ECONOMIC TENDENCY SURVEYS AND ECONOMIC POLICY— MEASURING OUTPUT GAPS AND GROWTH POTENTIALS

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Poznań 2022

The project implemented with Narodowy Bank Polski under the economic education programme

The publication was possible thanks to the project 20031P0DE62F financed by Narodowy Bank Polski. The opinions expressed in this publication are those of the authors and do not represent the position of Narodowy Bank Polski.

ISBN 978-83-8211-128-6
eISBN 978-83-8211-129-3
https://doi.org/10.18559/978-83-8211-129-3

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PREFACE

Business tendency surveys provide information which is valuable to the respondents themselves as well as to economic policy makers and analysts. This is the area of special interest for economists working in governments, national banks, statistical offices and for scientists.

CIRET international conferences are the meeting place for top scientists from all over the world and they successfully integrate academic and business community involved in business survey and business cycles. The conferences are held every other year, the academics from Poland have been involved in these events for more than 30 years. Year 2021 was special for two reasons: the conference was held in Poland, and it was the first online conference in CIRET history.

The book contains a selection of topics that have been discussed at 35th CIRET Conference titled **Economic Tendency Surveys And Economic Policy: Measuring Output Gaps and Growth Potentials**, which took place from 15 to 17 September 2021 in Poznań, Poland.[1]

The conference had 72 participants from 23 countries. It was organized together by KOF/CIRET (Switzerland) and Poznań University of Economics and Business (Poland). Part of the event was the Pre-Conference Workshop "Globalization and Economic Statistics: Challenges and Opportunities" organized by the United Nations Statistics Division (UNSD—USA), Poznań University of Economics and Business (Poland), and the KOF Swiss Economic Institute (Switzerland).

The CIRET organization committee:

- Jan-Egbert Sturm (KOF),
- Vagner Ardeo (FGV),
- Klaus Abberger (KOF),
- Katharina Bloch (KOF),
- Simone Egloff (KOF).

[1] Conference websites: https://www.ciret.org/conferences/, https://ue.poznan.pl/en/news,c16/konferencje,c14271/35th-ciret-conference-2021,c14270/ (local).

Suggested citation:
Białowąs, S. (Ed.). (2022). *Economic tendency surveys and economic policy—measuring output gaps and growth potentials*. Poznań: Poznań University of Economics and Business Press. https://doi.org/10.18559/978-83-8211-129-3

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- Jacek Jankiewicz (PUEB),
- Robert Skikiewicz (PUEB),
- Zuzanna Urbanowicz (PUEB).

The research area of all papers is the economic tendency surveys. The selection is driven around two goals. The first is to develop and improve research methods used in business tendency research, while the second is the assessment of the current situation. These goals are reflected in the structure of the book. The first part contains articles on the method in the articles, both trends related to the research of methods are presented, as well as the use regarding a broad range of methods applied in assessing the market economic situation. The second part of the book is focused on the use of methods and situation assessment.

The methodological part starts with the paper *Determinants of sample selection in business climate survey within the sector of banking and financial institutions*. The authors focus their attention on the methodology of research in the banking sector, its changes, and the possibilities to seamlessly match the results before and after the changes. The authors participated in the Institute for Economic Development (IRG) research, carried out for several years. After 20 years of conducting the research, the method needed to be refreshed. Thus, they describe expected changes in methodology and highlight challenges: maintaining continuity and comparability of historical data with that new; change of question wording or even meaning; and finally, unification of the survey to cover specifics of a number of individual market segments while, at the same time, obtaining comparable market data. Another two issues are mentioned and analysed in the text: the decreasing number of banks in the sector (influencing representativeness of the study), and the rising importance of other, non-bank institutions in the financial sector. Based on this analysis, the authors recommend some modifications of the business climate

surveys in the banking sector as part of the research palette regarding the SGH Institute of Economic Development. Those most important are: extending the sample, maintaining comparability of variables, including a testing period for new solutions and generating parallel results.

The next paper is titled *Use of Business Tendency Survey data in output gap estimation*, in which the results of an empirical study on the commonly-used macroeconomic indicators of business cycles in output gap estimation are examined. The authors focus their attention on principal component analysis (PCA). The obtained empirical evidence allows to confirm the usefulness of qualitative indices in modelling the output gap and, at the same time, to support the conclusions that inflation and current account balance are not adequate indicators of the cycle in Poland. The cyclical component achieved using PCA is highly correlated with the cyclical component of the RIED barometer and real GDP change. In this study, the correlation was confirmed between output gap, estimated via principal components based on selected macroeconomic indicators and business tendency surveys data, and the output gap measured by the real GDP growth rate. The authors prove that the traditional business cycle indicators (consumer price index and current account balance) generate ambiguous signals and, hence, are not suitable for output gap estimation. It turns out, however, that they can be successfully substituted for business tendency survey data, which contains valuable information about the current and anticipated state of an economy.

In the paper titled *Automatic turning point identification with the HMM-based indicator*, its author deals with the construction of early warning indicators and the detection of business cycle turning points. A proposal for a new, highly parametrisable method regarding quantitative representation of the business cycle is presented. The author investigates a combination the recognised asymmetric Christiano-Fitzgerald filter and the Bry-Boschan routine of cyclical turning point selection as a simplification of the previously proposed procedure. The basic idea of the remaining part of the HMM Signature Indicator procedure lies in the definition of the signature, which captures the pattern in the considered time series just before the peak or during. An integral part of the research was validation of the presented approach by designing two different HMM Signature Indicators (based on RIED SGH research).

In the article *Monetary policy under continuous market sentiment regimes*, a novel econometric method is prosed for analysing monetary policy under regimes that include the economic sentiments of unobserved agents.

The results indicate differences in the effectiveness of the monetary policy between the high and low economic sentiment regimes, both countries reacting in a similar way to the sentiment. In general, the low level of economic sentiment conducting monetary policy can become more challenging, as the reaction time for the economy increases and the changes in monetary policy need to be more vital to take effect.

The presented results are preliminary but very promising. Developing and confirming the method should lead to better policies and recession recovery programmes.

The paper titled *Do survey responses in manufacturing fluctuate along with business cycle? Evidence from Poland* opens the part of the book devoted to evaluations of business climate. The author investigates contraction and expansion phases in Poland, finding that during the contraction phases, absolute values of balance statistics are both lower, as measured by mean and median, and less volatile than during expansion phases. Her finding suggests that in hard times, enterprises are less likely to form opinions or expectations much different from the consensus. As far as the depth of the downturns is concerned, the contractions associated with the financial crisis appear worse, both with respect to observed and expected changes than in the case of the 2000–2002 slowdown. The author confirms excessive volatility in expansion phases, more often for observed changes than for forecasts. Lower uncertainty is visible in contraction phases, especially at times of financial crisis.

In the paper *Anti-inflation policy in Poland's economy during the period of transformation and integration*, the authors decided to have closer look at the inflation and scope of operation regarding the monetary and fiscal policy instruments applied by the anti-inflation policy in Poland, and went further to empirically evaluate the effectiveness of the policy for Poland's economy. At the beginning, the authors discuss the origin of inflation processes, and the National Bank and fiscal bodies policies to combat price increases. The second part contains the results of econometric analysis concerning the anti-inflation impact of the monetary and fiscal policy tools applied in Poland's economy in the recent twenty years. The authors explain the inflation processes in Poland both from the point of view of monetarist and Keynesian economics. They emphasize the high volatility of Polish anti-inflation policy and its historical changes. This empirical analysis allows to show that among the applied tools of monetary and fiscal policies, an anti-inflation nature of the relationship was found between both of the monetary policy instruments and prices, and also linked budget expenditures to the price level. Another conclusion is that variation of budget incomes did not facilitate price stabilisation in the Polish economy.

In the paper *Relationships between cyclical fluctuations in the banking and the services sectors in Poland*, the relationship is explored between cyclical fluctuations in the banking sector and the sections as well as divisions of the services sector in Poland.

The results of analyses conducted on the basis of data from business tendency surveys are presented. Results are given for cross-correlation analysis, in which the maximum length of lags and leads equal to four quarters was adopted.

The results of the analyses presented in the paper allow to conclude that synthetic the PIKBANK indicator from the business tendency survey conducted in the

banking sector can be classified as a leading or coincident indicator in relation to the general business confidence indicator (GBCI) for most of the services sectors. The length of PIKBANK lead or lag in relation to the general business confidence indicator (GBCI) is similar, regardless of the formula used to calculate quarterly values.

Household financial behaviour reflects preferences concerning intertemporal choice and strongly influences the whole economy. Allocating consumption in time, households balance their exposure to liquidity risk and modify their ability to withstand financial shocks. Consumer sentiment is the main factor shaping the decision-making processes of households.

