

ECONOMICAL RETROSPECTIVE OF DEVELOPMENT OF VERTICAL SPECIALIZATION THEORY

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Formulation of the problem. We explore the development of vertical specialization theory which is trade in goods across multiple stages of production on the relationship between trade and business cycle synchronization across countries. We study various papers about international trade model in which explores the degree of vertical specialization varying with trade barriers. We examine how and why these vertical specialization models created by economists and compare differences of those models. Since VS one of the most important changes involves the increasing interconnectedness of production processes in a vertical trading chain that stretches across many countries, with each country specializing in particular stages of a good's production sequence. *The purpose of the article* is to form a theoretical and methodological basis for an economic retrospective of the development of the theory of vertical specialization. The subject of the research is theoretical and methodological aspects of the economic retrospective of the development of the theory of vertical specialization. *Methods used in the study:* historical method, methods of verification of theoretical positions (morphological analysis of the content and relationship of categories, principles and laws, assessment of the correspondence of historical facts to theoretical hypotheses), methods of analysis and synthesis, induction and deduction, logical method (hypothetical and axiomatic approaches), comparison method. *Research hypothesis.* In the context of global challenges, it is necessary to change the nature of interaction, for which it is necessary to form a theoretical and methodological basis for an economic retrospective of the development of the theory of vertical specialization. *Presentation of the main material.* Vertical specialization occurs when a country uses imported intermediate parts to produce goods that it later exports. This definition reflects the idea that countries are consistently linked to each other to produce the final good. The fulfillment of the conditions is justified: the product must be produced in several successive stages, two or more countries must specialize in the production of some, but not all, stages, and at least one stage must cross the international border more than once. It is emphasized that vertical specialization occurs when a country uses imported intermediate parts to produce goods that it later exports. *Originality and practical significance of the research.* The study of the economic retrospective of the development of the theory of vertical specialization includes four interrelated blocks – the theoretical and exploratory basis of interaction, the substantive (paradigmatic and methodological), applied and managerial basis of the interaction of business entities, which will allow comprehensively cover possible aspects of interaction. *Conclusions of the study.* The article examines the theoretical and methodological basis of vertical trade also connects the growth of international trade with an increase in international production. The forces that have driven increased vertical trade – lowering trade barriers and improving transport and communication technologies – are likely to persist. Thus, we can conclude that the value of VS and vertical trade in world trade will grow from year to year.

Key words:

vertical trade, communication, technology, production, tariffs.

