The Cyclical Nature of International Trade: The Aspect of Technological Impact

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Abstract

Modern theories are increasingly focusing on cyclical nature. This article is dedicated to the cyclical nature of international trade examined from the impact of technology.

The study presented in the paper considers three different aspects. First, the paper discloses the theories of economic growth, such as classical, neoclassical, exogenous, and endogenous growth theories; it also reveals the importance of the impact of technology referred to the economic growth theories.

Second, in the paper different economic views to the length of cycle are presented. The study is reviewing the short-run (Kitchin cycle), mid-run (Juglar cycle, Kuznets swing), and long-run (Kondratjew wave, Grand Supercycle) economic cycles.

Third, in the paper the analysis of historical events is applied seeking to explain the cyclical nature of international trade, the length, strength, and the origin of economic cycles.

Keywords: international trade, innovations, technological change, economic cycles.

Introduction

All the processes of social development are cyclical. Cyclicality is analysed by various scientific disciplines. Obviously, international trade also has a cyclical nature.

The theories of economics are increasingly focusing on cyclical nature. The scientific literature states that the economic growth is caused by the spread the most important technological innovations (technical innovation), which happens every 50-60 years. This is a logical process which has a decisive impact on business cycles. It should also be noted that the emergence of new technologies and their spread (when is done through investments) sooner or later leads to the growth of trade volumes.

In the paper international trade is identified as the import and export of goods, the results of which are measured in the value of goods received from foreign domestic territory persons and vice versus.

Among Lithuanian authors international trade is considered an export and import activity. Export and import was researched by Rakauskienė (2006); export and import regulatory measures were examined by Bernatonytė (2009); the commercial architecture of international trade and the main Lithuanian export partners were analysed by Ginevičius and others (2005); Lithuanian exports structure and dynamics were presented by Purlys (2006); and the changes of export volumes were investigated by Jakutis and others (2005). However, the attention to cyclical fluctuations in international trade is not very high in Lithuania. On the other hand, the authors in the world's scientific literature investigate the cyclical nature of international trade from different directions. Mostly they focus on such directions: first, models, which explain how the cyclical nature of products demand is reflected in foreign trade; second, the fluctuations of production volumes; and, third, on the fluctuations of U.S. international trade and its features. Meanwhile, the impact of technology to the cyclical fluctuations of international trade is analysed by these and other authors: Rivera-Batiz and Oliva (2003), Cohen (2005), and Guerrieri (2008).

The application of new technology is opening up fundamental new possibilities: the favourable conditions for trade development in international markets are created. On the other hand, the successful and purposeful development of trade has to be based on scientific knowledge.

The analysis of economic science literature (reviewed books published by famous world publishers such as Oxford University Press, Cambridge University Press, Harvard University Press, Springer, M. E. Sharpe, Routledge, etc.) shows that the authors who published books on the trade topic have given much higher attention to the questions of the cyclical nature than the authors who have published books about international trade. Despite that, the higher or lower drop of international trade is characterized by high unemployment and the under-utilization of other production factors. Literature analysis also shows that usually authors point to other factors as the main sources of cyclicity and rarely find that technology shocks explain more than one quarter of output fluctuations (Justiniano, Primiceri, and Tambalotti, 2008). Usually for such analysis time series models are used. They focus on short-term fluctuations in trade. Other models, i.e., evolutionary models. try to

explore the feedbacks between the factors influencing aggregate demand and those driving technological change.

The interpretation of fluctuations of the volume of international trade still misses not only theoretical but also practical considerations. This paper analyses the cyclical nature of international trade and the main characteristics of fluctuations: length, strength, origin, and others.

In order to explain the world-wide fluctuations in international trade volumes, the analysis of historical events is carried out in the paper.

The object of research is the impact of technology on the cyclical fluctuations of international trade.

The aim of research is given to examine the cyclical nature of international trade disclosed from the impact of technology.

To achieve the aim the following tasks have to be solved:

1. To analyse the theories used to disclose the growth of economic activity.
2. To review short-run, mid-run, and long-run economic cycles.
3. To present the analysis of historical events seeking to explain the cyclical nature of international trade.

The article is based on historical, comparative, empirical, and systematic analysis.

The study is based on the methodology which covers:

1) A systematic approach,
2) The concept of international trade development,
3) The analysis of historic events.

A systematic approach is the methodological basis of systematic analysis. The essence of systematic approach is the research of a complex object as a unified whole system.

The concept of international trade development rests on the methods which are used to assess the features of the cyclical nature of international trade: cycles, strength, country of origin, and other significant characteristics.

The analysis of historic events is used to explain the evolution of international trade.

The theories of economic growth

There is a wide range of economic growth theories (Fagerberg, 2003), such as: classical growth theory, exogenous growth theory (Harrod–Domar growth model and neoclassical growth models), endogenous growth theory, unified theory of economic growth, energy growth theory, and Schumpeterian growth theory.

Classical economics refers to work done by the group of economists in the eighteenth and nineteenth centuries. The developed classical theories focus on the way the market economies function. Classical

economists also concentrate on the dynamics of economic growth.

The generalized classical theory speaks about growth and stagnation in works presented by Smith, Ricardo, and Malthus. The theory was put together by combining the common strands of thought of these renowned classical economists. To understand their ideas, let us first look into the individual theories propagated by each of the three economists in detail.

Smith posited the supply-side driven model of growth. Smith's model of growth remained the predominant model of classical growth. Smith identified that the promotion of foreign trade, which widens the market, is very important sources of growth.

Later on Ricardo modified the Smith model by adding main input (land). The view of Ricardo's also differs from Smith's with respect to the pace of economic development. Smith's system develops at an accelerated rate; therefore, Ricardo's system grows at the continuously declining pace.

Malthus thought that the abstinence on the part of the capitalist only reduces the amount of effective demand in the economy, thereby reducing the possibility of growth (Dosi and Nelson, 1994). Malthus also believed that the increase of population doesn't provide a stimulus to economic growth, as it does not mean the increase of actual buying. The main method for propelling the growth process is effective demand, which is the quantity of goods that consumers are actually buying at market prices.

Despite the disagreement between Smith, Ricardo, and Malthus, these classical economists had agreed at least that the growth process depended from the rates of technological progress.

The exogenous growth models include the Harrod–Domar growth model and neoclassical growth models.

The Harrod-Domar growth model is based on Keynesian ideas of incomplete markets and on the neoclassical models of exogenous growth. It is used in development economics to explain an economy's growth rate. According to the Harrod-Domar model there are three kinds of growth: warranted growth, actual growth, and the natural rate of growth.