The paper *Financial behaviours of households in European union countries—similarities and differences within the 2004–2016 period* concerns estimations of the relationship between economic sentiment (Economic Sentiment Indicator) and the shaping of household saving rates, as well as and household debt-to-income ratios. The results allowed the authors to describe similarities and differences in the financial behaviours of European Union households. The analyses cover 19 European countries between 2004-2020. The analyses conducted in the paper prove a significant relationship between Economic Sentiment Index and variables describing the financial behaviour of households, such as household saving rate and debt-to-income ratio. The countries form groups of similar indices, and the analysis of similarities conducted at three time points did not show significant changes in the structure of the groups.

In the closing paper titled *The propensity of Polish households to consume and save within the context of the COVID-19 pandemic*, consumer confidence indicators are used to examine changes in the propensity to consume and save among Polish households faced by the abnormal and dramatic situation bringing multifarious uncertainty into people's lives: the global COVID-19 pandemic. The calculations presented and the comparison of selected indicators show that changes in consumer sentiment, particularly in the propensity to consume and save, were largely very similar at the time of the pandemic to those occurring in response to the Great Recession. Uncertainty related to a deteriorating situation, regardless of its causes, contributes to a marked increase in the propensity to save. Furthermore, it can be assumed that during the pandemic, the degree of uncertainty, and thus, the level of anxiety about the future, was probably even greater than usual. After all, the situation that developed was unprecedented in the world.

In the nine papers presented, the variety within the scientific area of business tendency is shown. The works allow to prove the strong position of Polish science in this area as well. The publication was possible thanks to the project 20031P0DE62F financed by Narodowy Bank Polski.

Sylwester Białowąs

PART 1.
FOCUS ON METHODS

DETERMINANTS OF SAMPLE SELECTION IN BUSINESS CLIMATE SURVEY WITHIN THE SECTOR OF BANKING AND FINANCIAL INSTITUTIONS

https://doi.org/10.18559/978-83-8211-129-3/1

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Abstract

The aim of this study is to propose new directions of changes in research methodology, which are necessary due to the statistical quality of analysis and, at the same time, to take into account and adapt to the evolutionary changes in the Polish banking and financial sectors. An important criterion for the proposed recommendations is to maintain continuity and comparability of results in the period both before and after considering the new methodology.

In this study, two subject areas are covered: (i) assessment of the sample selection, and (ii) an overview of the proposed evolution of the survey. With regards to the first area, the main focus of analysis is placed on the decrease in the number of banks in the sector (including the aspect of statistical representativeness of the study). In the second case, focus is shifted towards the rising importance of other non-bank institutions in the financial sector as well as their impact on the national economy.

The development of a new survey is accompanied by three key considerations. First, it is a premise for maintaining continuity and comparability of historical data with that new. Secondly, the questions asked in the survey were reviewed and critically selected. Some questions, which were asked 20 years ago, are now not only less relevant, if not meaningless. On the other hand, recent developments in the banking sector are significantly different to the ones occurring 20 years ago. As such, it is now necessary to review the posed questions and ensure that they survey covers a wide spectrum of new issues reflecting these developments. Finally, the need to extend the sample to other financial market segments poses a challenge of unifying the survey to cover specifics of a number of individual market segments while, at the same time, obtaining comparable market data.

Keywords: banks, banking sector, financial sector, financial institutions, economic situation in the banking sector, sampling, methodology for analysing the economic situation in the banking sector.

JEL codes: C81, C83, E32, G2, G21, G22, G23.

Suggested citation:
Cholewiński, R., & Kluza, S. (2022). Determinants of sample selection in business climate survey within the sector of banking and financial institutions. In S. Białowąs (Ed.), *Economic tendency surveys and economic policy—measuring output gaps and growth potentials* (pp. 15–29). Poznań: Poznań University of Economics and Business Press. https://doi.org/10.18559/978-83-8211-129-3/1

Introduction

The Economic Development Institute (IRG) has been conducting business climate surveys in the Polish economy since the 1980s (Adamowicz, 2008), which have resulted in the following indicators:

- industrial confidence indicator (ICI);
- consumer sentiment index (CSI)—condition of households;
- construction confidence indicator (CCI);
- agricultural confidence indicator (ACI);
- banking confidence indicator (IRGBAN), and
- IRG SGH barometer (BARIRG).

The business climate survey in the banking sector was the last to supplement a wide range of business climate surveys conducted by the IRG. The idea to develop this research was born in the second half of the 1990s, along with the development and growing importance of the banking sector in the market economy during the transformation period. In 1997, work began on a methodology for analysing the business climate for the banking sector (Kluza & Kluza, 1998).

The research proposal prepared at that time, as well as methods for constructing forecasts and indices, have become the basis for conducting research over the last 20 years. As there have been no changes in the sample selection, survey structure or index construction, data collected over that time remained consistent, which is one of the major benefits of this survey.

On the other hand, the last 20 years of transformation have been characterised by dynamic development and numerous changes in the Polish economy. Similar processes could be observed in the entire financial sector, including the banking area. While in the 1990s the banking sector served as a benchmark for almost the entire financial sector, nowadays, attention must also be paid to the insurance sector and capital markets. In addition, the technological revolution that happened in financial services was not something that could have been fully predicted in the 1990s. Another determinant of the financial sector developments in the 21st century was the Great Financial Crisis started by the collapse of Lehman Brothers in 2008. It showed governments and public authorities the utopia of market self-regulation. Reflection on the fact that financial stability is a public good resulted in increased involvement of the state in functioning of the financial sector, and in particular, the banking sector. Since then, there has been significant development of financial market supervision institutions and an increased level of new regulations. All these events resulted in a significant change in the environment and conditions for doing business in the financial industry. The identification of these events should properly be reflected in the examination of business processes in the banking and financial sectors.

1. Research development

After 20 years of conducting business surveys in the banking sector, it is tempting to make corrections and modifications to the original survey. It is also an opportunity to assess whether the goals set for the study had been accomplished over that time. As a next step, it is also worth setting new research challenges. In the authors' view, it is worth undertaking a comprehensive review of the entire study and, at the same time, proposing various modifications. This study refers to 2 areas of further development of the study:

- sample selection,
- survey questionnaire update.

In the first case, the sample representativeness is assessed, i.e. whether the proposed group of entities identified 20 years ago is large enough in order to continue the survey in the future, and also whether the processes taking place in the financial sector have not meant that it should be extended to other groups of financial institutions. For example, attention should be paid to the development of the insurance and capital markets, as well as that of non-banking loan institutions. Furthermore, in the group of deposit and credit entities, one should notice processes that took place at that time in cooperative institutions.

Not only the events related to the evolution and maturation of the financial sector in the transformation period had significant impact on the shape of the Polish financial sector. In 2004, Poland joined the European Union, which caused the adoption of a set of rules resulting from the principles of the single market and solutions developed for the functioning of the financial sector in the EU. Moreover, the Great Financial Crisis started by the collapse of Lehman Brothers in 2008, affected structural and ownership processes in the banking sector and, more broadly, in the entire financial sector. The last 10 years have exposed the utopia of the idea regarding the financial sector's self-regulation and changed attitudes towards the state's regulatory and ownership role in the banking sector. In parallel, globalisation processes, as well as the penetration and development of comprehensive and complex financial services, have begun to blur the classic differences between banking, insurance and investment services. As a result, it is now more comprehensive and more appropriate to examine the economic situation in the entire financial sector (while, at the same time, acknowledging differences between its segments) rather than only in the selected group of just over 30 commercial banks.

From the point of view of assessing and forecasting the economic situation, it is important to predict the occurrence and increase (or disappearance) of systemic risks for the financial sector, the entities it serves, and consequently, for the entire economy.

In this study, an attempt has been made to identify these entities, to which the scope of the survey should be extended. In the next section of the study, various groups of entities operating on the Polish financial markets are identified and discussed, the assessment of which leads to a recommendation as to either include or omit them in the updated study. The study should take into account entities that, due to the scope of their activities, as well as their scale, significantly monitor and forecast the course of sectoral and macroeconomic processes.

The extension of the study to new groups of entities while, at the same time, limiting the sample to entities significant enough, is important in order to avoid such an effect that the excess of observations from less significant entities could outweigh the results designating systemic and leading entities, e.g. if the study diluted the answers and results stemming from around 30 commercial banks (over 90% of the sector's assets) in a large group of cooperative banks (over 500 entities). On the other hand, if appropriate proportion is maintained, the voice of smaller entities should also be represented in the study.