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ЕКОНОМІЧНА РЕТРОСПЕКТИВА РОЗВИТКУ ТЕОРІЇ ВЕРТИКАЛЬНОЇ СПЕЦІАЛІЗАЦІЇ

Постановка проблеми. Ми досліджуємо розвиток теорії вертикальної спеціалізації - торгівлі товарами на декількох етапах виробництва - на взаємозв'язку між торгівлею і синхронізацією бізнес-циклу в різних країнах. Вивчаємо різні статті про модель міжнародної торгівлі, в яких досліджуємо ступінь вертикальної спеціалізації в залежності від торгових бар'єрів. Досліджуємо, як і чому ці моделі вертикальної спеціалізації створені економістами, і порівнюємо відмінності цих моделей. Оскільки VS одне з найбільш важливих змін пов'язане зі збільшенням взаємозв'язку виробничих процесів у вертикальній торгової ланцюжку, яка охоплює багато країн, причому кожна країна спеціалізується на певних етапах виробничого послідовності товару. *Метою статті* є формування теоретико-методологічного базису економічної ретроспективи розвитку теорії вертикальної спеціалізації. *Предмет дослідження* – теоретичні та методологічні аспекти економічної ретроспективи розвитку теорії вертикальної спеціалізації. *Методи, використовувані в дослідженні:* історичний метод, методи верифікації теоретичних положень (морфологічний аналіз змісту та взаємозв'язку категорій, принципів і законів, оцінка відповідності історичних фактів теоретичним гіпотезам), методи аналізу і синтезу, індукції і дедукції, логічний метод (гіпотетичний і аксіоматичний підходи), метод порівняння. *Гіпотеза дослідження.* В умовах глобальних викликів необхідно міняти характер взаємодії, для чого слід сформувати теоретико-методологічний базис економічної ретроспективи розвитку теорії вертикальної спеціалізації. *Виклад основного матеріалу.* Вертикальна спеціалізація виникає, коли країна використовує імпорتنі проміжні деталі для виробництва товарів, які вона пізніше експортує. Це визначення відображає ідею про те, що країни послідовно зв'язуються один з одним для виробництва кінцевого товару. Обґрунтовано виконання умов: товар повинен вироблятися на декількох послідовних стадіях, дві або більше країн повинні спеціалізуватися на виробництві деяких, але не всіх стадій, і хоча б один етап повинен перетинати міжнародний кордон більше одного разу. Підкреслено, що вертикальна спеціалізація виникає, коли країна використовує імпорتنі проміжні деталі для виробництва товарів, які вона пізніше експортує. *Оригінальність і практичне значення дослідження.* Дослідження економічної ретроспективи розвитку теорії вертикальної спеціалізації включає чотири взаємозалежних блоку - теоретико-експлейнарний базис взаємодії, змістовний (парадигмально-методологічний), прикладної та управлінський базис взаємодії суб'єктів господарювання, що дозволить комплексно охоплювати можливі аспекти взаємодії. *Висновки дослідження.* У статті розглянуто теоретико-методологічний базис вертикальної торгівлі також пов'язує зростання міжнародної торгівлі зі збільшенням міжнародного виробництва. Цілком ймовірно, сили, які привели до збільшення вертикальної торгівлі - зниження торгових бар'єрів і вдосконалення транспортних і комунікаційних технологій – зберуться. Таким чином, можна зробити висновок, що значення VS і вертикальної торгівлі в світовій торгівлі буде зростати з року в рік.

Ключові слова:

вертикальна торгівля, комунікація, технологія, виробництво, тарифи.

ЭКОНОМИЧЕСКАЯ РЕТРОСПЕКТИВА РАЗВИТИЯ ТЕОРИИ ВЕРТИКАЛЬНОЙ СПЕЦИАЛИЗАЦИИ

Постановка проблемы. Мы исследуем развитие теории вертикальной специализации торговли товарами на нескольких этапах производства на взаимосвязи между торговлей и синхронизацией бизнес-цикла в разных странах. Мы изучаем различные статьи о модели международной торговли, в которых исследуем степень вертикальной специализации в зависимости от торговых барьеров. Мы исследуем, как и почему эти модели вертикальной специализации созданы экономистами, и сравниваем различия этих моделей. Поскольку VS одно из наиболее важных изменений связано с увеличением взаимосвязанности производственных процессов в вертикальной торговой цепочке, которая охватывает многие страны, причем каждая страна специализируется на определенных этапах производственной последовательности товара. *Целью статьи* является формирование теоретико-методологического базиса экономической ретроспективы развития теории вертикальной специализации. *Предмет исследования* – теоретические и методологические аспекты экономической ретроспективы развития теории вертикальной специализации. *Методы, используемые в исследовании:* исторический метод, методы верификации теоретических положений (морфологический анализ содержания и взаимосвязи категорий, принципов и законов, оценка соответствия исторических фактов теоретическим гипотезам), методы анализа и синтеза, индукции и дедукции, логический метод (гипотетический и аксиоматический подходы), метод сравнения. *Гипотеза исследования.* В условиях глобальных вызовов необходимо менять характер взаимодействия, для чего следует сформировать теоретико-методологический базис экономической ретроспективы развития



теории вертикальной специализации. *Изложение основного материала.* Вертикальная специализация возникает, когда страна использует импортные промежуточные детали для производства товаров, которые она позже экспортирует. Это определение отражает идею о том, что страны последовательно связываются друг с другом для производства конечного товара. Обосновано выполнение условий: товар должен производиться на нескольких последовательных стадиях, две или более страны должны специализироваться на производстве некоторых, но не всех стадий, и хотя бы один этап должен пересекать международную границу более одного раза. Подчеркнуто, что вертикальная специализация возникает, когда страна использует импортные промежуточные детали для производства товаров, которые она позже экспортирует. *Оригинальность и практическое значение исследования.* Исследование экономической ретроспективы развития теории вертикальной специализации включает четыре взаимосвязанных блока – теоретико-эксплейнарный базис взаимодействия, содержательный (парадигмально-методологический), прикладной и управленческий базис взаимодействия субъектов хозяйствования, что позволит комплексно охватывать возможные аспекты взаимодействия. *Выводы исследования.* В статье рассмотрен теоретико-методологический базис вертикальной торговли также связывает рост международной торговли с увеличением международного производства. По всей вероятности, силы, которые привели к увеличению вертикальной торговли – снижению торговых барьеров и совершенствованию транспортных и коммуникационных технологий – сохранятся. Таким образом, можно сделать вывод, что значение VS и вертикальной торговли в мировой торговле будет расти из года в год.

