
EXOGENOUS MACROECONOMIC SHOCKS AS CONTEMPORARY BUSINESS CYCLE DETERMINANTS

Veniamin P. Todorov¹

¹*University of Economics – Varna*

E-mail: 1vntodorov@ue-varna.bg

Abstract: The article presents the results of a research that aims to test the hypothesis that exogenous macroeconomic shocks affect present-day business cycle dynamics in a way that extends beyond the COVID-19 pandemic and the military conflict in Ukraine. The analysis covers the present-day manifestation of three key types of exogenous shocks - health shocks, oil price shocks and natural disasters. The research showed a lot of evidence that corroborates the hypothesis and hence it is confirmed. The three types of exogenous shocks have played an important role not only for the last two years, but also beyond this time horizon.

Keywords: exogenous shocks, health shocks, oil price shocks, natural disasters, business cycle.

This article shall be **cited** as follows: **Todorov, V.** (2022). Exogenous macroeconomic shocks as contemporary business cycle determinants. *Economic Archive*, (3), c. 3-17.

URL: www2.uni-svishtov.bg/NSArhiv

JEL: E30, E32, F44

* * *

Introduction

The emergence and spread of the COVID-19 virus, combined with measures to contain the health crisis, have resulted in macroeconomic effects that have generated considerable research interest. This gave a serious impetus to analysing the role of exogenous shocks and the way they affect the dynamics of macroeconomic activity.

The emphasis of the mainstream literature on business cycle determinants has traditionally been primarily on two other types of fluctuation factors that are part of the taxonomy of factors determining the direction of the

cycle - the macroeconomic system factors and macroeconomic policy factors. With the theoretical and empirical studies of R. Frisch, E. Slutsky, F. Kidland, E. Prescott, C. Nelson, C. Plosser, and others the impact of exogenous factors in terms of exogenous shocks is gradually being taken into account more seriously.

Today, there is a surge of scientific publications on business cycle analyses and this publication is part of it. Undoubtedly, the SARS-CoV-2 pandemic and the military conflict in Ukraine, and especially its impact on energy prices have been the major determinants of the economic activity dynamics for the last two years.

With this in mind, the study focuses on the contemporary manifestation of exogenous macroeconomic shocks. According to the modern view, there is a plethora of exogenous factors that can cause macroeconomic fluctuations as long as they meet the criterion to originate outside of the macroeconomic system and act as shocks. An exhaustive analysis of them all in a single publication, even in their contemporary context alone, is impossible.

This is the reason why this study focuses on three key types of exogenous shocks – health shocks, oil price shocks and natural disasters. The analysis will build on current research in this area. Our intention is that it should not be constrained only to their manifestation in the last two years but be expanded, taking into account the specifics of their influence in a more extended examination of the current period.

In this context, we formulated and tested the following ***hypothesis***: *Exogenous macroeconomic shocks affect present-day business cycle dynamics in a way that extends beyond the COVID-19 pandemic and the military conflict in Ukraine.*

1. Health shocks

Health shocks, as exogenous factors, are related to contagions that seriously affect the main macroeconomic variables, and hence the dynamics of the business cycle. Their effects on the economic activity in the short run is not studied enough.

Epidemics and especially pandemics are the most prominent factors of this type. The third type of epidemics, endemics, have characteristics that make them very different in terms of their impact on macroeconomic activity. Not only are they confined to certain areas, but they occur periodically, making them largely predictable, and the number of cases at their regular outbreaks remains relatively constant.

An example of such a factor today is the malaria endemic. According to data and estimates of the World Health Organization (WHO), in 2020 there were 241 million cases of malaria worldwide, and the number of deaths was 627,000. This type of endemic is typical for the tropics and especially for certain regions in Africa. In 2020, the African continent accounted for 95% of all cases of malaria and 96% of deaths caused by malaria in the world, with 53% of the cases reported in four countries: Nigeria (31.9%), the Democratic Republic of Congo (13.2%), the United Republic of Tanzania (4.1%) and Mozambique (3.8%).¹ The regularity and predictability of malaria outbreaks mean that their effects are incorporated in the economic forecasts. This is why malaria endemics affect the long-term economic development of these countries but do not have shocking effects for the dynamics of their business cycles.