Along with changes in the method of sample selection, as well as the need to update the questions and problems of the survey to new sector and macroeconomic conditions, it is recommended to review and update the survey, taking the following rules into account:

1. **Principle of continuity:** A number of questions that have been asked in previous versions of the survey should remain in an unchanged or comparable formula to the fullest extent possible, so that the knowledge and comparability of data from the last 20 years is not lost in the process. The revision of the study is not intended to create a new product, but to adapt it to the new reality and accurately reflect that changes that have taken places over the past 2 decades.
2. **Revision and update:** A set of new questions should be added in a way that relates to the relevant topics and problems reflecting the current point of view and also, the future of the financial sector in Poland.
3. **Elimination:** It is beneficial to remove individual questions relating to issues that were relevant in the past but have now lost their topical importance due to the fast-changing reality of the financial sector.
4. **Differentiation:** It is beneficial to formulate a survey capturing differences of opinion on similar issues from a perspective of varying segments within the broader financial market.
5. **Generalisation:** The original survey was dedicated only to the banking sector. Currently, with the unchanged sense of the questions, they should be formulated in a more general way in order to allow for other market segments to be properly included in the sample.

2. Sample selection

Business climate surveys in the Polish banking sector encounter a problem of small sample size. This problem is also gaining significance due to consolidation trends in the banking sector, which have increased in recent years. For example, only in 2013–2018, the number of domestic commercial banks dropped from 39 to 30 (i.e. by nearly a quarter), see the NBP report *Rozwój system finansowego w Polsce w 2018 r.* (Financial system in Poland in 2018, NBP, 2019). In the authors' opinion, the consolidation of the banking sector may be continued in subsequent years, which is supported by, among others:

1. strategic decisions of foreign investors on the sale of Polish subsidiaries;
2. insufficient level of capital of some foreign investors;
3. earlier ownership changes, as a result of which some banks currently operating as separate entities have a joint majority shareholder.

If these consolidation trends continue, the sample size of surveyed entities will become even smaller, unless the scope of the study is extended.

Other business climate surveys in the Polish banking sector have also faced the problem of small sample size. The authors of some surveys decided to monitor the economic situation in bank branches (Garczarczyk, 2003; Idzik, 2003). The large number of bank branches allows for a significant increase in the sample which can easily exceed, e.g. 1,000 elements or more. However, the quality of such a study is disputable, as responses coming from different branches of the same bank are likely to be uniform, while branch employees may not have the necessary level of expertise required to comment on business developments in the entire banking sector or the national economy.

The above-mentioned issues relating to the quality of the study of bank branches should be viewed from a historical perspective. In the 1990s, bank branches had some level of independence, particularly with regard to sales, credit and HR policies. The approach to examining the economic situation at the branch level was therefore justified. This remained true even though, at the time, some methodological doubts were raised because of the varying level of independence of branches in individual banks or even different branches in the same bank. Nevertheless, despite these doubts, at that time, it gave a sense of correct sample selection.

There have been a number of intensive centralisation processes that have taken place in banks over the course of the first 2 decades of the 21st century. The branches were basically deprived of autonomy in conducting local or regional sales policy. The entire creditworthiness assessment process has been standardised and centralised. HR policies have also been largely centralised. Over the years, the role of bank branches has been technically reduced to customer service points only

and, in the authors' opinion, the current organisational framework of the banking sector does not allow to extend the scope of the study to bank branches.

Another way of solving the problem of small sample size could be its extension to non-bank financial institutions. However, the survey would have to be revised so that it does not lose the continuity of data collected in relation to the banks themselves, as well as the comparability of these data with other sectors.

In Table 1, the types of entities are indicated that operated among the Polish financial sector in 2018, together with their number (although, since not all types of activities are subject to licensing or registration, reliable data on their number is not available for each type of institution) and an indication of the arguments for or against their inclusion in the study.

Table 1. Entities operating in the financial sector in Poland in 2018 within the context of a business climate survey

Type of institution	Number	Current participation in the study	Proposed participation in the future	Arguments
Commercial banks	32	yes	yes	included in the study so far
Branches of foreign credit institutions	31	no	yes	activity comparable to domestic banks (especially in the area of corporate and investment banking)
Representative offices of foreign banks	10	no	no	principal marketing function
Notification of cross-border activities	500	no	no	no physical branch in Poland
Affiliation banks for cooperative banks	2	yes	yes	included in the study so far
Cooperative banks (excluding affiliates)	549	no	yes, if total assets over PLN 500 mln	competing with commercial banks on a local market
Saving and loan affiliations	30	no	yes, if total assets over PLN 500 mln	competing with commercial banks on a local market
Insurers	49	no	yes (only one for each type of an insurer)	insurance is one of the most common financial products
Mutual insurance companies (TUW)	11	no	yes, if total assets over PLN 500 mln	competing with commercial insurers
Pension fund management companies (PTE)	10	no	yes	part of the mandatory pension scheme
Private pension funds	8	no	no	portfolio management outsourced
Employee pension funds	3	no	no	portfolio management outsourced
Employee pension plans (PPE)	2398	no	no	portfolio management outsourced
Mutual fund companies	63	no	yes	mutual funds are one of the most common financial products

Table 1 – cont.

Type of institution	Number	Current participation in the study	Proposed participation in the future	Arguments
Brokerage houses	40	no	yes	trading in financial instruments
Commodity brokerage houses	1	no	yes	trading in commodity derivatives
Banks conducting brokerage activities	9	no	no	included as banks
Custodian and depositary banks	15	no	no	included as banks or brokerage houses
Investment firm agents	500	no	no	acting on behalf of brokerage houses
Entities keeping registers	7	no	no	activity auxiliary to TFIs
Distributors of mutual funds	79	no	no	activity auxiliary to TFIs
Exchanges and clearing houses	5	no	yes	facilitating trading in financial instruments
Rating agencies	4	no	yes, if accredited by ESMA	important role in credit worthiness assessment
National payment institutions	38	no	yes	growing role in handling digital transactions, including the issue of electronic money
Loan companies	473	no	yes, if total assets over PLN 500 mln	competing with banks

Source: Based on (NBP, 2018) and the KNF website.

In 2018, the business climate survey in the banking sector covered 32 domestic commercial banks and 2 affiliations for cooperative banks, which gave a total number of 34 entities. However, this sample could have been extended to 65 entities if other monetary financial institutions, whose business takes deposits and grants loans or invests in securities on its own account, were also to included. This group includes 3 types of institutions: branches of foreign credit institutions, cooperative banks and credit unions.

Branches of foreign credit institutions operate in a similar way to domestic banks, except that they are subject to supervision from the home country belonging to the European Economic Area. The scale of operations concerning some of these institutions is similar to domestic commercial banks, especially in the area of corporate and investment banking. Due to the relatively small size of this group, and the fact that in their home countries they are treated as commercial banks, it seems justifiable to include all of them in the study. However, in the authors' opinion, this group should not include representative offices being in charge of

mainly marketing functions or institutions conducting cross-border activity on the basis of notification without a physical presence in Poland.

Cooperative banks other than affiliate banks are, in turn, a heterogeneous group of entities. Out of 549 institutions, as many as 294, or more than a half, have assets of less than PLN 200 million. Only 56 institutions, i.e. approximately 10%, have assets exceeding PLN 500 million, and only 2 are fully independent. In the authors' opinion, institutions with total assets exceeding PLN 500 million may appear on the local market as competitors to commercial banks. Including them in the study allows to increase the sample size to 121 entities.

Similar reasoning can be applied to saving and loans associations. As in the case of cooperative banking, the assets of individual associations are characterised by considerable concentration: the assets of the 4 largest associations constitute as much as 86% of the total assets for all 30 associations, and only 3 of them have total assets of above PLN 500 million. Including these 3 saving and loan associations leads to an increase in the sample size to 124 entities.

A further increase of the sample size requires going beyond the group of monetary financial institutions. The authors propose to extend the survey to entities from the insurance, pension and capital markets, as well as payment and loan institutions. The arguments for inclusion of individual types of institutions are presented below.

The inclusion of insurer institutions can be motivated by the fact that insurance is one of the most common financial products, save for basic banking services. Therefore, insurance companies have the opportunity to observe changes in the behaviour of consumers and enterprises which, at least, may be partly associated with economic fluctuations. In 2018, there were 24 companies operating in the field of property insurance in Poland and 24 in the area of life insurance, as well as 1 reinsurer. Since the companies conducting both types of insurance activities belong to the same capital groups and are characterised by a high level of interdependence, the authors propose to include only 1 institution for both types of the insurance business which, in turn, gives 24 entities and 1 additional reinsurer.

Apart from insurance companies, on the Polish market, there are mutual insurance companies, which may be seen as competing with commercial insurers, just like cooperative banks or saving and loans are, to some extent, competing with commercial banks. In 2018, only 1 institution met the criterion for the total assets of over PLN 500 million. Including this together with the commercial insurance companies allows to increase the sample size to 150 entities.