Well known in the neoclassical growth model is the Solow–Swan growth model. It was the first analytical attempt to model the long-run economic growth. It is noted in the model that countries can overcome steady state and continue growing by inventing new technologies (Firth and Mellor, 2000). According to their view, the role of technological change is crucial.

In neoclassical growth models, the long-run rate of growth is determined exogenously. A common

prediction of these models is that an economy will always converge towards the steady rate of growth, which also depends on the rate of technological progress. In standard neoclassical environment technology shock is the most natural source of business cycles, since it can easily produce a co-movement of output, consumption, investments, and labour productivity (Fusari, 1996).

Schumpeter suggested looking to economic growth as dissonant changes, when new uptakes stimulated by innovations, force ups; and downs are during the periods of change (Galindo and Méndez-Picazo, 2013). Such idea was opposite to the neoclassic approach prevailed at the time when economic development was treated as a constant and harmonious process. The model of Schumpeterian growth (Lambson and Kerk, 2007), which best illustrates that is Aghion-Howitt model (Dinopoulos and Thompson, 1999).

The Big Push model was presented by Rodan and suggested that countries needed to jump from one stage of development to another, in which, for example, large investments in infrastructure would move the economy to a more productive stage.

With the representative of endogenous growth theory Romer and Lucas subsequently developed alternatives to Solow's neo-classical growth model. They developed the framework that includes a mathematical explanation of technological advancement. In their research they focused on innovations which increase technological change.

Energy growth theory economists Ayres and Warr presented a model that aims to address deficiencies in the neo-classical and endogenous growth models. Key support for this theory is a mathematical model showing that the composite indicator of energy conversion is a good proxy for technological progress, which is the portion of economic growth.

Among endogenous growth models (Alcouffe and Kuhn, 2004) the Salter cycle model is well known. According to the model economic growth is enabled by increase in productivity, which lowers the inputs (labour, capital, etc.) for the given amount of outputs (products). Lowered costs increase demand for goods, which also results to the increase of capacity. New capacity is more efficient due to the application of new technology, improved methods and reached economy of scale. This leads to further price reductions, which later on increases demand until markets become saturated.

The unified growth theory was developed by Galor to explain the growth processes of individual economies and the world economy as a whole. The unified growth theory is consistent with the entire process of development.

The model presented by Krugman (1994) involves the pattern of international trade, which is determined by the continuing process of innovation and technology transfer. The model is developed for the innovating North and the non-innovating (imitating) South. In the North new products are introduced and produced immediately, but in the South the technology is adopted with a lag. This lag gives rise to international trade, because of new technology and pioneer, which reaps the benefits of pioneering activity (Reuveny and Thomson, 2008). Naturally, the higher intensity of adoption shows the shorter adoption lag (Comin and Mestieri, 2013).

New growth theory has provided more insights forward in the relationship between trade and growth. In the old theory of international trade, the static gains from trade and losses have been examined mainly. Now trade theory provides little guideline to the effects of technical progress to the growth of international trade (Yanikkaya, 2003).

In summary the author could mention that the impact of technology is investigated by growth theories. Mainly these theories rest on these ideas: (1) technological change leads to long-run growth; (2) the application of innovations is mainly applicable for companies; (3) the openness of the country to new technologies, e.g., to catch up with more developed countries.

Transmission mechanism

Trade is an important linkage between countries. In general, the shares of trade, export, and import in GDP are widely used in the literature and are found to be significantly and positively correlated with growth (Yanikkaya, 2003). The implication of increased trade means that trading countries, which are engaged in heavier trade integration, are becoming more closely linked with regard to their macroeconomic performance. The global business cycle is characterised by blocks – economic regions, when business cycles of different regions interact (Berk, 1997). The region responds to movements in international business cycle and on the role when trade flows play a role in the global transmission of the business cycle. So, the answer to the question asking, which economic region functions as an engine in the world economy, is the centre of gravity of the global business cycle (Berk, 1997).

In order to explain the business cycle co-movements in terms of trade flows, a reference to "traditional business cycle" theories is given. This class of models analyse the demand of different type of goods and different stages of business cycle.

The implications of classic theory present that international trade should take place between countries

that complement each other (based on inter-trade patterns). Frankel and Rose (2002) show that larger trade flows are associated with greater correlation in the business cycle. Increased trade is leading to closer or wider business cycles across countries – trading partners. The increased trade does not mean the increased synchronization of business cycles among trade partners. On the contrary, imperfect competition and economies of scale mean that trade flows are more likely to follow intra-industry patterns. Intra-industry trade, rather than inter-industry trade or the volumes of trade, is the main channel through which business cycles among trade partners become synchronized (Shin and Wang, 2004).

The authors think that if intra-industry trade is more pronounced than inter-industry trade, then business cycles will be more positively correlating if trade becomes more integrated. Literature analysis shows that there are some important linkages that lead to positive relation between increased trade and the co-movements of the business cycle. First, via demand shocks, which mean that the boom in one country, will require an increased volume of imports. Abeysinghe and Forbes (2005) analysed the indirect effect of shock in one country to the activity of other trade partners. Second, via policy shocks. These shocks rise when fiscal and monetary policies are pursued by trading partners (Frankel and Rose, 1998). Concerning other policies, such as trade policies, empirical strategies used to ascertain the link between trade policy and growth had serious shortcomings and showed significantly weaker findings (Yanikkaya, 2003). Third, via industry-specific technological shocks, if less specialization of production occurs, this will result in the synchronization of business cycles (Krugman, 1993). For example, one such technological shocks is information technology and telecommunications (ICT) shock, after which synchronisation remained relatively high (Moneta and Ruffer, 2006). Bridfman (2010) documented that the shock to GDP has a strong impact on trade (which is stronger even now than it was in the past). Peersman and Straub (2005) find the influence of technology shocks to business cycle fluctuations. Fourth, via investments shocks. Smets and Wouters (2007) recover that investment shocks account for less than 25% of fluctuations in GDP at any time horizon. Justiniano et al. (2008) apply the DSGE model where the investment and neutral technology shocks play a complementary role. For explaining the causes of macroeconomic fluctuations Justiniano et al. (2008) found that shocks to the marginal efficiency of investment are the key driver of macroeconomic fluctuations. These shocks affect the yield of a foregone unit of consumption in terms of tomorrow's capital input. The literature often refers to them as investment specific technology shocks, since they are equivalent to productivity shocks specific to the capital goods producing sector in a simple two-sector economy. For simplicity, we simply call them investment shocks (Justiniano et al., 2008)

Finally, it is clear that due to the structure of trade and the structure of output, business cycles become more synchronized because they are increasingly affected by the same shocks (Fies, 2007).