Epidemics are quite different because they are specific and often unexpected. Pandemics, on the other hand, have effects that are amplified by the international influence of the contagion and the measures to deal with it. This is why their macroeconomic consequences are more serious both on a global scale and for individual economic regions. In view of this, their research contributes to the greatest extent to a better understanding of their macroeconomic effects.

At present, research on the economic role of pandemics and epidemics as exogenous shocks is very limited. The spread of SARS-CoV-2 was defined as a pandemic, which for the first time sparked serious interest in this topic.

One of the most serious pandemics in terms of macroeconomic consequences was that of 1918 as a result of the so-called Spanish flu. Barro et al. (2020) used panel data for a group of countries to estimate that it caused a 6% decrease of GDP and shrank consumption by 8%. From the point of view of the significance of such a shock, we can claim that its severity is more or less comparable to the COVID-19 recession.

However, this pandemic cannot be defined as new because outbreaks of the same disease were reported as far as a century ago. In modern times, in addition to the SARS-CoV-2 pandemic, serious infectious outbreaks were those caused by the SARS-CoV-1, H5N1 and EVD viruses. They had a significant effects on the public life in the affected countries but the focus of this study is on macroeconomic activity.

A major SARS-CoV-1 epidemic was registered in 2003. According to Lee & McKibbin's (2004) CGE model, the global decline in GDP due to the disease was only 0.1% in that year. This refers to the slowdown in economic growth, since not only did the epidemic fail to change the direction of the

¹ <https://www.who.int/news-room/fact-sheets/detail/malaria> [Последен достъп: 20.07.2022].

business cycle but, on the contrary, in 2003, the world economy grew in real terms by 2.9% according to data from the World Bank (WB).

Hai et al. (2004) estimated that, due to the SARS-CoV-1 epidemic, China's GDP growth was 1 or 2% less than what was expected. At the same time, WB data shows that China's real GDP grew with 10% in 2003. According to Fan (2003), the negative effects are largely due to the psychological attitude of caution and the reduction of face-to-face communication.

The **H5N1 epidemic** of 2003 also failed to become a significant exogenous factor. According to Burns et al. (2006), considering the WB model, it caused only 0.1% annual loss of global GDP and 0.4% annual loss of GDP in the Asian economies that were most seriously affected.

The **EVD epidemic** in West Africa in 2014-2015 also did not have a major impact on the macroeconomic activity of the affected economies. It was the widest spread of the virus since it was discovered in 1976. The epidemic did not change the direction of the business cycle, i.e. its economic impact is not strong enough to cause a recession. The WB (2014) model estimates that its growth-reducing impact was between 2.1 and 3.4%.

The effect of the **COVID-19 crisis** is much more significant. The OECD data² for the G20 countries in the second quarter of 2020 show an "unprecedented decline" in real GDP totalling 6.9% (quarter-on-quarter, seasonally adjusted), well above the decline during the global financial crisis (1.6% for the first quarter of 2009). China was the only G20 country to register growth with the rest of the economies shrinking by an average of 11.8%. India suffered the most serious decline of 25.2%. North America ranks among those hit the hardest with declines of 17.1% for Mexico, 11.5% for Canada and 9.1% for the US.

The European economies slumped with declines of 20.4% for the UK, 13.8% for France, 12.8% for Italy, etc., and a EU-average of 11.4%. The other regions of the world could not avoid the extremely negative consequences as well, reporting contraction of the economies of South Africa by 16.4%, Brazil by 9.7%, Japan by 7.9%, Australia by 7%, etc. On an annual basis, the overall decline in GDP for the OECD countries was 9.1% in the second quarter added to the decline of 1.7% in the first quarter of 2020.

The above analysis leads to the conclusion that, with the exception of the COVID-19 recession, **there are no significant contemporary health shocks that have the characteristics of exogenous macroeconomic shocks that determine the dynamics of the business cycle.**

² <https://www.oecd.org/sdd/na/g20-gdp-growth-Q2-2020.pdf> [Last accessed on 18 July 2022]

2. Oil price shocks

The role of oil price shocks as business cycle determinants is relatively new. Health shocks have been known since antiquity while oil utilization is a much more recent phenomenon.

After the industrial revolution, energy sources became an extremely important economic factor since the traditional sources such as wood and water were not able to meet the demand of the new production technologies.

