate of productivity for all factors causes decreasing production costs and increasing competition resulting in an increase of domestic products competitiveness in the foreign markets leading to a higher growth rate of exports.

According to the H-O-V theory discussed in so far, one is able to estimate the comparative advantage of countries through generalizing a multi-variate model in the framework of export supply (Lectard and Rougier, 2018). Therefore, the explamentory variables such as exchange rate, productivity, human capital, labor force, knowledge capital, R&D expenditures and finally relative export price explain changes in exports (Yarbrough and Yarbrough, 2009).

Now, applying the model of export supply developed by Leamer (2000), Maskus and Nishioka (2009), Kiyota (2013) and Nishioka (2013), the model shown in (3) is specified and estimated to explore the effects of components of the factor content on Iran's non-oil exports flows to the trading partners as follows:

$$EX_{it} = \beta_1 ER_{it} + \beta_2 P_{it} + \beta_3 L_{it} + \beta_4 K_{it} + \beta_5 HC_{it} + \beta_6 KC_{it} + \beta_7 R\&D_{it} + \beta_8 EF_{it} + \beta_9 E_{it} + \varepsilon_{it} \quad (3)$$

where, the specified determinants on the country's exports (*EX*) include the exchange rate (*ER*), the relative export price (P), labour (L), physical capital (K), human capital (HC), knowledge capital (KC), R&D expenditures (R&D), productivity (EF) and Energy (E). *i* and *t* stands for cross section countriy and time, respectively.

The functional form of export supply is defined completely using a number of parameters in the initial model which is a type of parametric form. If the parametric model assumptions are correct, they can construct precise estimation empirical results. However, the parametric model may become ambiguous (Hardle, 1994). Accordingly, parametric models are compared to nonparametric and semi-parametric models. To describe unknown regression relationships, nonparametric methods present a flexible device. Nonparametric models rely on no assumptions about the functional form of the regression model. But if the number of regressor is large, these models may be hard to explain. In order to keeping the interpretability of parametric models and flexibility of nonparametric models, these two parts are joined by semi-parametric models (Hardle et al.,2004).

According to Racine (2008), nonparametric and semi-parametric techniques have pulled in a lot of consideration from statisticians in the recent decades, as proved by the enormous arrange of texts written by statisticians including Ruppert et al. (2003), Hardle et al. (2004), Fan and Yao (2005) and Malikov and and Sun (2017).

In the export model sepecification, a number of variables such as exchange rate, relative export price, labour force, physical capital, human capital, knowledge capital productivity, as the factor content, are used in the known functional form, implying mostly a parametric manner. The model is indeed flexible to include other indicators, such as R&D expenditures, which may have a nonparametric relation with export flows.

R&D expenditures depend on different proxies. For instance, on the one hand the framework of production model includes the variable of R&D expenditures where it is considered as productivity of production factors. The variable, on another hand, is considered as intensity of optimizing factors during time where such factors are counted as improving technology that emerge differently in countries. Therefore, the effect of R&D expenditures on exports may be assessed through a non-parametric manner, which are obtained with different

methods, so that one is a B-Spline estimator discussed by Pagan and Ullah (1999), Mamuneas et al. (2006), Durlauf and Blume (2010) and Ohadi Esfahani and Tayebi (2014).

To specify a semiparametric export model, Equation (3) is re-defind as follows:

$$EX_{it} = \beta_1 ER_{it} + \beta_2 P_{it} + \beta_3 L_{it} + \beta_4 K_{it} + \beta_5 HC_{it} + \beta_6 KC_{it} + \beta_7 EF_{it} + \beta_8 E_{it} + m(R\&D_{it}) + \varepsilon_{it} \quad (4)$$

where $m(R\&D_{it})$ stands for a non-parametric relationship between R&D and export supply.