Furthermore, moving on to the pension market, for many years, it was the pension fund management companies (PTEs) that played a major role. However, changes in the pension system relating to the introduction of Employee Capital Plans may be likely followed by a transformation of PTE into mutual fund companies (TFIs). Nonetheless, until this happens, PTEs remain an important

participant in the financial market, managing assets of PLN 157 billion at the end of 2018 on behalf of nearly 16 million Poles. In the authors' opinion, this justifies the extension of the sample to this group of institutions which, in turn, increases the sample size to 160.

There are also 3 other groups of entities operating on the pension market: employee pension funds, private pension funds and employee pension plans (PTE). However, since investment portfolios of all of these entities are managed by PTEs or TFIs, the authors believe that their inclusion in the sample would not add any significant or new information. To the contrary, it would extend the sample to institutions which, in fact, do not operate on the financial markets, but are merely intermediaries.

With regard to the capital market, there is a particularly large diversity of entities, among which the basic role is played by TFIs, managing investment portfolios and brokerage houses, providing investors (both institutional and individual) with access to trading in financial instruments. TFI assets at the end of 2018 reached PLN 256 billion, making them key participants in the domestic financial market. In turn, brokerage houses kept over PLN 1.2 million investment accounts. Therefore, both of these groups of institutions have good insight into the economic situation on the financial market, which speaks in favour of including them in the study. In addition, there were also 9 banks conducting brokerage activities (they have been already included in the study and categorised as banks) and 1 commodity brokerage house. Taking into account the latter allows to increase the sample to 264 entities.

Moreover, there are also a number of entities in the capital market whose activities are ancillary to TFIs or brokerage houses. This group includes custodian banks and depositaries, investment firm agents, entities that keep investment fund registers and distributors of mutual funds. Despite that, custodian banks and depositaries keeping securities accounts for individual and institutional clients are already included in the survey as they are legally subsidiaries of banks or brokerage houses. In turn, agents of investment firms do not conduct independent operations, but act for brokerage houses. Similarly, the role of entities keeping registers and distribution of investment funds is strictly limited and ancillary to the activities carried out by the TFIs.

On the other hand, stock exchanges and clearing houses play a key role in the capital markets, and without them, it would not be possible to execute transactions in financial instruments. At the end of 2018 there were 5 such entities in Poland.

In recent years, fixed income instruments, in particular bonds, have been gaining in significance. Rating agencies, which assess creditworthiness of issuers, play an important role in supporting bond trading. Out of these, 4 agencies operating in Poland had been awarded with accreditation by the pan-European supervisor ESMA. Including these 2 groups of entities allows to increase the sample size to 273.

Changes in socio-economic life, particularly the dissemination of electronic transactions, favoured development of non-bank institutions providing payment services, including those issuing electronic money. Among these entities only national payment institutions (KPI) operate independently. Digitalisation of subsequent areas of life and the related development of electronic payment methods suggests that the role of these institutions will increase and so will their insight into economic fluctuations. Therefore, in the authors' opinion, they should be included in the study; the sample then increasing to 311 entities.

The final group of entities that should be included in the study are loan companies, provided that their scale of operations is sufficient. As a result of changes in the banking sector after the Great Financial Crisis, combined with an increase in regulation and capital requirements, loan companies have taken over a significant share of the consumer loan market. At the end of 2018, as many as 473 loan companies operated on the Polish market and their assets were estimated at PLN 11.1 billion. However, in the absence of official data, an analysis of the asset size of these institutions remains a challenge. The NBP reports that 9 institutions exceeded the PLN 200 million threshold of assets. According to the authors, at least one institution had assets above PLN 500 million, a threshold which was used in the analysis of cooperative banks, saving and loan institutions and mutual insurance companies, which supports its inclusion in the sample.

As a result of the above analysis, the authors propose to expand the sample to include further types of institutions conducting competitive or complementary activity in relation to domestic commercial banks. Hence, it is possible to increase the sample size from 34 to at least 312 entities, i.e. by almost 10 times.

3. Questionnaire

Over the course of 20 years of research into the business climate in the banking sector, the survey has been only partially reviewed. Compared to the 1998 survey (when the study was started), 10 of the 26 questions have been modified. Those altered related to a bank's total revenues, overall financial position, as well as interest on loans and deposits. The survey has also been updated by removing questions about the value of services provided to foreign customers, the order of investment expenditure, the ratio of loans to deposits, the competitiveness of foreign banks, the mandatory reserve rate and the amount of NBP foreign exchange reserves. In addition, 4 possible answers were removed from the question about business barriers: lack of domestic cash, lack of qualified management staff, risk of currency crisis, way of thinking and habits of employees.

On the basis of the information given above, the survey can be primarily associated with a change in socio- economic realities. Specifically, the central bank's

monetary policy has changed significantly over the last 20 years, thus, making the questions about the amount of FX reserves or the risk of a currency crisis less relevant. Similarly, along with a systematic decrease in the reserve ratio, this parameter also lost significance. With the growing openness and internationalisation of the economy, questions about the value of services provided to foreign entities or the competitiveness of foreign banks have also become less relevant. On the other hand, factors such as inflation have become more pertinent. Since the adoption of the direct inflation target by the NBP, it has become 1 of the major variables influencing expectations of future interest rates.

Moreover, with regard to so-called soft factors, the systematic dissemination of higher education and the widespread availability of third studies for managers has reduced the problem of the lack of qualified management staff that could have previously be seen as a barrier to business. Interestingly, the habits and way of thinking of employees as barriers to activity were also abandoned, although in the era of technological transformation, this factor may once again become significant.

Minor changes also concerned the survey form. Compared to 1998, only 2 questions were removed: the first one in relation to the headquarters of the bank (in the vast majority of cases it was currently only Warsaw) and the other relating to the country of the bank headquarters (in case of international institutions).

The information discussed above concerns small scale of changes that allowed for the consistency of recorded data. On the other hand, the significance of individual questions may have changed over time, and some could now be detailed or broken down into component questions. Therefore, it seems reasonable to develop a new survey that would fully encompass the changes in socio-economic life from the past 20 years and the current conditions prevailing in the financial sector. Despite this, the study is less focused on the deeper problem of survey updating and other areas of the research methodology. Its main focus is reflection on expanding the sample to include new segments of the financial market, the importance of which has increased in the 21st century in the Polish financial sector. This should be accompanied by appropriate standardisation of the survey.

Expanding the sample of surveyed entities implies that the survey should be modified accordingly. The inclusion of non-banking institutions in the survey calls for the generalisation of questions so that they do not refer only to banks and that employees of such a wide range of entities as payment institutions or rating agencies can answer them. On the other hand, developing a new survey poses a methodological challenge with regards to maintaining continuity of the survey.

The authors propose the creation of 1 coherent version of the survey: (1) addressed to the current group of surveyed entities (i.e. banks) and branches of foreign credit institutions and cooperative banks (banking entities); (2) addressed to financial institutions other than banks, whose main activity is based on managing portfolios of assets and liabilities at their own risk (saving and loans, insurers,

including mutual insurance companies, brokerage houses, including commodity brokerage houses, loan companies, domestic payment institutions); (3) addressed to financial institutions other than banks, the main activity of which is managing portfolios of assets and liabilities at the client's risk (mutual fund companies, public pension funds); (4) addressed to financial institutions other than banks, whose main activity is not managing portfolios of assets and liabilities (stock exchanges and chambers of accounting, rating agencies).

For the sake of parsimony, instead of presenting all 4 versions of the new survey, the authors have reproduced only questions from the original survey, which is the basis for version (1), comparing them with the proposed set of new questions in versions (2) to (4). This process also allows for greater transparency (Table 2).

Table 2. Four different versions of the new survey—a comparison

Question No.	Version 1	Version 2	Version 3	Version 4
	How has/have… changed over the last quarter and will… change in this quarter, respectively…?			
1	net banking income of **your bank**	net operating income of **your institution**	net operating income of **your institution**	net operating income of **your clients**
2	conditions of your **banking operations**	conditions of your **operations**	conditions of your **operations**	conditions of your **clients' operations**
3	your net profit	your net profit	**your** net profit	net profit of **your clients**
4	quality of your **loan portfolio**	credit risk of your **assets**	credit risk of your **assets under management**	credit risk of your **clients**
5	interest of your clients in **banking services**	interest of your clients in **your services**	interest of your clients in **your services**	interest of your clients in **financial services**
6	level of employment	level of employment	level of employment	level of employment **in your clients' companies**
7	major barriers for growth	major barriers for growth	major barriers for growth	major barriers for growth **of your clients**
8	expenses and investments in fixed assets	expenses and investments in fixed assets	expenses and investments in fixed assets	expenses and investments in fixed assets **of your clients**
9	capital investments	capital investments	capital investments	capital investments **of your clients**
10	number of retail clients	number of retail clients	number of retail clients	*not applicable*
11	number of institutional clients	number of institutional clients	number of institutional clients	number of institutional clients
12	off-balance sheet operations	off-balance sheet operations	off-balance sheet operations **of your investment portfolios**	off-balance sheet operations **of your clients**
13	net interest income	net interest income	*not applicable*	*not applicable*
14	the general condition of the Polish economy	the general condition of the Polish economy	the general condition of the Polish economy	the general condition of the Polish economy

Table 2 – cont.

