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CONTENTS

Dear Readers,

We hereby commend the latest issue of *Argumenta Oeconomica Cracoviensia* to you. The current issue reflects the profile of the journal, which publishes original contributions in the field of economics and finance. This approach is a response to the noticeable trend, especially pronounced since the last financial crisis, to integrate financial disciplines with the economic sciences. Experience shows that detaching finance from its economic content can be dangerous for the economy and society alike. Therefore, in recent decades, these relationships have been continually examined and verified, both in terms of theory, and as a result of empirical analyses, which are very useful for economic policy. A distinctive feature of our journal, therefore, is that we mainly publish papers that incorporate the achievements of economics and finance as two sub-disciplines. This is reflected in the present issue, which contains articles dealing with economic phenomena and processes considered both from the perspective of the economic and financial sciences. The topics (categories) covered include: economic growth, inflation, foreign exchange reserves, the open economy, fiscal policy, the shadow economy, and the tax gap. In addition to these topics, one important contribution examines the verification of research methods used in microeconomic research.

The current issue of the journal opens with a paper by Tariq Nawab, Ali Zeb, Sajid Gul, Zahid Nawab, and Obaid Ullah entitled "Trade Openness and Economic Growth: Estimating the Inflation Threshold for Pakistan's Economy". The paper is devoted to verifying the relationship between inflation and economic growth. This issue is constantly researched by economists in relation to specific countries and economic groupings as well as across different time periods. The research presented in this paper is concerned with determining the nature of the relationship between these macroeconomic variables, i.e., whether they are linear or non-linear. Hence, the empirical results for Pakistan's economy cover a relatively long period

(1985–2015) and will certainly be of interest to researchers of this important macroeconomic relationship. An additional dimension to the findings is that, due to the pandemic and other events in the world economy, we have witnessed both elevated inflation and a slowdown in economic growth. The results obtained by the authors revealed the importance of the openness of the economy for economic processes (GDP growth), and in the case of Pakistan these two factors confirmed a positive relationship during the period under analysis, with a moderate level of inflation.

The authors' conclusions, which recommend a greater degree of openness of the economy (international trade), are closely related to other important macroeconomic relationships, namely, the relationship between the openness of the economy and the accumulation of foreign exchange reserves. This issue is addressed by Asad Karim, Sajid Gul, Ali Zeb, and Obaid Ullah in their paper entitled "A Comparative Analysis of the Effectiveness of Precautionary and Mercantilist Approaches to Accumulation of Foreign Exchange Reserves in Pakistan". The obtained results indicate that the decisive motive for accumulating foreign exchange reserves was the precautionary motive, and not the mercantilist one. The deliberations and analyses contained in this work, which is co-authored by some of the economists who contributed to the first paper discussed above, are part of a complementary approach to the studied macroeconomic processes in Pakistan. Although the period of analysis is somewhat shorter (1990–2015), the research included quarterly data series, which helped to objectify the results obtained. The authors correctly point to the importance of foreign exchange reserves in macroeconomic policy, in maintaining the adopted exchange rate regime, in export promotion, and in servicing foreign debt. The results obtained for the economy of Pakistan, a country classified as a developing country, may be of interest to researchers on economies with a similar degree of openness and a similar level of development.

Economic growth is influenced by many factors, including those shaped by the state's fiscal policy, namely, tax and spending. An attempt to evaluate the state's approach to supporting economic growth is presented in the paper by Jana Kušnírová, Juraj Válek, and Marcel Novák entitled "Tax Instruments Supporting Science and Research as a Factor of Economic Growth – Evidence from the Slovak Republic". In economic thought, the idea that a friendly state policy towards enterprises implementing innovative solutions promotes economic growth is not disputed. The same goes for policies supporting

research and development. On the basis of a case study of the Slovak Republic, the authors attempt to show that the state's misguided policy of no tax breaks for innovative companies and weak fiscal incentives, characteristic of the country before 2015, had a negative impact on the economy. Positive changes have taken place in the last seven years, with incentives being introduced in Slovakia's tax system, including the provision of tax relief in the form of a deduction of research and development costs and a tax breaks for new investments. The paper outlines the financial implications of the state's new approach to the use of fiscal instruments to stimulate economic growth. The latest solutions (2018) concern tax relief related to patents (patent box). A critical analysis of the Slovak case should be of interest to both specialists and economic policymakers.

In a developed market economy, insurance plays an important role for business entities and citizens alike. In countries that underwent systemic transformation, it was necessary to build a market-based insurance sector. It is worth noting that this sector makes a significant contribution to economic growth, job creation, etc. However, its most important role is to create institutional conditions for reducing the risks associated with business activities as well as to compensate for the material (financial) consequences of random events. In this regard, the article by Erika Pastoráková and Tomáš Ondruška, "The Origin of the Modern Insurance Industry in Slovakia and the Contribution of Dr Ján Alojz Wagner to its Development", is of relevance. The authors consider the role and function of insurance institutions and describe the contribution to the development of insurance made by the economist mentioned in the title. The historical perspective of the analysis is interesting. It begins with the Austro--Hungarian Empire before moving on to Czechoslovakia between the wars, that country during communist times, and finally the period after the establishment of the Slovak Republic. All of this is discussed from the point of view of the development of insurance – an economically and socially important institution.

In research on economic and social phenomena and processes that focuses on cause and effect, selecting the optimal research method is important for the results obtained. Wioletta Grzenda's paper, "Modelling the Opinions of Poles about Key Aspects of Professional Work Using a Nested Logit Model", addresses questions of a methodological nature with elements of verification of the method used. The aim of the paper is to examine the opinions of Poles about what they think is important in

their professional work. The author notes that when examining respondents' stated preferences using descriptive statistics or standard multinomial logit models, the conclusions drawn may be flawed. A better approach, according to the author, is to use the nested logit model as it reduces arbitrariness when combining different respondent preferences. The results of the research on employee preferences revealed the high importance of factors related to broadly-defined occupational hygiene. Due to the fact that the surveyed group of respondents was characterized according to various features (gender, age, education, place of residence, etc.), the author managed to objectify the results obtained. In addition, the author identified a shift in traditional preferences (stable employment, interesting work) in favour of preferences related to occupational hygiene. The obtained results can be of interest to managers when hiring employees and also when providing valuable existing staff with preferred working conditions, thus contributing to the development of the company.

One of the challenges of the state and its administration is to reduce the shadow economy. The shadow economy distorts key economic indicators, such as the level and dynamics of GDP, inflation, employment, and unemployment. It also violates the foundations of the market economy, i.e. the principle of fair competition, and reduces state budget revenues. All this makes it more difficult to pursue rational macroeconomic policies. Using Poland as an example, these issues are presented by Anna Gołdyn in her paper entitled "The Impact of the Grey Zone on the Economy in Poland". The author's main focus is on the budgetary effects of the grey zone in Poland and the systemic causes of this phenomenon, which can result in the formation of a shadow tax economy. One of these causes is the overly complicated tax system. The latter has made it difficult for the tax administration to recover tax that is owed. In her findings, the author correctly draws attention to the fact that state has been sluggish in raising public awareness about the negative consequences of the grey zone, both for the economy and for the state budget (honest taxpayers). The growth of the grey zone reduces public confidence in the state, forces it to increase expenditure on social programmes (the bogus unemployed), and increases the deficit and public debt. The paper reveals the scale of the grey zone in Poland and its main directions of change during the period under study. Because many countries (governments) face the problem of the shadow economy, the Polish case as described here should be of great interest to readers.

While commending the present issue to our readers, we would also like to invite contributions in the form of original texts, information about important academic events, and reviews of outstanding books. Texts in the field of economics and finance will be treated as most relevant to the journal's profile.

Prof. Stanisław Owsiak
Editor-in-chief

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Obaid Ullah

TRADE OPENNESS AND ECONOMIC GROWTH: ESTIMATING THE INFLATION THRESHOLD FOR PAKISTAN'S ECONOMY

Abstract

Objective: This paper examines inflation and growth: revisiting the estimation of the threshold level of inflation for Pakistan.

Research Design & Methods: The study uses time series data from 1985 to 2015. It employs the Generalized Least Square (GLS) and Conditional Least Square (CLS) methods with the aim of determining the impact of trade openness on economic growth and estimating the threshold level of inflation for the economy of Pakistan.

Findings: The findings of the study revealed that there is a significant positive impact of trade openness on economic growth because the coefficient of trade openness improved

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from 4.26 before trade liberalization to 4.98 after trade liberalization. Secondly, the threshold level of inflation was estimated at 7% for the Pakistan economy.

Implications/Recommendations: The study therefore recommends, among others, that Pakistan should liberalize its economy through a decrease in taxes on international trade as a percentage of tax revenue. Secondly, policymakers and the state bank should try to keep inflation below or at 7% for the good health of the economy.

Contribution: It was observed that trade openness had a significant impact on the economic growth of Pakistan ($R_{(2;\ 11)}$ = 4.98, p < 0.05) accounting for 77.6% of its variance (Adj. R^2 = 0.776). Invariably, trade openness significantly contributed to Pakistan's economic growth between 2002 and 2015. However, it is evident that after trade liberalization the coefficient of trade openness significantly improved from 4.26 between 1987 and 2001 to 4.98 between 2002 and 2015. This implies that trade liberalization significantly and positively affects economic growth in Pakistan (p < 0.05). The analysis to assess the impact of trade openness on economic growth was carried out using data before and after the structural break between 2001 and 2015 to capture whether trade liberalization could affect economic growth differently before and after liberalization. The study found that trade openness had a significant positive impact on economic growth because the coefficient of trade openness improved from 4.26 before trade liberalization to 4.98 after trade liberalization. Secondly, the Khan and Senhadji model (2001) for estimating the threshold level of inflation for developed and developing countries was adopted to estimate the threshold level of inflation for the Pakistan economy. The study revealed a threshold level of 7% for the Pakistan economy.

Keywords: inflation and growth, trade openness, economic growth, threshold level of inflation.
JEL Classification: C12, C13, C22, C82, E58, E62.

1. Introduction

The main effort of policymakers and the central bank is to attain and maintain high and sustainable economic growth along with low and stable inflation. But these twin objectives of low inflation and sustainable economic growth for policymakers depend on the relationship between economic growth and inflation and other macroeconomic variables. Trade openness is one of these factors. It plays an important role in promoting economic growth. It helps in the diffusion of technological knowledge, in helping countries to specialize in different sectors, and in the sharing of ideas apart from trade in commodities. The wave of trade liberalization began in Pakistan after 1985, and by 2001 Pakistan was considered an open economy in a study conducted by Wacziarg and Welch (2008). Based on this, we analyze whether trade liberalization has acted as an engine promoting economic growth in Pakistan.

Inflation plays an important role in promoting economic growth beyond trade openness. According to Mankiw and Reis (2007), inflation is a crucial macroeconomic variable, defined as the persistent increase in the general price level throughout the economy over time. It is an index of economic growth, but harmful also when it is high, as it creates uncertainties; as a result, investment and saving are discouraged, and the cost of capital increases.

Empirical studies draw evidence-based conclusions on the relationship between inflation and economic growth, i.e. positive, negative, or no relationship. Most empirical studies conducted before the 1970s revealed a positive impact of inflation on economic growth, and inflation has not been deemed a threat to economic growth due to the modest inflation rate. In comparison, the negative impact of inflation on economic growth was observed in empirical studies conducted after the 1970s due to rising inflation (Sarel 1996). De Gergorio's (1993) and Fischer's (1993) empirical results found a negative impact of inflation on economic growth. This negative impact became a concern for policymakers and researchers. But, over time, researchers and policymakers concluded that moderate and stable inflation helped to promote economic growth, while high inflation restricted it (Mubarik 2005, Singh 2010, Leshoro 2012, Iqbal & Nawaz 2010a). Therefore, it is of interest to note that a low level of inflation, known as the threshold level of inflation, promotes economic growth; above this level, inflation restricts economic growth. In this regard, Khan and Senhadji (2001) carried out studies to estimate the threshold level of inflation for developed and developing countries. The estimated threshold level of inflation ranges from 1–3% for developed countries to 7–11% for developing countries. The present study has used Khan and Senhadji's (2001) methodology to estimate the threshold level of inflation in Pakistan.

Our study is different from other studies conducted in the context of Pakistan in two ways; first, it uses, as the measure of trade openness, taxes on international trade as a percentage of tax revenue, which is the trade restrictions/barriers aspect of trade openness rather than trade volume; and the analysis is carried out before and after trade liberalization. Secondly, the study uses taxes on international trade as a percentage of tax revenue to estimate the threshold level of inflation. Other studies on Pakistan, by contrast, use the trade volume aspect of trade openness such as exports plus imports as a percentage of GDP, exports/GDP ratio, and imports/GDP ratio, etc., which show trade volume rather than trade restrictions/barriers.

The paper has two objectives: first, to analyze the impact of trade openness on economic growth before and after trade liberalization; and second, to estimate the threshold level of inflation for Pakistan using data from 1987 to 2015. In this context, the following questions are posed:

– What is the impact of trade openness on economic growth?

– What is the threshold level of inflation for Pakistan?
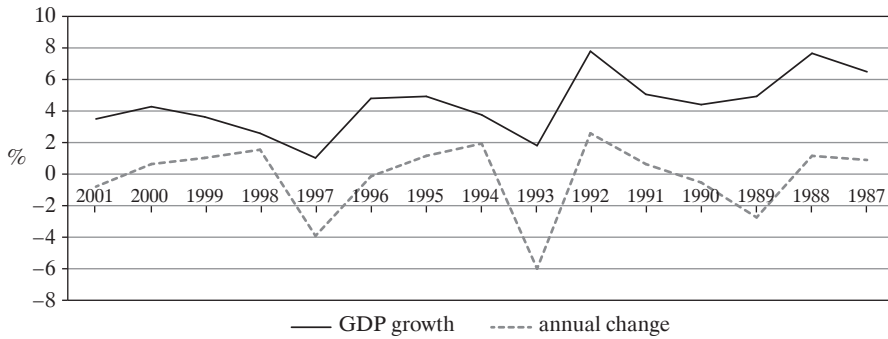
Fig. 1. An Overview of Pakistan GDP Growth Rate from 1987–2001

Source: World Bank, https://www.worldbank.org/en/home.
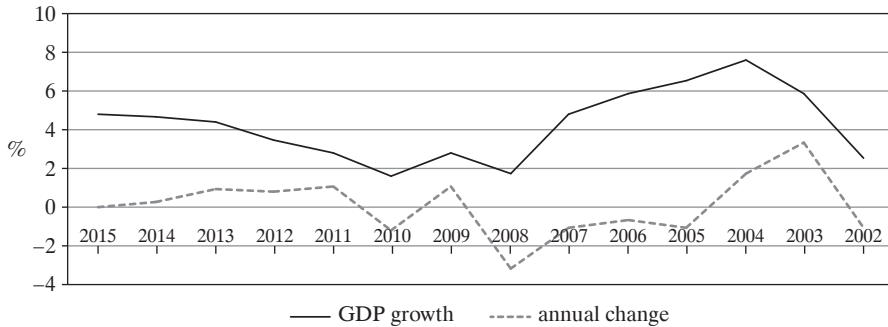
Fig. 2. An Overview of Pakistan GDP Growth Rate from 2002–2015

Source: World Bank, https://www.worldbank.org/en/home.

The remainder of the paper is ordered as follows: section 2 discusses related studies; section 3 deliberates on the methodology used; section 4 analyzes and discusses the findings; and section 5 offers conclusions.

2. Review of Related Studies

2.1. Trade Openness and Economic Growth Nexus

There is a vast body of empirical literature on the relationship between trade openness and economic growth, which reveals both the positive and the negative impacts of trade openness on economic growth.

Ramzan, Asif and Mustafa (2013) scrutinized the impact of trade openness and other macroeconomic variables such as FDI, the employment rate, and the exchange rate on economic growth for the economy of Pakistan. The study measured trade openness as the ratio of total imports plus exports to GDP. The findings showed that trade openness negatively affects the GDP growth rate, while the exchange rate, employment rate, and FDI positively impact economic growth.

Salinas and Aksoy (2006) conducted empirical analyzes for a set of 39 countries. The study's purpose was to analyze the economic growth of those countries before and after trade liberalization, which occurred between 1970 and 2004, to see whether economic growth increased or decreased over the period concerned. The results showed a positive impact of trade liberalization on economic growth as growth increased by 1.2 times after trade liberalization.

Ali and Abdullah (2015) investigated the impact of trade openness on economic growth in Pakistan for the period between 1980 and 2010. The findings showed the negative impacts of trade openness on economic growth in the context of Pakistan's economy for the period concerned.

Bayar (2016) explored the impact of trade openness, measured as exports and imports of goods and services as a percentage of GDP and economic freedom, on economic growth for the transition economies of the European Union between 1996 and 2012. The study's empirical results showed that trade openness and economic freedom positively impacted economic growth in these European Union countries over the period concerned.

Siddiqui and Iqbal (2005) looked at the impact of trade openness on economic growth from 1972 to 2002. Trade openness was proxied as the sum of exports and imports divided by real GDP. The results showed the negative impacts of trade openness on the economic growth of Pakistan.

Javed *et al.* (2012) explored the impact of trade openness, terms of trade, total exports to GDP ratio, and ratio of imports to GDP on economic growth between 1973 and 2010 for the economy of Pakistan. Using the Ordinary Least Square (OLS) method, they examined the relationship between

dependent and independent variables. The results showed the positive impacts of trade openness and of the other independent variables under study.

Wacziarg and Welch (2008) analyzed data from a group of 141 countries. They showed that countries that liberalized their trade experienced an average annual growth rate of 1.5% to 2.0% higher than before liberalization. Secondly, the post-liberalization average trade-to-GDP ratio increased by about 5% points. The countries were considered open based on certain criteria, with Pakistan being considered an open economy in 2001. The results of the study showed that openness significantly affected economic growth based on these criteria after liberalization.

Chatterji, Mohan and Dastidar (2013) researched the connection between trade openness and economic growth from 1970 to 2010 for the Indian economy. They used four measures of trade openness to carry out the analysis. Further in the study, trade volume and barriers were used as proxies for trade openness. The authors concluded that the impact of trade openness on economic growth was positive in the case of trade volume measures, while in the case of trade restrictions it was inconclusive.

Mecran *et al.* (2013) analyzed the impact of trade openness on economic growth for a group of developing countries from 1989 to 2010. The trade openness variable is measured as the rate of external trade, i.e. the ratio of exports and imports, to GDP. The results showed the positive impact of trade openness on economic growth – a 1% increase in trade openness led to an increase in the economic growth rate by 0.27%.

2.2. Inflation and Economic Growth Nexus

Khan and Senhadji (2001) analyzed panel data for both developed and developing countries. The study analyzed data from 1960 to 1998 and investigated the inflation threshold above which economic growth is slowed down by inflation. The analyzed data comprised a group of 140 countries. The authors used Nonlinear Least Square (NLS) econometric techniques to carry out their analysis. They calculated the threshold level separately for developed and developing countries. For developing countries, based on the analyzed data, the estimated inflation threshold point was given in the range of 7% to 11%; and for developed countries, the estimated threshold point of inflation was given in the range of 1% to 3%. The results of the study suggested that these countries should keep inflation in that range to avoid the harmful effects of inflation on the economic growth of these countries.

Lee and Wong (2005) analyzed quarterly data separately for the Taiwanese and Japanese economies. The authors used the approach devised by Tong (1978) and Hansen (1996). They estimated the inflation threshold for Japan and Taiwan. For Taiwan, the inflation threshold was estimated at 7.3%, while for Japan, the first threshold was estimated at 2.5% and the second at 9.7%. Based on the study results, it was suggested that these countries should keep inflation below that level.

Sergii (2009) examined the Commonwealth of Independent States (CIS). The study used data from 2001 to 2008 and estimated the inflation threshold at 9% for CIS countries. Danladi (2013) analyzed four West African countries, including Burkina Faso, Nigeria, Ghana, and Senegal from 1980 to 2009. The study used Khan and Senhadji's (2001) methodology for threshold estimation. The empirical findings revealed that these countries' optimal level of inflation was estimated at 9%. The findings suggested that the Central Banks of these four countries should keep inflation below the target 9% level to avert any damage to economic growth.

Espinoza, Leon and Prasad (2010) used panel data from 1960 to 2007 for a group of 165 countries to approximate the threshold stage of inflation for these countries. For the analysis, the authors used the Smooth Transition Model (STR). The countries were divided into three groups – advanced, emerging, and oil-producing economies. For emerging economies, including Pakistan, the authors estimated the threshold level of inflation, which was 10%. In the case of the advanced economies, the calculated threshold point of inflation was at the low level of 1%. For oil-producing economies, the results of study the were not robust, but suggested that the effect of high inflation is stronger for these economies compared to the others.