5. Empirical Results

We estimate Equation (4) to explore the effect of trade factor content on Iran's non-oil exports. Labour, export and R&D expenditures data were obtained from World Development Indicators (WDI)[1]. Human capital, physical capital and export relative price were collected from Penn World Table (PWT)[2], while we used the OECD website[3] to collect data on energy, exchange rate, knowledge capital and productivity. Based on the availability of data, we considered the period from 1990 to 2020.

As discussed previously, the empirical results obtained by estimating a semi-parametric model specified in Equation (4), including two parts of parametric and non-parametric relationships. Based on panel data approach, the parametric method follows the fixed effects (Baltagi, 2008), and in the nonparametric part, Nadaraya-Watson estimator was used for the calculation of equation coefficiences.

The empirical results obtained are presented in Table (1), which reports the parametric effects of the explanatory variables except for R&D on Iran's exports. Figure (1) also displays a non-parametric relationship between the dependent variable (Iran's non-oil exports to its trading partners and the R&D expenditures, in which a smoothery line is appeared in a shadow area to draw this relationship.

Table (1): Parametric estimation of H-O-V model of Iran and trade partners by B-Spline estimator

Variable	Coefficient	t statistic	Pr > |t|
LnHC	0.93	2.13	0.048
LnK	0.047	0.53	0.596
LnE	0.31	1.17	0.245
LnKC	0.26	2.18	0.031
LnEF	2.38	4.28	0.0001
LnL	0.050	2.75	0.007
LnER	0.063	2.15	0.034
LP	0.37	2.65	0.009

Source: Authors

[1] www.worldbank.org
[2] www.cid.econ.ucdavis.edu/pwt.html
[3] www.oecd.org

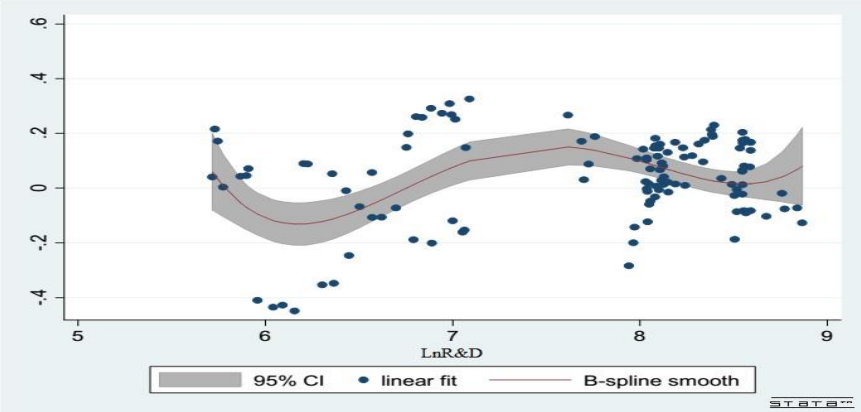

Figure 1: Non-parametric relationship between R&D expenditures and Iran's non-oil exports by B-Spline estimator

Source: Authors

Based on estimated parametric results, variables such as human capital, knowledge capital, productivity, exchange rate and relative export price have mostly significant effects on exports. The results show that a one percent increase in human capital leads Iran's exports to increase by 0.93 percent. Other results indicate that one percent increase in knowledge capital, productivity, labour force, exchange rate and the relative export price leads Iran's exports to its trading partners to increase 0.26 percent, 2.38 percent, 0.050 percent, 0.063 percent and 0.37 percent, respectively.

These results confirm the findings by Andersson and Johansson (2010) and Kadochnikov and Fedyunina (2017), who explain human capital affects intensively the export capability of production based on education and training. Human capital is thus considered as one of the crucial determinants of comparative advantage and trade expansion in developing countries.

Additionally, knowledge capital has positive and significant effect on exports, in which the result is similar to the findings obtained by Fleisher et al. (2015), Kiyota (2013) and Nioshika (2013). More specifically, knowledge capital leads to an increase in productivity and production, resulting in shifting export potentials to the high-tech industries in the countries under consideration.