Berk's (1997) studies showed that the continental Europe, which is the trading partner for all the main world markets, functions as an engine for the global economy. In addition, authors Fidrmuc and Korhonen (2009) found a significant link between trade ties and the dynamic correlation of growth rates of GDP in OECD and large emerging Asian countries. Thus, transmission mechanism here means the distribution of shocks to foreign economies.

However, the studies of Artis, Fidrmuc, and Scharler (2008) show that trade integration usually goes hand-in-hand with financial integration, so these effects are often similar. Finally, the general belief is that the trend in manufacturing to produce goods in the number of locations becomes a source of increased trade volumes, as a bit value is added at each stage (Berk, 1997).

The length of cycle in economic theories

Cycle – the fluctuations of economic activity (Fig.1). The cycle consists of drop and boom, this sequence of changes is recurrent (Navickas, Bagdonaitė, and Juščius, 2006).

The concept of cycle has been developed by Kondratjew and Schumpeter (Wonglimpiyarat, 2005). They have stated that the economic increase is caused by the spread of innovations and downturns are influenced by conditions that existed during the boom (David, 1992).

The waves may occur over the period of months or years. Economists distinguish between short-run economic changes and long-run economic growth (Howitt and Aghion, 1998). Generally, economists attribute the booms and drops of economic activity as fluctuations in aggregate demand; also they assume that short-run economic changes are creating fluctuations around the long-run trend in economic growth.

The cyclicality of the world trade has specific features. Cycles may be of varying duration and amplitude (Lipsey and Harbury, 1992). Stoneman (2002) argues that there are different cycles: the long-run cycle, called the Kondratjew cycle, which lasts 50-54 years, the mid-run cycle, known as the Kuznets cycle, which lasts 15-25 years, and the short-run cycle, called the Juglar cycle, whose the duration is
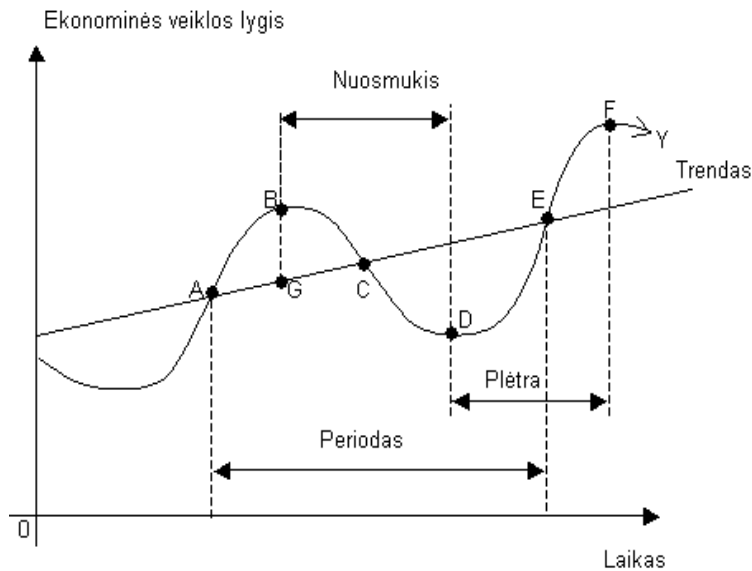
Fig. 1. The economic cycle (Pragarauskas, 2006)

7-11 years (Andersen, 1996; Hugill, 1995; Stoneman, 2002). The literature states there are very short and very long cycles in practice (Hugill, 1995; Solomou, 1998). The Kitchin cycle is a short-run cycle discovered in 1920s, which lasts about 40 months. This cycle is reflecting time lags in information movements affecting the decision making of commercial firms. As a result of this the market gets full with commodities whose quantity is excessive: demand declines, prices drop, the produced commodities get accumulated in inventories, which cause the reaction of the entrepreneur to reduce output. After the drop takes place the conditions for the new phase can be observed: the growth of demand, prices, and output.

The Juglar cycle is a mid-run cycle with the length of 7 to 11 years, analysing the respective changes in inventories. In the 2010 research employing spectral analysis confirmed the presence of Juglar cycles in world GDP dynamics (Korotayev and Tsirel, 2010).

The Kuznets swing is called a mid-run cycle, which last 15–25 years. Kuznets swings are forced by infrastructural investment cycles (Forrester, 1977; Korotayev et al., 2010). Kuznets swings can be found in the world GDP dynamics (Korotayev et al., 2010). Korotayev et al. (2010) think based on the results of

empirical analysis that the Kuznets swing should be regarded as higher frequency of the Kondratieff wave rather than as a separate independent cycle.

The Kondratjew wave is a long-run cycle, estimated to last 50–54 years (Fig. 2). Each presented Kondratjew wave had its main driving forces, geographical centres and technologies (Szul, 2010). According to the innovation theory, waves arise from technological revolution when some radical, advanced technology encourages the emergence of a new industry that affects all sectors of an economy (Sandulli, Fernandez-Menendez, Rodriguez-Duarte, and Lopez-Sanchez, 2012). Badalian and Krivorotov showed that waves, first noticed by Kondratjew, correspond to the lifecycle of a resource-dependent infrastructure of an era (Badalian et al., 2006a; Badalian et al., 2006b). Kondratjew identified three phases in the cycle: expansion, stagnation, and recession. But nowadays the division into four periods is more common (see Fig. 1): AB & EF – prosperity, BC – recession, CD – depression, and DE – improvement.

The Grand Supercycle is based on Kondratjew wave's analysis. The Grand Supercycle is the longest-run cycle, which lasts more than 70 years. The Grand
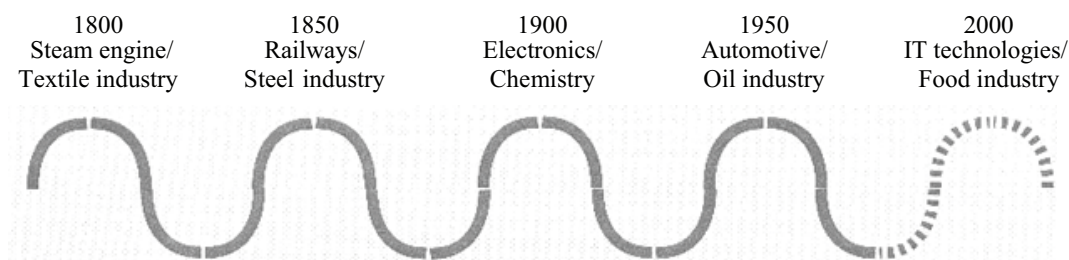
Fig. 2. The economic cycle (Pragarauskas, 2006)

Supercycle swings are subdivided into the smaller generations of waves. In technical analysis they are often compared to the Kondratjew waves. The idea of a Grand Supercycle was born based on the fact that humankind never learns from past mistakes or becomes self-aware in a macro-economic sense.