Yilmazkuday (2013) analyzed panel data from 1965 to 2004 for a group of 84 countries. The five-year average standard variables for these 84 countries were used. Pakistan was also included in the analysis. The empirical findings of the study revealed that: a) growth is promoted by human capital positively when inflation does not exceed 15%; b) economic growth is promoted by financial development when inflation does not exceed the 10% optimal level of inflation; c) trade yields positive consequences for growth when inflation does not exceed the optimal level of 8%; d) government expenditure exerts negative effects on growth when inflation is below 10%; and e) the impact of the catch-up effect is positive when inflation is below the target optimal level of 12%.

Seleteng, Bittencourt and van Eyden (2013) used panel data from South African Development Community (SADC) countries between 1980 to

2008 to estimate the inflation threshold. The study used the Panel Smooth Transition Regression (PSTR) model and estimated these countries' inflation threshold at 18.9%.

Kremer, Bick, and Nautz (2013) conducted an analysis of panel data for a set of 124 countries consisting of both developed and developing countries. The study analyzed data between 1950 and 2004. The authors estimated 2.5% and 17% inflation thresholds for developed and developing countries, respectively.

Eggoh and Muhammad (2012) investigated 102 countries between 1960 and 2009. The authors used a PSTR model for threshold estimation. They divided the countries into four groups based on income level. For the global sample, the threshold occurred at 12.4%. For subgroups, i.e. lower-middle-income countries, high-income countries, upper-middle-income countries (including Pakistan), and low-income countries, the inflation threshold occurred at 3.4%, 10%, 12%, and 20%, respectively.

Vinayagathasan (2013) analyzed 32 Asian economies from 1980 to 2009. The study used dynamic panel threshold growth regression for threshold estimation. It estimated the inflation threshold at 5.43% for these countries.

Yabu and Kessy (2015) analyzed data from three East African Community (EAC) countries – Kenya, Tanzania, and Uganda. The study estimated 6.8%, 8.8%, and 8.4% inflation thresholds for these countries, respectively.

Singh and Kalirajan (2003) analyzed data for the Indian economy from 1971 to 1998 to estimate the inflation threshold. They used the techniques of Sarel (1996). The authors did not identify any threshold level of inflation for the Indian economy.

Sweidan (2004) examined the economy of Jordan from 1970 to 2000. The study estimated the inflation threshold at 2% for the Jordanian economy. Seleteng (2005) analyzed quarterly data from 1981 to 2000 for the Lesotho economy and the estimated the threshold level of inflation at 10% for the country's economy.

Ahmed and Mortaza (2005) used Khan and Senhadji's (2001) methodology for threshold estimation. They used data from 1981 to 2005 and estimated the inflation threshold at 6% for the economy of Bangladesh. Mehrara (2007) analyzed Iran's annual time series from 1959 to 2004 and estimated the threshold level of inflation to be in the range of 9% to 12%. Munir and Mansur (2009) used Hansen's (2000) methodology for the Malaysian economy from 1970 to 2005 and estimated an inflation threshold of 3.89% for the Malaysian economy.

Singh (2010) analyzed the Indian economy from 1971 to 2009. The study used the specification of Sarel (1996) and Khan and Senhadji (2001), and estimated the inflation threshold at 6%. Salami and Kelikume (2010) used two periods, i.e. 1970 to 2008 and 1980 to 2008. Their study used Khan and Senhadji's (2001) methodology and estimated the inflation threshold at 7% and 8%, respectively, for these two periods. Frimpong and Oteng--Abayie (2010) analyzed data between 1960 and 2008 for Ghana's economy; an estimated inflation threshold of 11% was observed. Hasanov (2011) used data from 2001 to 2009 for the Azerbaijan economy. The study used Khan and Senhadji's (2001) methodology and estimated the inflation threshold at 13%. Bhusal and Silpakar (2011) analyzed Nepal's economy using Khan and Senhadji's (2001) methodology and estimated the inflation threshold at 6%. Mohanty *et al*. (2011) carried out an analysis of the economy of India. The study used Sarel (1996), Khan and Senhadji (2001), and Espinoza, Leon and Prasad's (2010) specifications and estimated inflation in the range of 4% to 5.5% for the Indian economy. Leshoro (2012) analyzed South Africa's economy from 1980 to 2010 and estimated the inflation threshold at 4% for the country. Younas (2013) carried out an analysis of the economy of Bangladesh from 1976 to 2012 and estimated the inflation threshold to be between 7% and 8%.

Cooray (2013) analyzed the economy of Sri Lanka and estimated the threshold level of inflation at 11%. Phiri (2013) analyzed data for the economy of Zambia from 1998 from 2010 and estimated the inflation threshold at 22.5%.

Sehrawat and Giri (2015) used quarterly data from 2004 to 2014 for India. They used Sarel's (1996) and Espinoza, Leon and Prasad's (2010) specifications and, through the PSTR model, estimated the inflation threshold to be 6.75% for India.

Mubarik (2005) used Khan and Senhadji's (2001) methodology for data between 1973 and 2000, and estimated the inflation threshold at 9% for the Pakistan economy. Hussain (2005) analyzed data from 1973 to 2005 for Pakistan and suggested a 4% to 6% inflation threshold for Pakistan. Iqbal and Nawaz (2010b) analyzed annual time series data for Pakistan from 1961 to 2008. The study estimated two threshold levels of inflation for economic growth, the first at 6% and the second at 11% for the economy of Pakistan. Ayoub, Chaudhry and Farooq (2011) used data from 1972 to 2010 to estimate the threshold level of inflation, which was 7% for the economy of Pakistan.

3. Methods and Materials

3.1. Design

To estimate the threshold level of inflation between 1987 and 2015, this study analyzed the association between economic growth and other explanatory variables such as inflation and trade openness. Specifically, the study assessed the threshold phase of inflation for growth in Pakistan's economy. The data was divided into two sub-groups: before and after the structural break. The data collected from 1987 to 2001 and 2002 to 2015 were analyzed separately, and the results before and after trade liberalization were compared.

3.2. Sources of Data

For this study, data was collected from World Development Indicators (WDI), the World Bank, and various editions of the Pakistan economic survey. Time series data on ratio scales were taken for the period from 1987 to 2015. The data was referred for assessment to time series properties tests for robustness.

3.3. Method of Data Analysis

The study used descriptive statistics, which helped explain the econometric analysis and involved the use of mean, median, minimum, maximum, standard deviation, skewness and kurtosis, providing a base for further analysis. The study also used the Generalized Least Square (GLS) and Conditional Least Square (CLS) methods as inferential statistics at a 0.05 level of significance to measure before and after the structural break and estimate the threshold level of inflation.

3.4. Model Specification

Linear Specification

The model in linear form is given in equation 1:

$$GDP = \alpha_0 + \alpha_1(inf_t) + \beta_1(open_t) + \varepsilon_t, \qquad (1)$$

where α_0 is the intercept and > 0 and α_1, β_1 symbolize coefficients of independent variables and ε_t represents an error term in equation (1), where: *GDP* represents the economic growth rate, *inf* represents the inflation rate (CPI), and *open_t* represents trade openness measured as taxes on international trade as a percentage of tax revenue.

When the model in linear form was estimated through OLS, the results were insignificant. For this purpose, when a Chow test was performed for the structural break, the results of the Chow test were significant at a 5% level of significance in 2001.

Chow test for the structural break at observation 2001.

Null hypothesis: There is no structural break.

Alternative hypothesis: There is a structural break.

Test statistic $= 2.76101$, p-value $= 0.0463027$.

So the null hypothesis of no structural break is rejected and the alternative hypothesis of structural break is accepted. The data was then divided into two groups and analyzed before and after the structural break.

4. Results

The analyzes were carried out through GLS separately before and after the structural break in 2001.

Table 1. Summary Statistics of Variables CPI, GDP, and Trade Openness, 1987 to 2015

Variable	CPI	GDP	OPEN
Mean	8.6588	4.3514	16.351
Median	8.8379	4.4586	12.979
Minimum	2.5395	1.0144	6.7127
Maximum	20.286	7.7059	30.706
SD	3.9927	1.9120	8.6921
C.V.	0.46112	0.43939	0.53158
Skewness	0.59206	0.16517	0.43976
Ex. kurtosis	0.72381	−0.75700	−1.4470
5% percentile	2.7268	1.3105	6.7228
95% percentile	17.084	7.6866	30.528
Interquartile range	6.1288	2.5098	16.715
Observations	29	29	29

Source: authors' estimation.

Table 1 represents the summary statistics derived from 29 observations between 1987 and 2015. It shows the average values of the data series as mean and median. The mean and median for CPI and GDP are close to one another, which reflects minor symmetry, while the mean and median values for OPEN are not too close, reflecting minor asymmetry. The value of the

standard deviation for GDP is 1.91, which implies less dispersion of values from its mean. The values for CPI and OPEN are 3.99 and 8.69, respectively, which implies more dispersion of values from its mean. The covariance value for all variables is positive, showing that the variables are positively correlated. The value of skewness is given for each variable of the data series. The value of skewness indicates the symmetry and asymmetry of the data set. The symmetric distribution has a value of skewness equal to zero. A glance at the table shows that CPI, GDP, and OPEN are positively skewed, which means that these distributions have a long right tail.

The kurtosis value for each variable is given. In the table, the kurtosis value for the CPI, GDP and OPEN series is less than 3, which means that these series have a flat distribution and are platykurtic. However, from the simple values of kurtosis and skewness, it cannot be easily concluded whether the given data series is normally distributed or not. The last rows present the 5% percentile, 95% percentile, and interquartile range values. This is further illustrated in Figure 3.
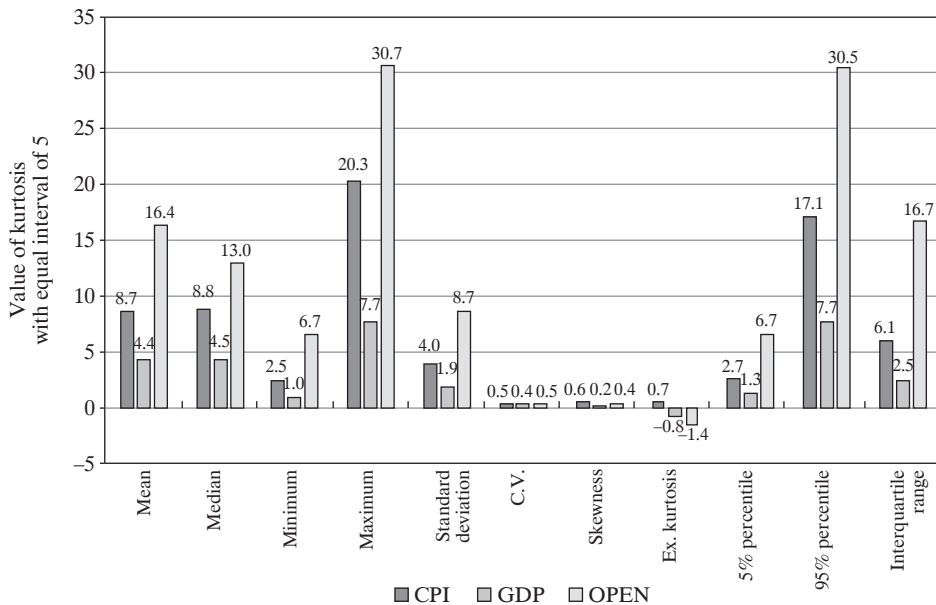
Fig. 3. Summary of Data for CPI, GDP, and Trade Openness

Source: authors' estimation.

Table 2. Heteroskedasticity-corrected, Using Observations 1987–2001 ($T = 15$), Dependent Variable: GDP_

Variable	Coefficient	Std. error	t-ratio	p-value
Const	−7.27965	1.68225	−4.3273	0.00098***
l_OPEN	4.26434	0.533596	7.9917	<0.00001***
CPI	−0.183993	0.0711885	−2.5846	0.02389**
R-squared	0.845220	–	–	–
Adjusted R-squared	0.819423	–	–	–
Statistics Based on the Weighted Data				
Sum squared resid	26.78253	SE of regression		1.493947
R-squared	0.845220	Adjusted R-squared		0.819423
$F(2, 12)$	32.76470	p-value (F)		0.000014
Log-likelihood	−25.63183	Akaike criterion		57.26365
Schwarz criterion	59.38780	Hannan-Quinn		57.24103
Rho	−0.160026	Durbin-Watson		2.312791
Statistics Based on the Original Data				
Mean dependent var	4.335675	SD dependent var		1.990471
Sum squared resid	37.29628	SE of regression		1.762959

Note: (**) and (***) mean 5% and 10% level of significance respectively.

Source: authors' estimation.

Table 2 shows the impact of trade openness on the economic growth of Pakistan from 1987 to 2001 using GLS. It was observed that trade openness had a significant impact on the economic growth of Pakistan ($R_{(2; 12)}$ = 4.26, $p < 0.05$), accounting for 81.9% of its variance (Adj. $R^2 = 0.819$). Invariably, trade openness significantly contributed to the economic growth of Pakistan between 1987 and 2001.

Table 3 shows the impact of trade openness on the economic growth of Pakistan from 2002 to 2015 using GLS. It was observed that trade openness had a significant impact on the economic growth of Pakistan ($R_{(2; 11)}$ = = 4.98, $p < 0.05$), accounting for 77.6% of its variance (Adj. R^2 = 0.776). Invariably, trade openness significantly contributed to the economic growth of Pakistan between 2002 and 2015. However, it is evident that after trade liberalization the coefficient of trade openness improved significantly from 4.26 between the years 1987 and 2001 to 4.98 between the years 2002 and 2015. This implies that trade liberalization significantly and positively affects economic growth in Pakistan ($p < 0.05$).

Table 3. Heteroskedasticity-corrected, Using Observations 2002–2015 ($T = 14$), Dependent Variable: GDP_

Variable	Coefficient	Std. error	t-ratio	p-value
Const	–3.77949	2.80104	–1.3493	0.20435
CPI	–0.303167	0.0507247	–5.9767	0.00009***
l_OPEN	4.98279	1.31486	3.7896	0.00300***
Statistics Based on the Weighted Data				
Sum squared resid	28.23264	SE of regression		1.602062
R-squared	0.810527	Adjusted R-squared		0.776078
$F(2, 11)$	23.52794	p-value (F)		0.000106
Log-likelihood	–24.77509	Akaike criterion		55.55018
Schwarz criterion	57.46735	Hannan-Quinn		55.37271
Rho	0.154439	Durbin-Watson		1.489614
Statistics Based on the Original Data				
Mean dependent var	4.368277	SD dependent var		1.899037
Sum squared resid	11.24903	SE of regression		1.011256

Note: (***) means 10% level of significance.

Source: authors' estimation.

Threshold Model Specification and Estimation

Linear equation 1 is presented in its nonlinear form in equation 2:

$$GDP = \alpha_0 + \alpha_1(inf_t) + \alpha_2 \times D_t(inf_t - k) + \beta_1(open_t) + \varepsilon_t. \qquad (2)$$

In the above equation (2), D_t is incorporated. It is a dummy variable which shows that:

– $D_t = 1$ in the case when $inf > k$ and
– $D_t = 0$ in the case when $inf \leq k$

and k shows the threshold inflation stage above which inflation yields inimical effects on growth. The parameter k shows that the association between both variables of inflation and growth is given by α_1 when inflation is low and $\alpha_1 + \alpha_2$ when inflation is high. High inflation has significance; here, it means in the case when in the long-run the inflation estimate becomes significant so that both α_1 and α_2 are added up and their combined impacts would be seen on economic growth; as a result, this will be the optimal stage of inflation. In order to identify the inflation threshold stage, different values of k (ranging from 2, 3, 4, and so on) are incorporated in the model for k and

the regression model is estimated through Conditional Least Square for each value of k, and the inflation threshold value is selected from the regression one which maximizes the value of R^2 (Coefficient of Determination) for the estimated regression or minimizes the residual sum of square (RSS).

Table 4. Results of Threshold-level Estimation through Conditional Least Square by Incorporating Different Values of k in the Model

k	Variable	Coefficient	Std. error	t-statistic	p-value	R^2	RSS
3	Const	3.3281	2.05829	1.6169	0.11844	0.139818	88.04635
	l_CPI	−0.73026	0.823041	−0.8873	0.38339		
	l_OPEN	1.21556	0.680005	1.7876	0.08598*		
	Inf_3	−0.763431	1.67035	−0.4570	0.65158		
4	Const	4.09522	2.06685	1.9814	0.05865*	0.195719	82.32447
	l_CPI	−1.93466	0.98984	−1.9545	0.06191*		
	l_OPEN	0.885353	0.680076	1.3018	0.20484		
	Inf_4	2.1534	1.53775	1.4004	0.17369		
5	Const	5.28966	2.21371	2.3895	0.02473**	0.240177	77.77385
	l_CPI	−3.0059	1.28762	−2.3345	0.02790**		
	l_OPEN	1.13392	0.63162	1.7953	0.08471*		
	Inf_5	2.88559	1.53399	1.8811	0.07166*		
6	Const	5.28966	2.21371	2.3895	0.02473**	0.240177	77.77385
	l_CPI	−3.0059	1.28762	−2.3345	0.02790**		
	l_OPEN	1.13392	0.63162	1.7953	0.08471*		
	Inf_6	2.88559	1.53399	1.8811	0.07166*		
7	Const	6.25456	1.99908	3.1287	0.00442***	0.371482	64.33375
	l_CPI	−3.99188	1.16175	−3.4361	0.00207***		
	l_OPEN	1.24826	0.57483	2.1715	0.03959**		
	Inf_7	4.05084	1.31423	3.0823	0.00495***		
8	Const	2.18337	2.55328	0.8551	0.40060	0.145443	87.47056
	l_CPI	−0.419561	1.0841	−0.3870	0.70202		
	l_OPEN	1.27735	0.69326	1.8425	0.07729*		
	Inf_8	−0.703994	1.14987	−0.6122	0.54591		
9	Const	1.44922	2.30384	0.6290	0.53503	0.194768	82.42178
	l_CPI	0.128466	1.0191	0.1261	0.90069		
	l_OPEN	1.25958	0.653346	1.9279	0.06530*		
	Inf_9	−1.45299	1.04611	−1.3890	0.17710		

Table 4 cnt'd

k	Variable	Coefficient	Std. error	t-statistic	p-value	R^2	RSS
10	Const	1.57354	1.98253	0.7937	0.43484	0.276001	74.10690
	l_CPI	0.395539	0.876476	0.4513	0.65568		
	l_OPEN	0.988175	0.621545	1.5899	0.12443		
	Inf_10	–2.09734	0.942622	–2.2250	0.03534**		
11	Const	1.82188	1.91704	0.9504	0.35103	0.290848	72.58726
	l_CPI	0.441497	0.861498	0.5125	0.61282		
	l_OPEN	0.8487	0.624698	1.3586	0.18641		
	Inf_11	–2.25854	0.956314	–2.3617	0.02629**		
12	Const	2.74903	2.0036	1.3720	0.18224	0.177362	84.20342
	l_CPI	–0.3422	0.850197	–0.4025	0.69074		
	l_OPEN	0.952234	0.682365	1.3955	0.17514		
	Inf_12	–1.30637	1.12045	–1.1659	0.25465		

Note: (***), (**) and (*) mean 5%, 10% and 1% level of significance respectively.
Source: authors' estimation.

Based on estimation using Khan and Senhadji's (2001) methodology, the threshold level of inflation is estimated at 7% for the Pakistan economy, because at that level the coefficient of determination (R^2) is maximized or the residual sum of square is minimized. At that level of inflation, the summation of coefficient exerts maximum positive effect on economic growth, and when inflation rises to 8%, the impact of the summation of the coefficient becomes negative.

5. Conclusions

The objectives of this study were to assess the impact of trade openness on economic growth before and after trade liberalization and to estimate an exact threshold level of inflation for the economy of Pakistan. The analysis was carried out using data before and after the structural break between 2001 and 2015 to capture whether trade liberalization could affect economic growth differently before and after liberalization. The study found that trade openness had a significant positive impact on economic growth because the coefficient of trade openness improved from 4.26 before trade liberalization to 4.98 after trade liberalization. Secondly, the Khan and Senhadji (2001) model for estimating the threshold level of inflation for developed and developing countries was adopted to estimate the threshold level of inflation

for the Pakistan economy. The study revealed a threshold level of 7% for the Pakistan economy. Based on the above results, it was recommended that Pakistan should liberalize its trade by decreasing taxes on international trade as a percentage of tax revenue in order to achieve better economic growth and development. Finally, policymakers and state banks should try to keep inflation below or at the level of 7% to ensure Pakistan's sustainable economic growth and development.