Question No.	Version 1	Version 2	Version 3	Version 4
	How has/have… changed over the last quarter and will… change in this quarter, respectively…?			
15	the general condition of the financial industry in Poland	the general condition of the financial industry in Poland	the general condition of the financial industry in Poland	the general condition of the financial industry in Poland
16	Polish zloty exchange rate	Polish zloty exchange rate	Polish zloty exchange rate	Polish zloty exchange rate
17	official interest rates	official interest rates	official interest rates	official interest rates
18	central bank reverse repo operations	not applicable	not applicable	not applicable
19	money supply	money supply	money supply	money supply
20	inflation	inflation	inflation	inflation

Source: Own work.

Version (1) of the questionnaire is the original survey as of January 2020, with 1 minor change that should help maintain continuity of the study. This version is addressed to the group of institutions which have been analysed so far, and to other institutions exhibiting the greatest similarity to the original group. The only change relates to the question about money supply instead of the real money supply—as in the era of persistently low inflation being reasonably close to the central bank's target the differentiation between both of them is no longer that relevant.

In version (2) of the survey, questions referring strictly to banking operations have been replaced by those about operations in general, and questions referring to the spread between interest rates on loans and deposits have been replaced by more general questions about the net interest income. In this and all subsequent ones, i.e. (3) and (4) versions of the survey, the question about the central bank's reverse repo operations has been abandoned, given that the institutions to which these versions of the survey are addressed, do not participate in such operations.

In version (3) of the survey, similarly to version (2), questions referring to banking operations have been replaced by those referring to operations, while assets of a given institution have been changed in relevant questions to assets under management. In contrast to version (2) of the survey, the question about net interest income has been abandoned due to the fact that the institutions, to which this version is addressed, do not manage portfolios on their own behalf. Moreover, the question about the number of branches has been removed, given that these institutions operate in a strictly centralised form.

In version (4) of the survey, relative to version (3), questions referring to operations have been replaced by those referring to the activity of clients concerning the analysed institutions. The question about the number of individual clients has also been removed because, in principle, the institutions targeted by this version of the survey only serve institutional clients.

Conclusions and recommendations

Based on the analysis above, the authors recommend commencement of works on the modification and further development of the business climate surveys in the banking sector as part of the research palette of the SGH Institute of Economic Development. This recommendation comprises a two-step process. At the first stage, it is recommended to:

1. Extend the survey to cover other entities of the financial sector in order to increase the size of the surveyed population, both in terms of methodically increasing the currently small sample and also better rendering of business processes, not only in the banking sector, but more broadly, in wider financial market entities.
2. Change the title of the study in such a way that there is no loss of continuity and perception so that it is essentially still the same study, but only extended to other financial sector institutions. The proposed revised title being: "Business Climate Survey in the Banking Sector and Other Financial Institutions".
3. Maintain the continuity of the study and comparability of variables (before and after sample adjustment). This should be achieved by maintaining the survey in its current form and unifying it by taking into account the diversity of entities operating in the financial sector. It could be also possible to slightly extend the survey in order to include relevant contemporary issues.
4. Test (for about 10 editions) the effects of extending the sample without making deeper changes to the test methodology. The goal is to capture possible random or systematic errors as well as permanent differences resulting from sample modification (qualitative and quantitative).
5. Generate parallel results (for about 10 editions) regarding the banking sector vs. other financial institutions, to capture the scale and direction of the differences resulting from the new sample.

After testing the results of extending the sample to include institutions from the entire financial sector, it is recommended to proceed to the second stage of work on the research methodology. The second stage should be focused on 2 key issues:

1. In-depth survey review, taking the possibility of significant adjustments to the posed questions into account. This would provide the opportunity to both remove questions deemed no longer relevant, and also, to add new ones.
2. Overviewing the calculation and structure of the business climate index in the banking sector (and other financial institutions) due to the selection of variables and their associated weights.

The process of conducting both stages of study modification should be evolutionary and spread out over the time. This process should serve the quality of the results, their comparability over time and better monitoring of the applied changes.

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USE OF DATA FROM BUSINESS TENDENCY SURVEYS IN OUTPUT GAP ESTIMATION[1]

https://doi.org/10.18559/978-83-8211-129-3/2

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Abstract

In this paper, the results of empirical research are presented regarding the most commonly used macroeconomic indicators of business cycles together with the Research Institute for Economic Development (RIED) Business Tendency Surveys data in output gap estimation. As a tool for determining business cycle, principal component analysis (PCA) is used. The empirical evidence allows to confirm the usefulness of qualitative RIED indices in modelling the output gap and, at the same time, support the conclusions made by Roeger, McMorrow, Hristov and Vandermeulen (2019) that inflation and the current account balance do not perform well as indicators of the cycle in Poland. The cyclical component obtained using PCA is highly correlated with the cyclical component of the RIED barometer and real GDP change.

Keywords: business cycle, cycle indicators, output gap, principal components, survey data.

JEL codes: C38, C83, E32.

Introduction

Following Okun (1962), the output gap is the ratio of actual output over potential output. It is an indicator of real economic imbalance, thus it shows a cyclical position of an economy. The imbalance puts pressure on prices, wages, interest rates and the exchange rate, among others. For example, the CPI above its long-term growth rate and a current account deficit testifies that the output gap is positive, i.e. an economy

[1] This is a revised and extended (with recent data) version of: E. Ratuszny, & K. Walczyk. (2020). Zastosowanie danych z badań koniunktury IRG SGH w modelowaniu luki produktowej. In M. Męczarski (Ed.), *Metody ekonometryczne, statystyczne i matematyczne w modelowaniu zjawisk społecznych. Part I: Metody probabilistyczne w zastosowaniach ekonomicznych* (pp. 209–222). Warszawa: Wydawnictwo SGH.

Suggested citation:
Ratuszny, E. & Walczyk, K. (2022). Use of data from business tendency surveys in output gap estimation. In S. Białowąs (Ed.), *Economic tendency surveys and economic policy—measuring output gaps and growth potentials* (pp. 30–38). Poznań: Poznań University of Economics and Business Press. https://doi.org/10.18559/978-83-8211-129-3/2

produces above-potential output. In this position, according to the European Commission, was the Polish economy in 2019 (European Commission, 2019, p. 132).

The output gap is used for policymaking purposes, provided that its estimation is correct. Assessment of the output gap, however, requires determining the potential output, the measurement of which—both in terms of estimation methods and data selection—is questioned (e.g. by Tooze, 2019). For example, according to European Commission estimates, the economies of Italy and Germany were in 2019 in the same cyclical position despite the very fact that their performance greatly differed (Roeger, McMorrow, Hristov, & Vandermeulen, 2019, p. 5).

The purpose of this paper is to show that there are indeed reasons to undermine the output gap estimation method adopted and used by the European Commission (described by Havik et al., 2014). To do so, the results of estimating the output gap in Poland are compared using 2 groups of economic indices: (1) a standard set of quantitative business cycle indicators, and (2) survey databased indicators, developed by the Research Institute of Economic Development of the Warsaw School of Economics (RIED). It has been shown that some of the traditional indicators are not useful in estimating the output gap, because they contain strong trend components. Furthermore, they can be successfully replaced by qualitative indicators. It has also be shown that estimation method has significant impact on output gap estimates.

This paper consists of 3 parts. In the first one, the method and data used to estimate the output gap in Poland are presented, while in the second part, the results of this estimation are demosntrated. Conclusions resulting from the method comparison are included in the summary of the analysis.

1. Output gap estimation methods

As it was mentioned above, contrary to actual output of an economy, potential output, and thus, also of the output gap, cannot be observed and measured directly, but only estimated. In order for this to be done, a vast plethora of methods are used and compared, but they all assume that the actual volume of output is the resultant of 2 overlapping processes with different characteristics and origin, i.e. a trend that corresponds to potential output, and a business cycle that deviates an economy from its trend. Amongst many methods, the most commonly used are:

- econometric models, including those based on the macroeconomic production function;
- statistical techniques.[2]

[2] See Álvarez and Gómez-Loscos (2017) for a brief review of output gap estimation methods.