This is how fossil fuels (coal, oil/petroleum, natural gas, peat, etc.), which were known but were not used routinely until then, became extremely important and have remained a major economic factor in the modern world. Alternative energy sources still cannot substitute them for a number of reasons. As a source of energy, biofuels do not yet have the potential to meet the demand; nuclear energy sources are associated with concerns about potential negative effects on the environment (potential accidents, handling of nuclear fuel, disposal of production waste, etc.); solar and wind energy generation technologies still need to be further developed and improved both from a resource and from economic point of view (in terms of production costs, transportation, etc.). The desire to reduce carbon emissions may change the situation in the future, but at this stage economies are heavily dependent on fossil fuels.

It took some time for the changed production conditions in the 20th century and especially after the Second World War to gradually attract the attention of researchers. A milestone in this process was the publication of Hamilton (1983), who argues that price shocks to the supply of crude oil are one of the leading causes of economic fluctuations.

As Tian (2012) points out, oil is the most important natural energy source. This is also confirmed by the data of the Statistical Review of World Energy, published by British Petroleum. Immediately after World War II, coal was the major source of energy but in 1965 oil was already the leader among fossil fuel consumption worldwide with 18,109 terawatt-hours against 16,140 terawatt-hours generated from coal. In the following years, the gap between oil and coal energy production became much greater. In 2019, for example, global consumption of oil was 53,620 terawatt-hours compared to 43,849 terawatt-hours of coal, and 39,292 terawatt-hours of natural gas.

Oil price shocks are associated with the unanticipated components of significant changes in oil prices. These components are defined as the difference between expected and actual price changes (Baumeister & Kilian, 2016).

The price of oil depends on market supply and demand, as, especially after 1986, the market is deregulated and expectations are of key importance (Mitchell, 2002). In terms of supply, they are mainly related to the physical

availability of the raw material in terms of current conditions and future prospects. The uncertainty regarding the quantities that will be produced and marketed in the future plays a major role (Hamilton, 2009, 2013; Fattouh, 2007; Kilian, 2008b).

In terms of demand, expectations traditionally depend on the general expectations of the dynamics of the business cycle, i.e. to what extent the supply will meet the expected demand. In this case, the uncertainty about possible shortages (i.e. the probability that demand will exceed supply) is significant (Hamilton, 2013; Kilian, 2009; Kilian & Murphy, 2014).

Oil price shocks are classified as exogenous shocks because research shows that they are traditionally caused not by endogenous causes that are internal to the market and the economic system as a whole, but by exogenous factors.

In this type of shock, the direction of the price change is not irrelevant. Studies by Davis & Haltiwanger (2001) and Hamilton (2003) show that increases in the price of oil have a stronger effect than decreases.

In his extensive study focused mainly on the US economy, Hamilton (2013) covers the period from 1859 to the first decade of the 19th century. He argues that such shocks are mainly due to disruptions in oil production and supply caused by geopolitical events involving oil-exporting countries (including international armed conflicts, civil wars, riots, political turmoil, revolutions, mass strikes, embargoes for political reasons, etc.)

In his publication, he juxtaposes significant oil price changes and the business cycles of the US economy (see Table 1). On the one hand, sharp price increases are to a large extent the result of events such as the Suez crisis, the OPEC embargo, the Iranian revolution, the Iran-Iraq war, the First and Second Persian Gulf wars, etc. On the other hand, these events correlate with business cycle peaks and the beginnings of periods of decline of macroeconomic activity.

The effects of oil shocks in seven leading advanced economies are the subject of a study by Kilian (2008a), who found a strong correlation among them. Exogenous disruptions in oil supply result in temporary declines in real GDP growth with a delay of two years. A median change in CPI-based inflation is reported after three to four quarters. It is typical to observe declining real wages, rising short-term interest rates and rising rates of exchange of the national currency to the US dollar. The study identified periods of stagflation in Germany, Japan and Canada.

Table 1. Major oil price changes and the corresponding business cycle phases of the US economy