According to the empirical results obtained by this study, productivity also has positive and significant effect on exports, which confirms the findings of Nioshika (2013). Indeed, productivity differences are important in increasing the export potentials of countries, leading to the capacity building to product more exportables goods and services.

Based on the empirical results, as productivity changes, relative endowment of production factors also changes, which is consistent with the trade theory of HOV. In addition, the relative export price and exchange rate have positive and significant effects on exports, as by increasing one percent of the export price leads to an increase of 0.37 percent in export potentials. Moreover, exchange rate has a positive and significant effect on the export supply, which is expected theoretically, even though its effectiveness is quite low among Iran and the trading countries.

According to the non-parametric part of the results as shown in Figure (1), the relationship between R&D expenditures and Iran's export supply could lead to develop through the higher rate of R&D expenditure. As dicussed by Nioshika (2013) and Coe et al. (2009), the more R&D level boosts in a country, the more the export advantage increases especially in production of technology intensive goods. Kiyota (2013) shows that R&D has a positive effect on the components of technical coefficients and thus, in accordance with Vanek theory, it leads to further increase in export supply. The non-parametric results show that the relationship between research and development expenditures and trade is various based on the different levels of R&D expenditures. As these expenditures increase, it will act as incentives and increase exports, and at other levels, these costs will act as a barrier and may reduce exports.

According to Figure (1), the U-form of the effect of R&D expenditures on exports is consistent with the study conducted by Do, et al. (2016). The implication is that the relationship between export supply and R&D expenditures will develop in higher levels of R&D; therefore, the more increase in investments in the R&D expenditures, the more exports of Iran are supplied to its trading partners.

6. Conclusion

The purpose of this study was to investigate the potentials of trade relations between Iran and its selective trading partners based on the H-O-V theory. The concentration of the Vanek theory is on considering multi factors instead of two factors of labours and capital. According to the empirical results obtained, human capital, physical capital, knowledge capital, R&D expenditures and productivity are the major determinants, as the factor content, of the trade relations between Iran and its partners including China, UAI, Iraq, Turkey, India, Japan, Russia and Germany during 2009-2020.

Empirical results showed that all afformentioned production factors have significant and positive effects on Iran's exports. Therefore, generalizing two factors model to a multiple factor model emphasized by the H-O-V theory has explored the effects of more variables on Iran's export advantages. Factors such as productivity, human capital and knowledge capital are more effective in comparison with labor force and energy.

As found by this research, a nonparametric relationship between R&D expenditures and export supply has been quite substantial to expand trade relations between Iran and its trading partners. Hence, R&D expenditures are significant to consider as a main factor content because it causes productivity boosting and changes the technology matrix of countries.

Therefore, policy making in increasing R&D expenditures that shows technology boosting in the production process helps competitive tradable goods and services, which are more competitive and have high quality attitudes, towards enhancing Iran's trade relations with other countries.

References

1. Afshari, Z. and Moahed, M. (2010), "The Test of Heckscher-Ohlin-Samuelson Theory in Intra-industry Trade of Iran (a Dynamic Panel Approach)," *Trade Studies*, 14 (54), 1-23.

2. Amoroso, N., Chiquiar, D. and Ramos, M. (2011), "Technology and Endowments as Determinants of Comparative Advantage: Evidence from Mexico", *North American Journal of Economics and Finance*, 22, 164–196.

3. Andersson, M. and Johansson, S. (2010), "Human Capital and the Structure of Regional Export Flows", *Technology in Society*, 32(3), 230-240.

4. Baltagi, B. (2008), Econometric Analysis of Panel Data, Forth Edition, England: Wiley & Sons.

5. Coe, D.T., Helpman, E. and Hoffmaister A., (2009), "International R&D Spillovers and Institutions", *European Economic Review*, 53, 723–741.

6. Davis, D. R., Weinstein, D. E., Bradford, S. C. and Shimpo, K. (1997), "Using International and Japanese Regional Data to Determine When the Factor Abundance Theory of Trade Works," *American Economic Review* 87 (3), 421–446.