Ключевые слова:

вертикальная торговля, коммуникация, технология, производство, тарифы.

Formulation of the problem. Numerous changes are occurring in the nature of international trade by the effect of globalization. Production procedures increasingly involve a sequential, vertical trading chain spreading out across many countries, with each country specializing in particular stages of a good's production sequence. In this literature review paper, we observe vertical specialization and its role in world trade by studying. We observe the evolution of vertical specialization in different papers and mainly pay our attention to international VS. In some cases, vertical specialization may span international boundaries and is associated with complex international production networks. We examine how and why these vertical specialization models created by economists and compare differences of those models. Since VS one of the most important changes involves the increasing interconnectedness of production processes in a vertical trading chain that stretches across many countries, with each country specializing in particular stages of a good's production sequence.

This paper expands the set of systematic evidence that characterize verticality in trade. We study the developed concept that is called vertical specialization, the key feature of which is that imported inputs are used to produce a country's export goods. The concept emphasizes the twin notions that the production sequence of a good involves at least two countries, and that during this sequence, the good-in-process crosses at least two international borders. This latter notion highlights the sequential production,

the multiple-border crossing, and the back-and-forth aspect of an increasing amount of international trade.

Analysis of recent research and publications. International trade has been major topic among economists for centuries, for instance by developing his classical theory [1-7] comparative advantage D. Ricardo stated that countries try to specialize in one kind of commodities and export them at maximum cost advantage and minimum comparative advantage [8]. Probably Ricardo promoted to establish the theory of vertical specialization.

Campa and Goldberg [9] created a theoretical framework that would explain the causes and economic implications of fragmentation on the structure and composition of trade. The new trade theory explains trade in final goods in a context of imperfect competition and product differentiation. Nevertheless, it does not provide appropriate background for the analysis of intermediate goods whose trade can be better explained in a context of comparative advantages and differences in factor endowments.

The localization of fragments of intermediate goods production in different regions or countries takes advantage of differences in productivity and factor prices as suggested in the Ricardian theory of comparative advantages. In this respect, the analysis of VS and fragmentation means a return to the Ricardian comparative advantage theory and the Heckscher-Ohlin-Vanek (HOV) model; together, the two models create a framework to explain the operation of production segmentation.





The theoretical model developed by Jones and Kierzkowski [10] has verified the feasibility of fragmented processes in the new area of international trade and can be explained within the classical theories of Ricardo and HOV. Jones and Kierzkowski's [8-10] contribution is to point to the advances in communications engineering and financial services as the main drivers of international fragmentation of production. Technological development of services (transportation, communications, and financial services) has enabled integrated production processes that can be broken into two or more production segments and coordinated through service links. Based on differences in factor endowments, the authors determined the pattern of product specialization between countries in which fragmentation should be seen as the result of biased technical progress.

The purpose of the article is to form a theoretical and methodological basis for an economic retrospective of the development of the theory of vertical specialization. The subject of the research is theoretical and methodological aspects of the economic retrospective of the development of the theory of vertical specialization.

Presentation of the main research material. In this section, we compare different definitions about VS by studying previous concept and ideas. Therefore, tried to collect other econoists definitions about vertical specialization for comparing with each other. The table on the below illustrates all definitions from the beginning to the end.