In combined-cycle concept Schumpeter said that one Kondratjew wave consists of six Juglar cycles, each of which - of three Kitchin cycles. According to this concept there are three autonomous cycles at the same time – Kitchin, Juglar, and Kondratjew.

Finally, Mandel (1975; 1980) demonstrated that during the boom period of the Kondratjew wave growth rates in world trade were on average significantly higher than within drop during the period between 1820 and 1967. Similar results were arrived by Kuczynski (1982) and Goldstein (1988) for the average growth rates of the world economy from 1850 to 1977.

The effect of technology adoption

The technologies considered in study satisfy such criteria. First, they are introduced at the time considered; second, they were used in productive activities (i.e., activities that entered the GDP); third, they were present at the wide range of countries.

The Comin et al. (2013) study shows that in all three historical periods (1000 BC. e., 0 A.D., II c.) Europe and Asia had the highest average levels of overall technology adoption, while America and Oceania – the lowest, and Africa was in between.

This suggests the macroeconomic consequences of technology. Comin and Hobijn (2009) measured the diffusion of 104 technologies (from most of the sectors of economic activity) for 150 countries over the last 200 years using the ratio which reflects the intensity showing how producers or consumers employ a specific technology at a given time moment. For 202 cases, the predicted initial adoption matches with the invention date of the technology. For 336 cases, the predicted adoption date is unrealistically late in the first country (20-150 years later than the invention of the technology).

Francis et al. (2006) found out the presence of positive technology shocks in the period from 1889 to 1940. Alexopoulos (2011) shows that technology adoption leads to the fluctuation of GDP at a time period t+1. This effect is the strongest in 9 years horizon. This is because new technologies bring new production processes, machines, products (Comin and Hobijn, 2007). Francis and Ramey (2006) mention that there are positive technology shocks, which if constantly on-going suggest steady technological progress over the period. This effect shows that innovation through the increase of the range of goods influence the increase of real world productivity (Korner, 2011).

This technology-adaptation process is at the heart of the mechanism of economic growth and development. The interaction of technology-adaptation may explain cycles of different periods simply by considering various kinds of innovations. The exploitation of the large set of innovative possibilities along the intermediate cycle's technology-adaptation implies also long waves (Fusari, 1996).

Additionally, endogenize innovation, uncertainty, and adaptation represent, in general, the main features of the evolutionary process of economy (Fusari, 1996).

The evolution of international trade: the analysis of historical events

To explain the volume of international trade world-wide fluctuations, it is necessary to carry out an analysis of historical events. Such analysis is based on Buckman's (2005) timeline of the major historical events and historical facts mentioned in other sources.

During the analysis, re-exports and the inventory stocking of domestic territory persons are not separately assessed.

The evolution of international trade has started since the beginning of human civilization. International trade was developed by the first civilizations, such as Babylon, Ancient Egypt, Greece and others (from 4000 BC. e.). International trade was developed the Babylonians, who lived in the territory of Iraq and reached the cities in Syria and Canaan (Israel territory); the Ancient Greeks, which developed trade with the cities in the Mediterranean and Black Sea coasts. In ancient times international trade was developed by the ancient inhabitants of Syria – the Phoenicians, which supplied products to Africa and Europe; Ancient Roman people – Romans, which has organized a special trade with the Baltic land, bought goods from Chinese merchants; Etruscans, who lived in central Italy and traded with Greece and the Far East; Panama and Central American people, which carried out inter-trade and for the movement of goods have used carriers and canoes.

The development of international trade has been affected by various factors. III-I century B.C. trade was stimulated by the development of road construction and the progress of map technologies. These technological advances have resulted in the formation of different Eurasian trade routes (Michelbertas, 1986) for spices, silk, amber, etc. and roads in Africa – three parallel trade routes through the Sahara.

The expansion of Western Europe in the Vth-VIIIth c. of international trade was affected by inter-generic exchange (Michelbertas, 1972), and in the
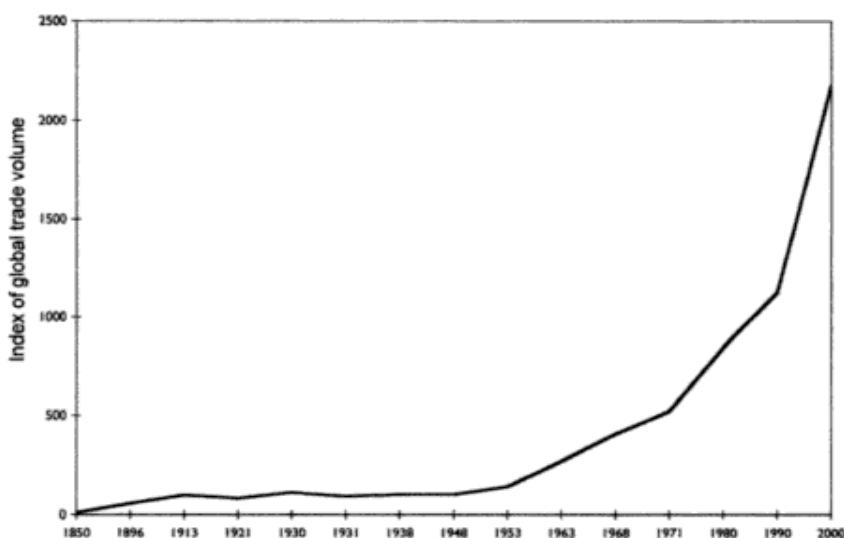
Fig. 3. International trade volume in the world since 1850 (Buckman, 2005)

XIVth-XVth century international trade was stimulated by the development of maritime discovery, navigation, and technology perfection. The development of trade between Europe and America was stimulated also by important inventions that allowed the creation of such ships as the caravel (Buckman, 2005). Later, in the XVIIth c., for the development of international trade the important resource was the resources of gold and silver in the world. This period was described in Raisijus's book "Treatise on trade" (written in 1611) as the craft, which enabled the exchange by own and foreign objects (Ališauskas, Jovaiša, Paknys, Petrauskas, and Raila, 2001). The international trade in the end of the eighteenth century was affected by the utilization of steam power, and the mechanization of labour. The invention of the textile knitting machine (1760); the emergence of mass production machinery; the use of steam power (in 1774) reduced the level of production costs (Buckman, 2005). These changes have led to the higher turnover of trade in goods internationally.