Econometric modelling requires certain forms of processes which contribute to output growth, being adopted *a priori*. In ST models, e.g., trends and cyclical components are separately estimated (see e.g. Harvey, Koopman, & Shepard, 2004; Harvey, 2005), and the accuracy of estimation depends on statistical properties of time series and assumptions regarding forms of those processes that are stochastic in nature. Alternatively, potential output is estimated on the basis of the macroeconomic production function—this method is used, e.g. by the European Commission (see Havik et al., 2014)—but in this case, the accuracy of estimation depends on assumptions regarding the form of the production function and its parameters.

The idea of statistical methods is quite different. They separate a trend from short-term fluctuations based on statistical analysis of output variability over time. Two approaches are used: the first is based on trend estimation and residual determination of a cyclical component (e.g. the Hodrick-Prescott filter), in the second, a cyclical component is estimated, and a residual trend is determined (e.g. the Baxter-King filter, the Christiano-Fitzgerald filter). Although computational algorithms used to derive the filtres are different, these methods provide similar results (see e.g. Adamowicz, Dudek, Pachucki, & Walczyk, 2009; Fagiolo, Napoletano, Piazza, & Roventini, 2009; Larsson & Vasi, 2012). Here we use the asymmetric Christiano-Fitzgerald filtre (2003)[3], an advantage of which is that it performs lossless approximation of the cyclical component, and endof-sample estimates are relatively stable (see e.g. Adamowicz et al., 2009).

The following standard cycle indicators are used to estimate the output gap regarding:

- real GDP growth rate;
- consumer price index;
- average gross nominal wage growth rate;
- unemployment rate (BAEL);
- current account balance.

In addition, partly due to the suggestions of Fleischman and Roberts (2011) and Geyer and Marc (2018), several qualitative indicators are included in the study, namely: the RIED barometer[4] and the balances of overall assessment concerning the economic situation in Poland, derived from business tendency surveys conducted by RIED in the manufacturing (MAN) and construction (CON) industries, and trade (TRD). It is argued that, by construction, business tendency indicators are

[3] Lower and upper bounds are 8 and 48 quarters. Mean adjustment applied.

[4] The RIED barometer is a composite indicator calculated as a weigthed average of seven confidence indicators based on business and consumer survey balances. It has been found to be a good indicator of economic activity in Poland ($r \approx 0.8$).

sufficiently precise indicators of a cyclical position of an economy and, as such, those which are complementary to traditional indicators (Fleischman & Roberts, 2011; Gayer & Marc, 2018).

The time series under study are quarterly,[5] and span between Q1 2003 to Q3 2021. If non-stationarity is observed, the stationarity is obtained by differentiation. Then, principal components analysis (PCA) is applied. It allows to extract principal components from individual cycle indicators, which are assumed to be proxies for the cyclical component of output. Moreover, using this method, the correlational degree between indicators and principal components can also be assessed.

2. Results of output gap estimation in Poland

2.1. Principal component analysis

The results of principal component analysis show that the first 2 components together, explain almost 2/3 of the variability for each indicator, of which 40% accounts for the first component (Table 1). Some indicators, namely: the balances of economy assessment made by manufacturers (MAN) and construction firms (CON), and the real GDP growth rate, are highly correlated with the first component (Table 2). In total, these 3 indicators constitute 3/4 of the first component (Table 3). Together with the trade balance (TRD), they contribute to the majority of the first principal component (91.6%).

In Figure 1, a positive correlation is shown between the first component and all indicators. The current account balance, CPI and the wage growth rate are strongly and positively correlated with the second principal component, which raises concern about their ability to identify cyclical positions. The unemployment rate has a valid negative sign of the correlation with PC2. All the other indicators are not (or weakly) correlated with the second component. In Figure 2, it is indicated that the second principal component does not reveal a strong cyclical pattern.

Table 1. Percentage of explained variability by principal components

	PC1	*PC2*	*PC3*	*PC4*	*PC5*	*PC6*	*PC7*	*PC8*
Standard deviation	1.79	1.45	0.97	0.91	0.59	0.53	0.49	0.26
Proportion of variance (%)	40	26	12	10	4	3	3	1
Cumulative proportion (%)	40	66	78	88	93	96	99	100

Source: Own computation based on Eurostat and RIED data.

[5] The business tendency survey in the manufacturing industry is conducted monthly. Quarterly estimates are calculated as weighted averages of monthly data with weights of 1/6, 1/3 and 1/2 for subsequent months.

Table 2. Correlation coefficient between individual indicators and principal components

	PC1	*PC2*	*PC3*	*PC4*	*PC5*	*PC6*	*PC7*	*PC8*
CPI	0.01	0.68	0.68	–0.07	0.02	–0.13	0.23	0.00
Real GDP growth rate	0.85	0.03	–0.04	0.31	0.15	–0.36	–0.14	–0.04
Wage growth rate	0.37	0.83	0.10	–0.08	0.21	0.22	–0.26	0.04
Current account balance	0.36	0.65	–0.26	0.51	–0.33	0.10	0.08	–0.02
Unemployment rate (BAEL)	0.08	–0.61	0.63	0.42	–0.11	0.13	–0.15	0.01
CON	0.91	–0.24	0.04	–0.15	0.09	0.19	0.12	–0.18
TRD	0.75	–0.04	0.10	–0.51	–0.37	–0.08	–0.12	0.04
MAN	0.90	–0.30	–0.08	0.08	0.13	0.07	0.19	0.18

Source: Own computation based on Eurostat and RIED data.

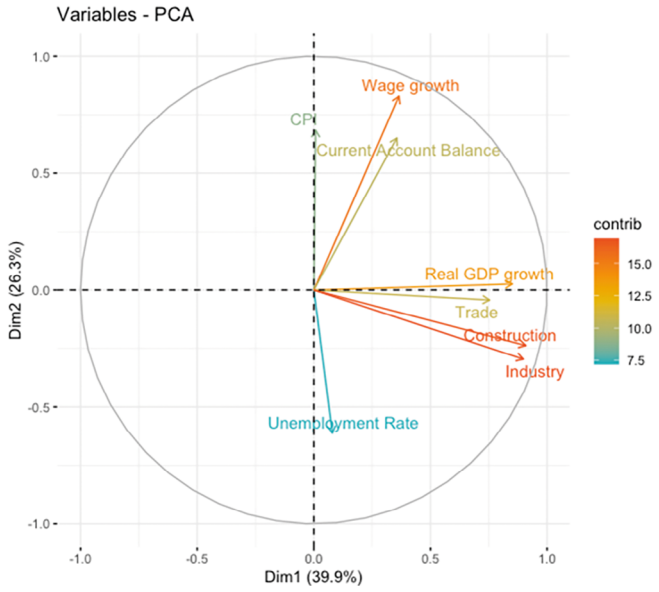

Figure 1. Target loads of individual indicators

Notes: The coordinates for the end of each of the plotted vectors correspond to the factor loading of the individual indicators. The length of the vector represents the information stock of the indicators that the principal components capture. The longer the vector, the greater the contribution of the indicators to the principal components. The vector end coordinate sign, i.e. the sign of the factor load, indicates a positive or negative correlation of the indicators and principal components. If we consider both axes together (PC1 & PC2), then primary variables can be classified into 1 of 4 categories, depending on the combination of +/– signs for their factor loads. The angle between the vectors indicates the correlation:

- $0 < \alpha < 90°$: the smaller the angle between the vectors representing the indicators, the stronger the positive correlation between them;
- $\alpha = 90°$: the vectors are perpendicular, i.e. the individual indicators are not correlated;
- $90 < \alpha < 180°$: the larger the angle between the vectors representing the indicators, the stronger the negative correlation between them.

Source: Based on Eurostat and RIED data.

Table 3. Contribution of individual indicators to principal components

	PC1	*PC2*	*PC3*	*PC4*	*PC5*	*PC6*	*PC7*	*PC8*
CPI (%)	0.0	22.3	48.3	0.5	0.1	6.4	22.3	0.0
Real GDP growth rate (%)	22.7	0.0	0.2	11.5	6.3	48.1	8.6	2.7
Wage growth rate (%)	4.2	32.8	1.0	0.8	12.7	17.7	28.4	2.4
Current account balance (%)	4.0	20.1	7.2	30.9	31.0	3.4	2.7	0.5
Unemployment rate (BAEL) (%)	0.2	17.8	41.4	21.1	3.6	6.4	9.4	0.2
CON (%)	25.9	2.7	0.2	2.7	2.4	13.7	6.5	45.9
TRD (%)	17.8	0.1	1.0	31.6	39.0	2.2	6.1	2.2
MAN (%)	25.3	4.2	0.6	0.9	4.9	2.0	16.0	46.1

Source: Own computation based on Eurostat and RIED data.