As Table 1 shows, several components of the definition are common to the different terms. Firms slice up production and divide it among different locations abroad (offshoring), with (intra-firm) or without (third-party service) ownership links. Parts and components or intermediate goods can cross borders several times, transformed as final products or as more elaborated intermediate goods. These products can go back to the same country or end up in a third or fourth country. Another common element is the domestic content of exports or the quantity of imports embedded in exports, since the final market is the global market. Lastly, multinational firms have contributed to the expansion of this new international economic specialization. Questions about the correct term for a production process spread among different countries often arise, but terminology depends on the focus of the study. VS has been used as

synonymous with product-sharing, intra-product specialization, external orientation, fragmentation and trade-in-tasks, for example.

Feenstra and Hanson have studied patterns of trade specialization with special focus on the North-South trade in several works. In several joint (1996, 1997, and 2003) and separate papers [2; 3], they analyze offshoring and its effects on the labor market (specifically on the demand for skilled labor and wages in the country of origin and the host country). Feenstra and Hanson point out differences in factor endowments and factor intensities as premises for deciding the fragmentation of production. According to them, offshoring can take the form of imported intermediate inputs (parts and components) as well as of service for the assembly of a product overseas while keeping the brand or company logo. They state that outsourcing will contribute to the growth of demand for skilled labor in both states, and consequently to increasing wages [2]. Thus, outsourcing increases the wage gap between skilled and unskilled labor, which can be considered as a form of technological change in capital intensive activities [2; 3; 4; 5]. In the same vein, Shelburne (2004) stresses that outsourcing results in a biased technological change with an increase in inequality in both developed and developing countries through downward pressures on wages for unskilled labor.

According to Hummels vertical specialization occurs when a country uses imported intermediate parts to produce goods it later exports. This definition captures the idea that countries link sequentially to produce a final good. Three conditions must hold for our definition of vertical specialization to occur: (1) a good must be produced in multiple sequential stages, (2) two or more countries must specialize in producing some, but not all, stages, and (3) at least one stage must cross an international border more than once. In other words, vertical specialization occurs when a country uses imported intermediate parts to produce goods it later exports.

Kleinert [7] recognized that trade patterns of intermediate goods differ from trade in final goods and extended Feenstra and Hanson's models accordingly in order to study the factors behind the increasing share of intermediate goods in total imports by developed countries, in particular when Foreign Direct Investment (FDI) is the reason for this type of trade.

Table 1: Definitions of development of the theory of vertical specialization

Name Authors Definition	Name Authors Definition	Name Authors Definition
International vertical integration/Vertical FDI/Vertical production network	Helpman and Krugman (1985); Hanson et al. (2005)	Refers to the trade and investment relationship that multinational firms establish with their subsidiaries in which headquarters has control and ownership of those subsidiaries. Multinationals spread their activities across different locations. An intra-firm trade results between the parent company and its subsidiaries.
External orientation	Campa and Goldberg (1997)	Defined as the difference between the participation of industrial exports and the share of imported inputs in production. One of the first works to make use of Input-Output tables as an alternative to trade statistics that were not extensive in accounting for intermediate goods.
Vertical specialization	Hummels et al. (1998)	Discusses the division of production in sequential steps performed in different countries. In regards to trade flows, refers to the import content of export production. This concept differs from outsourcing or vertical integration and FDI as the last two relate to the strategy of multinational enterprises, while vertical specialization refers to production operations that occur in countries without an explicit reference to the ownership status.
Subcontracting/ Outsourcing/ Offshoring	Feenstra (1998);	Defined as the practice in which a company divides production stages and then locates each stage in a country where the costs are the lowest. It includes the practice of hiring a third party (subcontracting) that conducts the whole production process, keeping the company logo
Intra-product specialization	Arndt (2001)	Refers to the trade in parts and components that corresponds to the same end use of a good. Depending on the product, imports of parts and components are not only for assembly, but also for transformation into other parts and components which in turn are exported either for final assembly in the country of origin or in a third country .
International product sharing	Yeats (2001)	Defined as the internationalization of manufacturing in which countries participate in different stages of the manufacturing of goods. Stages of production are located in the most efficient and lowest cost site. Additionally, it refers to special tariff provision 9802 (previously 806/807) of the Offshore Assembly Program (OAP) that governs trade in parts and components, not only between the U.S. and Mexico, also between other partner countries.
International fragmentation of production	Baldone et al. (2001); Kierzkowski (1990, 2001)	Defined as the segmentation of the product chain that is carried out in different countries, either by multinational enterprises or companies that hire third-party services. Made possible by technological innovations in communications and the liberalization of financial services.
Trade in tasks	Grossman and Rossi Hansberg (2006)	Assumes that the production of goods requires ongoing tasks for each of the factors of production. Once determined, tasks can determine what can be done in different locations assuming that marginal costs at all locations are equal.
Value-added trade	Daudin et al. (2011); Koopman (2012)	Koopman (2012) The growth of intermediate goods implied a redefinition of what is registered as a final good since a product in different stages of production crosses several borders until it becomes a final good. Therefore, the value-added of a good needs to be considered instead of the final value of a good.