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A COMPARATIVE ANALYSIS OF THE EFFECTIVENESS OF PRECAUTIONARY AND MERCANTILIST APPROACHES TO ACCUMULATION OF FOREIGN EXCHANGE RESERVES IN PAKISTAN

Abstract

Objective: This study explores and compares short-run and long-run analyses of the validity of precautionary and mercantilist approaches to accumulation of foreign exchange reserves (FER) in Pakistan.

Research Design & Methods: This study uses quarterly data from 1990 (1st) to 2015 (4th). The autoregressive distributed lags (ARDL) test is used to check short-run and long--run analyses of the mercantilist and precautionary approaches for the accumulation of foreign exchange reserves in Pakistan.

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Findings: The empirical results of the study reveal that Pakistan accumulates FER for a precautionary motive. The variables associated with precautionary motives are economically and statistically important in explaining FER accumulation. In contrast, variables linked to mercantilist motives are statistically significant, while insignificant economically for FER accumulation.

Implications/Recommendations: In an underdeveloped economy like Pakistan's, a large volume of international reserves helps not only in handling exchange rate strategies, but also in pursuing macroeconomic policies such as: export promotion, development projects, repayment of foreign debt, maintaining employment opportunities, and improvement of the financial sector.

Contribution: The econometric estimates show that Pakistan accumulates FER for a precautionary motive. The variables associated with precautionary motives are economically and statistically important in explaining FER accumulation. In contrast, variables linked to mercantilist motives are statistically significant, while insignificant economically for FER accumulation. These results are also true for most of the research studies, including on China, that we see in the literature.

1. Introduction

This study explores the validity of precautionary and mercantilist approaches to accumulating foreign exchange reserves (FER) in Pakistan. Central banks hold FER as a financial resource for the exchange rate and adjustment of monetary policies in the economy. According to the fifth edition of the International Monetary Fund (IMF) balance of payment (BOP) manuals, foreign exchange reserves are defined as those foreign assets that are easily accessible to, and controlled by, monetary authorities for financing external imbalances in the economy directly or indirectly by intervening in exchange markets to affect exchange rates, and for a variety of other purposes. There is disagreement among stakeholders about FER holdings; some believe that FER are unutilized and useless. Friedman and Friedman (1953) criticized fixed exchange rates with the view that they involve unutilized FER. The proponents of FER holdings argue that they should be accumulated to smooth imbalances (Kemal 2002). Recently, there has been a growing pattern of reserve accumulation among underdeveloped and developed countries. The IMF assesses that worldwide FER holdings have increased from USD 1.58 trillion to USD 11.60 between 1996 and 2014, with the shares of underdeveloped economies having improved – from USD 0.45 trillion to USD 7.97 trillion (30% to 72%). This has occurred despite the vast majority of economies moving from fixed to flexible exchange rate

regimes. Countries previously needed to hold low levels of FER to avoid currency crises. This unprecedented rise in FER is a reason for concern for central banks regarding management policies.

Countries that accumulate FER either erect a barrier against the unexpected withdrawal of foreign exchange (precautionary motive) or control exchange rates to support the export sector (mercantilist motive). According to the precautionary approach, underdeveloped economies' financial integration has expanded their exposure to hot money and volatile capital streams, which can be rapidly stopped and reversed (Edwards & McCarthy 2004). The decline in growth rates caused by the crisis persuaded policymakers to adopt tight internal and external adjustment policies for output stabilization. In these circumstances, FER holdings can be considered output stabilizers. According to the mercantilist approach, FER accumulation is the outcome of the undervalued exchange rate strategies implemented by some Asian countries to target domestic investment and boost their exports and export industries (foreign direct investment, FDI).

A few studies have empirically assessed the accumulation of FER in Pakistan, but no study has focused on the precautionary and mercantilist motives. Khan, Ahmed and Kazmi (2005) argued that FER demand in Pakistan is more sensitive to capital account vulnerability. They argued that FER accumulation in Pakistan results from asymmetric State Bank of Pakistan (SBP) intervention in the forex market. Our study attempts to assess the relevance of the two alternative views that seek to explain FER accumulation in the context of a single country – Pakistan. To achieve the desired objectives, variables such as BOP uncertainty, imports, average propensity to import (APM), inter-bank call rate, exchange rate uncertainty for the precautionary motive, balance of trade (BOT), and measure of the real effective exchange rate (REER) for the mercantilist motive are considered. Davidson and MacKinnon (1981) employ a hybrid model by merging the precautionary and mercantilist models. Our results show that Pakistan's accumulation of FER supports the precautionary motive and rejects the mercantilist rationale. These results align with Aizenman and Lee (2007), Prabheesh, Malathy and Madhumathi (2009), and several other studies.

Only a few studies have conducted empirical work on Pakistan's demand for international reserves. Yet none has focused on a comparative analysis of the effectiveness of precautionary and mercantilist motives and their relative importance in driving the accumulation of foreign reserves.

2. Accumulation of Foreign Exchange Reserves (Empirical Studies)

Since the 1960s, different studies have examined the adequacy of FER and their determinants. Among the work done by various authors, the analysis done by Heller (1966) stands out because it proposed a precise formula for determining ideal and optimal levels of FER. The procedure presented by Heller showed what occurred if the actual or real level of FER is higher or lower than the ideal or optimal levels of FER, whereas most of the various studies showed only FER's quantitative and relative nature. Heller (1966) developed a model to analyze the impacts of changes in external imbalance. The study examined different factors affecting the volume of FER holdings. It articulated the three variables with the ideal levels of FER, namely marginal propensity to import (MPI), the opportunity costs of holding, measured as the difference between the return on government bonds and the return on liquid FER, and the average of yearly BOP imbalances. The study utilized data from sixty countries between 1949 and 1963 and tested the ideal levels of the FER model. The optimal levels of FER for particular nations were ascertained, and the volume of natural or actual FER relative to the ascertained optimal FER was used as a measure of adequacy. The established amount showed by how much the volume of actual FER exceeded or was less than the ideal or optimal. The results showed that the total level of FER in the world is adequate. However, the problem concerns the distribution of FER across various countries. The study further concluded that European and North American countries have more FER than is optimal.

In contrast, Latin America, Africa, and Asia have an aggregate level of FER below the ideal or optimal level. The study further compared the actual to optimum levels as well as imports to test the credibility of estimates. Finally, the results showed that primary/optimum FER better predicts FER volume adjustments than does FER to imports.

In addition, Kenen and Voivodas (1972) found that adjustments in FER can be expressed as a simple autoregressive plan. To put it another way, BOP variations, as calculated by adjustments in FER, reflect current disturbances and the "carry-forward" or "duration" of all past troubles. They propose the hypothesis that a country's BOP can be expressed by three parameters: the mean, the variance of net disturbances, and the duration or carry--forward. The study utilized data from 14 countries to test the hypothesis. The authors found a positive and significant result in eight countries for the duration parameter, while the results were insignificant in the remaining

eight countries. They further found that the mean for the disturbances variable showed negative and negligible signs. Lastly, the variance for the disturbance variable showed positive signs and was significant in all countries. They further examined FER demand substituting domestic (internal) money supply instead of net disturbances. This domestic (internal) money supply impacted domestic FER demand. The final results showed that only net disturbances variance was significant, while the remaining variables were insignificant.

Cruz (2015) examined the mercantilist motive for holding FER in ten Latin American countries: Bolivia, Argentina, Brazil, Dominican Republic, Colombia, Nicaragua, Peru, Uruguay, Honduras, and Mexico. The study utilizes annual data from 1996 to 2011. It considers FER as a determinant of actual exchange rates. The variables included in the model are real exchange rates, real income/per capita, terms of trade (TOT), interest rates (accurate), government expenditure, current account, workers' remittances, and foreign aid. The study finds no evidence of FER accumulation via tradable goods because they appreciate the exchange rate. The study concludes that FER accumulation in Latin America supports the precautionary motive.

Similarly to Aizenman and Marion (2004), Prabheesh, Malathy and Madhumathi (2009) examined the relative importance of the mercantilist and preventive approaches to FER demand in India. The variables included in their model are FER opportunity cost proxied by Treasury bill rates, imports, foreign institutional investments included for the precautionary motive, and REER included for the mercantilist motive. The ARDL co-integration results indicate a long-run relationship between FER and explanatory variables. The results show that mercantilist demand for FER is more statistically significant than the precautionary motive.

Akdoğan (2010) analyzed the movements of FER and their relation to different economic variables (consumption, gross domestic product – GDP, imports, exports, inflation, and interest rates) for a sample of four developing countries – Argentina, Turkey, Brazil, and Korea – by utilizing annual data from 1960 to 2009. The study applied unrestricted VAR for structural shifts and the Granger causality test. The results indicate two main points: 1) for Turkey and Argentina, interest rate differentials with the US contain potentially helpful information for FER accumulation; and 2) for Korea, net exports and consumption differentials with the US contain helpful information for FER movements, suggesting that the precautionary motive is stronger relative to portfolio adjustment for explaining FER accumulation.

3. Accumulation of Foreign Exchange Reserves

In the literature, only a few studies have been done on Pakistan. The first study on the precautionary motive by Khan, Ahmed and Kazmi (2005) used quarterly data from 1981 (1st) to 2003 (2nd) to analyze the determinants of FER in the case of Pakistan. The variables used were FER, BOP, inter-bank call rate used as a proxy for opportunity cost, APM, workers remittances, and level of imports. Dummy variables were also included in the model to capture the impact of the 9/11 event and the takeover by the military and autonomy of the SBP. The authors also compared the role of short-run monetary disequilibrium with the main determinants of FER holdings. Their co-integration results revealed that, except remittances, all variables were significant. They identified the existence of a long steady run FER demand function. They also found that imports and variations in BOP had a positive effect on FER, and that the inter-bank call rate and remittances had a negative impact on FER in Pakistan. They concluded that the variations in BOP and imports were the leading indicators of rising FER in the case of Pakistan. The speed adjustment parameter in the error correction mechanism (ECM) was also insignificant. They concluded that the monetary disequilibrium drove FER in the short run, confirming the applications of the economic view to BOP in Pakistan. The dummy variable used for the autonomy of the SBP was significant in ECM, suggesting that SBP autonomy has a significant positive effect on FER holdings.

The second study on the mercantilist motive, by Tariq *et al.* (2014), examined accurate exchange rates and the FER nexus in Pakistan with the mercantilist approach. The authors followed Ramachandran (2004) to analyze the mercantilist motive for Pakistan. They utilized a wide range of data selected annually from 1973 to 2008. The first regimes were chosen from fixed regimes (1973–81), two were selected from managed authorities (1982–99), and the third regime was selected from floating regimes (2000–08). The model includes FER-lagged actual exchange rates, APM for trade openness, lagged interest rate differentials for opportunity cost, and remittances. The study adopted an ECM approach and co-integration to assess FER determinants in Pakistan. It also imposed two dummies for regime shifts. The study found a positive and significant relationship between FER and real exchange rates and revealed that FER holdings were a by-product of export growth strategies due to exchange rate devaluation. Furthermore, the authors found that the switch from fixed to floating exchange rate policies by the SBP was done to raise Pakistan's FER holdings.

A study by Chaudhry *et al*. (2011) empirically investigated the relationship between FER and inflation in Pakistan by applying ARDL and co-integration bound testing techniques. The study used annual data from 1960 to 2007. The variables included were FER measured at current prices and GDPD as a proxy for inflation. The results showed a negative association between FER and the inflation rate in Pakistan, indicating that any shortfall in FER has some harmful effects on prices of goods.

4. Econometric Methodology

4.1. Data Nature and Sources

In this study, quarterly data from 1990 (1st) to 2015 (4th) was taken from different databases, the Pakistan Bureau of Statistics, International Financial Statistics (IFS), the Pakistan Institute of Development Economics (Statistical Paper Series) for data on quarterly GDP, and the State Bank of Pakistan.

4.2. Empirical Model

First, we designed a precautionary model and then a mercantilist model. Next, we combined both models to make a hybrid model.

Precautionary Model

$$
\begin{aligned}
\log\left(\frac{RES}{GDP}\right)_t = {} & \alpha_0 + \alpha_1 \log(IM)_t + \alpha_2 \log(IBCR)_t + \alpha_3 \log(BOP\_U)_t \\
& + \alpha_4 \log(APM)_t + \alpha_5 \log(ER_U)_t + \varepsilon_t.
\end{aligned}
\tag{1}
$$

In equation 1, RES/GDP is the dependent variable, which denotes the stock of reserves to GDP ratio (nominal), IM, IBCR, BOP_U, APM, ER_U denote the value of imports, inter-bank call rate, balance of payments variations, average propensity to import, exchange rate uncertainty. ε_t represents random disturbance.

Mercantilist Model

$$
\log\left(\frac{RES}{GDP}\right)_t = \beta_0 + \beta_1 \log(td\_REER)_t + \beta_2 \log(BOT)_t + \varepsilon_t.
\tag{2}
$$

In this equation, the term $(td\_REER)_t$ denotes deviation of the real effective exchange rate from its trend and $(BOT)_t$ denotes balance of trade. Variable ε_t represents random disturbance. The term deviation of the real effective exchange rate from its trend is expected to be inversely related

to FER because a negative $(td\_REER)_t$ represents an undervalued real effective exchange rate and enhances FER. We used balance of trade data to control for export growth. We expected this sign to be positive because of a positive $(BOT)_t$. This shows that exports increased due to accumulating FER. If a country accumulates FER for the mercantilist motive, then the value of export growth will be expected to be positive (Aizenman & Lee 2007, Dooley, Folkerts-Landau & Garber 2003, Prabheesh, Malathy & Madhumathi 2009).

Hybrid Model

We combined both models to make one hybrid model:

$$\log\left(\frac{RES}{GDP}\right)_t = \delta_0 + \delta_1\log(IM)_t + \delta_2\log(IBCR)_t + \delta_3\log(BOP\_U)_t + \delta_4\log(APM)_t$$
$$+ \delta_5\log(ER\_U)_t + \delta_6\log(td\_REER)_t + \delta_7\log(BOT)_t + \varepsilon_t. \tag{3}$$

Alternative Models

In this study, we have to choose between two rival models, where neither can be nested within the other, i.e. neither is a restricted version of the other. We have two rival models called the precautionary and mercantilist models, we well as one hybrid model which combines the precautionary and mercantilist models. Davidson and MacKinnon (1981) J-tests are employed. These tests are used for testing the hybrid model. When the alternative hypothesis cannot be derived as a particular case of the null hypothesis, non-nested hypothesis tests are used. This may be caused by different sets of regressors in competing possible models or through other stochastic term distributions.

J-test Approach

The augmented equation is as follows:

$$\log\left(\frac{RES}{GDP}\right)_t = \alpha_0 + \alpha_1\log(IM)_t + \alpha_2\log(IBCR)_t + \alpha_3\log(BOP\_U)_t + \delta_4\log(APM)_t$$
$$+ \alpha_5\log(ER\_U)_t + \beta\left(\frac{RES}{GDP}\right)_t^{M2} + \varepsilon_t, \tag{4}$$

where $\beta\left(\frac{RES}{GDP}\right)_t^{M2}$ is the predicted value from model 2.

We add the predicted values from model 1 as an explanatory variable in model 2 and then estimate again to obtain the new results. The augmented equation is as follows:

$$\log\left(\frac{RES}{GDP}\right)_t = \beta_0 + \beta_1\log(td\_REER)_t + \beta_2\log(BOT)_t$$
$$+ \alpha\left(\frac{RES}{GDP}\right)_t^{M1} + \varepsilon_t, \tag{5}$$

where $\beta\left(\dfrac{RES}{GDP}\right)_t^{M1}$ is the predicted value of model 1.

5. Results and Discussion

Before the model estimation, the augmented Dickey Fuller (ADF) test is applied to determine the unit's existence and order of integration of all the variables involved. A data series with mean and auto covariances depending on a time trend is non-stationary.

5.1. Unit Root Tests

Table 1 contains the ADF test results, where all variables are stationary at first difference.

Table 1. Results of ADF Test

Variables	Order of integration	ADF results	t-stat/p-value	Integration order
log(RES/GDP)	level	−1.4371	−2.8897/0.5613	I(1)
	1st difference	−8.1073	−2.8903/0.0000	
log(IM)	level	−2.1905	−2.8897/0.211	I(1)
	1st difference	−9.1526	−2.8900/0.000	
log(APM)	level	−0.7224	−2.8897/0.8356	I(1)
	1st difference	−6.4212	−2.8903/0.0000	
log(IBCR)	level	−1.9839	−2.8909/0.2934	I(1)
	1st difference	−8.9746	−2.8909/0.0000	
log(BOP_U)	level	−2.7768	−2.8900/0.0652	I(1)
	1st difference	−13.443	−2.8900/0.0000	
log(BOT)	level	−2.7841	−2.8900/0.0641	I(1)
	1st difference	−16.043	−2.8900/0.0000	
log(ER_U)	level	−2.1253	−2.8900/0.2534	I(1)
	1st difference	−18.003	−2.8900/0.0000	
log(REER)	level	−1.6304	−2.8998/0.4634	I(1)
	1st difference	−8.8497	−2.8998/0.0000	

Source: authors' own calculations based on data from Pakistan Bureau of Statistics, International Financial Statistics (IFS), the Pakistan Institute of Development Economics (Statistical Paper Series).

5.2. ARDL Bound Test Results

ARDL Bound Test Precautionary Model

Table 2 shows the ARDL bound test results for the precautionary model. The results of the bound test indicate that at a 1% level of significance, the *F*-statistic has a more excellent value than the upper determined value. Consequently, we reject the null hypothesis that there is no long-term relationship. As a result, the bound test demonstrates that our precautionary model does have a long-term relationship.

Table 2. ARDL Bound Test Precautionary Model

Test statistic	Value	*k*
F-statistic	4.7721	5
Critical Value Bounds		
Significance	Lower bound (I0)	Upper bound (I1)
10%	2.26	3.35
5%	2.62	3.79
1%	3.41	4.68

Source: same as for Table 1.

ARDL Bound Test Mercantilist Model

Table 3 shows the ARDL bound test results for the mercantilist model. The results of the bound test indicate that the value of the null hypothesis is rejected of no long-run correlation since the *F*-statistic is higher than 0.05 at the 5% level of significance. As a result, the bound test ensures that a long--term relationship persists in our mercantilist model.

Table 3. ARDL Bound Test Mercantilist Model

Test statistic	Value	*k*
F-statistic	5.3624	2
Critical Value Bounds		
Significance	Lower bound (I0)	Upper bound (I1)
10%	3.17	4.14
5%	3.79	4.85
1%	5.15	6.36

Note: Significance level at $\alpha = 5\%$.
Source: same as for Table 1.

Short-run and Long-run Parameter Estimates of the Precautionary Model

Table 4 shows the outcome of the ARDL short-run and long-run coefficient of co-integration for the precautionary model. Here the dependent variable is a log of FER to GDP ratio, and the explanatory variables are INTERBANK CALL RATE, log(IM), log(APM), log(BOP_U), and log(ER_U). The value of error correction term (ECT) in Table 4 has a significant and negative sign, illustrating the speed of adjustment towards a long-run equilibrium state. It also shows the rate of convergence in the long run. If this sign is positive and insignificant, there is no sign of convergence in the long run. It also shows the long-run causality running from independent to dependent variables.

Table 4. Estimates of Short-run and Long-run Coefficients of the Precautionary Model

Dependent variable: log(RES/GDP)
Selected Model ARDL: (1,0,1,0,1,1)

Variable	Coefficient	S. E	t-stat	Prob
Short-run Cointegrating Form				
(INTER BANK CALL RATE)	3.0308	0.8778	3.4525	0.0008
log(APM)	–3.8175	0.2511	–15.1995	0.0000
log(BOP_U)	2.8209	0.2804	10.0601	0.0000
log(ER_U)	0.3853	0.9841	0.3915	0.6963
log(IM)	0.1854	0.3886	4.674	0.0003
CointEq (–1)	–0.1721	0.0745	–2.3109	0.0230

Cointeq = log(RES/GDP) – (17.603*IBCR – 19.2324* log(APM) + 16.3841* log(BOP_U) – 18.4203*log(IM) + 10.5720*log(ER_U) + 15.6218)

Variable	Coefficient	S. E	t-stat	Prob
Long-run Coefficients				
INTER BANK CALL RATE	17.6036	10.5376	1.6705	0.0982***
log(APM)	19.2323	8.1499	–2.3598	0.0204**
log(BOP_U)	16.3841	6.8332	2.3977	0.0185**
log(ER_U)	10.5720	8.0757	1.3091	0.1937***
log(IM)	0.6998	5.0387	2.657	0.0001**
C	15.6218	24.6260	0.6343	0.5274

Note: (***), (**) and (*) denote significance levels at 10%, 5% and 1%, respectively.
Source: same as for Table 1.