In the XIXth c. the development of railways and the emergence of telecommunications led to the increase of international trade. Until the nineteenth century coastal cities were mainly involved in international trade; the level of trade was low. The discovery and application of railways (1804), telegraph service (1816), and fax machine (1846) initiated the growth of international trade. Orders shipped via telegraph, arrived from 5 to 15 times faster than surface mail (Ahvenainen, 1986). The inventions in the field of transport made possible the movement of goods much faster and in larger quantities (Buckman, 2005). It is estimated that until 1800 the global volume of international trade was only 3% of GDP (Buckman, 2005). Since 1820 the growth of international trade in the world was fast (especially in 1840-1870) (Buckman, 2005; Held, 2002) (Fig. 3).

Since 1880 Europe has become the centre of world trade (especially England, which used steam power successfully and had the trustable net of ports, which were supplemented with the carbon stock) (Buckman, 2005). European products started to dominate in international exchange (Buckman, 2005). In the XXth c. the development of international trade was associated with the inventions in aviation (improved appearance of airplanes during the Second World War), the rise of chemistry industry (the production of chemicals) (Budde, Felcht, and Frankemölle, 2006), and the development of telecommunications (the introduction of transatlantic telephone in 1930).

Hugill (1995) notes that during the nineteenth century, because of intensified production in England, the international trade of US and France developed rapidly. Also such progress was influenced by advanced transportation and telegraph technologies (Hugill, 1995).

Francis et al. (2006) analysed technology shocks across time periods and found the low contribution of technology shocks in the pre-WWII period.

In the second half of the twentieth century the international trade was affected by the progress of biotechnology, information technology and telecommunications (the creation of the commercial computer in the sixth decade of the twentieth century and the introduction of the Internet protocol in 1990) (Fig. 4).

It is necessary to draw attention to the very rapid absorption of Internet technology. 50 million users mastered the technology of Internet in five years (ITU, 2005). Such penetration has been noticed in world trade during 1997-1999 years (Freund and Weinhold, 2004).

In the twenty-first century the priority is given to the ICT. The continuous development of communications technology, introduction of e-commerce, e-business technologies, and ICT is increasingly used in various
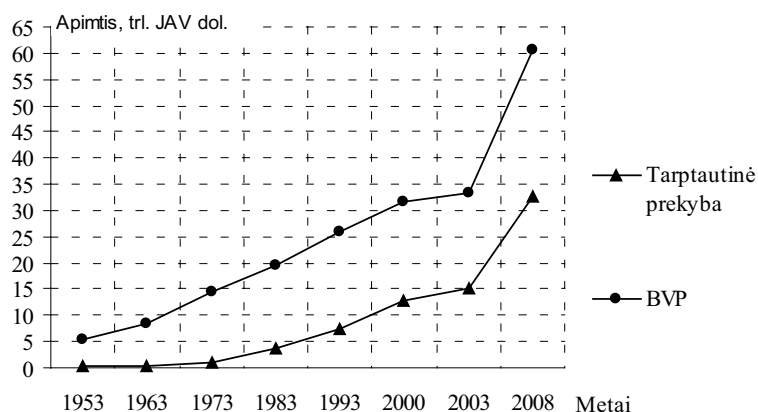
Fig. 4. World trade and GDP.

Source: the author concluded based on WTO (2008), World Bank (2008) data

fields. Under these conditions, the view was formed that the subjects involved in international trade are competing using information technology and telecommunications (Jonnard, 1997).

The scientific literature states that the economic growth is caused by the spread of the most important technological innovations (technical innovation), which happens every 50-60 years. And that is a logical process that has a decisive impact to economic cycles. Lavington (2007) believes that every boom and drop affected by the new set of different reasons, due to which impact the volume of economic activity is changed.

It should be noted that the emergence of new technologies and their spread (as is done through investment) sooner or later leads to the growth of trade volume (Lipsey et al., 1992). Stoneman (2002) says that growth is caused via the introduction and spread of generic technologies, such as steam power, railways (Solomou, 1998), electricity, and ICT. Nell (1998) believes that economic growth is influenced by the introduction of productivity-enhancing technologies (such as mass production and transport technologies). According to Carbaugh (2008) the appearance of technology leads to the introduction and improvement of new production and trade methods, which may be regarded as a cause for the increase of trade volumes.

According to Buckman's (2005) timeline of historical events and historical facts mentioned in other sources, the conducted analysis of historical events shows that the booms of international trade and the global drops have been closely associated with political forces (prosperity and the collapse of the empire, military action) and technological forces (the rise and spread of new technologies). During the examination of international trade volumes in the world from 1850 to 2009, the author noticed that the cyclical nature was met rarely (Fig. 3 and 4).

It is interesting to point attention to the cycle that began in 1950. Its duration takes more than 70 years (and still continues). The amplitude (the maximum deviation from the equilibrium position) of this cycle in 2007 was 163 times higher than the amplitudes of previous cycles.

This cycle is related to inventions in the field of transport technology. The volume of world trade during this cycle had the highest enlargement. This level of rapid economic growth can be explained by Kuznets 1971 ideas. He said that now the continuation of previous trends exists and also changes happen much faster. He also noticed the presence of acceleration that speeds the development of international trade (Čiegys, 2006; Maler, 1992).

Wallace (1990) argues that during this period there were several periods of rapid technological progress. Identified, that the first such progress was during the Second World War and it is associated with the improved appearance of aircrafts, mass production of automobiles, and discoveries in chemistry. The second period of progress associated with the emergence of electronics and biotechnologies. However, when considering the author's observations, the drop of international trade volumes was not detected, it is therefore expected that such technological advances have contributed to an even stronger international trade growth in the world. It is also noted that in the world since 1950 the growth rate of export volume was 12.5% faster than the growth rate of production volume (measured in production units). This shows that the spread of ICT had a significant impact on the rapid growth of international trade.

Conclusions

In the theoretical part of the article the study of economic growth theories is presented. The author demonstrated that the impact of technology is investigated by growth theories. Long-run growth is stimulated by

cumulative waves of technological expansion, including successive waves of early industrialization in steam engine and mass textile production, transport technologies and steel production, electronics and chemistry, electrification and gasoline engines, and today ICT. Also disclosed that the growth theories rests on these three ideas: (1) technological change leads to long-run growth; (2) the application of innovations is mainly applicable for companies; (3) the openness of the country to new technologies, e.g., to catch up with more developed countries. In general, if trading partners, the application of technologies and economic integration raises the worldwide growth rate, it may differently affect individual countries, because there are geographical factors, country size, and other variables.

The author presented a detailed examination of the characteristics of economic cycles and demonstrated that during the analysis of the cyclical nature of international trade, the rise and spread of new technologies must be taken into account. Also in the paper the author mentioned that the cyclical nature of world trade has its own origin, duration, and strength characteristics.

During the examination of international trade in the world from 1850 to 2009, the author noticed that the cyclical nature was rarely met.

The conducted analysis of historical events shows that the booms of international trade and the global drops have been closely associated with political forces (prosperity and the collapse of the empire, military actions) and technological forces (the rise and spread of new technologies).