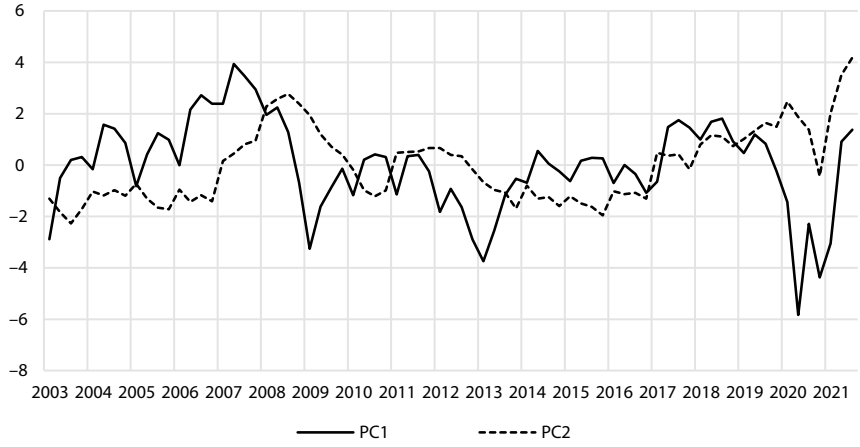

Figure 2. Comparison of PC1 and PC2
Source: Based on Eurostat and RIED data.

2.2. Output gap

Bearing in mind the above, the output gap in Poland is estimated only on the basis of the first principal component. In Figure 3, a comparison is presented between the first principal component and the real GDP growth rate[6] as well as the RIED barometer. It is illustrated that, on the whole, all the 3 indicators are coincident and highly correlated with each other. Indeed, as shown in Tables 4 and 5, the correlation coefficient between the first principal component and the real GDP growth rate is 0.851, while the Harding-Pagan's concordance index for the pair of the indicators totals 0.676.[7] The 2 measures are even higher for the cyclical components of the indicators (see Tables 6 and 7). All turning points of

[6] The real GDP growth rate has been chosen for reference since the Polish economy has not recorded a recession (in the technical or classical sense) for the last three decades, not including the COVID-19 pandemic episode.

[7] Both of them are lower for lags/leads.

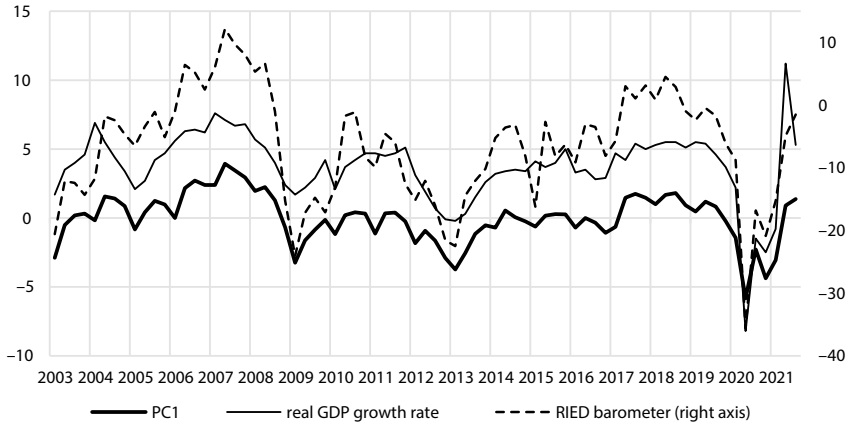

Figure 3. PC1, real GDP growth rate and RIED barometer, Poland, 2003–2021
Source: Based on Eurostat and RIED data.

the cyclical component concerning the real GDP growth rate are signalled by the turning points of the cyclical component of PC1, with 4 out of 10 of them being synchronous, 4 leading, and 2 lagged (see Figure 4).

Table 4. Correlation between PC1, real GDP growth rate and the barometer

	PC1	GDP growth rate	RIED barometer
PC1	1	0.851	0.927
GDP growth rate		1	0.746
RIED barometer			1

Notes: p-value < 0.001.
Source: Own computation based on Eurostat and RIED data.

Table 5. Concordance between PC1, real GDP growth rate and RIED barometer

	PC1	GDP growth rate	RIED barometer
PC1	1	0.676	0.784
GDP growth rate		1	0.649
RIED barometer			1

Source: Own computation based on Eurostat and RIED data.

Table 6. Correlation between the cyclical components of PC1, the real GDP growth rate and the RIED barometer

	PC1	GDP growth rate	RIED barometer
PC1	1	0.936	0.956
GDP growth rate		1	0.837
RIED barometer			1

Notes: p-value < 0.001.
Source: Own computation based on Eurostat and RIED data.

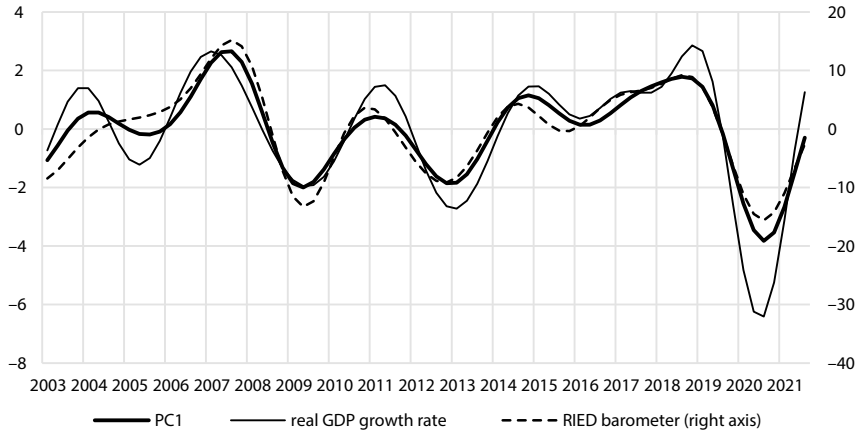

Figure 4. Cyclical components of PC1, real GDP growth rate and RIED barometer, Poland, 2003–2021

Source: Based on Eurostat and RIED data.

Table 7. Concordance between the cyclical components of PC1, the real GDP growth rate and the RIED barometer

	PC1	GDP growth rate	RIED barometer
PC1	1	0.878	0.878
GDP growth rate		1	0.784
RIED barometer			1

Source: Own computation based on Eurostat and RIED data.

Conclusions

In this study, it has been shown that the output gap, estimated by principal components based on selected macroeconomic indicators and data from business tendency surveys, coincides with the output gap measured by the real GDP growth rate. In this respect, specifically, the first principal component outperforms the RIED barometer, which has been found to be a good indicator of output in Poland. Analysis allows to reveal that traditional business cycle indicators, such as: the consumer price index and current account balance, generate ambiguous signals and, hence, are not suitable for output gap estimation. It turns out, however, that they can be successfully substituted for data regarding business tendency surveys (here: the balances of manufacturing and construction firms' opinions about general economic situation in Poland), which contains valuable information about the current and anticipated state of an economy.

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AUTOMATIC IDENTIFICATION OF TURNING POINTS WITH HMM-BASED INDICATOR

https://doi.org/10.18559/978-83-8211-129-3/3

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Abstract

In this paper, the issues of constructing early warning indicators, as well as the business cycle turning point detection, are raised. Following the original procedure presented by Bernardelli (2020), modification and simplification of one of the procedure stages were proposed. The stage with turning point identification was replaced by a combination of well-known and recognised asymmetric Christiano-Fitzgerald filter and the Bry-Boschan routine of cyclical turning point selection. Presenting improvement in the procedure was the key objective of this article. The basic idea of the remaining part of the HMM Signature Indicator procedure lies in the definition of the signature, which captures the pattern in the considered time series, just before the peak or trough. In the presented approach, the following concepts were exploited: the hidden Markov model (HMM), Viterbi path (VP) and Monte Carlo simulations (MC).

However, the value-added characteristic of this article is not only the proposition of a new, highly parametrisable method for quantitative representation of the business cycle. An integral part of the research was the validation of the presented approach. The data from the business tendency survey in the Polish manufacturing industry conducted by RIED SGH was used to design 2 different HMM Signature Indicators. Each of the them was constructed on the basis of different input time series. Despite this, both demonstrated leading properties, and therefore, effectiveness of the proposed solution was proved. In the majority of cases, the turning points were properly caught in reasonable advance. This means that the presented method can be successfully used for the construction of early warning indicators.

Keywords: indicator, hidden Markov model, Viterbi path, turning point, business tendency survey, Christiano-Fitzgerald filter, Bry-Boschan algorithm.

JEL codes: C63, C88, E37.