Source: developed by the authors

Kleinert builds a model that includes intermediate goods in the production function of Multinational Enterprises (MNEs). The model highlights the relationship between foreign affiliates and the home-country supplier network and predicts that the MNEs' subsidiaries abroad tend to import intermediate goods in a greater proportion than the national counterpart [7].

Another stream of research examines trade flows of intermediate goods that relate to the flow of intra industry trade (IIT), which can be considered part of the new trade theory. Ethier (1982) was one of the first to extend a theoretical model of horizontal IIT in differentiated intermediate goods based on Dixit and Stiglitz's (1977) preferences for variety. However, a later





work by Lüthje (2003) cautions that Dixit and Stiglitz's ideas on preferences for variety cannot be used to analyze trade in intermediate goods since variety is not important for the intermediate goods demand because the intermediate goods need to meet the final good product specifications. Lancaster's preferences for an ideal better explain this type of trade (Lüthje 2003). Differences in factor endowments between countries again determine the pattern of trade specialization. Indeed, analyses of trade in intermediate goods often assume that the number of available varieties of intermediate goods in the production of a final good is negatively related to the difference in factor endowments between countries, while the number of adaptations in the intermediate good production of a final good is positively related to differences in factor endowments between countries.

A more recent explanation for the relationship between VS and intermediate goods comes from the theoretical framework where VS can be denoted as trade-in-task. The pioneering work of Grossman and Rossi-Hansberg (2006) indicates that the increase in the trade of parts and components, more than the trade in final goods in the last two decades, reflects changes in firms' production strategies. Instead of a production process that maximizes the best combination of inputs at lowest costs, firms seek production processes where tasks are performed at the lowest costs. On this subject, Grossman and Rossi-Hansberg offer a new paradigm with seemingly contradictory implications for standard trade theory [10]. Outsourcing of tasks affects the price of inputs and their productivity as well as trade policy. As noted by previous works, technological change is occurring at home and in host countries. In this case, Grossman and Rossi-Hansberg's theoretical model shows that offshoring tasks will increase productivity of factors involved in those tasks and thus increase wages.

The literature treating the formation of trade agreements in the early 90's [7; 9; 11] suggested that engaging in trade agreements was the result of an exogenous process guided by the quantification of Vinerian gains. Countries would engage in regionalism if they expected trade creation to outpace trade diversion. However this exogenous approach to FTA formation gave way to a more endogenous approach with the emergence of the notion of 'natural trading blocs'. Baldwin (1993) put forward the domino theory of FTA formation

where he suggested that governments engage in FTAs by weighing up national pro-membership forces against anti membership forces (promembership forces can be seen as export oriented firms and anti-membership forces as import competing firms). Baldwin argued that as FTAs become bigger, the pro-membership forces of nations outside the region become stronger. This brings about incentives for countries that have been left out to try to engage in bilateral talks. Essentially, as markets get bigger through regionalism, the cost of being left out of a preferential area increases as do the benefits from being inside. This contrasts with Grossman and Helpman's (1995) political economy approach which saw FTA formation as a result of the weighted interests of domestic player's preferences i.e. voter's utilities and import competing and export firms (lobbies). FTAs are then the result of targeted trade creation benefits for exporting firms and targeted trade diversion benefits for domestic firms. However, it was not till the work of Magee (2003), Baier and Bergstrand (2002, 2004, 2007) and Baier, Bergstrand and Egger (2006) that a more endogenous approach to FTA formation was formulated.