Table 4 also shows the long-run coefficients of ARDL. For the precautionary model, the estimated long-run relationship coefficients are essential for log(APM), IBCR, and log(BOP_U), but negligible for log(ER_U). As shown by the model, FER varies positively in reaction to variations in the BOP. The SBP's strategy, where the central bank plays a significant role, is compliant with the positive sign of the variability test. In the foreign exchange market, the central bank is very influential. Imports have a positive symbol, implying that scale elasticity is positive in Pakistan. APM is also an optimistic and essential indicator, which is seen as a proxy for trade openness. As the demand for FER rises, trade openness also increases. However, the APM's resulting sign is optimistic, matching our expectations and consistent with the conventional buffer-stock model's theoretical prediction. IBCR, on the other hand, gave an unexpectedly positive sign. This positive sign of the IBCR implies that the opportunity cost channel may be of limited relevance for a developing country like Pakistan. A larger stock of FER can be used for several purposes, such as rupee value appreciation in the foreign exchange market, import payments, debt payments, and inflation control. The opportunity cost of capital has little relevance for most countries; however, according to Aizenman and Marion (2004), most studies found it negligible or essential.

Short-run and Long-run Parameter Estimates of the Mercantilist Model

The short-run and long-run coefficients for the mercantilist model are shown in Table 5. The value of ECT in Table 5 is negative and significant, showing the speed of adjustment towards a long-run equilibrium state. It shows us the rate of convergence in the long run. If this sign is positive and significant, there is no evidence of convergence in the long run. Table 5 also shows the long-run coefficients of ARDL. For both log(REER) and REER, the estimated coefficients of the long-run relationship for the mercantilist model are statistically less relevant to BOT. The interpretation that countries accumulate FER to hold the exchange rate depreciated is backed by the negative sign of the log(REER). This finding supports the results of Prabheesh, Malathy and Madhumathi (2009), who found the very same thing. When countries accumulate FER, the REER decreases, and exports become less expensive. If the REER increases, the result is inexpensive exports to that country. The 10% decrease in log(REER) will result in a long-run increase of 45% in the RES/GDP ratio. In the long run, this result supports the theory of the mercantilist motive that depreciated REER increases FER. The country supplies domestic currency to the international market

Table 5. Estimates of Short-run and Long-run Coefficients of the Mercantilist Model

Dependent variable: $\log(\text{RES}/\text{GDP})$
Selected Model ARDL: (1,1,0)

Variable	Coefficient	S. E	t-stat	Prob
Short-run Cointegrating Form				
$\log(\text{REER})$	3.0308	1.1083	2.7345	0.0074
$\log(\text{BOT})$	0.5062	0.1772	2.8556	0.0052
CointEq (–1)	–0.1721	0.0494	–3.4795	0.0008
Cointeq = $\log(\text{RES/GDP})$ – (–4.5692*$\log(\text{REER})$ + 2.9405*$\log(\text{BOT})$) = 16.3841				
Long-run Coefficients				
$\log(\text{REER})$	–4.5691	2.0500	–2.2288	0.0281
$\log(\text{BOT})$	2.9404	1.3676	2.1499	0.0340
C	16.3841	9.5562	1.7144	0.0896

Note: (***), (**) and (*) denote significance level at 10%, 5% and 1%, respectively.
Source: same as for Table 1.

and demands FER to devalue the domestic exchange rate. Our results support the studies of Aizenman and Lee (2007), Prabheesh, Malathy and Madhumathi (2009), and several others. The exchange rate value is negatively related to FER and is not highly significant. The coefficient of export growth proxied by BOT is statistically significant and positive. It supports the view that countries accumulate FER to increase their exports. The value of $\log(\text{BOT})$ is 2.904, which shows that if LBOT increases by 10%, FER will also grow by 29%. This value is likewise not highly significant. We concluded that the mercantilist motive here is statistically significant but economically insignificant. Aizenman and Lee found that the variables linked to mercantilist explanations, namely export growth and depreciated real exchange rate, are not highly significant. While variables connected to precautionary motives are highly effective in a sample of 128 countries, our results are consistent with those (Aizenman & Lee 2007).

J-test Output

The J-test results are shown in Tables 6 and 7. In Table 6, we added predicted values of model 2, i.e. $\log(\text{RES/GDP})^{\text{M2}}$ in model 1, and then estimated the model. The results show that t-statistic values for the regression coefficient of the variable are statistically insignificant. The study reveals that the mercantilist model is unsuccessfully challenging the precautionary model. In Table 7, we added predicted values of model 1 $\log(\text{RES/GDP})^{\text{M1}}$

in model 2 and then estimated the model. The results reveal that the value of *t*-statistic coefficients associated with this added variable is statistically significant.

Table 6. J-test Results of the Precautionary Model

Dependent variable: $\log(\text{RES}/\text{GDP})$
Method: ARDL
Maximum dependent lags: 1 (Automatic selection)
Model Selection method: AIC
Dynamic regressors (1 lag, automatic): IBCR $\log(\text{APM})$ $\log(\text{BOP\_U})$ $\log(\text{IM})$ $\log(\text{ER\_U})$
Fixed regressors: $\log(\text{RES}/\text{GDP})^{\text{M2}}$ C
Selected Model: ARDL (1,0,1,0,1,1)

Variable	Coefficient	S. E	*t*-stat	Prob
$\log(\text{RES}/\text{GDP})(-1)$	0.6051	0.0801	7.5529	0.0000
IBCR	–1.0004	0.8848	–1.1316	0.2607
$\log(\text{APM})$	0.5336	0.2527	2.1115	0.0374
$\log(\text{APM})(-1)$	–0.4653	0.2168	–2.1461	0.0345
$\log(\text{BOP\_U})$	1.2982	0.3438	3.7756	0.0003
$\log(\text{ER\_U})$	–5.0671	0.9911	–5.1122	0.0000
$\log(\text{ER\_U})(-1)$	2.7788	1.1569	2.4017	0.0183
$\log(\text{RES}/\text{GDP})^{\text{M2}}$	–0.1222	0.1233	–0.9910	0.3243
C	–13.4993	4.1776	–3.2313	0.0017

Source: same as for Table 1.

Further, it indicates that the precautionary model successfully challenges the mercantilist model in explaining variations in the accumulation of FER in Pakistan. Or we can say that the precautionary model is more applicable than the mercantilist model in Pakistan. We conclude that Pakistan accumulates FER with a precautionary motive like other developing countries. These results support other studies (Aizenman & Lee 2007, Prabheesh, Malathy & Madhumathi 2009). They show that countries accumulate FER mainly for precautionary motives, and the variables associated with this motive are the most significant.

6. Conclusions and Policy Recommendations

In developing economies, Asian countries hold a considerable amount of Forex reserves. But what factors have contributed to the accumulation

Table 7. J-test Results of the Mercantilist Model

Dependent variable: log(RES/GDP)
Method: ARDL
Maximum dependent lags: 4 (Automatic selection)
Model Selection method: AIC
Dynamic regressors (4 lagS, automatic): log (REER) log(BOT)
Fixed regressors: log(RES/GDP)^{M1} C
Selected Model: ARDL (2,1,0)

Variable	Coefficient	S. E	t-stat	Prob
log(RES/GDP)(–1)	0.6085	0.1006	6.0478	0.0000
log(RES/GDP)(–2)	–0.1349	0.0912	–1.4792	0.1424
log(REER)	2.2398	1.0522	2.1285	0.0359
log(REER)(–1)	–2.3435	1.0679	–2.1943	0.0306
log(BOT)	0.2353	0.1752	1.3431	0.1824
log(RES/GDP)^{M1}	0.5166	0.1068	4.8377	0.0000
C	0.5062	1.6945	0.2987	0.7658

Source: same as for Table 1.

of the stockpiled resources in these countries? Some researchers have used the buffer stock model, which indicates that precautionary motives have increased the stock of FER in these countries. Other researchers believe that mercantilist motives prompt FER holdings. This study compares mercantilism and motives in the accumulation of FER by Pakistan utilizing quarterly data from 1990 to 2015. Previous studies for Pakistan analyzed the role of precautionary factors in the determination and adequacy of demand for reserves and the part played by the mercantilist motive in FER demand. However, this paper examines the relative importance of precautionary and mercantilist reasons. The econometric estimates show that Pakistan accumulates FER for a precautionary motive. The variables associated with precautionary motives are economically and statistically crucial in explaining FER accumulation. In contrast, variables linked to mercantilist reasons are statistically significant while insignificant economically for the FER heap. These results are also accurate for most developing economies, including China.

Our study has several implications. First, the hoarding of FER (mercantilist motive) is not pursued in Pakistan, which is the right approach given Pakistan's BOP position. Second, the main driving factor for holding FER in Pakistan is the precautionary motive, particularly in light of the

uncertainty associated with BOP and ER. Given the history of large-
-scale fluctuations in the exchange rate (BOP), Pakistan has to maintain
a sufficient amount of FER to meet unexpected demand. Currently, FER
in Pakistan amount to USD 18 billion, equivalent to four months' imports.
Although, historically, Pakistan has maintained a lower amount of FER,
it faces severe crises because of this practice. To avoid any such situation
developing, Pakistan could increase its FER by up to six months of imports.
To achieve that target, Pakistan could allow nominal exchange rates to follow
market conditions, i.e. to allow the rupee to devalue according to purchasing
power parity (PPP). The research will enable Pakistan to build FER and its
BOP position.

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TAX INSTRUMENTS SUPPORTING SCIENCE AND RESEARCH AS A FACTOR OF ECONOMIC GROWTH – EVIDENCE FROM THE SLOVAK REPUBLIC

Abstract

Objective: The main aim of this paper is to provide a united view on the issue of tax instruments supporting science and research in the Slovak republic and to evaluate their impact on state budget revenues.

Research Design & Methods: The research question that this paper tries to answer is whether the support of research and development in the Slovak Republic through tax instruments is sustainable and suitable for the business sector. Qualitative and quantitative methods are used in the research. The paper analyzes legislation related to the issue of super deduction in order to identify the factors that affect this tax instrument. At the same time, the authors adopt the descriptive and normative economic approaches. Based on the deduction, procedures are subsequently chosen

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to quantify selected factors and their impact on state budget revenues in the Slovak Republic.

Findings: Apart from the last seven years, the Slovak Republic has been characterized by almost no state support for research and development. However, since 2015, new forms of tax incentives have included the provision of tax relief in the form of a deduction of research and development costs, a patent box, as well as tax breaks for new investments. In 2015, 83 entities claimed a deduction of research and development costs amounting to more than EUR 9 million, while in 2019 the amount of this deduction increased to more than EUR 119 million. The statistics of the Financial Administration of the Slovak Republic also show that small companies with 10 to 49 employees apply the deduction to the highest degree, followed by medium-sized companies with 50 to 249 employees, micro-enterprises with up to 9 employees, and large companies with over 250 employees. The highest rate of deduction of research and development cost in terms of regional distribution was recorded in the Bratislava, Trenčín and Trnava regions.

Implications/Recommendations: Tax incentives for research and development encourage investment and are therefore considered an appropriate form of support for the business environment. However, the biggest positive is the duplication of the possibility of claiming costs with respect to the reported corporate tax base. The question arises here: how often should the percentage rate for duplicate costs be changed? The analysis of applicants for a deduction of research and development costs in the Slovak Republic also showed that the number of new applicants for the tax benefit is constantly growing. This may encourage the re-use of such a tax credit in future years. The decrease in the volume of the deduction of research and development costs in 2019, with a 1.5-times increase in its rate, can be assessed negatively. It is clear that the success of this instrument of tax stimulation of private investment in research and development in Slovakia may encounter a barrier such as the inability to claim the costs incurred in the form of a deduction of research and development costs against a sufficient tax base.

Contribution: The question arises here: how often should the percentage rate for duplicate costs be changed? The success of this instrument of tax stimulation of private investment in research and development in Slovakia may also run into the barrier of not being able to claim the costs incurred in the form of a deduction of research and development costs against a sufficiently high tax base, especially in the current period, when there has been a significant decline in Slovak companies' profits. What, then, is the perspective for deducting research and development costs in the pandemic period and in the post-pandemic period, respectively?

1. Introduction

The role of tax policy is not only to ensure enough funds for public budgets, but also to support the entrepreneurship and innovation of tax entities. A country's tax policy should, therefore, through the tax system, help to solve the problems of employment and price stability, but mainly

support economic growth. These aims can be supported by selected tax instruments. Close cooperation between experts from OECD countries has resulted in the creation of a database of tax instruments for research and development, which makes it possible to analyze the effects of these incentives on research and development activities. With the support of the European Union's Horizon 2020 programme, these efforts have intensified. The growing interest in the use of indirect tax instruments to support research and development can be observed in OECD countries in particular, where direct support has been gradually declining for some time. The decline in direct support has been partly due to imposed budgetary constraints, economic pressures, and changing government funding priorities (Czarnitzki & Fier 2001). In individual OECD countries, we can notice two basic approaches to supporting research and development, the first being fiscal (tax) support, and the second involving financial instruments. The introduction of fiscal instruments gives innovative companies the opportunity to reduce their tax liabilities to the state, which ultimately reduces their overall costs (Frank, Kozovský & Prčová 2005).

Since the mid 2010s, the number of OECD countries providing tax incentives to support research and development has been steadily growing. In 2021, this included 23 EU Member States. The results of an OECD study on tax incentives for research and development showed that 2020 saw several significant changes in the field of tax incentives for research and development (Balsalobre-Lorente *et al.* 2021). The availability of research and development tax incentive measures has been increased, and new research and development tax incentive schemes have been introduced. The pandemic was the driving force behind the 2021 reforms in this area. Because of the pandemic, nine countries have introduced research and development adjustments or management. Governments in these countries seek to support investment in research and development in the economy through a certain preferential tax treatment of research and development costs and costs generated by companies in this area (OECD 2019). The share of research and development costs in OECD countries reached 0.1182% of GDP in 2019. The corresponding figure for the Slovak Republic was 0.0273%.

Between 2000 and 2018, tax support for research and development increased in many OECD countries, although this increase was often interrupted by the onset of the global financial and economic crisis. In general, we can say that the amount of tax support for research and development will usually increase significantly either immediately after its introduction

(Ireland, the Czech Republic) or after the introduction of new, revised tax measures (France in 2008). The possibility to pass on the deduction of research and development costs in the case of non-reporting of the tax base also affects how the tax relief curve for research and development companies develops. This can be seen in Ireland, Hungary, and even Austria, where the deduction of research and development expenditure peaked just after the financial crisis as companies did not achieve a sufficiently high tax base during the crisis (Agrawal, Rosell & Simcoe 2020).

The Slovak Republic is also one of the OECD countries that has been using the tax advantage for taxpayers carrying out research and development since January 2015 in the form of a deduction of research and development costs. The deduction of research and development costs is a transparent, fair, and administratively less demanding form of support for corporate research and development than funds provided in the form of a targeted or institutional subsidy. In other OECD economies, this method of additional deduction has been used for several years.

the taxpayer carries out a research and development project, in the implementation of which it incurs research and development costs

the taxpayer shows a positive tax base after deducting the tax loss, and it is possible to transfer the unused deduction to the next five tax periods

the costs to which the deduction is applied are also tax costs

the taxpayer has not received public support for these costs

at the same time, the taxpayer does not claim a tax credit for recipients of research and development incentives
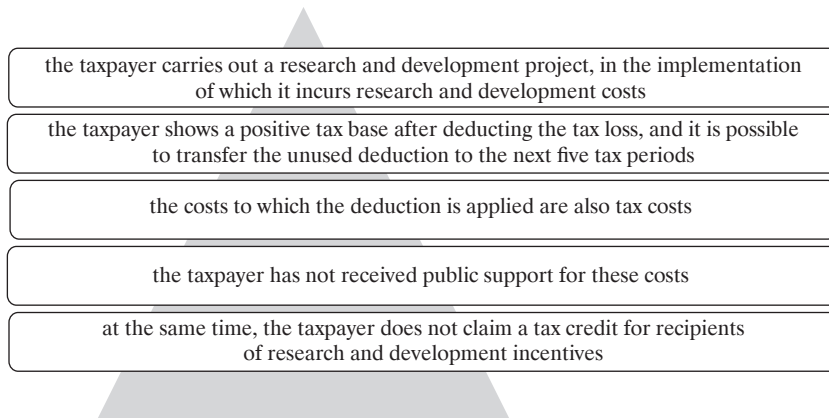
Fig. 1. Basic Conditions for Applying a Deduction of Research and Development Costs in the Slovak Republic
Source: prepared by the authors.

A new tax instrument, the super deduction, consists in deducting research and development costs from the tax base. This deduction can be made by a natural or legal person that implements a research and development project. In connection with this, the person incurs costs which are part of the economic result and which are eligible for deduction from the tax base,

less a deduction of tax loss of 100% (in the years 2020 and 2021, the value of the indicator was 200%; from 2017 until the end of 2019, it was 100%; for the first two years from the creation of this instrument, a rate of 25% was applied). In practice, this means that tax-deductible costs that have been used for research and development can be deducted from the tax base twice – first, as a regular, tax-deductible expense, and second, as another super deduction. No approval process precedes the application of the deduction. Tax legislation defines the basic conditions that a taxpayer must meet when applying a deduction. These are summarized in Figure 1.

By using this deduction, assistance is given to the company in the form of a reduction in its tax obligations, as it allows the deduction of a higher amount of research and development costs when filing an income tax return. The deduction of research and development costs thus has a stable place in tax legislation. However, it undergoes significant changes every year and can therefore have a demotivating effect on the business environment.

2. Literature Review

Empirical studies (OECD 2020a, 2020b, 2019) examining the impact of enterprise size on the emergence or magnitude of the additional research and development funding effect show that small and medium enterprises tend to invest more of their own resources for research and development if they also draw on public funding resources. Small companies need to overcome the barrier to entry into the sector, whereas large ones have relatively sufficient resources for ongoing as well as interim investments to maintain competitiveness. Medium-sized companies tend to invest almost the same amount of money in research and development, regardless of whether they receive public support or not. In estimating the effects of public funding on the extent of corporate research and development investment according to whether research and development is carried out regularly or only occasionally, the study identified that non research and development enterprises regularly show a slightly higher leverage effect of public support (Streicher, Schibany & Gretzmacher 2004).

Statistics-based research shows that investment in research and development is the key factor in economic growth (Congressional Budget Office 2005). In a group of seven industrialized countries, research has shown that in the United States, Japan, Germany, France, the United Kingdom, Italy and Canada between 1971 and 1990, every USD 100 invested in research and development led to GDP growth of USD 123 (Coe & Helpman 1995).

Research conducted in EU Member States between 1980 and 1998 showed that for every USD 100 spent on research and development in a company, it increased the country's GDP by USD 113 (Guellec & van Pottelsberghe de la Potterie 2001).

Investment in research and development also brings social benefits, which can be considered as externalities. Among the external effects, we also include knowledge transfer, whereby the investment of one entity is the basis for the creation of new knowledge of another entity. The result is an increase in the competitiveness of both entities (Żabiński & Pohulak-Żołędowska 2014). Knowledge transfer is crucial, especially in sectors that base their advancement on research and development costs and highly qualified staff. The stronger the knowledge, the smaller the distance between the recipient companies. This can be explained by the significance of change that facilitates the work of experts in a particular field, and by the importance of interpersonal contacts. Such a claim seems to challenge the geographical location of many industrial groupings that have developed in the vicinity of one or more universities (Audretsch & Feldman 1996). Indirect financial effects occur when knowledge created in a particular subject affects the financial performance of other companies. An assessment made based on the increase in productivity or usability by the buyer is higher than the market price taken over by the seller (Griliches 1992).

3. Research Methodology

The main aims of this paper are to: provide a united view on the issue of tax instruments supporting science and research in the Slovak Republic and to evaluate their impact on state budget revenues; identify taxpayers who use these tax stimuli to the most significant extent, both in terms of size and from the regional aspect; and outline the impacts of these stimuli as one of the factors behind the gradual growth of competitiveness of the European Union as whole. The research question that the paper tries to answer is whether the support of research and development in the Slovak Republic through tax instruments is sustainable and suitable for the business sector.

In terms of research methodology, the paper was designed in four phases: a review of secondary academic and professional theoretical sources and their systematization, with an emphasis on the deduction of research and development costs in OECD countries as well as in the Slovak Republic; the creation of databases and a summary of academic research on the issues under analysis; the evaluation of the research results; and the proposal of

recommendations for the reform of tax benefits for science and research in the Slovak Republic.