7. Do, Q. Levchenko, A. and Raddatz, C. (2016), "Comparative Advantage, International Trade, and Fertility," *Journal of Development Economics*, 119, 48–66.

8. Doruk, Ö. T. (2015), Intra Industry Trade and R&D Intensity: An Empirical Assessment for Turkey, 4th International Conference on Leadership, Technology, Innovation and Business Managemen, 210, 52 – 57.

9. Durlauf, S. and Blume, L. (2010), Microeconometrics, Houndmills, Basingstoke, Hampshire; New York: Palgrave Macmillan, the New Palgrave Economics Collection.

10.Fan, J. and Yao, Q. W. (2003), Nonlinear Time Series: Nonparametric and Parametric

11.Methods. Springer Series in Statistics, Springer-Verlag, New York.

12.Feenstra, R. (2002), Advanced International Trade Theory and Evidence, University of California, Davis, National Bureau of Economic Research.

13.Fleisher, B. M., McGuire, W. H., Smith, A. N. and Zhou, M. (2015), "Knowledge Capital, Innovation and Growth in China," *Journal of Asian Economics*, (39), 31-42.

14.Hardle, W. (1994), Applied Nonparametric Regression, Humboldt-Universitat zuerlin,

15.Wirtschaftswissenschaftliche Fakultat, Institutfur Statistik und Okonometrie, pandauer Str.1, D-10178 Berlin.
16.Hardle, W., Muller, M. Sperlich, S. and Werwatz, A. (2004), Nonparametric and Semi-
17.parametric Models, an Introduction, Springer-Verlag Berlin Heidelberg.
18.Lectard, P. and Rougier, E. (2018), **"**Can Developing Countries Gain from Defying Comparative Advantage? Distance to Comparative Advantage, Export Diversification and Sophistication, and the Dynamics of Specialization," *World Development*, 102, 90-110**.**
19.Johansson, M. (2004), The Statistical and Economic Role of Jumps in Continuous-Time Interest Rate Models, The Journal of Finance, 1 (2), 227-260.
20.Kadochnikov, S. M. and Fedyunina A. A. (2017), "The Impact of Financial and Human Resources on the Export Performance of Russian Firms," *Economic Systems*, 41(1), 41-51.
21.Kiyota, K. (2013), "Skills and Changing Comparative Advantage: The Case of Japan", *Japan and the World Economy*, 28, 33–40.
22.Lai, H. and Chun Zhu, S. (2007), "Technology, Endowments, and the Factor Content of Bilateral Trade", *Journal of International Economics*, 71, 389–409.
23.Leamer, E. (2000), "What's the Use of Factor Contents?" *Journal of International Economics*, 50, 17–49.
24.Malikov, E. and Sun, Y. (2017), Semi-parametric Estimation and Testing of Smooth Coefficient Spatial Autoregressive Models," *Journal of Econometrics*, 199, 12–34.
25.Mamuneas, T. P., Savvides, A. and Stengos, T. (2006), "Economic Development and the Return to Human Capital: A Smooth Coefficient Semiparametric Approach", *Journal of Applied Econometrics*, 21, 111–132.
26.Maskus, K. E. and Nishioka, S. (2009), "Development-Related Biases in Factor Productivities and the (H-O-V) Model of Trade," *Canadian Journal of Economics*, 42 (2), 519–553.
27.Nioshika, S. (2013), "R&D, "Trade in Intermediate Inputs, and the Comparative Advantage of Advanced Countries," *Journal of the Japanese and International Economies*, 30, 96–110.
28.Ohadi Esfahani, S. and Tayebi, S. K. (2014), "the Role of R&D in Trade Expansion: A Semi-parametric Gravity Specification for East and West Asia", *International Economic Studies*, 44 (1), 15- 26.