The emergence of new technologies has resulted in that since 1950s the development of international trade continues for more than 70 years. The drop between Kondratjew technological advancement periods was not found. This suggests that the longest economic cycle functions in international trade. The amplitude of the latest cycle in 2007 was 163 times greater than the amplitudes of preceding cycles.

This research has its own limitations. Therefore, further research could extend the presented study to the following directions: the first direction could be oriented to the investigation the cyclical fluctuations of foreign trade in selected countries; the second direction to the fluctuations of the volume of world trade in specific goods markets; the third direction to the interaction of business cycle and their impact to international trade; the fourth direction to the analysis of the principle effects of economic cycles of international trade; and to the other directions.

References

1. Abeysinghe, T., Forbes, K. (2005). Trade linkages and output-multiplier effects: A structural VAR approach with a focus on Asia. *Review of International Economics*, 13(2), 356-375.
2. Alcouffe, A., Kuhn, T. (2004). Schumpeterian endogenous growth theory and evolutionary economics. *Journal of Evolutionary Economics*, 14 (2), 223-236.
3. Ališauskas, V., Jovaiša, L., Paknys, M., Petrauskas, R., Raila, E. (2001). *Lietuvos Didžiosios Kunigaikštijos kultūra*. Vilnius: Aidai.
4. Andersen, E. S. (1996). *Evolutionary economics – post-Schumpeterian contributions*. UK: Routledge.
5. Artis, M. J., Fidrmuc, J., Scharler, J. (2008). The transmission of business bycles: implications for EMU enlargement. *Economics of Transition*, 16, 559-582.
6. Badalian, L., Krivorotov, V. (2006a). Applying natural sciences to studying history: the Kondratieff-wave as lifecycle of a resource dependent infrastructure, Part III. *Santalka*, 14 (3), 54–67.
7. Badalian, L., Krivorotov, V. (2006b). Applying natural sciences to studying history: regarding the example of England and the industrial revolution, Part II. *Santalka*, 14 (3), 37-53.
8. Berk, J. M. (1997). Trade flows as a channel for the transmission of business cycles. *Quartely Review*, 201, 187-212.
9. Bridfman, B. (2010). *International supply chains and the volatility of trade*. US Bureau of Economic Analysis.
10. Bernatonytė, D. (2009). Intra-industry trade and export specialization: Lithuanian case. *Economics & Management,* 14, 668–675.
11. Buckman, G. (2005). *Global trade – past mistakes, future choices*. London: Zed Books.
12. Budde, F., Felcht, U., Frankemölle, H. (2006). *Value creation – strategies for the chemical industry*. Germany: Wiley-VCH.
13. Carbaugh, R. J. (2008). *International economics*. Boston: Cengage Learning.
14. Cohen, B. J. (2005). *International Trade and Finance: New Frontiers for Research.* Cambridge: Cambridge University Press.
15. Comin, D. A., Mestieri, M. (2013). Technology diffusion: measurement, causes and consequences. *NBER working paper series*, 19052, 1-66.
16. Comin, D., Hobijn, B. (2007). *Implementing Technolog*y. Technology report.
17. Comin, D., Hobijn, B. (2009). The CHAT Dataset. US National Bureau *Working Paper*, 15319, 1-24.
18. Čiegys, R. (2006). *Ekonominių teorijų istorija*. Vilnius: Vilniaus universiteto leidykla.
19. David, W. P. (1992). *Macmillan dictionary of modern economics*. New York: Macmillan Press Ltd.
20. Dinopoulos, E., Thompson, P. (1999). Scale effects in Schumpeterian models of economic growth. *Journal of Evolutionary Economics*, 9 (2), 157-185.
21. Dosi, G., Nelson, R. R. (1994). An introduction to evolutionary theories in economics. *Journal of Evolutionary Economics*, 4 (3), 153-172.
22. Fagerberg, J. (2003). Schumpeter and the revival of evolutionary economics: an appraisal of the literature. *Journal of Evolutionary Economics*, 13 (2), 125-159.
23. Fidrmuc, J., Korhonen, I. (2009). The impact of the global financial crisis on business cycles in Asian emerging economies. *CESifo working paper*, 2710, 1-27.

24. Fies, N. (2007). Business Cycle Synchronization and Regional Integration: A Case Study for Central America. *The World Bank Economic Review*, 21(1), 49–57.

25. Firth, L., Mellor, D. (2000). Learning and the new growth theories: policy dilemma. *Research Policy*, 29 (9), 1157-1163.

26. Forrester, J. W. (1977). Alternatives to Growth – A Search for Sustainable Futures. In Meadows, D. L. (Eds.), *New Perspectives on Economic Growth* (56-67). Cambridge: Ballinger.

27. Francis, N., Ramey V. A. (2006). The Source of Historical Economic Fluctuations: An Analysis using Long-Run Restrictions. *NBER working paper series*, 84, 17-73.

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

29. Frankel, J., Rose, A. (2002). An Estimate of the Effect of Currency Unions on Trade and Growth. *Quarterly Journal of Economics*, 117(2), 437–66.

30. Freund, C., Weinhold, D. (2004). On the effect of the internet on international trade. *Journal of International Economics*, 62 (1), 171-189.

31. Fusari, A. (1996). Paths of economic development: modelling factors of endogenous growth. *International Journal of Social Economics*, 23(10/11), 164-191.

32. Galindo, M. A.., Méndez-Picazo, M. T. (2013). Innovation, entrepreneurship and economic growth. *Management Decision*, 51 (3), 501-514.

33. Ginevičius, R., Rakauskienė, O. G., Patalavičius, R., Tvaronavičienė, M, Kalašinskaitė, K., Lisauskaitė, V. (2005). *Eksporto ir investicijų plėtra Lietuvoje*. Vilnius: Technika.

34. Goldstein, J. (1988). *Long Cycles: Prosperity and War in the Modern Age*. New Haven: Yale University Press.

35. Guerrieri, P. (2008). *Technology and international trade performance in the most advanced countries*. Berkeley: University of California.

36. Held, D. (2002). *Globaliniai pokyčiai: politika, ekonomika, kultūra*. Vilnius: Margi raštai.

37. Howitt, P., Aghion, P. (1998). Capital Accumulation and Innovation as Complementary Factors in Long-Run Growth. *Journal of Economic Growth*, 3 (2), 111-130.

38. Hugill, P. J. (1995). *World trade since 1431 – geography, technology, and capitalism*. New York: JHU Press.

39. ITU (2005). *ICT market liberalisation reports for CEE countries and Baltic States*. Accessed at Internet: http://www.itu.int/pub/D-FIN-SEM-2005.