The initial steps of the research were aimed at comparing the deduction of research and development costs as a tool for improving the tax competitiveness of companies in the European area. Qualitative and quantitative methods were used in the research. The authors analyzed legislation related to the issue of super deduction in order to identify the factors that affect this tax instrument. At the same time, the authors adopted the descriptive and normative economic approaches. Based on the deduction, procedures were subsequently chosen to quantify selected factors and their impact on state budget revenues in the Slovak Republic.

The area of tax incentives to support research and development was thoroughly analyzed to identify the reasons for the high volatility of this instrument. We have thus quantified the amount of state budget revenues allocated to the said tax instrument. Based on a summary of national and international statistics on the amount of support for research and development, it was subsequently possible to make a basic comparison in the international arena. Part of the work involved mapping the support for research and development in the Slovak Republic from 2015 to the present, taking into account the influence of the European Union, OECD, and the direction of government tax policy. Mathematical and statistical calculations and time series analysis are also part of the paper.

The researched period (2015 to 2020) was analyzed using selected indicators. The authors also undertook a short-term analysis of selected factors which, especially on an annual basis, significantly affected budget revenues through the deduction of research and development costs. By applying the methods of deduction and induction, a statistically significant time-period was evaluated, on the basis of which it was possible to form general conclusions and recommendations about the direction of tax policy in the Slovak Republic with an emphasis on support for research and development. The subject of the research was the position of the deduction of research and development costs in tax systems as well as its impact on the business environment. The most important sources of statistical data were the databases of the Statistical Office of the Slovak Republic and OECD statistics. The secondary data sources were mainly Slovak legislation, European Commission and OECD studies, and FINSTAT data.

4. Results

A favourable business environment is a prerequisite for long-term competitiveness as well as economic growth. The basic conditions for its operation are thus created not only by business entities, but also by the state, which can influence employment, savings, and investments through tax incentives. Tax incentives are one of the forms of support aimed at increasing the volume of investment in the Slovak Republic and improving the business environment. The alignment of tax policy with the policy of state aid and selected tax relief for science and research has also had its place in the Slovak tax system since 2015. The deduction of research and development costs to support research and development is one of the most effective tax instruments. The advantages and disadvantages of super deduction are summarized in Table 1.

Table 1. Advantages and Disadvantages of a Deduction of Research and Development Costs in the Slovak Republic

Specification	Advantages	Disadvantages
Deduction of research and development costs to support research and development	Little intervention in the market Stable support for research and development Less bureaucratic, more predictable Easily applicable form of support Higher potential results of innovation	Planar tool which does not allow support for research and development in specific locations Insufficient return from completed projects

Source: prepared by the authors.

Work on the issue of support for research and development in the Slovak Republic followed on from professional discussions and the findings of studies. Selected partial analyses of the position of this tax instrument in the national as well as international arenas have become key. The position of the deduction of research and development costs in the context of the Slovak Republic is depicted in Figure 2.

Research and development represents an irreplaceable intensifying factor for Slovakia's continued economic development. Global pressure to increase competitiveness and guarantee sustainable growth requires making the process of transferring science and technology knowledge into business

development plans more effective. The quantification of indicators related to the deduction of research and development costs is documented in Table 2.
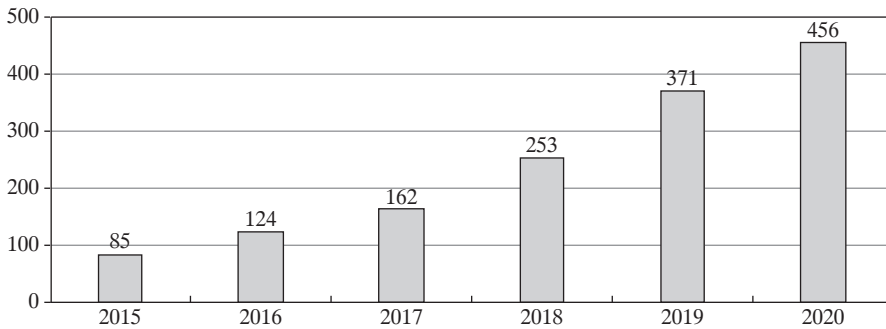

Fig. 2. Number of Taxable Persons Deducting Expenditure on Science and Research

Source: prepared by the authors.

Table 2. Number and Amount of Deductions on Research and Development in the Slovak Republic

Specification	2015	2016	2017	2018	2019	2020
Number of taxpayers	83	112	163	264	373	460
Amount of deduction of research and development costs in EUR million	9.23	16.49	40.12	120.28	119.53	156.20
Amount of deduction of research and development costs in %	25	25	25	100	150	200
Nominal corporate rate in %	22	22	21	21	21	21
Amount of saved corporate income tax in EUR million – revenue missed by the state budget	2.027	3.626	8.424	25.257	25.101	32.802
State budget revenue from corporate income tax in EUR billion	2.728	2.740	2.744	2.698	2.713	2.699

Source: prepared by the authors on the basis of Slovak Financial Institution data.

The statistics of the Financial Administration of the Slovak Republic also show that small companies with 10 to 49 employees apply the deduction to the highest degree, followed by medium-sized companies with 50 to 249 employees, micro-enterprises with up to 9 employees, and large companies with over 250 employees. The highest rate of deduction of research and development cost in terms of regional distribution was recorded in the

Bratislava, Trenčín and Trnava regions. The breakdown of the deduction of research and development costs by industry is summarized in Figure 3.
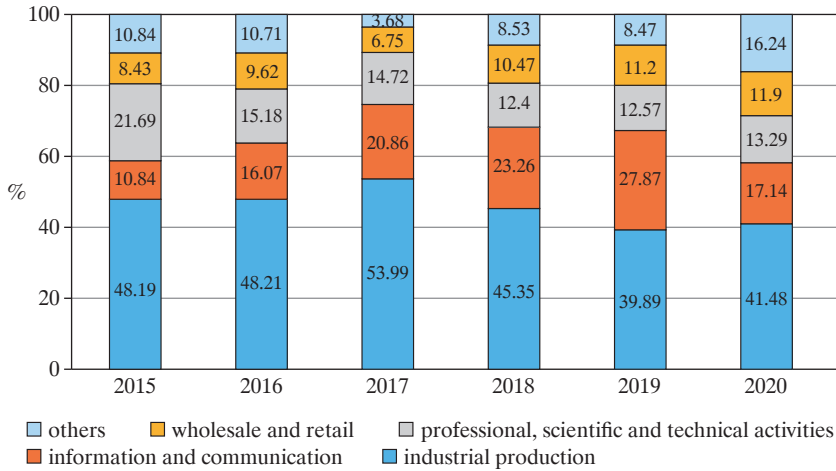

Fig. 3. Share of Industries Deducting of Research and Development Costs in the Slovak Republic

Source: prepared by the authors.

The decrease in the volume of the deduction of research and development costs in 2019, with a 1.5-times increase in its rate, can be assessed negatively. It is clear that the success of this instrument of tax stimulation of private investment in research and development in Slovakia may encounter a barrier such as the inability to claim the costs incurred in the form of a deduction of research and development costs against a sufficient tax base. The decline in the profits of Slovak businesses across almost all sectors of the economy appeared as early as 2018 and developed in the same way in 2019, i.e. in the years before the pandemic. Although tax legislation has made it possible to increase the rate of deduction of research and development costs to 200% in 2020, the question remains as to how many entities will have a chance to use this rate given the economic effects of the pandemic. Since 2020, a new tax incentive aimed at supporting research and development in the form of a patent box has also been introduced in the Slovak Republic, and since 2022 a new tax instrument in the form of a deduction of investment costs has been introduced.

A partial evaluation of the operation of this tax incentive in the Slovak Republic is also documented by OECD statistics (OECD 2021, 2020a,

2020b), which examined the marginal level of tax support for research and development for small and medium-sized companies. Slovakia has achieved the best results among the EU countries and has even overtaken France, which provides companies with the highest support for research and development in the EU. It is clear that these newly introduced tax instruments in Slovak tax legislation have great potential and enable companies investing in research and development to generate significant financial savings that would otherwise be paid to the state in the form of tax.

5. Discussion

The main advantage of the deduction of research and development costs is its simple application as well as the lower administrative burden compared to obtaining relief in the form of state investment aid. Tax incentives for research and development encourage investment and are therefore considered an appropriate form of support for the business environment. However, the biggest positive is the duplication of the possibility of claiming costs with respect to the reported corporate tax base. The question arises here: how often should the percentage rate for duplicate costs be changed? The success of this instrument of tax stimulation of private investment in research and development in Slovakia may also run into the barrier of not being able to claim the costs incurred in the form of a deduction of research and development costs against a sufficiently high tax base, especially in the current period, when there has been a significant decline in Slovak companies' profits. What, then, is the perspective for deducting research and development costs in the pandemic period and in the post-pandemic period, respectively?

Although tax legislation in the 2020–21 period introduced an attractive increase in the rate of deduction of research and development costs up to 200%, the question remains as to how many entities will have a chance to use this rate given the economic effects of the pandemic. A tax loss or an insufficient tax base postpones the deduction of research and development costs to the next tax period, when a sufficient tax base allows them to be claimed. So far, this option has been limited in time to a maximum of four years, and from 2020 it was extended to five years. Another important question is how many entities had to reduce or completely abandon their research and development activities due to the pandemic.

Understanding the legislation regarding the deduction of research and development costs remains a challenge for Slovak companies. Many

companies are not entirely sure whether the deduction of research and development costs can be applied to their projects. Some companies are also afraid of being sanctioned by the financial administration if they wrongly apply for a deduction of research and development costs, and therefore they are waiting until there are enough methodological guidelines on how to apply the deduction correctly.

6. Conclusions

The world economy has found itself in crisis again, and this fact has had a significant impact on the Slovak economy. There have been significant economic losses. Due to these macroeconomic problems in particular, the role of the tax administration has been constantly growing, with an emphasis on eliminating the negative effects on both the revenue and expenditure sides of the state budget. To mitigate the effects of the crisis, OECD member countries are responding with changes to economic policies and with measures of a fiscal and non-fiscal nature. A new challenge in the field of tax policy are tax reliefs aimed at supporting research and development, creating new investment, and creating new jobs. In the long run, it is higher investment that will support the growth of productivity and employment.

Apart from the last seven years, the Slovak Republic has been characterized by almost no state support for research and development. However, since 2015, new forms of tax incentives have included the provision of tax relief in the form of a deduction of research and development costs, a patent box, as well as a tax deduction for new investments. The results of our analysis of the support for research and development in the Slovak Republic make it possible to identify key areas that affect budget revenues the most and that affect the business environment in terms of providing tax benefits for taxpayers performing research and development. These include maintaining or reducing the corporate tax rate to bolster economic growth and competitiveness, and carrying out an audit and a more detailed analysis of the impacts of the aforementioned tax incentives, as their impact on research and development has had a positive effect both in terms of the number of applicants and the amount of funds drawn. In 2015, 83 entities claimed a deduction of research and development costs amounting to more than EUR 9 million, while in 2019 the amount of this deduction increased to more than EUR 119 million.

Another motivation for companies in Slovakia to invest in research and development is the new patent box regime. It has been in force since January

2018 and was introduced as a separate tax regime that provides an exemption from income tax for reasons of granting the right to use protected patents, utility models or software from the taxpayer's own development activities in Slovakia. The analysis of applicants for a deduction of research and development costs in the Slovak Republic also showed that the number of new applicants for the tax benefit is constantly growing. This may encourage the re-use of such a tax credit in future years. The latest tool to support research and development is the deduction of investment costs, which means that the Slovak Republic currently provides several tax instruments to support research and development. However, a more comprehensive analysis of the impacts on budget revenues as well as on the business environment cannot be provided at this time.

Acknowledgements

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Erika Pastoráková
Tomáš Ondruška

THE ORIGIN OF THE MODERN INSURANCE INDUSTRY IN SLOVAKIA AND THE CONTRIBUTION OF DR JÁN ALOJZ WAGNER TO ITS DEVELOPMENT

Abstract

Objective: The aim of the article is to capture the key elements determining the development of modern insurance in today's Slovakia and to evaluate the role of Dr Ján Alojz Wagner in the establishment of insurance companies with Slovak capital on the territory of today's Slovakia, which principally means in the newly-formed Czechoslovakia.

Research Design & Methods: In-depth analysis of historical sources from several sources, such as libraries, archives and depositories. We used documentary, biographical and archival methods, which are useful in terms of historical research.

Findings: A summary and analysis of Dr Wagner's contribution to the establishment and subsequent development of the insurance industry in the region of Slovakia.

Implications/Recommendations: We consider Dr Wagner to be a figure who contributed to the formation of this market, and we believe that an understanding of his work can help us to better understand how the Slovak insurance industry currently operates.

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Contribution: This article is a summary and analysis of Dr Wagner's contribution to the establishment and subsequent development of the insurance industry in the region of Slovakia. Dr Wagner's ideas were a knowledge base for the development of insurance in Slovakia, and his practical work laid the foundations of the Slovak insurance market.

Keywords: insurance market, development of the insurance market, actuary, life insurance.
JEL Classification: G22.

1. Introduction

Modern insurance on the territory of today's Slovakia is often associated with the establishment of an independent Czechoslovakia in 1918. At that time, on the one hand, there was a "founding fever" represented by the emergence of a number of insurance companies and also an increase on the demand side for insurance. However, the origin of these major changes in the insurance market lies in activities and developments that occurred before 1918. These were caused by positive changes in property rights and the elimination of feudal social relations, greater opportunities for the accumulation of financial resources in order to establish financial institutions (today's banks, savings banks, and insurance companies) and, last but not least, the significant personal contribution of several individuals. The greatest impact was made by Dr Ján Alojz Wagner, who is considered a key figure in the Slovak insurance industry. His contribution is considerable in the field of insurance. As far as a conceptual understanding of modern insurance is concerned, it is necessary to state that, in theory, documents point to the emergence of modern insurance in the period between the 14th and 17th centuries – see, for instance *The History of Insurance: Risk, Uncertainty and Entrepreneurship* (Masci 2011). This is a relatively long time period, but historical developments suggest that modern forms of risk-taking did indeed flourish in individual countries during that period. They involved the use of commercial insurance contracts. The period also witnessed the establishment of insurance companies operating on commercial principles. In this article, forms of risk transfer from individual to group, where the insured and the insurer are clearly distinguishable, as well as communities and institutions that wanted to make a profit from risk-taking, can be understood as modern insurance and the modern insurance industry. The aim of the article is to capture the key factors determining the development of modern insurance in today's Slovakia and to evaluate the role of Dr Ján Alojz Wagner in the establishment of insurance companies with Slovak capital on the territory of today's Slovakia, which principally means in the newly--formed Czechoslovakia. The article is structured as follows: the first

section describes the social and economic development of Slovakia and the possibilities of meeting insurance needs. It deals in more detail with the obstacles that hampered the transition to modern forms of insurance in Slovakia compared to the more developed areas of the Austro-Hungarian Empire, to which Slovakia belonged until 1918. The second section highlights the contribution made by Dr Ján Alojz Wagner to the field of insurance and the insurance industry in the territory of today's Slovakia. We attempt to bridge the knowledge gap about Dr Ján Alojz Wagner and his achievements, which had an impact on the development of the insurance industry in Central Europe. Several methods were used in the processing of historical sources. On the one hand, we conducted an in-depth analysis of historical sources kept in libraries, archives, and depositories. On the other hand, we applied documentary, biographical, and archival methods, which are useful in terms of historical research.

2. Economic and Social Conditions as Determinants of the Development of Insurance and the Insurance Industry in Slovakia during the Austro--Hungarian Empire

2.1. General Remarks

In the 18th century, when developed countries experienced significant economic and social changes, Slovakia, as part of the Austro-Hungarian monarchy, struggled with the consequences of Ottman invasions and religious strife, which took the form of domestic and economic crises (Cvetková & Leková 2013). The state of the economy, as well as the conditions for the development of modern insurance on a larger scale, reflected this. The obstacle to the development of the insurance industry in Slovakia was the persistence of feudal social relations, which hampered the accumulation of capital and the development of the financial system. An obstacle to the creation of financial resources was also the excessive tax burden imposed on the bourgeoisie, as a result of which the majority of the Hungarian population was largely unable to raise its own funds, which significantly limited its purchasing power. The revolutions of 1848–1849 and the subsequent legislative changes removed feudal barriers and created the preconditions for new trends and market relations. However, slow industrialization, frequent famines, and a growing number of deprived peasants caused even greater poverty, which resulted in mass emigration that did not cease even in later periods (in the first decade of the 20th century, about 20,000 people left Slovakia every year to work abroad).

Industry fell into the hands of predominantly Austrian and other foreign capital, which drew on the region's raw material base and utilized its cheap labour. It should be noted that although manufactories were gradually established on the territory of today's Slovakia as early as the 18th century (1725 in Banská Bystrica, 1736 in Šaštín, 1743 in Holíč), and mining and metallurgy continued to develop (precious metals in Banská Štiavnica and Kremnica, copper in Banská Bystrica, iron ore in Gemeri and Spiši, as well as magnesite, cobalt, nickel and salt), until the beginning of the 19th century the Slovakian economy was essentially based on agriculture. This was reflected in the composition of the population: at the end of the 18th century, 52.6% were farmers, 24.4% workers, 11.4% burghers, 4.6% nobility, and 6.5% others (civil servants and clergy only accounted for 0.1% and 0.4% of the population, respectively).

In addition to these economic conditions, the poorly developed financial system in Slovakia was still an obstacle to the development of the insurance industry in the second half of the 19th century. The development of the credit system was hampered mainly by a lack of financial capital, the absence of financial institutions, and the existence of barriers to the entry of foreign capital onto the Hungarian market. The fact that independent financial institutions (the precursors of today's banks) did not begin to be established on the territory of today's Slovakia until the 1840s illustrates the delay in development compared to surrounding countries[1]. National self-help associations began to form during the same period in the Slovakian countryside, and were the germ of future cooperative finance and popular finance in general. The aim of these associations was to protect the poorest classes from poverty and usury. They were noticeably influenced by members of the national revival movement, who, within the framework of their national programme, made efforts to improve the economic and social conditions of the population as a whole. The gradual economic boom encouraged the establishment of Slovak companies in the spheres of industry and finance, which went hand in hand with national-emancipation tendencies in the territory of today's Slovakia, which was still part of Hungary. In 1868, the Turčiansko-Sväto-Martinská savings bank was established as the first purely Slovak financial institution. It played a major role in the founding of other Slovak financial institutions and in supporting Slovak business plans.

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[1] The first independent financial institution was the Bratislava Savings Bank (Pressburger Sparkasse, later Bratislavská I savings bank), established in Bratislava in 1841. This became the prototype for eleven other banking companies established in Slovakia by the end of the 1840s, e.g. in Košice, Banská Bystrica, Komárno, Levoča and Trnava.

2.2. Institutions Satisfying Insurance Needs on the Territory of Present-Day Slovakia during the Austro-Hungarian Empire

For a very long time, risk coverage in the territory of today's Slovakia was provided by various associations, guilds, and fraternities. In contrast to developed countries, where the switch to modern forms of risk coverage through insurance companies occurred relatively early, the initial forms of coverage in the form of reciprocal coverage lasted much longer in the territory of today's Slovakia. In the 18th century, risk coverage principally took the form of church funds set up in Catholic parishes as well as various other associations. Indeed, associations were an extremely widespread form of risk coverage for a very long time, despite being only limited in scope. We can mention at least some of the many preserved historical records that point to the existence of associations. For example, in 1496, the treasuries[2] of miners in the mines of Ján Thurzo (one of the main creditors of the Hungarian ruling family) are mentioned (Kočiš & Kurucárová 2012), while in 1746, a document from the village of Ochtiná (Rožňava district) refers to the insurance association for livestock insurance, associations of traders and carters in Gemer, and many others. In total, large numbers of individuals are documented – approximately 80,000 craftsmen, traders, miners, metallurgists, and coal miners were members of support associations (Marvan & Patoprstý 1989). The limits of these associations became apparent in the middle of the 18th century, when due to rapid economic and social growth, they were no longer able to compensate for the increasing damage to property, especially the property of the urban population. Therefore, the first insurance entities were established in the form of institutions or companies, such as the Rév-Komárom Shipping Insurance Company (1807), the Komárno Pension Retirement Institute (1823), the Gemersko-Malohontský fire damage replacement institute, the Zemplín fire damage replacement association (1848), the Hungária Insurance Bank based in Bratislava (1864), the Bratislava funeral home (1871), which was the first joint-stock company in the monarchy for funeral and life insurance, and the Košice Participating Association for securing care and dowries (1872). In 1871 and 1872, other local insurance companies were established, such as the St Nicholas mutual dowry securing association, the Prešov association for securing marriages and dowries, the Nitra mutual fire insurance

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[2] These types of mining funds were created by mutual agreement between the miners and the mine owners and were managed by the miners themselves. Deposits took the form of miners' membership fees and employer contributions. Every subscribed member of the mining treasury was entitled to compensation (Kočiš & Kurucárová 2012).

company, the Turniansky mutual fire damage compensation association, and others. Most of these disappeared after a short period of operation. It is also worth mentioning the local cattle insurance associations, for example in the village of Ochtiná (1746), which were probably founded by members of the Miners' Guild established in 1697, the Muránska Dlhá Lúka (1840), the Kameňany and Slavošovce (1842), and others. Some of these associations remained in operation until the nationalization of the insurance industry in 1945 (Marvan & Patoprstý 1989).