Gasoline shortage	Price increase	Price control	Key factors	Business cycle peaks in the US
Nov. 1947- Dec. 1947	37%: Nov. 1947-Jan. 1948	no (imposition threats)	high demand; limited supply	Nov. 1948
May 1952	10%: June 1953	yes	strike; revocation of price limits	July 1953
Nov. 1956- Dec. 1956 (in Europe)	9%: Jan. 1957-Feb. 1957	yes (in Europe)	Suez Crisis	Aug. 1957
n.a.	n.a.	no	---	April 1960
n.a.	7%: Feb. 1969 8%: Nov. 1970	no	strike; high demand; limited supply	Dec. 1969
юни 1973 декември 1973-март 1974	16%: Apr. 1973-Sept. 1973 51%: Nov 1973-Feb. 1974	yes	high demand; limited supply, OPEC embargo	Nov. 1973
май 1979-юли 1979	57%: May 1979-Jan. 1980	yes	Iran Revolution	Jan. 1980
n.a.	45%: Nov 1980-Feb. 1981	yes	Iran-Iraq War; revocation of price limits	July 1981
n.a.	93%: Aug. 1990-Oct. 1990	no	First Persian Gulf War	July 1990
n.a.	38%: Dec. 1999-Nov. 2000	no	high demand	March 2001
n.a.	28%: Nov. 2002-March 2003	no	Venezuela unrests; Second Persian Gulf War	n.a.
n.a.	145%: Feb. 2007-June 2008	no	high demand; stagnation of supply	Dec. 2007

Source: Hamilton, 2013.

In another paper, Kilian (2008b) concludes that exogenous oil supply shocks cause a sharp decline of the real GDP growth of the US economy after five quarters and a spike in CPI-based inflation after three quarters.

The impact of oil price shocks on Turkey's economy as a typical open economy of an oil-importing country was analysed by Levent & Acar (2011). The conclusion from the simulations they made is that oil prices have a significant impact on macroeconomic indicators (GDP, price level, trade balance).

Taghizadeh-Hesary & Yoshino (2015) compare the effects of oil price changes on GDP and inflation in developed and emerging oil-importing economies using the examples of China, Japan, and the United States. They use a model that also includes monetary variables (money supply and a currency exchange rate). Their results show a more serious impact on the GDP of the developing country and a weaker impact on the gross output of the two developed countries. On the other hand, inflation in Japan and the US reacts more strongly to oil price changes than that in China.

The most recent example of a sharp price change - the rise in the price of oil in the last third of 2021 and especially in 2022 - has yet to be analysed by researchers. The change is due mainly to the COVID-19 crisis and the subsequent efforts to restore macroeconomic activity, and in 2022 – mostly under the influence of the military conflict in Ukraine. Whether the trend will persist and the negative macroeconomic impact will deepen to match the "shock" definition is a matter of future parameters and dynamics.

The results of this analysis are twofold. On the one hand, they show a **stronger contemporaneous effect** of oil price changes **compared to health shocks**. On the other hand, however, this effect is **far weaker than the macroeconomic effects as a result of the COVID-19 pandemic and the measures for its containment** measures.

3. Natural disasters

Historically, natural disasters have very strong effects (Benson & Clay, 2004). This is confirmed by the fact that the early exogenous theories include them in one way or another. This is not surprising, because until the industrial revolution in the 18th and the 19th centuries, economies were mainly agrarian. A sharp positive or negative change in weather conditions resulted in a sharp change in the amount of agricultural produce and therefore – in an increase or decrease of GDP.

After the industrial revolution, the sectoral structure of economies gradually changed. Today there are also economies that rely to a large extent on

the *primary sector*, but they are rather an exception. Traditionally (especially when we talk about developed economies) this sector has a relatively small share in GDP, but regardless of this its role remains very important.

Despite the spread of ideas about the economic globalization and the benefits of specialization based on comparative advantages, countries continue to maintain agriculture as part of the local economy. The higher costs are not a sufficient argument for switching entirely to imports mostly because of the key role of this sector for feeding the population and because a strong food supply dependency is generally undesirable.

In the context of the implementation of the principles of most favoured nation and national treatment in the organization of the various negotiation groups within the WTO, historically the most sensitive topic has been precisely the agrarian sector. This can be seen not only in terms of the negotiations themselves, but also when talking about the inclusion of the various agrarian aspects in the negotiations agenda. The reduction of tariff and non-tariff restrictions on world trade in this type of goods is going through a long and probably incomplete process. Moreover, agriculture remains the most subsidized sector in modern economies.

All this shows the role of the primary sector, which, despite the modern development of technology, remains dependent to a considerable extent on natural conditions and hence, exogenous shocks could be important.

The impact of natural disasters is not limited to the primary sector. Many disasters could affect almost all *industries and aspects of economic activity*. A more detailed assessment of the economic impact of natural disasters is only beginning to unfold in modern economic research literature (Clower, 2006).