40. Jakutis A., Petraškevičius V., Stepanovas A., Šečkutė L., Zaicev S. (2005). *Ekonomikos teorija*. Kaunas: Smaltija.

41. Justiniano, A., Primiceri, G. E., Tambalotti, A. (2008). Investment shocks and business cycles. *Federal Reserve Bank of Chicago Working paper*, 2008-12, 1-54.

42. Jonnard, C. M. (1997). *International business and trade – theory, practice and policy*. USA: CRC Press.

43. Korner, J. (2011). *International Trade - Multinational Corporations and Technology Transfer*. UK: Verlag, 3-21.

44. Korotayev, A. V., Tsirel, S. V. A. (2010). Spectral Analysis of World GDP Dynamics: Kondratieff Waves, Kuznets Swings, Juglar and Kitchin Cycles in Global Economic Development, and the 2008–2009 Economic Crisis. *Structure and Dynamics*, 4 (1), 3-57.

45. Krugman, P. R. (1994). *Rethinking international trade*. Cambridge: MIT Press.

46. Krugman, P. (1993). Lessons of Massachusetts for EMU. In Giavazzi, F. and Torres, F. (Eds.), *The Transition to Economic and Monetary Union in Europe* (241-261). New York: Cambridge University Press.

47. Kuczynski, T. (1982). Leads and Lags in an Escalation Model of Capitalist Development: Kondratieff Cycles Reconsidered. *Proceedings of 8th International Economic History Congress*, (27-35). Budapest: International Economic History Congress.

48. Lambson, V. E., Kerk, L. P. (2007). Market structure and Schumpeterian growth. *Journal of Economic Behavior & Organization*, 62(1), 47-62.

49. Lavington, F. (2007). *The trade cycle*. New York: Read books.

50. Lipsey, R. G., Harbury, C. (1992). *First principles of economics*. Oxford: Oxford University Press.

51. Mandel, E. (1975). *Late Capitalism*. London: New Left Books.

52. Mandel, E. (1980). *Long Waves of Capitalist Development*. UK: Cambridge University Press.

53. Michelbertas, M. (1986). *Prekybiniai ryšiai*. Vilnius: Mokslas.

54. Michelbertas, M. (1972). *Prekybiniai ryšiai su Romos imperija*. Vilnius: Mokslas.

55. Moneta, F., Ruffer, R. (2006). *Business cycle synchronisation in East Asia*. Frankfurt: European Central Bank.

56. Navickas, V., Bagdonaitė, R., Juščius, V. (2006). Business cycle and small business. *Engineering economics*, 3 (48), 36–42.

57. Nell, E. J. (1998). *Transformational growth and the business cycle*. UK: Routledge.

58. Mäler, K. (Eds.) (1992). *Nobel Lectures: Economics 1981–1990*. Singapore: World Scientific Publishing Co.

59. Peersman, G., Straub, R. (2005). Technology Shocks and Robust Sign Restrictions in a Euro Area SVAR. *Ghent University working paper*.

60. Pragarauskas, H. (2006). *Aiškinamasis ekonomikos anglų–lietuvių kalbų žodynas*. Vilnius: TEV.

61. Purlys Č. M. (2006). Porter modelio taikymo galimybių, rengiant Lietuvos prekių ir paslaugų eksporto rėmimo ir plėtros strategiją, tyrimas, *Verslas, vadyba ir studijos'2005 Conference proceedings: [electronic source]*, (43-53). Vilnius: Technika.

62. Rakauskienė, O. G. (2006). *Valstybės ekonominė politika*.Vilnius: Mykolo Romerio universiteto leidybos centras.

63. Reuveny, R., Thomson, W. R. (2008). Uneven Economic Growth and the World Economy's North–South Stratification. *International Studies Quarterly*, 52, 579–605.

64. Rivera-Batiz, L., Oliva, M. A. (2003). *International Trade: Theory, Strategies, and Evidence*. Oxford: Oxford University Press.

65. Sandulli, F. D., Fernandez-Menendez, J., Rodriguez-Duarte, A., Lopez-Sanchez, J. I. (2012). Testing the Schumpeterian hypotheses on an open innovation framework. *Management Decision*, 50 (7), 1222-1232.

66. Shin, K., Wang, Y. (2004). Trade Integration and Business Cycle Synchronization in East Asia. *Asian Economic Papers*, 2(3), 1-20.

67. Smets, F., Wouters, R. (2007). Shocks and Frictions in US Business Cycles: A Bayesian Approach. *American Economic Review*, 97(3), 586-606.

68. Solomou, S. (1998). *Economic cycles – long cycles and business cycles since 1870*. Manchester: Manchester University Press.

69. Stoneman, P. (2002) *The economics of technological diffusion*. UK: Wiley-Blackwell.

70. Szul, R. (2010). The end or a new quality of the third wave of globalisation?, *Beyond Globalisation: Exploring the Limits of Globalisation in the Regional Context: Conference proceedings: [electronic source]*, (35-41). Ostrava: University of Ostrava Czech Republic.

71. Yanikkaya, H. (2003). Trade openness and economic growth: a cross-country empirical investigation. *Journal of Development Economics*, 72, 57– 89.

72. Wallace, I. (1990). *The global economic system*. UK: Routledge.

73. World Bank (2008). On-line database 2008. Accessed at Internet: http://siteresources.worldbank.org/datastatistics/.

74. Wonglimpiyarat, J. (2005). The nano-revolution of Schumpeter's Kondratieff cycle. *Technovation*, 25 (11), 1349-1354.

75. WTO (2008). International trade statistics 2008. Accessed at Internet: http://www.wto.org/english/res_e/statis_e/statis_e.htm.

Aurelija Burinskienė

Tarptautinės prekybos cikliškumas. Technologijų poveikio aspektas

Santrauka

Tarptautinė prekyba pasižymi itin dideliu dinamiškumu: joje sparčiai reiškiasi sudėtiniai pokyčiai, nuolat reaguojama į naujus iššūkius ir taikomos naujos technologijos.

Visi socialinės raidos procesai yra cikliški. Cikliškumas yra nagrinėjamas įvairių mokslo sričių darbuose. Akivaizdu, kad cikliškumas pasireiškia ir tarptautinėje prekyboje.

Ekonomikos teorijose vis dažniau atkreipiamas dėmesys į cikliškumo klausimą. Autoriai teigia, kad didesnis ar mažesnis tarptautinės prekybos nuosmukis reiškia didelį nedarbą ir ne visai panaudotus kitus gamybos veiksnius.