In the 19th century, insurance needs in Slovakia were mostly met by insurance companies based in today's Hungary or in other parts of the Austro-Hungarian monarchy as well as by insurance companies from Germany, France, Great Britain, and the like. They were usually represented in the larger cities. The most important insurance company operating in Slovakia was the First Hungarian General Insurance Company, founded in 1857 in Budapest (Hanzlík 1912).

The termination of insurance activities in Slovakia (due to legislative changes caused by the disintegration of the Austro-Hungarian Empire) is related to the emergence of one of the most important Slovak insurance companies, to which Dr Ján Alojz Wagner made a significant personal contribution. To give an idea of the amount of competition in the insurance market in the territory of today's Slovakia in the period before the disintegration of the Austro-Hungarian Empire (1918): there were 25 insurance companies dealing in property insurance, 45 companies dealing in life insurance, 205 local insurance cooperatives of the Hungarian Mutual Insurance Company that were active in livestock insurance, and many separate self-help insurance associations. With the exception of self--help associations, no insurance company with Slovakian capital operated in Slovakia in 1918 (Fekete 1985).

Dr Ján Alojz Wagner, the doyen of the insurance industry, pointed to this fact. As an employee of the Donau insurance company in Vienna, he was aware that the operation of Hungarian and Austrian insurance companies in Slovakia was very profitable. In his articles (e.g. Wagner 1909) he emphasized that building a Slovak insurance company would have provided many Slovaks with work in a new and interesting profession[3]. He tried, both through

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[3] Given that mutual insurance did not establish deeper roots in Hungary, Wagner proposed the establishment of an insurance company with the legal form of a public limited company, with a registered share capital of 100,000 in gold. At first, this insurance company existed to provide fire insurance, and only later, after the share capital increased, did it begin to provide life insurance. Wagner assumed that shares in the first Slovak insurance company would be bought primarily by existing Slovak financial institutions and, in part, by wealthier Slovaks. He therefore expressed the

personal contacts and through journalism, to arouse the interest of the wider Slovak public in building a Slovak insurance company (Wagner 1924). He saw the economic benefits of establishing a Slovak insurance company, whose reserves, especially from life insurance, could be stored in debenture bonds, which, from the point of view of the national economy of Slovakia, were of great importance. His idea was that the reserves of the insurance company would be deposited in banks with Slovak capital. Today we know that it took almost twenty years from Dr Ján Alojz Wagner's first efforts (in around 1899) before a national Slovak insurance company was established in Slovakia.

3. Ján Alojz Wagner and his Contribution to the Development of Insurance in the Territory of Today's Slovakia

3.1. General Remarks

Dr Ján Alojz Wagner (born on 3 July 1864 in Slovenské Pravno) was the son of a Slovakian organ master whose interests drew him to the natural sciences. After doing his military service in Vienna, he successfully completed his studies at the Faculty of Arts in Vienna, where he graduated as a doctor of philosophy on 23 July 1889. In September 1890, he joined the Donau insurance company in Vienna as an actuarial mathematician. He worked at the company for nine years in various positions and in various cities[4]. This work experience was followed by several positions at the Universale and Austria insurance companies in Vienna. At the beginning of 1900, he returned to Pest as head of the life insurance department of Universale and chief mathematician of the National Accident Insurance Company. He worked in these positions for the next 19 years, dealing with all

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optimistic view that an average annual dividend of 10% of the share capital could be expected. Wagner estimated that there was a relatively wide "free insurance field" in Slovakia at that time, as only 35% of property affected by fire was insured. He proposed Turčiansky Svätý Martin or Liptovský Svätý Mikuláš as the company's headquarters, but he did not exclude Budapest.

[4] In 1894, he was transferred to the insurance company's general office in Graz, where there was an academy which served as an educational institution for actuaries. Wagner described it as "a small insurance company led by the meticulous chief actuary Leder". Along with Wagner, those who ran the branches of insurance companies, or even the insurance companies themselves, were educated here. In the spring of 1896, Wagner was given a new role. He was appointed head of the life insurance department at the Pest branch of the Donau insurance company. However, he also received another offer. He was approached by Dr Blaschke, who had been appointed technical head of the newly established supervisory authority. "I would have had to obtain Austrian citizenship, which would have been easy as I had been in Austria for twelve years, but although I was flattered by the invitation, I decided not to go beyond Pest, especially as I would be there more and more". The branch in Pest, however, was led by a certain Reichardt, who in his "bureaucratic ways" discouraged many promising collaborators.

branches of insurance, with an emphasis on accident and public insurance. In addition, he co-founded several private pension funds (Goldberger, Mliekáreň, Chevra Kadivka, etc.). He was even asked to determine the pension rights of Hungarian city officials, which was to serve as the basis of their pension funds. It was a very responsible task, which Wagner accepted and successfully implemented. After the disintegration of the Austro--Hungarian Empire, he moved back to his homeland, convinced that the time had come to establish insurance companies exclusively with Slovak capital. He wanted to use his knowledge in the field of insurance technology for the benefit of this young country. In April 1919, his goal was fulfilled when he was appointed CEO of the First Slovak Insurance Company based in Bratislava, and a few months later he was also appointed chief curator of insurance companies in the curatorial report.

3.2. Ján Alojz Wagner as CEO of the Insurance Company and his Work as Chief Curator

Dr Ján Alojz Wagner's long-term efforts to establish a national Slovak insurance company were fulfilled after the disintegration of the Austro--Hungarian Empire. He described his success as follows: "After my arrival in Slovakia (in early April 1919), work began immediately, and on 26 April, the first Slovak insurance institute was established: the first Slovak insurance company, a participating association based in Bratislava". Among the founders of the insurance company were other leading figures of the day from all areas of public, political and economic life. The registered capital of the company was two million crowns, and the First Czech Mutual Insurance Company also contributed to its establishment. On 2 April 1919, at the founding general meeting, the company statutes were adopted and also approved by the Minister, who had power-of-attorney for the administration of Slovakia. Ján Alojz Wagner was appointed director of the company, which began operating on 1 July 1919 as the first Slovak insurance company in history[5].

[5] For the sake of completeness, it should be added that the first Slovak insurance company, a participating association in Žilina, was established as the first insurance company with its registered office in Slovakia. It was established on 3 February 1919, and was registered in the Commercial Register in Trenčín on 8 February 1919. As this insurance company did not initially obtain the necessary capital and a sufficient number of employees, it did not carry out any activity. It was therefore reorganized with the help of the Viennese company Phönix. Its goal was to gradually take control of the newly established first Slovak insurance company, which over time succeeded. At a meeting on 23 November 1919, amendments to the statutes were proposed. The insurance company also changed its name to Poisťovňa Slovakia general insurance company, a participating company in Žilina. Poisťovňa Slovakia did not begin operating until 1920. We believe that the first

From the beginning of its operation, it tried to take over the Slovak insurance group from the First Hungarian General Insurance Company, a participating company (Első magyar általános biztosító társaság) based in Budapest. It handled a really large volume of insurance business – its insurance stock accounted for up to half of the total stock of all Hungarian insurance companies in Slovakia. Naturally, the First Hungarian Company did not agree to the transfer of the stock. The situation changed when a curatorial report was imposed on the branches of all Hungarian insurance companies in Slovakia on 30 July 1919. Dr J. A. Wagner became the chief curator. In essence, these insurance companies were banned from further activity, as a result of which the First Hungarian Party agreed to negotiate the organization of their stock in Slovakia. The outcome of the negotiations was that the two companies would jointly establish a new insurance company, in which, in addition to the First Slovak Insurance Company in Bratislava, the First Hungarian Insurance Company would also have a capital share.

The curatorial report established as a result of the disintegration of the Austro-Hungarian Empire dealt with the issue of the activities of insurance companies in the newly created states and the transfer of existing insurance contracts concluded in another state to the citizens or entrepreneurs of the new state. In the case of the curatorial report established in 1919, these were insurance contracts concluded with Hungarian or Italian insurance companies, which, after the establishment of Czechoslovakia, became contracts that were concluded in "foreign" insurance companies. The Slovakian Ministry of Administration was established by Regulation No 3802/1919 on 30 July 1919 and included 19 Hungarian insurance companies under curatorial administration (Wagner 1924). Dr Ján Alojz Wagner became the chief curator, who headed the ten-member curatorial commission[6]. The aim of the curatorial report was to protect the interests of policyholders and to ensure that insurance stocks were transferred by the insurance companies curated by "domestic" insurance companies. Naturally, the Hungarian insurance company did not want to give up its insurance stocks and sought to create several obstacles, which included trying to delay the transfer of the stocks.

Slovak insurance company was the one that actually developed its insurance business first, and it was therefore Prvá Slovenská Poisťovňa, a participating association based in Bratislava, whose director was J. A. Wagner.

[6] Dr Wagner was appointed chairman of the commission. The members of the commission (throughout its operation) were: Jozef Kopečný, Jaroslav Donáth, Dr Ivan Derer, Vladimír Makovicky, Dr Pavol Blaho, Dr Ferdiš Juriga, Dr Jozef Zadina, Igor Beniac, Dr Emil Stodola, and Dr Peter Čech.

In May 1920, negotiations took place between the First Slovak Insurance Company (based in Bratislava), the First Hungarian Insurance Company (based in Budapest), and the First Czech Mutual Insurance Company (based in Prague) in Starý Smokovec, where the representatives of these insurance companies agreed to establish a new insurance company called Bratislava. This title was later changed to the Slovak Insurance Company, a participating company in Bratislava. These insurance companies agreed to hand over their insurance stocks in Slovakia to the newly established insurance company. As a result, the First Slovak Insurance Company, which was a participating association in Bratislava, ceased to exist; its successor became the newly formed Slovak Insurance Company (Patoprstý *et al*. 1993).

Dr J. A. Wagner's idea that this insurance company should be run by Czechs and Slovaks became a reality. As stated in chapter III of the company's statutes in the paragraph entitled §10 Company Organization: "Only persons who are citizens of the Slovak Republic may be elected as a member of the administrative board and the supervisory board". The chairman and vice-chairman of the board of directors had to be Slovak nationals. Dr Ján Alojz Wagner got a position in the directorate of the company.

Several pieces of data on the management of this insurance company are preserved. At the beginning of its operation (1924–25), a substantial part (81%+) of the written premium was non-life insurance, of which the predominant part was fire insurance. In 1929, fire insurance accounted for up to 78% of the total written premium. Years of growth and decline alternated in the life insurance industry, which was also due to political influence. In 1926 and 1927, for example, the reactions of wealthier Slovaks who had taken out life insurance policies in the original insurance companies, whose stocks were taken over by the Slovak Insurance Company, had a significant impact (Wagner 1926). In those years, many life insurance contracts were terminated, as a result of which the insurance company faced life insurance redemption payments. At the end of 1929, the Slovak Insurance Company had 33,872 life insurance policies with an insured amount of over 228 million crowns. The average per policy was around 6,700 crowns (Patoprstý *et al*. 1993).

The Slovak Insurance Company invested its temporary free resources in several types of repositories. In first place, investments were made in real estate, with apartment buildings being bought in Bratislava and in other large cities in Slovakia. In addition, it provided mortgage loans, mainly in

the larger cities; the loans were conditional upon the borrowers insuring their property in that company (Patoprstý *et al*. 1993).

Dr Ján Alojz Wagner devoted many years of his professional life to the Slovak Insurance Company. His pedagogical ambitions were also fulfilled when be began giving lectures in insurance technology at the Comenius University from 1925 (Wagner 1930). He was very pleased to be able to pass on his expertise and his many years of experience to students of the Faculty of Law at the Comenius University. Dr Ján Alojz Wagner died on 18 October 1930 in Bratislava. Between 1919 to 1930 he had managed to do a lot for the cause of insurance in Slovakia.

4. Conclusion

All changes in society, whether political, demographic or social, are reflected in developments in the insurance market. This is also the case in the insurance market of the Slovak Republic. The social and economic conditions in the territory of today's Slovakia determined the long-term, prevailing presence of risk transfer from the individual to the group in the form of mutual insurance, without any commercial aspect. These were institutions of local importance (fraternities, treasuries, cattle insurance associations, etc.). This form of insurance lasted much longer than in Western Europe.

Various insurance institutions providing coverage of fire risk, funeral expenses, pensions, securing dowries and the like began to operate only at the beginning of the 19th century in the territory of today's Slovakia. Later, insurance companies based in today's Hungary and in other parts of the Austro-Hungarian Empire, as well as insurance companies from Germany, France and Great Britain, met the insurance needs of people in the territory of today's Slovakia.

Experts, originally from Slovakia, with knowledge in the field of insurance technology, observed the outflow of funds from the territory of Slovakia, and for many years called for the establishment of an insurance company with Slovak capital. Dr Ján Alojz Wagner, who lived during a period of turbulent change in the insurance market, was foremost among them. He contributed to the establishment of several insurance companies with Slovak capital and was involved in taking over insurance stocks as head of the curatorial commission. Last but not least, he was a lecturer in insurance and the author of several professional books and articles about insurance.

Acknowledgements

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Wioletta Grzenda

MODELLING THE OPINIONS OF POLES ABOUT KEY ASPECTS OF PROFESSIONAL WORK USING A NESTED LOGIT MODEL

Abstract

Objective: The objective of this paper is to examine the opinions of Poles about what they think is important in their professional work.

Research Design & Methods: The paper analyzes the preferences of Poles regarding occupational hygiene factors and motivating factors using Generations and Gender Survey data for Poland. Due to the frequent connections between the possible alternatives of choice, the use of the nested logit model to model the preferences of respondents was proposed in this study.

Findings: This study presents the factors that are important for Poles in their professional work depending on their socio-economic and demographic characteristics. For women, compared to men, options related to occupational hygiene and stable employment were less important than other motivating factors. However, for younger people, compared to people from the last age group, options related to occupational hygiene were also important.

Implications/Recommendations: In the research on the opinions and preferences of respondents, a common approach is to perform a comparative analysis using descriptive statistics or standard logistic regression models. The use of standard multinomial logit models may lead to erroneous conclusions, because in discrete choice problems the available options are rarely unrelated. In such cases, the suggested solution is to use nested logit models.

Contribution: The paper reveals the features of groups of respondents for whom good pay is not necessarily the most important factor in professional work, and so-called higher needs are also important.

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1. Introduction

In recent years, a drop in the unemployment rate has been observed in Poland. According to Eurostat data (Eurostat 2019), the unemployment rate in 2014 was 9%, and in 2018 only 3.9%. This may be one of the consequences of the aging of Polish society and the decline in labour supply. The decline in the number of people of working age brings with it many challenges for the labour market in Poland nowadays. The situation of employers is changing, and in order to recruit valuable employees, they must create appropriate working conditions for them. Because people with appropriate qualifications generally have no problems with finding a job, they increasingly look for jobs that best suit their individual preferences. Proper recognition of these preferences can benefit both employers and employees. In the case of employers, this is not only limited to recruiting and retaining valuable employees, but can also can have a large impact on employee productivity. In this paper we present the results of an analysis of the preferences of Poles regarding what they think is important in their professional work. The modelling was performed using data from the Generations and Gender Survey (GGS).

There are many theoretical concepts in which factors influencing satisfaction with work are considered (Zalewska 2003, Borowska-Pietrzak 2014). The main one and the basis of many later ones is Herzberg's two-factor theory, also known as Herzberg's motivation-hygiene theory (Herzberg, Mausner & Snyderman 1959). In this article, in the context of Herzberg's theory, an analysis of Poles' preferences regarding what they think is important in their professional work is conducted.

According to Herzberg's theory, two groups of factors can be distinguished in the work environment: factors related to occupational hygiene and motivating factors (or "motivators"). Hygiene factors refer to so-called lower needs, including, among others, working conditions, pay, non-payroll benefits, organization of working time, work safety, and organization of the enterprise. These factors do not affect job satisfaction, but their absence causes dissatisfaction with work. Motivating factors relate to higher needs, including the possibility of professional development, work prestige, recognition for achievements, and responsibility for activities undertaken. The division of factors defined in Herzberg's motivation-hygiene

theory (Herzberg, Mausner & Snyderman 1959) was used in this study to map individual factors to the nests of the model. Moreover, in the remainder of the study, the division of factors into hygiene and motivating factors as defined in the Herzberg's theory is used. Ensuring that these factors remain at an appropriate level affects the employees' satisfaction with their work. According to Herzberg, employers should first eliminate dissatisfaction from work and then focus their attention on creating conditions conducive to job satisfaction. The research problem addressed in this study is an assessment of the importance of occupational hygiene factors and motivating factors for Poles, depending on their socio-economic and demographic characteristics.

The chances that a given person will find a job depend primarily on their hard and soft skills as well as the ways in which they look for a job (Socha & Sztanderska 2002), whereas the decision to take up employment in a given organization depends on their individual preferences as well as on their family and economic situation. According to Marschak (1960), each economic entity making a choice proceeds in a rational manner in order to maximize the usefulness of the decisions made (*Mikroekonometria…* 2012).

Discrete choice models are commonly used to model consumer preferences (Anderson, De Palma & Thisse 1992). In their basic form, these models have certain limitations because they can be used to describe choices between options that are mutually exclusive and unrelated to each other. This assumption in research on respondents' preferences is often not met. Therefor, the use of the nested logit model (McFadden 1978, Maddala 1983) is proposed in this paper. The estimation of this model using the classical method based on the maximizing likelihood function can be problematic due to the difficulties associated with finding the global maximum. In this paper, to model the opinions of respondents, the nested logit model in the Bayesian approach for unordered categories is proposed.

2. The Nested Logit Model

In socio-economic studies, models for qualitative variables are very popular (Cramer 2003, Marzec 2008, Allison 2009, *Mikroekonometria…* 2012). These models are also referred to as discrete choice models. If a dependent variable takes more than two values, multinomial models are considered. The multinomial logit model (MNL) considered in this paper also belongs to this class of models. It is obtained by assuming an appropriate probability distribution for random components in the utility function.

Let the i-th unit $(i=1,…,n)$ have to select one of J unordered categories. In the multinomial logit model, random components $\varepsilon_{ij}\,(j=1,…,J)$ are independent and have the same Gumbel distribution (the type I extreme--value distribution). Moreover, the unobserved stochastic parts of the utility are uncorrelated for all alternatives and have the same variance (McFadden 1974). Then the probability of observing the choice by the i-th unit $(i=1,…,n)$ of the j-th category $(j=1,…,J)$ is given by the formula:

$$p_{ij}=\frac{\exp(\mathbf{x}'_{ij}\boldsymbol{\beta})}{\sum\limits_{k=1}^{J}\exp(\mathbf{x}'_{ik}\boldsymbol{\beta})},\quad i=1,…,n,j=1,…,J, \tag{1}$$

where $\mathbf{x}$ denotes the vector of explanatory variables and $\boldsymbol{\beta}$ is the vector of parameters.

These models are used to describe choices between mutually exclusive and unrelated categories (*Mikroekonometria…* 2012). According to the assumptions given in McFadden (1974), in order to use the multinomial logit model, the analyzed categories must fulfill the assumption of independence from irrelevant alternatives (IIA). In practice, this assumption is often not met, because once we eliminate one of the available options, the probability ratio of choosing any two other categories often also changes. Then the solution can be to use the nested logit model (Train 2009).

The nested logit model has a hierarchical structure. The set of all possible alternatives is divided into so-called nests (subsets) so that the assumption of independence from irrelevant alternatives (IIA) is met in each nest, while the ratio of the probability of choosing any two alternatives in different nests is not independent of the existence of other alternatives in these two nests, i.e. the assumption of IIA does not have to be fulfilled between the nests. Therefore, in the nested logit model all the random components $\varepsilon_{ij}\,(j=1,…,J)$ do not have to be independent. Moreover, instead of Gumbel's distribution, generalized extreme-value distribution (GEV) is assumed for them. Let

$$U_{ij}=\mathbf{x}'_{ij}\boldsymbol{\beta}+\varepsilon_{ij},\quad i=1,…,n,j=1,…,J \tag{2}$$

denote the utility function. Let K denote the number of disjoint subsets (nests) $S_1,S_2,…,S_K,$ on which, as described above, the alternatives are divided. Then the cumulative distribution for the vector of random components $\boldsymbol{\varepsilon}_i=(\varepsilon_{i1},\varepsilon_{i2},…,\varepsilon_{iJ}),$ is given by the formula:

$$F(\boldsymbol{\varepsilon}_i)=\exp\left(-\sum_{k=1}^{K}\left(\sum_{j\in S_k}\exp\left(-\frac{\varepsilon_{ij}}{\lambda_k}\right)\right)^{\lambda_k}\right). \tag{3}$$

In the given nest, random components ε_{ij} $(j=1,\ldots,J)$ are correlated with each other. The parameter λ_k is a function of the correlation coefficient between possible alternatives in the k-th nest and is used to measure the correlation between the alternatives in a given nest. Value 1 for the parameter λ_k means no correlation in the k-th nest, so if the value of this parameter for all nests is 1, then the nested logit model can be replaced with a standard logit model.