The contemporary impact of natural disasters is expressed in terms of **direct and indirect macroeconomic losses** (NASEM, 1999). Direct losses are the loss of human lives, the deterioration of the health status of the workforce, the negative effects on real property, production facilities and equipment, raw materials, work in progress, inventories, transportation infrastructure, bridges, dams, educational infrastructure, etc.

Indirect losses are related to interruptions of production processes, loss of contractors and suppliers, logistics difficulties, disruption of supply chains, reduction of business opportunities, etc.

Another aspect of the effects of natural disasters are the losses incurred by private businesses, households and the public sector (NASEM, 1999). With regard to **private businesses**, the types of damages are clearly seen from the above examples of direct and indirect losses. For **households**, these effects are defined as a decrease in income and wealth, reduction of job opportunities and worse working conditions, deterioration of the quality of life, difficult movement, loss of free time due to the time and effort to overcome the daily life

difficulties, increase of medical expenses, interruption of studies, etc. Regarding the **public sector**, there are losses related to the decrease in the quantity, quality and value of short-term and long-term tangible assets, loss of tax revenues, increased budget spending both for public goods and services and for transfer payments, etc.

Some of the disasters cause regional shock. Such an example is *Hurricane Katrina* of 2005, which caused extensive damage and reduced macroeconomic activity in the states of Louisiana and Missouri causing the loss of 230,000 jobs (Clower, 2006). On the other hand, the economy of these states represents only 2% of US's GDP and employment for the entire country was down by 35,000 jobs.

However, other natural disasters have a very serious impact on the macroeconomic activity and GDP of entire economies. Cavallo et al. (2010) estimate that there were 2000 natural disasters worldwide between 1970 and 2008. The selection criteria they used were the loss of human lives (dead and missing persons) and the drop in GDP. The research shows that some of the disasters take the form of regional shocks, but others lead to a high macroeconomic cost – billions of US dollars in direct damage. Some of them are listed in Table 2 below.

Table 2. Major natural disasters that caused macroeconomic exogenous shocks in the period 1970-2010

Country	Year	Natural disaster	Casualties	Number of deaths per 1 mln. citizens	Damage (in USD mln.)
Haiti**	2010	earthquake	200000 - 250000	20000 - 25000	7200 - 8100
Nicaragua	1972	earthquake	10000	4046	4325
Guatemala	1976	earthquake	23000	3707	3725
Myanmar	2008	Nargis cyclone	138366	2836	4113
Honduras	1974	Fifi cyclone	8000	2733	2263
Honduras	1998	Mich cyclone	14600	2506	5020
Shri Lanka	2004	tsunami*	35405	1839	1494
Venezuela	1999	flood	30005	1282	4072
Bangladesh	1991	Gorki cyclone	139252	1232	3038
Solomon Islands	1975	tsunami	200	1076	n.a.
Indonesia	2004	tsunami *	165825	772	5197

Note: * – The tsunami of 2004 affected directly 12 countries in the Pacific region and caused about 226 000 deaths

Source: Cavallo et al., 2010.

The last column of Table 2 shows the cost of damage for the individual cases. For the 2010 Haiti earthquake, for example, the estimated damage costs are between \$7.2 billion and \$8.1 billion., including the loss of short-term and long-term tangible assets, loss from interruption of business activities, fiscal cost, loss of household income, etc. This is an extremely large figure considering that the country's overall nominal GDP for that year was \$11.86 billion. according to WB data. Real GDP in 2010, on the other hand, shrank by 5.5%. According to a research conducted by Best & Burke (2019), in the period 2010-2015, the macroeconomic losses averaged 12% of GDP despite the mitigating effect of the foreign aid received by the country.

Exogenous shocks in the form of natural disasters affect both developed and developing countries. Most of the examples so far referred to developing countries. Horwich (2000) focuses on a developed country, examining the effects of the *Kobe earthquake* of January 17, 1995. He concludes that as a result of the earthquake and the ensuing fires, more than 100,000 businesses were destroyed, 300,000 individuals were left homeless, and 6,500 people died. The estimated damage amounts to \$114 billion, which is a loss of about 2.5% of Japan's GDP.

As incomes and the development of an economy increase, the amount of damage caused by natural disasters also increase, but the relative damage and number of lives lost decrease (Freeman et al., 2003). On the other hand, with regard to developing countries, a study by the IMF (2003) shows that since the end of the 1970s there has been a significant increase in the frequency, damage and macroeconomic impact of natural disasters in this group of countries. This is even more pronounced in low-income economies, as in the period 1997-2001, for example, the average damage caused by one natural disaster was over 5% of GDP.