Magee's work (2003), provided compelling evidence on the endogeneity of FTA formation and trade flows. He found that high levels of bilateral trade play an important role in increasing the probability of forming a FTA. In a cross sectional gravity model setting for the year 1980 Magee found a positive FTA coefficient for agreements that were only present in the period 1985-2001. This suggested that countries engaging in preferential trade deals were already heavily engaged in trade. Baier and Bergstrand (2001, 2004 and 2007) then developed a series of papers which sought to control for the endogenous formation of trade agreements in a gravity setting. They argued that selection into agreements (unobserved heterogeneity) is likely to be the biggest cause of endogeneity. The unobserved variables affecting trade flows are also likely to play an important role in the formation of FTAs. Hence estimating a gravity model that does not account for this is likely to yield severe downwards biases on the FTA coefficients. They also suggest that IV techniques [9] will not adjust for the unobserved heterogeneity as well as panel estimations with fixed effects. This is because using fixed effects allows for arbitrary correlation of unobservables with the FTA dummy. Baier and Bergstrand [11]

find that when one controls for endogeneity, FTAs approximately double the amount of trade between partners.

Hitherto, researchers have seen VS in relation to trade of intermediate goods, explained by differences in factor endowments between countries and facilitated by the decrease of transportation and communication costs. Furthermore, the traditional North-South inter-industry trade specialization changed with the rise of vertical IIT led by the flows of intermediate goods. One of the primary challenges in the analysis of VS has been the issues with measurement. The next section will review the empirical evidence related to the quantification of VS and the databases used in order to quantify the trade of intermediate goods.

The initial model of VS is the Dornbusch-Fischer-Samuelson (DFS) model of international trade was created by three Massachusetts Institute of Technology (MIT) professors in 1977. This model expands the widely accepted theory of comparative advantage of classical economist David Ricardo (1772–1823) to a conceptually infinite number of commodities, and the model integrates money and payments into what essentially had been a barter model. The differing from modern VS models, the model assumes the traditional classical framework of two trading countries and of labor being the sole factor of production. The countries are A and B. Country A exports any good where the wage rate for A's workers (W_A) multiplied by the labor time needed to produce a unit of the good (L_A) is less than the wage rate for B's workers (W_B) multiplied by the labor time needed to produce a unit of that good in B (L_B); that is, A exports any good where $W_A L_A < W_B L_B$. Country A imports goods where $W_A L_A > W_B L_B$. Expressed alternatively, country A will export goods where $(W_A/W_B) < (L_B/L_A)$ and import goods for which $(W_A/W_B) > (L_B/L_A)$, and, in DFS, a continuum of goods is specified in descending order of (L_B/L_A) .

Authors of this model did not take into consideration transport costs, tariffs, and that the exchange rate or they assumed for they are fixed at one unit of A's currency = one unit of B's currency. Yet the model plays as a role of basis for latter VS models.

Rudiger Dornbusch, Stanley Fischer, and Paul Samuelson themselves (1980) later incorporated a second factor (capital) into the model in a Heckscher-Ohlin framework and produced further conclusions. (Heckscher-Ohlin

[or alternatively, Heckscher-Ohlin-Samuelson] refers to a standard trade model based on relative factor endowments of countries and relative factor intensities in the production of commodities.) The DFS model also has been extended, among much other research, in its Ricardian formulation to more than two countries in growth and customs union contexts (Wilson 1980; Appleyard et al. 1989) and into a multicountry framework, combined with monopolistic competition and econometric work, in its Heckscher-Ohlin formulation (Romalís 2004). A considerable amount of empirical work over the years has supported the relationship between labor productivity/costs and trade patterns predicted by the classical economists and DFS, a comprehensive example being Wendy Carlyn, Andrew Glyn, and John Van Reenen (2001). Criticisms of the model can be directed toward the realism of its assumptions of perfect competition and of smooth adjustment to technological change and other disturbances.

Dornbusch-Fischer-Samuelson conducted two studies to investigate the strength of the theoretical relationship between labor cost and vertical specialization. Authors posited two models to account for vertical specialization. In the first model, labor cost, fixed currency rate are studied as a main factors. In the second model, labeled labor cost, fixed currency and capital are observed as a trade patterns.