With these assumptions, the probability of observing the choice by the i-th unit $(i=1,\ldots,n)$ of the category $j \in S_k$ is given by the formula:

$$P(y_{ij}=1)=\frac{\exp\left(\dfrac{\mathbf{x}'_{ij}\boldsymbol{\beta}}{\lambda_k}\right)\left(\displaystyle\sum_{m\in S_k}\exp\left(\dfrac{\mathbf{x}'_{im}\boldsymbol{\beta}}{\lambda_k}\right)\right)^{\lambda_k-1}}{\displaystyle\sum_{l=1}^{K}\left(\displaystyle\sum_{m\in S_l}\exp\left(\dfrac{\mathbf{x}'_{im}\boldsymbol{\beta}}{\lambda_l}\right)\right)^{\lambda_l}}. \tag{4}$$

Then the likelihood function for the model under consideration is:

$$p\left(\mathbf{y}\mid\boldsymbol{\beta},\boldsymbol{\lambda}\right)=\prod_{i=1}^{N}\prod_{j=1}^{J}\left(P(y_{ij}=1)\right)^{y_{ij}}, \tag{5}$$

where $\boldsymbol{\lambda}=(\lambda_1,\ldots,\lambda_K)$. If for all k we have $0\le\lambda_k\le1$, then the model is consistent with the principle of utility maximization for all possible values of explanatory variables, whereas when $\lambda_k>1$, it is only consistent for some values of these variables. The negative values of λ_k indicate that the obtained results are inconsistent with this principle (*Mikroekonometria*… 2012).

In this paper, the Bayesian approach has been used to estimate the parameters of the nested logit model (Lahiri & Gao 2002, Rossi, Allenby & McCulloch 2005). The Bayesian estimation requires selecting the prior distributions for the vector of parameters $\boldsymbol{\beta}$ and the vector of parameters $\boldsymbol{\lambda}$. In the case of the vector of parameters $\boldsymbol{\beta}$, depending on the prior information, flat prior distributions or normal prior distributions are most often selected. The overview of prior distributions for the vector of parameters $\boldsymbol{\lambda}$ can be found in the Lahiri and Gao (2002). In the present work, the following prior distribution was used:

$$p(\lambda)=\begin{cases}a\lambda^{a-1}\exp(-\lambda^a) & \text{for }\lambda>0,\\ 0 & \text{for }\lambda\le0.\end{cases} \tag{6}$$

For the nested logit model, the formula for posterior distribution can be written as follows:

$$p\left(\boldsymbol{\beta},\boldsymbol{\lambda}\mid\mathbf{y}\right)\propto p\left(\mathbf{y}\mid\boldsymbol{\beta},\boldsymbol{\lambda}\right)p(\boldsymbol{\beta})p(\boldsymbol{\lambda}). \tag{7}$$

In this paper, the Markov Chain Monte Carlo (MCMC) method, in particular the Metropolis algorithm (Gelman *et al*. 2000) and the Gamerman algorithm (Gamerman 1997), were used to determine marginal posterior distributions.

3. Scope of the Research

The study used a data set derived from the Generations and Gender Survey panel survey for Poland conducted as a part of the Generations and Gender Programme (GGP 2019). The data comes from the second half of 2014. The GGS survey is conducted on a random sample of respondents aged 18–79. Taking into account recent changes in the retirement age in Poland, in this study it was decided to extract from the entire data set those people who were between 18 and 65 years of age at the time of the research. In this way, a sample consisting of 9,805 observations was obtained. The endogenous variable was created on the basis of the answers given by the respondents to the following question: What in your opinion is important at work?

In response to this question, the respondents had to indicate what they believed to be the most important feature from the following set of possible answers:

1. Good pay.
2. Little stress (tension).
3. Stable employment.
4. Work generally respected by people.
5. Appropriate working hours.
6. Possibilities to show initiative.
7. Many days off from work.
8. Work that gives you the feeling that you can achieve something.
9. Responsible work.
10. Interesting work.
11. Work according to skills.

Based on a preliminary analysis of the responses, it was found that 51.98% of people indicated "good pay" and 23.24% chose "stable employment". None of the other nine alternatives were indicated by more than 8% of the respondents. On the basis of the theoretical foundations of the subject presented in the introduction, the categories: "good pay", "appropriate working hours" and "many days off from work" were combined into one. Then, for the purposes of modelling, a dependent variable was created in such a way that the value 1 was assigned to those three categories,

Table 1. A Set of Potential Explanatory Variables

Variable	Description of the variable	Names and labels of levels	Percent
sex	sex	0 = woman	58.06
		1 = man	41.94
age_group	age group	1 = from 18 to 34 years old	31.61
		2 = from 35 to 49 years old	29.07
		3 = from 50 to 65 years old	39.32
klm	place of residence during the survey	1 = city of 100,000 residents and more	40.41
		2 = city under 100,000 residents	18.70
		3 = rural areas	40.89
education	level of education	1 = higher	15.50
		2 = post-secondary and professional secondary	30.11
		3 = general secondary	11.19
		4 = basic vocational	27.16
		5 = primary	16.04
financial_situat	current financial situation of the household in the respondent's opinion	1 = good	13.29
		2 = average	59.46
		3 = poor or no response	27.25

Source: author's own calculations based on GGS data (2014).

2 was assigned to "stable employment" responses, and 3 to the other seven possible variants. The study analyzed what variables affected the thus--defined endogenous variable and how. A set of potential exogenous variables describing selected socio-economic and demographic characteristics of the respondents is presented in Table 1.

4. The Model Estimation

Among the possible answers to the question "What in your opinion is important at work?", factors related to occupational hygiene and motivating factors can be distinguished. The first group includes the categories "good pay", "appropriate working hours", and "many days off from work", while the second group includes the remaining categories. In the second group of factors, the answer "stable employment", which was indicated by as much as 23.24% of respondents, was particularly frequent. Therefore, the right research tool for modelling the three-level dependent variable defined in

section 3 is the nested multinomial logit model. The model with two nests was selected. Factors related to occupational hygiene were placed in one nest (variant 1) and motivating factors were placed in the second nest. The latter divided the responses to the "stable employment" option (option 2) and others (option 3).

Taking into account large sample size, all considered models were estimated using the non-informative prior distributions. In each model, the normal non-informative prior distributions with the mean 0 and the variance 100 were used to estimate the $\boldsymbol{\beta}$ parameter vector. The formula for the prior distribution for the lambda parameter is presented in Formula 6. To minimize the impact of initial values on posterior estimation, it was assumed that the number of burn-in iterations would be 500, and 20,000 chain states were accepted for the posterior reasoning. For sampling, the Metropolis algorithm or the Gamerman algorithm were used, depending on the model considered. Moreover, Figures 1 to 3 show the posterior density of parameters for the nested logit model, for the standard logit model, and for the nested logit model with sex variable, respectively.

First, the nested logit model and the standard logit model were estimated in order to compare their usefulness in modelling the studied phenomenon. The obtained results for the nested logit model are presented in Table 2, and for the standard logit model in Table 3. Evaluation of convergence of the Markov chains was made using the Geweke test. Based on the results obtained for both models, at the significance level of $\alpha = 0.05$, the null hypothesis that the obtained chains for the considered parameters of these models are convergent cannot be rejected (Table 2 and 3).

Then, for these two models, the values of the deviance information criterion (DIC) were compared (Congdon 2006). A slightly lower value of this statistic was obtained for the nested logit model, which means that this model fits better to empirical data than the standard logit model. In addition, the posterior expected value obtained for the lambda parameter was investigated. This parameter is used to measure the correlation between possible alternatives in the given nest. Under the assumed initial assumptions for the considered models, this parameter is only one, because the first nest is degenerated and consists of only one option. It was found that the lambda value is less than 1, hence the nested logit model is a better model for analyzing the preferences of the respondents compared to the standard logit model, because it takes into account the correlation between possible alternatives in the second nest. Therefore, the results obtained for this

model were interpreted. Also, the more complex nested logit models were estimated including the selected characteristics of the surveyed respondents.

Based on the results presented in Table 2, it may be concluded that if from the set of possible options all motivating factors apart from the "stable employment" factor were removed, then for the surveyed respondents the factors of work hygiene such as "good pay", "appropriate working hours" and "many days off from work" (option 1) would be more important, while option 2, including "stable employment", would lose importance, in both cases compared to option 3.

Table 2. Statistics of the Posterior Samples and Geweke Convergence Diagnostics for the Nested Logit Model

Parameter	Posterior expected values	Posterior standard deviation	Highest probability density interval (α = 0.05)		Geweke diagnostics	
					z	p-value
Option 1	0.7329	0.2686	0.2068	1.2655	1.4982	0.1341
Option 2	−0.0172	0.0313	−0.0808	0.0478	−0.2343	0.8148
Lambda	0.8957	0.3900	0.1381	1.6706	1.4006	0.1613

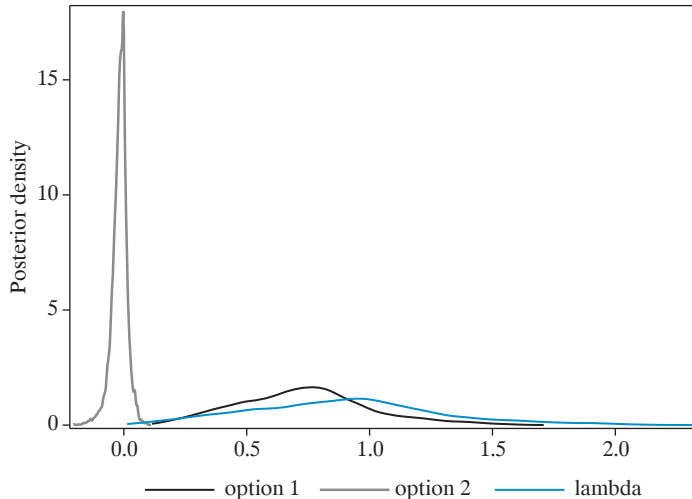Source: author's own calculations based on GGS data (2014).

Fig. 1. The Posterior Density of the Parameters of the Nested Logit Model

Source: author's own calculations based on GGS data (2014).

Table 3. Statistics of the Posterior Samples and Geweke Convergence Diagnostics for the Standard Logit Model

Parameter	Posterior expected values	Posterior standard deviation	Highest probability density interval (α = 0.05)		Geweke diagnostics	
					z	p-value
Option 1	0.8039	0.0250	0.7559	0.8530	−1.9512	0.0510
Option 2	−0.0211	0.0296	−0.0800	0.0356	−1.2450	0.2131

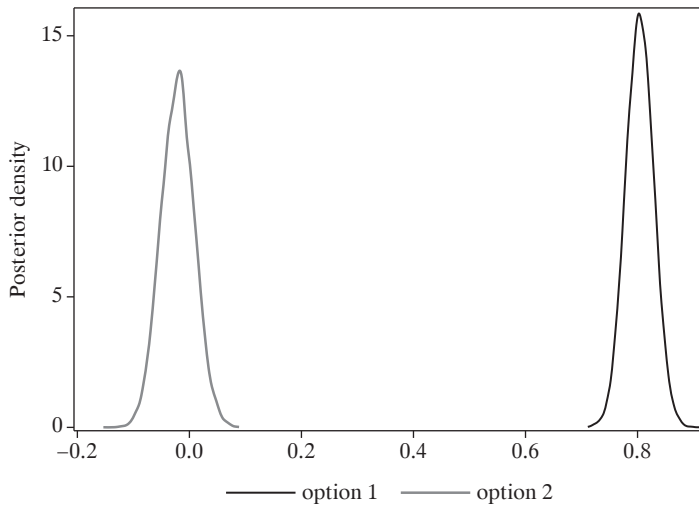Source: author's own calculations based on GGS data (2014).

Fig. 2. The Posterior Density of the Parameters of the Standard Logit Model

Source: author's own calculations based on GGS data (2014).

In the next stage of the research, the opinion of Poles about key aspects of their professional work were analyzed, depending on their socio--economic and demographic characteristics. This required the construction of models with interactions between the studied features and the considered alternatives. The introduction of interaction was necessary because for a given respondent for each possible option the values of considered variables are the same. These models were estimated using the same initial assumptions as in the first model. Before interpreting the results, the convergence of the generated Markov chains was evaluated using the Geweke test. Based on the obtained results, it was found that with the significance level α = 0.01, the null hypothesis that the obtained chains for the considered parameters of these models are convergent cannot be rejected (Tables 4 to 8).

First, a variable describing the sex of the respondent was included in the model. The obtained results are presented in Table 4. It was found that when all factors other than the "stable employment" option were eliminated from the set of possible motivating factors, in the case of women, compared to men, both alternative 1, i.e. occupational hygiene factors such as "good pay", "appropriate working hours" and "many days off from work", and, albeit to a lesser extent, alternative 2, i.e. "stable employment", were less preferred.

Table 4. Statistics of the Posterior Samples and Geweke Convergence Diagnostics for the Nested Logit Model with the *sex* Variable

Parameter	Posterior expected values	Posterior standard deviation	Highest probability density interval ($\alpha = 0.05$)		Geweke diagnostics	
					z	p-value
Option 1	1.0317	0.2875	0.4786	1.5931	0.2633	0.7924
Option 2	−0.00748	0.0585	−0.1292	0.1042	−0.7051	0.4807
Option 1 * sex0	−0.2741	0.0575	−0.3904	−0.1666	0.4325	0.6654
Option 2 * sex0	−0.0238	0.0755	−0.1739	0.1247	0.5072	0.6120
Lambda	1.0985	0.4125	0.3470	1.9381	0.4295	0.6676

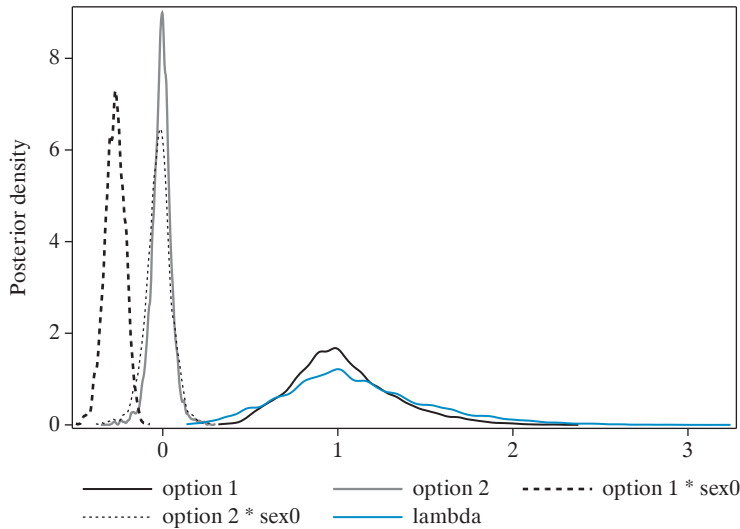Source: author's own calculations based on GGS data (2014).

Fig. 3. The Posterior Density of the Parameters of the Nested Logit Model with the *sex* Variable

Source: author's own calculations based on GGS data (2014).

For the variable describing the age group of the respondents, when option 3 was eliminated from the group of motivating factors, it was found that the youngest persons (from 18 to 34 years old) were more likely to choose option 1, i.e. factors related to work hygiene such as "good pay", "appropriate working hours" and "many days off from work", while option 2 – "stable employment" – suited them less compared to people aged 50 to 65 (Table 5). On the other hand, people aged from 35 to 49, as compared to the oldest ones, had in both cases a higher probability of choosing both the first and second alternatives compared to the third option. This probability was the highest for the first alternative i.e. occupational hygiene factors.

Table 5. Statistics of the Posterior Samples and Geweke Convergence Diagnostics for the Nested Logit Model with the *age_group* Variable

Parameter	Posterior expected values	Posterior standard deviation	Highest probability density interval ($\alpha = 0.05$)		Geweke diagnostics	
					z	p-value
Option 1	0.8677	0.3091	0.3173	1.5067	–1.6330	0.1025
Option 2	0.0240	0.0567	–0.0895	0.1373	–2.3833	0.0172
Option 1 * age_group1	0.0259	0.0806	–0.1493	0.1668	1.9839	0.0473
Option 1 * age_group2	0.2450	0.0752	0.1067	0.4023	0.4909	0.6235
Option 2 * age_group1	–0.3199	0.1461	–0.5945	–0.0467	1.8361	0.0663
Option 2 * age_group2	0.1652	0.1079	–0.0125	0.3957	0.6799	0.4966
Lambda	1.2032	0.4377	0.4366	2.1153	–1.4891	0.1365

Source: author's own calculations based on GGS data (2014).

Considering the model with a variable describing the place of residence during the survey (Table 6), it was found that respondents living in cities both above and below 100,000 residents (level 1 and 2) were less willing to choose both options 1 and 2 compared to option 3, in both cases compared to the residents of rural areas. At the same time, this inclination was lower in the case of the persons living in the cities below 100,000 residents.

The variable describing the respondents' level of education was included in the model as a binary variable, where a value of zero meant having a lower education than a higher education. It was found that people with

a lower education compared to people with a higher education had a higher probability of choosing both options 1 and 2 as compared to option 3 (Table 7). At the same time, these people were more likely to choose the factors related to work hygiene: "good pay", "appropriate working hours" and "many days off from work", than the "stable employment" alternative.

Table 6. Statistics of the Posterior Samples and Geweke Convergence Diagnostics for the Nested Logit Model with the *klm* Variable

Parameter	Posterior expected values	Posterior standard deviation	Highest probability density interval (α = 0.05)		Geweke diagnostics	
					z	p-value
Option 1	1.1873	0.3246	0.6041	1.8460	0.7916	0.4286
Option 2	0.1330	0.0788	0.00931	0.2971	0.1111	0.9115
Option 1 * klm1	−0.2823	0.0711	−0.4284	−0.1533	−1.2216	0.2218
Option 1 * klm2	−0.6559	0.1129	−0.8665	−0.4388	−0.1389	0.8895
Option 2 * klm1	−0.1330	0.1007	−0.3497	0.0353	−0.8915	0.3726
Option 2 * klm2	−0.4735	0.2011	−0.8859	−0.1271	1.0679	0.2856
Lambda	1.1973	0.4248	0.4393	2.0617	0.6845	0.4937

Source: author's own calculations based on GGS data (2014).

Table 7. Statistics of the Posterior Samples and Geweke Convergence Diagnostics for the Nested Logit Model with the *education* Variable

Parameter	Posterior expected values	Posterior standard deviation	Highest probability density interval (α = 0.05)		Geweke diagnostics	
					z	p-value
Option 1	0.1765	0.2486	−0.2742	0.6761	−0.2561	0.7979
Option 2	−0.3297	0.1575	−0.6501	−0.0723	0.5863	0.5577
Option 1 * education0	0.8303	0.1044	0.6502	1.0545	−0.6052	0.5451
Option 2 * education0	0.3831	0.1795	0.0979	0.7600	−0.7285	0.4663
Lambda	1.0937	0.4405	0.2771	1.9700	−0.2695	0.7875

Source: author's own calculations based on GGS data (2014).

The last of the variables considered was a variable describing the current financial situation of the household in the respondent's opinion (Table 8). Respondents who assessed the financial situation of their household as good compared to people who assessed the financial situation of their

Table 8. Statistics of the Posterior Samples and Geweke Convergence Diagnostics for the Nested Logit Model with the *financial_situat* Variable

Parameter	Posterior expected values	Posterior standard deviation	Highest probability density interval (α = 0.05)		Geweke diagnostics	
					z	p-value
Option 1	1.4140	0.3520	0.7862	2.1353	2.3417	0.0192
Option 2	0.2534	0.1157	0.0545	0.4909	1.4187	0.1560
Option 1 * financial_situat1	–1.1227	0.1667	–1.4575	–0.8045	–2.3809	0.0173
Option 1 * financial_situat2	–0.4711	0.0770	–0.6226	–0.3294	–0.9936	0.3204
Option 2 * financial_situat1	–0.8966	0.3333	–1.5976	–0.3211	–2.3732	0.0176
Option 2 * financial_situat2	–0.2238	0.1180	–0.4546	–0.0134	–1.1124	0.2660
Lambda	1.2331	0.4393	0.4801	2.2030	2.3562	0.0185

Source: author's own calculations based on GGS data (2014).

household as poor or did not answer this question had the lowest probability of choosing a variant including factors related to work hygiene – "good pay", "appropriate working hours" and "many days off from work" – compared to motivating factors, except for the "stable employment" option. In addition, people who assessed the situation of their household as good compared to those who rated it as poor preferred option 2 – "stable employment" – as compared to option 3. Among those assessing the situation of their household as average compared to people assessing the situation of their household as poor, a slightly lower tendency to choose both options 1 and 2 was observed, in both cases compared to option 3. To sum up, it is worth emphasizing that some of the results should be treated in a suggestive way, because not in all the cases considered were the posterior expected values significantly different from 0.