29.Pagan, A. and Ullah, A. (1999), Nonparametric Econometrics, England: Cambridge University Presss, 6-8.
30.Rajabzadeh Moghani, N., Salimifar M. and Seyed Agha Hosseini, S. M. (2015), "The Impact of Human Capital Investment on Economic Growth in the MENA Countries, Using the Dynamic Panel Data Estimated by GMM Method," *Quarerly Journal of Research and Planning in Higher Education*, 21 (1), 1-19.
31.Ruppert, D., Carrroll, R. J. and Wand, M. P. (2003), Semiparametric Regression Modelling, Cambridge University Press, New York.
32.Sauré, P. (2017), "Time-intensive R&D and Unbalanced Trade," *European Economic Review*, 91, 229-244.
33.Taghavi, M., Esfandyar Jahangard, E. and Safavi, R. (2011), Testing Heckscher-Ohlin-Vanek (HOV) Model in Iran, *Journal of Economic Modeling Research*, 1(3), 45-69.
34.Trefler, D. (1999), "An Interview with Elhanan Helpman", *Macroeconomic Dynamics*, 3(4), 571–601.
35.Trefler, D. and Chun Zhu, S. (2010), "the Structure of Factor Content Predictions", *Journal of International Economics*, 82, 195–207.
36.Yarbrough, B. V. and R. M. Yarbrough (2009), the World Economy: Trade and Finance, 7th Edition, USA: Thamson South-Western Ltd.
37.Zymek, R. (2015), "Factor Proportions and the Growth of World Trade," *Journal of International Economics*, 95, 42–53.

ارزیابی رهیافت هکشر–اهلین–ونک (H-O-V) در روابط تجاری ایران و شرکای تجاری

چکیده:

در این مقاله، روابط تجاری ایران و شرکای تجاری اصلی کشور بر اساس نظریه هکشر–اوهلین–ونک (H-O-V) با هدف ارزیابی توسعه روابط تجاری در چارچوب شدت عامل صادرات مورد بررسی قرار گرفته است. در نظر گرفتن چندین عامل تولید مانند نیروی کار، سرمایه فیزیکی، سرمایه دانش، هزینه‌های تحقیق و توسعه، بهره‌وری و انرژی در فهرست عامل در مدل عرضه صادرات کشور از سال ۱۹۹۰ تا ۲۰۲۰ به منزله نوآوری این مطالعه محسوب می‌شود.

با توجه به نقش هزینه‌های تحقیق و توسعه در گسترش تجارت، به نظر می‌رسد برای بهره‌مندی از توزیع یکسان بین کشورهای توسعه یافته و در حال توسعه شکاف تخصیص این منبع وجود دارد، در حالی که یافته-های تجربی موجود در ادبیات تجارت نیز حاکی از تأثیر غیرقابل پیش بینی متغیر مخارج تحقیق و توسعه بر جریان تجاری است. بنابراین، تجزیه و تحلیل اثر این متغیر بر جریان‌های تجاری به یک رابطه پارامتری محدود نمی شود. با این وجود، عوامل دیگری مانند نیروی و کار و سرمایه اثرات متمایز و پارامتریک بر تجارت دارند، به طوری که از روش نیمه پارامتریک برای مدل‌سازی عرضه صادراتی ایران در رابطه با شرکای تجاری‌اش استفاده شده است. نتایج تجربی نشان داد که بهره‌وری، سرمایه انسانی و سرمایه دانش که مولفه-های اصلی فهرست عامل تجارت هستند، بیشترین تأثیر را بر جریان‌های صادراتی ایران و شرکای تجاری آن داشته اند. علاوه بر این، بخش ناپارامتریک مدل نشان داد که درصد بالاتری از هزینه‌های تحقیق و توسعه به طور قابل‌توجهی بر جریان‌های صادراتی ایران با نرخ بالاتری اثر می‌گذارد.

کلمات کلیدی: نظریه هکشر–اهلین–ونک، فهرست عامل تجارت، روش نیمه پارامتریک.

طبقه‌بندی JEL: C14، F14 .