Alan Deardorff, in his "Weak Links in the Chain of Comparative Advantage" (1979), discovered the basic logic of comparative advantage extended to many goods and countries, many factors, without factor price equalization, and with costly trade. His propositions are an early example of the now common approach of looking for sufficient statistics that describe distributions of outcomes implied by models as opposed to a full catalog. On average, a country's trade vector will export goods that in autarky would be relatively cheap and import goods that in autarky would be relatively expensive. "On average" is defined as an easily interpreted covariance or correlation. On average, the factor content of a country's trade vector will export factors that in autarky would be relatively cheap and import factors that in autarky would be relatively expensive. Here the logic required "on average" to mean a covariance among three variables that Alan termed a "comvariance." In the H-O approach presented by Deardorff, vertical specialisation occurs through differences in factor endowments across countries. The US





exports skilled labour intensive goods to Mexico where they are assembled by unskilled labour and re-exported back as final goods to the US (e.g. Maquiladoras trade). Firms take advantage of lower costs of labour to decrease costs of production.

Hummels, “Vertical Specialization and the Changing Nature of World Trade”, developed VS modelling by adding extra factors which effects on trading intermediate goods. Like pioneer economists they stated that, two countries and two stages of production, there are four possible production techniques or specialization patterns for each good:

HH: Home country produces both stages.

HF: Home country produces first stage; foreign country produces second stage.

FH: Foreign country produces first stage; home country produces the second stage.

FF: Foreign country produces both stages.

The equation above plays crucial role for developing new model:

$w_1(z) + w^*a^2(z) < w_1(z) + w_2(z)$, (HH)

$w_1(z) + w^*a^2(z) < w^*a^1(z) + w_2(z)$, and (FH)

$w_1(z) + w^*a^2(z) < w^*a^1(z) + w^*a^2(z)$, (FF)

Authors assume that reductions in trade barriers, such as tariffs and transportation costs, are the exogenous shocks driving the growth of vertical specialization and trade. In particular, “iceberg” transportation costs implemented, which can be equivalently modeled as a uniform, proportional tariff levied on all imports, where the tariff revenue finances government purchases that generate no productive or consumption value. They also present a simple numerical application of the second special case to illustrate the effect of tariff liberalization on vertical specialization and trade growth.

According to the paper VS occurs only when:

1. A good is produced in two or more sequential stages,

2. Two or more countries provide value-added during the production of the good,

3. At least one country must use imported inputs in its stage of the production process, and some of the resulting output must be exported

It's clear that for VS a product must pass two or more sequential processes, in second condition countries participate in value-added during the creating the product but it happens not only cross-border actions but also domestic economy there sectors acts as participants. Their

third condition focuses on the sequential, ‘back-and-forth’ aspect of trade that recent case study evidence suggest has risen dramatically.

Conclusions and prospects for further research. For concludes, all economists, who researched VS, did different approaches on opening importance and role of vertical specialization in trade. Some of them observed VS in terms of intra industry level (Lüthje (2003) Ethier (1982)) and others focused on international level (Hummels(2001) Feenstra and Hanson Kierzkowski, Heckscher-Ohlin-Vanek). The theory and modelling of VS has been developing, for instance initial economists like Heckscher-Ohlin studied VS on the behalf of labor wages, latter economists added extra factors like capital, currency rate, trade barriers, transportation costs and technologies in order to increasing quality of research.

Impact of Vertical specialization is increasing from year to year on international trade. Yet the nature of trade has changed to the point where countries increasingly specialize in producing particular stages of a good, rather than making a complete good from start to finish. However, countries need not to spend extra costs for completing the products, instead of this they can export intermediates to other partner countries. In XX century transportation costs was common problem for countries, so that they would have rather completing all production stages in their national economies. Yet, in XXI century new innovations and technologies introduced in transportation sector, recent reforms promoted creating new services and decreasing transportation costs. Indeed, falling transportation costs highly effected on rising VS level among countries. This vertical trade is also what links heightened international trade to greater international production. In all likelihood, the forces that have led to increased vertical trade –lower trade barriers and improvements in transportation and communications technologies – will continue. Thus, we can conclude that significance for VS and vertical trade in the world trade will continue to rise from year to year.

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