A more recent research by Hoeppe (2016) shows that, since the 1980s, there has been a trend of increase of the macroeconomic losses on a global scale. According to him, the number of disasters that take the form of exogenous shocks has tripled during this period compared to previous periods.

Macroeconomic effects also depend on the initial state of an economy and the phase of its business cycle before the disaster. In their research, Hallegatte & Ghil (2007) find evidence of what they call the 'vulnerability paradox'. The negative effects of the shock are smaller when the economy is already in a downward phase due to the possibility to activate resources that are not currently being used. On the other hand, if the disaster occurs during an upswing of the economy, the negative effects are stronger because it increases the already existing imbalances due to the increase in the prices of production, the increase in wages, the decrease in loanable funds, etc.

Considering the above analyses, we can draw the **conclusion** that **for some countries and regions, natural disasters are significant exogenous shocks**. In certain cases, such as the disaster in Haiti, the negative impact is even stronger than that of the COVID-19 crisis.

Conclusion

Examining the contemporary importance of health shocks, oil price shocks, and natural disasters as three major types of exogenous macroeconomic shocks shows that they play an important role in determining the level of economic activity, and this role is even stronger for certain countries and regions.

In view of this, a conclusion can be drawn that the initially formulated **hypothesis** that *exogenous macroeconomic shocks affect present-day business cycle dynamics in a way that extends beyond the COVID-19 pandemic and the military conflict in Ukraine* **is confirmed** by the analysis of the empirical evidence.

The effects of the COVID-19 pandemic and the military conflict in Ukraine are not an isolated contemporary phenomenon in terms of their exogenous impact on macroeconomic activity in the short run. Exogenous shocks are not the only explanation of the business cycle. As determinants of its dynamics, the factors of the macroeconomic system and the factors of the macroeconomic policy are also important. At the same time, the present study argues that exogenous macroeconomic shocks were a significant driving force not only in the last two years, but also in terms of a broader view of the modern period.

References

- Barro, R., Ursua, J., & Weng, J. (2020). The Coronavirus and the Great Inuena Pandemic: lessons from the “Spanish flu” for the Coronavirus' Potential Effects on Mortality and Economic Activity. NBER Working Papers No. 26866, National Bureau of Economic Research.
- Baumeister, C., & Kilian, L. (2016). Forty Years of Oil price Fluctuations: Why the Price of Oil May Still Surprise Us. *Journal of Economic Perspectives*, Vol. 30(1), pp. 139–160.
- Benson, C., & Clay, E. J. (2004). Understanding the Economic and Financial Impacts of Natural Disasters. Disaster Risk Management Series No. 4,

The International Bank for Reconstruction and Development / The World Bank.

- Best, R., & Burke, P. J. (2019). Macroeconomic Impacts of the 2010 Earthquake in Haiti. *Empirical Economics*, Vol. 56, pp. 1647–1681.
- Burns, A., van der Mensbrugge, D., & Timmer, H. (2006). Evaluating the Economic Consequences of Avian Influenza. World Bank Working Paper No. 47417, World Bank.
- Cavallo, E., Powell, A., & Becerra, O. (2010). Estimating the Direct Economic Damages of the Earthquake in Haiti. *The Economic Journal*, Vol. 120(546), pp. 298–312.
- Clower, T. L. (2006). Economic Applications in Disaster Research, Mitigation, and Planning. In McEntire, D. A. (ed.) *Disciplines, Disasters and Emergency Management: The Convergence and Divergence of Concepts, Issues and Trends from the Research Literature*. Emmitsburg, MD: Emergency Management Institute.
- Davis, S. J., & Haltiwanger, J. (2001). Sectoral Job Creation and Destruction Responses to Oil Price Changes. *Journal of Monetary Economics*, Vol. 48(3), pp. 465–512.
- Fan, E. (2003). SARS: Economic Impacts and Implications. ERD Policy Brief No. 15, Manila: Asian Development Bank, Economic Research Department.
- Fattouh, B. (2007). The Drivers of Oil Prices: The Usefulness and Limitations of Non-Structural Models, Supply-Demand Frameworks, and Informal Approaches. *EIB papers*, Vol. 12(1), pp. 128-156.
- Freeman, P., Keen, M., & Mani, M. (2003). Dealing with Increased Risk of Natural Disasters: Challenges and Options. IMF Working Paper No. 03/197, Washington, DC: International Monetary Fund.
- Hai, W., Zhao, Z., Wang, J., & Hou, Z. G. (2004). The Short-Term Impact of SARS on the Chinese economy. *Asian Economic Papers*, Vol. 3(1), pp. 57-61.
- Hallegatte, S., & Ghil, M. (2007). Endogenous Business Cycles and the Economic Response to Exogenous Shocks. *Economic Theory and Applications Working Papers No. 10275*, Fondazione Eni Enrico Mattei.
- Hamilton, J. D. (1983). Oil and the Macroeconomy since World War II. *Journal of Political Economy*, Vol. 91(2), pp. 228–248.
- Hamilton, J. D. (2003). What is an Oil Shock? *Journal of Economics*, Vol. 113(2), pp. 363–398.
- Hamilton, J. D. (2009). Understanding Crude Oil Prices. *The Energy Journal*, Vol. 30(2), pp. 179–206.
- Hamilton, J. D. (2013). Historical Oil Shocks. In *Routledge Handbook of Major Events in Economic History*, ed. by Randall E. Parker & Robert