Lietuvoje tarptautinė prekyba dažniausiai yra nagrinėjama kaip eksporto ir importo veikla. Tarp autorių eksporto ir importo raidą nagrinėja Rakauskienė (2006); eksporto, importo reguliavimo priemones analizuoja Bernatonytė (2009); tarptautinės prekybos prekinę sandarą, pagrindinius Lietuvos eksporto partnerius tiria Ginevičius ir kiti (2005); Lietuvos eksporto struktūrą ir dinamiką nagrinėja Purlys (2006); eksporto apimties pokyčius aiškina Jakutis ir kiti (2005). Vis dėlto tarptautinės prekybos cikliškumo tyrimai Lietuvoje nėra labai išvystyti. Tuo tarpu pasaulio mokslinėje literatūroje tam skiriama nemažai dėmesio. Tarptautinės prekybos cikliškumas nagrinėjamas įvairiais aspektais. Daugiausiai dėmesio skiriama, visų pirma, modeliams, kurie paaiškina, kaip skirtingų produktų vartojimo netolygumai atsispindi užsienio prekyboje; antra, darbams, nagrinėjantiems gamybos pakilimus; trečia, tyrimams, paaiškinantiems JAV tarptautinės prekybos apimčių svyravimų ypatumus. Štai technologijų poveikis tarptautinės prekybos cikliškumui nagrinėjamas retai, pavyzdžiui, autorių: Rivera-Batiz ir Oliva (2003), Cohen (2005), Guerrieri (2008). Tenka pažymėti, kad naujų technologijų taikymas atveria iš esmės naujas galimybes: sukuriamos palankios sąlygos prekybos plėtrai tarptautinėse rinkose. Taigi technologijų poveikis tarptautinei prekybai turi būti grindžiamas tiek teorinėmis, tiek praktinėmis žiniomis.

Tyrimo objektas – technologijų poveikis tarptautinės prekybos cikliškumui.

Tyrimo tikslas – išanalizuoti tarptautinės prekybos cikliškumo ypatumus, kai cikliškumas nagrinėjamas per technologijų poveikio prizmę.

Tyrimo metodai: istorinė, lyginamoji, empirinė ir sisteminė analizė.

Tyrimo metu remiamasi metodologija, kurios pagrindą sudaro: (1) sisteminis požiūris; (2) tarptautinės prekybos plėtojimo koncepcija; (3) istorinių įvykių analizė.

Straipsnyje nagrinėjami su tarptautinės prekybos cikliškumu susiję klausimai trim skirtingais aspektais. Pirma, apžvelgtos ekonominio augimo teorijos. Straipsnyje pateikta ekonominio augimo teorijų studija; jos metu parodyta technologijų poveikio svarba įvardinama ekonominio augimo teorijose. Atskleista, kad dažniausiai augimo teorijos remiasi šiomis trimis idėjomis: (1) technologinės pažangos idėja, vedančia į ilgalaikį augimą; (2) dažniausiai pasireiškiančia inovacijų taikymo privačiose įmonėse idėja; (3) šalies gebėjimo prisitaikyti prie naujų technologijų idėja, tai yra, suspėti kartu su labiau išsivysčiusiomis šalimis. Siekiant paaiškinti tarptautinės prekybos augimą, įvardinami transmisijos (efekto perdavimo tarp skirtingų šalių ir regionų) mechanizmo veikimo principai. Taip pat atskleista, kad technologijų įsisavinimas yra esminis pagrindas ekonominės veiklos plėtrai.

Antra, straipsnyje nagrinėjami ekonominių ciklų ypatumai; aptariami skirtingos trukmės ekonominiai ciklai: trumpojo laikotarpio, vidutinės trukmės ir ilgojo laikotarpio. Atskleista, kad tarptautinės prekybos apimčių augimo tempai yra ženkliai didesni Kondratjew bangos pakilimo nei nuosmukio metu.

Trečia, siekiant paaiškinti tarptautinės prekybos apimties pasaulio mastu svyravimus, vykdoma istorinių įvykių analizė, kurios metu remtasi Buckman (2005) pagrindinių istorinių įvykių laiko juosta ir kituose šaltiniuose minimais istoriniais faktais.

Atlikta istorijos įvykių analizė parodė, kad tarptautinės prekybos pakilimai bei nuosmukiai pasaulio mastu buvo glaudžiai susiję su politiniais veiksniais (imperijų klestėjimu bei žlugimu, kariniais veiksmais) ir technologiniais veiksniais (naujų technologijų atsiradimu ir plitimu). Išnagrinėjus tarptautinės prekybos apimtis pasaulyje 1850-2009 laikotarpyje pastebėta, kad cikliškumas pasireiškė retai.

Naujų technologijų atsiradimas lėmė, kad tarptautinės prekybos plėtra nuo 1950 m. tęsiasi daugiau negu 70 metų. Vis tik autoriai teigia, kad šiuo laikotarpiu buvo keletas sparčios technologinės pažangos periodų. Įvardijama, kad pirma tokia pažanga prasidėjo Antrojo pasaulinio karo metu ir ji siejama su patobulintų lėktuvų pasirodymu, masine automobilių gamyba, atradimais chemijos srityje. Antrasis pažangos periodas siejamas su elektronikos bei biotechnologijų atsiradimu. Vis dėlto nuosmukio tarp Kondratjew technologinės pažangos periodų 2000 m. neaptikta, todėl manoma, kad antroji technologinė pažanga prisidėjo prie dar spartesnio tarptautinės prekybos apimties pasaulyje didėjimo. Taip pat galima teigti, kad tarptautinėje prekyboje veikia ilgiausios trukmės ekonominis ciklas. Be to, pokyčiai vyksta kur kas greičiau; įžvelgiamas tarptautinės prekybos plėtojimo pagreičio buvimas. Paskutinio ekonominio ciklo amplitudė 2007 m. buvo 163 kartus didesnė už prieš tai buvusių ciklų amplitudes.

Tyrimo rezultatai rodo, kad cikliškumui pasaulio prekyboje būdingi tam tikros kilmės, trukmės ir stiprumo ypatumai; kad analizuojant tarptautinės prekybos cikliškumą turi būti atsižvelgta į į naujų technologijų atsiradimą ir jų plitimą.

Šis tyrimas nėra visa apimantis. Taigi tolesni tyrimai galėtų išplėsti pristatytą studiją tokiomis kryptimis: pirma, pasirinktų pasaulio šalių užsienio prekybos raidos ir ciklinio svyravimo procesų tyrimo kryptimi; antra, konkrečių prekių rinkoms būdingų pasaulio prekybos apimčių svyravimų įvardinimo kryptimi; trečia, atskirų tarptautinės prekybos ekonominio ciklo fazių ypatumų nagrinėjimo kryptimi; ketvirta, tarptautinės prekybos ekonominių ciklų veikimo principų atskleidimo kryptimi; kitomis kryptimis.