5. Summary and Conclusions

This work presents a model approach to the analysis of the preferences of Poles about key aspects of professional work. One of the most popular methods in modelling economic activity, including employment and unemployment, is the logit model (Baranowski *et al*. 2016, Kubiak 2017, Śliwicki 2013). In this paper, discreet selection models have been used

to analyze the occupational hygiene factors and the motivating factors. Attention was paid to the possibilities and limitations of these models, which are commonly used to model consumer preferences (*Mikroekonometria…* 2012). Due to the frequent connections between the possible alternatives of choice, the use of nested logit model to model the preferences of respondents was proposed in this study.

It was found that once motivating factors such as "little stress (tensions)", "work generally respected by people", "possibility of showing initiative", "work that gives you the feeling that you can achieve something", "responsible work", "interesting work", and "work according to skills" are eliminated, for the surveyed respondents an important role is played by factors related to work hygiene, such as: "good pay", "appropriate working hours" and "many days off from work", but the option "stable employment" becomes less important. In addition, it was shown that the decisions of respondents differed depending on their socio-economic and demographic characteristics.

For women, compared to men, both options related to occupational hygiene and "stable employment" were less important than the other motivating factors. However, for younger people (from 18 to 34 years old and from 35 to 49 years old), in comparison to people from the last age group (from 50 to 65 years old), options related to occupational hygiene were also important. Moreover, for young people (from 18 to 34 years old) employment stability did not matter much. Persons without higher education, compared to people with higher education, paid greater attention both to factors related to occupational hygiene such as "good pay", "appropriate working hours" and "many days off from work" and to the motivating factor "stable employment". For the respondents assessing the financial situation of their household as good or average, as compared to those assessing the financial situation of their household as poor and those who did not provide information, both options related to occupational hygiene and the "stable employment" option were of less importance compared to other motivating factors. Similar results were obtained for city residents, both of cities above and below 100,000 residents, compared to residents of rural areas. Summing up, this paper identifies groups of respondents for whom good pay is not necessarily the most important factor in professional work, and so-called higher needs are also important.

The relatively good situation on the labour market means that employers have more and more problems in finding and retaining well-qualified employees. There is a large turnover of employees with high qualifications,

and the departure of such employees often entails large costs for the company (Grzenda & Buczyński 2015). This study presents those factors that are important for Poles in their professional work depending on their socio-economic and demographic characteristics. The results of the study can contribute to the solutions that companies should implement if they want to acquire valuable employees and keep them as long as is necessary in their organizations. Providing employees with appropriate working conditions can also affect the results they achieve, increase work efficiency, and thus contribute to the growth of an organization's profits.

Acknowledgements

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Anna Gołdyn

THE IMPACT OF THE GREY ZONE ON THE ECONOMY IN POLAND

Abstract

Objective: This study analyzes the phenomenon of the grey zone in Poland and identifies the tax gap in Poland caused by its development. This raises the question of the extent to which the shadow economy affects the Polish economy, and in particular its contribution to the tax gap.

Research Design & Methods: The article is based on grey zone data in the Polish economy. The data was obtained from the EY Economic Analysis Team report as well as from the CASE report for the European Commission on the VAT gap.

Findings: The study shows that the impact of the grey zone on the economy is multi-faceted. The growth of the grey zone is largely due to the government's mismanagement of economic policy. In turn, the reason for the reduction in the grey zone in Poland is the reduction in the amount of tax fraud through the use of better government measures and an increase in cashless transactions. The results show that although the grey zone in Poland has been increasing since 2019, it remains at a similar level to before. By contrast, since 2015 the tax gap has reduced by more than 20%.

Implications/Recommendations: The study shows that in order to reduce the negative phenomenon of the grey zone in the economy, effective measures should be taken through the application of appropriate economic policies. The actions of the government should be focused on eliminating systemic factors that favour activities which are not officially registered. It is through the development of unregistered activities that the government loses tax revenue.

Contribution: The article contributes to the literature on the changing size of the grey zone in Poland over the last decade. The analysis enhances our understanding of how the impact of this phenomenon on the Polish economy changed in recent years.

Keywords: grey zone, economy, tax gap, labour market.
JEL Classification: E24, E26, J46, O17.

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1. Introduction

The phenomenon of the grey zone in the economy has been of interest to academics for a number of years. The way it operates is complex and multidimensional. It is difficult to estimate the true size of the grey zone because it is not possible to summarize all the reasons for its existence and the factors contributing to its development. This, in turn, makes it difficult to effectively scale down and completely eliminate this phenomenon. However, regardless of the size of the grey zone, its impact on the economy is negative.

The concept of the grey zone cannot be defined in a consistent way. The variety and complexity of its processes have influenced how many of the definitions of the grey zone operate in the language of economics. These definitions vary depending on the purpose of research and on the methods used to study it (Schneider & Enste 2000). The basic definition presents the grey zone as all activities carried out in the area of the state economy which contribute to official GDP growth but which remain directly unregistered. These are activities which are not prohibited by law, but which involve conducting illegal trade in legal goods and services, and the income derived from that trade is hidden in whole or in part from the public administration.

The phenomenon of the grey zone has permanent effects. It not only affects the markets of underdeveloped countries and economies in transition, but is also present in all economies around the world and in almost all industries (Krajewska 1998). All economic actors can observe its effects with varying degrees of intensity. If the investment conditions of a state are favourable, corruption is low, and there is a high level of awareness in society about the harmful impact of the grey zone, then its size will be negligible. By contrast, in poorer countries, where taxes are not too high but corruption is a widespread phenomenon, and society calls for such practices, then the tendency to conduct business in the grey zone will be relatively high.

After exhibiting a downward trend for several years, the shadow economy is on the rise again in Poland. Growth has been recorded since 2019. The COVID-19 pandemic, as well as rising inflation and the war in Ukraine, have all contributed to it. The war has an impact on the shadow economy in that it increases the costs of running a business, which are reflected in the need to look for savings through illegal practices (Cieślak-Wróblewska 2022a). The rising costs of running a business do not have a positive impact on the number of people taking up work in an officially registered manner. An analysis of the shadow economy can indicate the policy direction that

the Polish government should follow in order to limit the development of this phenomenon.

The purpose of this paper is to analyze the grey zone in Poland and identify the tax gap caused by its development. This raises the question of the extent to which the shadow economy affects the Polish economy, and in particular its contribution to the tax gap. In order to analyze this phenomenon, quantitative data based on desk research are used. By using this research method, it was possible to present the changes in the grey zone in Poland between 2013 and 2021. This method was also used to present the changes in the tax gap, which is closely related to the size of the grey zone. Indeed, the grey zone is to some extent responsible for the incidence of the tax gap.

2. Literature Review

Researchers have a problem with defining the shadow economy. The most popular view is that the unofficial economy is the one that, while creating new value, is not subject to registration in the national accounts. We do not take into consideration the production activity of households aimed at their own needs. Also, for many experts, avoidance of taxation is the main motive for locating entities in the unobservable economy. In connection with this, the shadow economy is often referred to as tax abuse (Pasternak-Malicka 2019).

The grey zone consists of the following activities (Pauch 2015):

– illegal activity – this includes trade in goods and services, the possession, sale and distribution of which is prohibited by law. An activity which is normally legal but becomes illegal if it is carried out in a situation where no licence or authorization has been obtained, e.g. medical practice, legal practice, taxi transport, is also considered illegal. The most common activities carried out outside the area of state control are the smuggling of tobacco products, the production and trafficking of drugs, and deriving income from the prostitution of others. It is not possible to clearly identify entities operating illegally in the grey zone. They are generally unregistered economic entities, usually criminal gangs, but the participation of registered and legally operating companies in illegal activities is increasing;

– hidden activity (undeclared) – this refers to activities carried out by officially registered economic entities whose transactions are not against the law, but are not reported to the tax authorities, because the amount of turnover is deliberately understated. Such activity is pursued in order to

avoid payment of taxes such as income tax or VAT and to avoid payment of social security contributions. The desire to hide the amount of turnover from the public administration is also associated with non-compliance with the standards required by law, e.g. minimum wage, maximum working hours, occupational health and safety, technical standards, and environmental regulations;

– informal activity – this involves not keeping any records. Most often it concerns individuals providing paid services to other persons or enterprises. The total lack of registration of their activities is most often the result of the small scale of the services provided or may be dictated by the casual or seasonal nature of the work undertaken. This group consists of: unemployed people with little chance of finding work on the official labour market due to, for instance, low qualifications; employees who want to earn extra money in the grey zone, sometimes using their employers' materials, equipment and devices for this purpose; pensioners; students; and migrant workers.

The main reasons for the development of the shadow economy are considered to be the high costs of doing business that are directly related to the tax system and the excess of economic regulations imposed on enterprises by the state. From the point of view of the entrepreneur, the most significant and burdensome costs are tax costs (income tax, VAT), followed by social insurance contributions and administrative fees depending on the type of activity carried out (Fundowicz, Łapiński & Wyżnikiewicz 2018). The greater the propensity of entrepreneurs to move their activities into the grey zone, the higher the costs of doing business legally. Economic overregulation e.g. the need to obtain the concessions permits authorizations necessary to carry out certain activities, the excess of compulsory forms and declarations, and excessive and frequent inspections carried out by various state institutions discourage entrepreneurs from doing legal business. Many publications suggest that the emergence of a grey zone is associated with the violation of ethical principles in the application of law and points to the weakness of the state; it is manifested, for instance, in discretion on the part of officials, corruption, and the ineffectiveness of the justice system (Szwałek 2003).

The existence of a few positive aspects of the economic impact of the grey zone is only a consequence of the imperfection of the economic system and does not change the overall negative influence of this phenomenon; it should not therefore be regarded as an aspiration in itself (Łapiński, Peterlik & Wyżnikiewicz 2014). National governments must draw up economic programmes that balance economic and social issues and propose measures

to systematically and progressively reduce the size of the grey zone. This should be done by pursuing an appropriate economic policy directly aimed at eliminating systemic factors conducive to the development of undeclared activities. The most important elements of such a policy should be measures aimed at (Fundowicz *et al*. 2016):

– simplifying the tax system,

– reducing the fiscal burden,

– reducing the non-tax operating costs of conducting economic activity,

– reducing the number of regulations (including the number of permits and authorizations),

– limiting the necessary number and scope of inspections in companies,

– supporting the development of cashless trading (e.g. through the promotion of electronic payments and the introduction of administrative restrictions on cash payments).

An effective method of reducing the size of the grey zone that is widely used by many countries is the promotion and popularization of non-cash trading. In the grey zone, payments are made only in the form of cash transactions, which leave no audit trail in the financial system and therefore make it impossible to establish that the activities concerned are illegal (Pauch 2015).

3. Research Methods

The principal characteristic of activities undertaken within the grey zone is that they are not registered and remain unnoticed by administrative authorities. It is therefore difficult, but not impossible, to analyze the actual size of the grey zone phenomenon. To that end, the following analyses are used (Fundowicz *et al*. 2016):

– analysis of the labour market – this enables the involvement of employees in business in the grey zone to be assessed. It uses a comparative method of the number of registered unemployed and the number of unemployed estimated using the International Labour Organization's definition;

– fiscal analysis – this refers to examining the level of tax evasion;

– analysis of the monetary sphere – this consists in assessing the speed of cash turnover and the demand for high-denomination banknotes, which are typical for settlements made in the grey zone;

– comparative analysis in the national accounts – based on the differences between household income and expenditure. Indeed, statistical studies show

that expenditure exceeds household income and savings, which suggests that this is the result of income received from the grey zone;

– econometric modelling – this looks for relationships between variables describing the grey zone;

– random and curiosity approach – this is an estimate of selected aspects of the grey zone, e.g. an analysis of electricity consumption in different locations assuming that above-average consumption indicates activity in the grey zone.

The methods used to measure the informal economy can be divided into two groups: direct methods and indirect methods. Direct methods include questionnaire research, while indirect methods include analysis of macroeconomic data. Compared to questionnaire surveys, indirect methods do not have any of the disadvantages typical of questionnaires, e.g. subjective assessments of people directly involved in creating the shadow economy. There are also no restrictions related to the number of respondents here (Czapkiewicz & Brzozowska-Rup 2021).

In order to analyze this phenomenon, quantitative data based on desk research were used. By using this research method, it was possible to present the changes in the grey zone in Poland between 2013 and 2021. This method was also used to present the changes in the tax gap, which is closely related to the size of the grey zone. Indeed, the grey zone is to some extent responsible for the incidence of the tax gap. The data was obtained from the EY Economic Analysis Team report as well as from the CASE report for the European Commission on the VAT gap.

4. Results

Currently, two conditions are identified that contribute to the reduction of budget revenues from taxes (Buszko 2017):

– grey zone, i.e. conducting business that is not registered to avoid taxes,

– tax fraud.

In addition, the elements that have an impact on the reduction of budget revenues are social acceptance of tax avoidance and lack of appropriate legislation (Buszko 2017). According to a study on the measurement of the grey zone in Poland carried out by the Institute of Economic Forecasts and Analyses, in the years 2013–16 the grey zone remained at a similar level. However, Figure 1 shows that it began to get bigger from 2020. It was estimated that it could reach 18.9% of GDP in 2022 (PLN 590 billion),

whereas in 2021 it amounted to 18.3% (PLN 511 billion), and in 2020 – 18% (PLN 449 billion) (Cieślak-Wróblewska 2022b). This study focuses on measuring gross value added to cash payments, which is defined as the cash shadow economy.
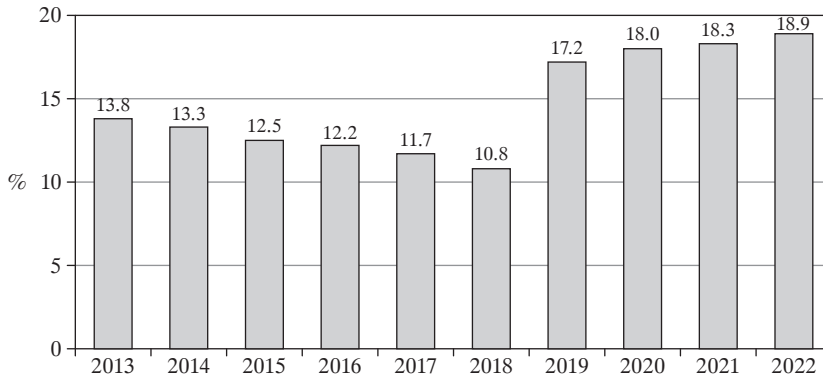

Fig. 1. The Level of the Grey Zone in Poland, 2013–2022

Note: for 2022 – estimated value.

Source: author's own elaboration based on data from the EY Economic Analysis Team (EY EAT 2020) and Statistics Poland.

The factors supporting the level of the grey zone in Poland include:
– economic results that are related to the state's economic situation or unemployment rate,
– GDP per capita,
– level of income per person in the family,
– level of taxation (PIT, CIT, excise duty),
– the complex tax system is cited as a key factor.

Concern about the income situation and standards of living also contributes to the development of the grey zone in Poland (Buszko 2022).

Given this phenomenon, it is important to analyze the tax gap. Compared to the grey sone, the tax gap is the difference between the value of the taxes that should theoretically be collected and the actual value of tax revenues. The grey zone, in turn, covers a wide range of unregistered activities and is responsible for only part of the tax gap. The loss of VAT revenues has a negative impact on spending on public goods and services, including schools, hospitals and transport, which are used by all Poles (Słomski 2022).

Figure 2 shows the level of the tax gap in Poland in the years 2013–21. Since 2013, the size of the tax gap has been falling. The decline continued until 2018. The tax gap then decreased from more than 25% in 2013 to 11.7% in 2018. In 2019, the level of tax gap was similar to the previous year. However a downward trend is observed from 2020 onwards.
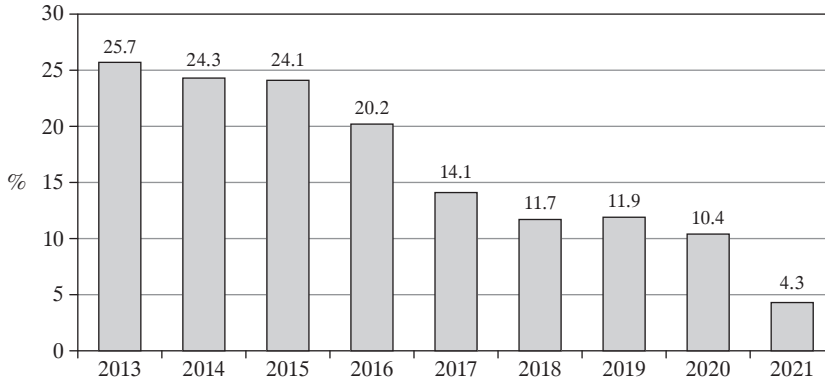

Fig. 2. The Tax Gap in Poland, 2013–2021

Source: author's own elaboration based on data from EC (2021).

Throughout the period under analysis, there was a systematic decline in the cash grey zone. This was facilitated by the proliferation of non-cash transactions, resulting in a reduction in the value of the VAT gap. The most visible decline in the gap was seen between 2016 and 2017. This decrease was due to a reduction in tax fraud. Another significant decline was recorded in 2021, which attests to the improved actions of the government in combating tax fraudsters. The decrease is noticeable, because over a period of almost 10 years, the tax gap has decreased from more than 25% to 4.3% in 2021.

5. Conclusions

The aim of the study was to analyze the phenomenon of the grey zone in Poland and to identify the tax gap in Poland caused by its development. The study showed that the grey economy is multi-faceted problem that arose as a result of the consequences of the economic policy pursued by the state. Its growth was mainly due to the tax system, which for many entrepreneurs is complicated and does not allow them to derive satisfactory income from their activities. The implementation of corrective and preventive measures

faces various obstacles, but is necessary in order to make the public aware that the impact of the grey zone is harmful and that it is in the public interest to curtail it. The results demonstrated that although the grey zone in Poland has been increasing since 2019, it remains at a similar level to before. By contrast, since 2015 the tax gap has reduced by more than 20%.

The existence of a grey zone distorts key economic indicators, such as the level and dynamics of GDP, inflation, and employment, which makes achieving the goals of a rational economic policy chaotic and ineffective. The grey zone decreases state budget revenues, which contributes to the formation of a budget deficit in the long run. It causes a general weakening in the efficiency of the economy, reduces the degree of public confidence in the state, and increases state budget expenditure on social programmes. The grey zone interferes with the proper functioning of market mechanisms. Business entities operating in the grey zone often become more competitive than companies operating fully legally. By avoiding taxation, and thus unfairly reducing their costs, they can offer goods and services at lower prices. This distorts the basic concept of competition, since the prices at which such goods can be purchased in the grey zone cannot be offered by non-tax evaders. In periods of economic downturn, when consumer incomes are not growing rapidly or are falling, the price criterion plays an important role. The bad economic situation and the need to measure up to unfair competition forces companies that pay their taxes honestly to move their activities into the grey zone. In a situation where the most important factor determining sales is price, other aspects of competition, such as the quality or innovation of products and services, are becoming increasingly important. On a macroeconomic scale, less investment in research and development means a decline in the innovation and international competitiveness of the economy. It also indirectly affects the rate of economic growth. In this way, the negative effects of the microeconomic grey zone extend to the macroeconomic dimension. The impact of the grey zone on the economy is generally negative, but there are also positive aspects of the operation of the market in this area. The grey zone creates opportunities for unregistered work, especially for those with low or no professional qualifications who cannot find employment in the official economy. The income they earn is spent mostly in the legal economy and contributes to state budget revenues via VAT. It also translates into relief for the state budget as regards spending on social benefits for those persons and their families (Fundowicz, Łapiński & Wyżnikiewicz 2018). Undeclared work also means lower employment

costs for employers, who bypass administrative barriers and thus recruit workers for short periods of time in order to get the necessary work done more quickly (Pauch 2015).

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