- Whaples, New York: Routledge Taylor and Francis Group, pp. 239–265.
- Hoeppel, P. (2016). Trends in Weather Related Disasters – Consequences For Insurers And Society. *Weather and Climate Extremes*, Vol. 11, pp. 70–79.
- Horwich, G. (2000). Economic Lessons of the Kobe Earthquake. *Economic Development and Cultural Change*, Vol. 48(3), pp. 521–522.
- Kilian, L. (2008a). A Comparison of the Effects of Exogenous Oil Supply Shocks on Output and Inflation in the G7 Countries. *Journal of the European Economic Association*, Vol. 6(1), pp. 78–121.
- Kilian, L. (2008b). Exogenous Oil Supply Shocks: How Big Are They and How Much Do They Matter for the U.S. Economy? *The Review of Economics and Statistics* Vol. 90(2), pp. 216–240.
- Kilian, L. (2009). Not All Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market. *American Economic Review*, Vol. 99(3), pp. 1053–1069.
- Kilian, L., & Murphy, D. (2014). The Role of Inventories and Speculative Trading in the Global Market for Crude Oil. *Journal of Applied Econometrics*, Vol. 29(3), pp. 454–478.
- Lee, J. W., & McKibbin, W. (2004). Estimating the Global Economic Costs of SARS. In: *Learning from SARS: Preparing for the Next Outbreak*, ed. by S. Knobler, A. Mahmoud, S. Lemon, A. Mack, L. Sivitz, and K. Oberholtzer, The National Academies Press.
- Levent, A., & Acar, M. (2011). Economic Impact of Oil Price Shocks on the Turkish Economy in the Coming Decades: A Dynamic CGE Analysis. *Energy Policy*, Vol. 39(3), pp. 1722–1731.
- Mitchell, J. V. (2002). A New Political Economy of Oil. *The Quarterly Review of Economics and Finance*, Vol. 42(2), pp. 251–272.
- National Academies of Sciences, Engineering, and Medicine. (1999). *The Impacts of Natural Disasters: A Framework for Loss Estimation*. NASEM, Washington, DC: The National Academies Press.
- Taghizadeh-Hesary, F. & Yoshino, N. (2015). *Macroeconomic Effects of Oil Price Fluctuations on Emerging and Developed Economies in a Model Incorporating Monetary Variables*, ADBI Working Paper No. 546, Asian Development Bank Institute.
- Tian, H. (2012). *The Relationship Between Oil Price Shocks and Macroeconomic Aggregates*. PhD Thesis, Osaka Prefecture University, Graduate School of Economics, https://opera.repo.nii.ac.jp/?action=pages_view_main&active_action=repository_view_main_item_detail&item_id=836&item_no=1&page_id=13&block_id=21 [Последен достъп: 11.6.2022]

World Bank (2014). The Economic Impact of the 2014 Ebola Epidemic: Short and Medium Term Estimates for West Africa. World Bank Report.

Veniamin Todorov is a Chief Assistant Professor at the department of General Economic Theory of the University of Economics in Varna. He has defended a doctoral thesis in Economics in the field of macroeconomic policy and its effects in conditions of asymmetric information. **Scientific interests:** fiscal policy, monetary policy, business cycle, financial stability and financial crises, sovereign debt management, country-specific risk.

ORCID: 0000-0002-1921-4872

ISSN 0323-9004

Economic Archive

Svishtov, Year LXXV, Issue 3 - 2022

**Exogenous Macroeconomic Shocks
as Contemporary Business Cycle Determinants**

Bulgaria's Energy Balance – a Strategic Analysis

**The Japanese Model of Transition to a Circular
Economy**

**The Digitalization of Transport Infrastructure and its
Impact on Human Resource Management**

**Alternative Accounting Approach for Electricity
Compensations to Industrial Enterprises**

D. A. TSENOV ACADEMY OF ECONOMICS
SVISHTOV



EDITORIAL BOARD:

Prof. Andrey Zahariev, PhD – Editor-in-chief
Prof. Yordan Vasilev, PhD – Deputy Editor
Prof. Stoyan Prodanov, PhD
Assoc. Prof. Iskra Panteleeva, PhD
Assoc. Prof. Plamen Yordanov, PhD
Assoc. Prof. Svetoslav Iliychevski, PhD
Assoc. Prof. Plamen Petkov, PhD
Assoc. Prof. Anatoliy Asenov, PhD
Assoc. Prof. Todor Krastevich, PhD

INTERNATIONAL BOARD:

Prof. Mihail A. Eskindarov, DSc (Econ) – Financial University under the Government of the Russian Federation, Moscow (Russia).
Prof. Grigore Belostechnik, DSc (Econ) – Moldovan Academy of Economic Studies, Chisinau (Moldova).
Prof. Mihail Zveryakov, DSc (Econ) – Odessa State Economic University, Odessa (Ukraine).
Prof. Andrey Krisovatiy, DSc (Econ) – Ternopil National Economic University, Ternopil (Ukraine).
Prof. Yon Kukuy, DSc (Econ) – Valahia University, Targovishte (Romania).
Prof. Ken O'Neil, PhD – University of Ulster (Great Britain)
Prof. Richard Thorpe, PhD – Leeds University (Great Britain)
Prof. Olena Nepochatenko, DSc (Econ) – Uman National University of Horticulture, Uman (Ukraine)
Prof. Dmytro Lukianenko, DSc (Econ) – Kyiv National Economic University named after Vadym Hetman, Kyiv (Ukraine)
Assoc. Prof. Maria Cristina Stefan, PhD – Valahia University of Targoviste (Romania)
Assoc. Prof. Anisoara Duica, PhD – Valahia University of Targoviste (Romania)
Assoc. Prof. Vladinir Klimuk, PhD – Baranovichi State University, Branovic (Belarus)

Support Team

Rositsa Prodanova, PhD – Technical Secretary
Anka Taneva – Bulgarian Copy Editor
Ventsislav Dikov – Senior Lecturer in English – Translation from/into English
Petar Todorov, PhD – Senior Lecturer in English – Translation from/into English

Editorial address:

2, Emanuil Chakarov street, Svishtov 5250
Prof. Andrey Zahariev, PhD – Editor-in-Chief
☎ (+359) 889 882 298
Rositsa Prodanova, PhD – technical secretary
☎ (+359) 631 66 309, e-mail: nsarhiv@uni-svishtov.bg
Blagovesta Borisova – computer graphic design
☎ (+359) 882 552 516, e-mail: b.borisova@uni-svishtov.bg

In 2022, the journal will be printed using a financial grant from the Scientific Research Fund – Agreement № KP-06-NPZ-69 from Bulgarska Nauchna Periodika – 2022 competition.

© Academic Publishing House “Tsenov” – Svishtov
© D. A. Tsenov Academy of Economics – Svishtov

ECONOMIC ARCHIVE

YEAR LXXV, BOOK 3 – 2022

CONTENTS

Veniamin Todorov

Exogenous Macroeconomic Shocks as Contemporary Business Cycle Determinants /3

Kaloyan Pargov

Bulgaria's Energy Balance – a Strategic Analysis /18

Nikolay Todorov

The Japanese Model of Transition to a Circular Economy /34

Petya Koralova-Nozharova, Shteryo Nozharov

The Digitalization of Transport Infrastructure and its Impact on Human Resource Management /48

Rosen Iliyanov Kolev

Alternative Accounting Approach for Electricity Compensations to Industrial Enterprises /68