Introduction

Assessment of the past and current economic situation is not straightforward and could vary depending on the approach used for the identification of business cycle phases. Within such a context, predicting the future state of the economy is even

Suggested citation:
Bernardelli, M. (2022). Automatic identification of turning points with HMM-based indicator. In S. Białowąs (Ed.), *Economic tendency surveys and economic policy—measuring output gaps and growth potentials* (pp. 39–55). Poznań: Poznań University of Economics and Business Press. https://doi.org/10.18559/978-83-8211-129-3/3

more difficult. Over the years, many methods of analysis have been developed to identify a business cycle change at the earliest possible moment (Boldin, 1994). Therefore, all the methods have one thing in common: the goal to monitor the economic situation and provide some warning signals in advance. Having information about the impending recession allows to take reduction measures with regard to damage caused by the crisis or even avoid a shift towards a phase of recession.

A considerable percentage of monitoring methods are based on the construction of the indicator. The proper indicator should have the feature of signalling changes in the economy early enough for policymakers to take the necessary action. The process of constructing a new indicator or adaptation of existing ones requires a great deal of knowledge and effort. There are many aspects to consider, including selection and transformation of input data, choice of modelling method, along with parameter calibration and extensive testing based on historical data. The universal approach presented by Bernardelli (2020) allows to address almost the complete indicator construction process, apart from the input data selection. This so-called HMM Signature Indicator procedure explores the advantages of the hidden Markov models (HMM), Viterbi paths (VP), and the idea of the signature, discussed in more detail later in this article. A few drawbacks have been identified concerning this approach, particularly, at the last stage of the algorithm, where the turning points are established on the values of the indicator. While the proposed procedure is methodologically correct and seems to work in practice, it is also quite complex and difficult to execute. Therefore, a modification of the procedure was proposed, in which the final stage was simplified by the use of well-known and recognised methods for time series decomposition and the Bry-Boschan routine of cyclical turning points selection (Bry & Boschan, 1971). Presenting improvement in the procedure was the key objective of this article. A detailed description was given along with a broad discussion on the limitations and possibilities of generalisation regarding this approach.

One of the more known indicators is the OECD composite leading indicator (CLI; OECD, 2022), designed to capture large fluctuation of economic activity in advance. There are, however, many country-specific indicators, which even better reflect the economic specifics of a particular country. Some of those indicators are based on macro-economic data, while some allow to explore the benefits of business tendency surveys. In Poland, a monthly business tendency survey is conducted, for example, by the widely-recognised Research Institute for Economic Development (RIED) at SGH Warsaw School of Economics. Based on the opinions of the respondents from the manufacturing industry (see Adamowicz, Dudek, Kluza, Ratuszny, & Walczyk, 2019), the industrial confidence index (RIED ICI) is calculated, which is proved to be a leading indicator in relation to the economic situation of the whole Polish industry. A secondary research goal was empirical verification regarding the effectiveness of this new procedure, based on the data

from the business tendency survey carried out in the Polish manufacturing industry. The obtained results were compared with the reference time series for which the RIED ICI was chosen. The selection was made because this indicator, and the related turning points, are determined on the basis of the same input data, i.e. a business tendency survey.

This paper consists of 5 sections. After the Introduction, in section 1, basic facts about HMMs and VPs are presented. Both are the main concepts used in the HMM Signature Indicator procedure. These concepts are introduced not in the strict mathematical notation, but rather from an intuitive point of view in a degree allowing to understand the HMM Signature Indicator procedure, which is described in section 2. The differences between the original (Bernardelli, 2020) and the proposed procedure are emphasized. The empirical analysis, which is an implementation of the indicator construction process, is demonstrated in section 3. In this part, the characteristics of selected questions from the business tendency survey are presented. Also, a tabular summary and visualisation of the results are given. The article ends with concluding remarks and ideas for further research in this area.

1. HMMs and VPs concepts

In this section, the hidden Markov model concept is introduced. However, focus is shifted towards the idea behind the theory, instead of presenting mathematical details and formal definitions. The description has been enriched with examples and figures. The description will begin with a historical outline and an overview of the known applications.

HMMs are related to the name Hamilton (1994), and are a generalisation of the Markov models. In 1970, the algorithm of HMM parameters estimation was proposed (Baum, Petrie, Soules, & Weiss, 1970). This algorithm is known by the name of Baum-Welch. In the HMM, compared to the classical models, the—included in the name—hidden layer is added (Cappé, Moulines, & Rydén, 2005). Therefore, the model consists of two layers: one with observable observations, based on which the path of states from the second, unobservable layer is discovered. Discovering comes down to identifying the pattern to which the input data is best suited (of course, if such a pattern exists). The idea behind the HMM is in line with pattern recognition and, therefore, the application occurs in all areas where these kinds of processes are explored, such as speech, handwriting, gesture or voice recognition. Recent years have seen an increase in the application of macro-economics. HMM has proved to be useful in, e.g. business cycles synchronisation analysis (Smith & Summers, 2005; Dufrénot & Keddad, 2014), turning point identification (Chauvet & Hamilton, 2005; Bernardelli, 2015) or convergence

analysis (Bernardelli, Próchniak, & Witkowski, 2021). This method was also the basis for constructing early warning indicators (Abberger & Nierhaus, 2010). In all of those fields and applications, HMMs proved to be an excellent alternative to the classical methods.

The key advantage of this approach is the nearly total lack of assumptions to be fulfilled, compared to econometric methods. However, there are 2 major complications related to the HMM. The first one is the potential unoptimality of the result. The Baum-Welch algorithm is a deterministic method, but the resulting set of model parameters strongly depends on the initial values. Therefore, beginning with arbitrarily chosen initial values, we can obtain a solution that will not be optimal. The easiest way to increase the chance of finding an optimal solution is to repeat the computations for different initial points. This kind of repetition for random initial values is referred to as Monte Carlo simulation (Cappé et al., 2005). The number of simulations depends on the stability of the results. It needs to be emphasized that this non-deterministic nature regarding the combination of the Baum-Welch algorithm and Monte Carlo simulations does not make the results probabilistic because the simulation does not concern the input data but the initial points. Hence, non-determinism means suboptimalism of the result.

The second issue concerns the output format of the Baum-Welch algorithm, which is just a set of probabilities of being in a particular state at each time point. Thus, the output set of probabilities needs to be assigned to the correct order of states. Several possible solutions to this problem exist, but in practice, smoothed or filtered probabilities were the most commonly used in the early years (Milas, Rothman, Dijk, & Wildasin, 2006). However, a superior approach exists, based on the completely deterministic Viterbi algorithm (Viterbi, 1967). In this approach, the whole period covered by the analysis is taken into consideration at once, instead of "step by step" decoding. It is much more computationally complex, but results in the most likely sequence of hidden states called the Viterbi path.

In the HMM Signature Indicator procedure, described in the next section, any hidden Markov model may be used, regardless of the number of states or the assumed form of the observable layer probability distribution. With regard to the empirical analysis presented in this article, Gaussian distribution was assumed, and the 3-element state-space $S = \{0, 1/2, 1\}$. Interpretation of states depends on context, but in traditional notation, state 1 is always associated with periods of relatively good conditions, while state 0 is associated with a worse situation. State 1/2 corresponds to an uncertain, transient period. The ordering of states is forced by assuming that state 1 is associated with the greatest mean value (within the meaning of the parameter with normal distribution), and state 0 with the smallest mean value.

To visualise the effectiveness of pattern recognition with the use of HMM, in Figure 1, raw data from the RIED business tendency survey for the question

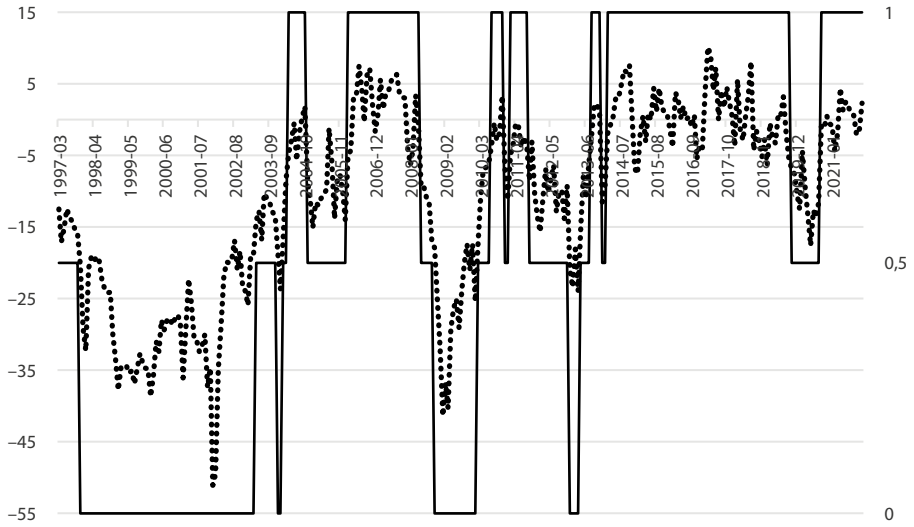

Figure 1. The difference between percentages of positive and negative answers to the question from the RIED business tendency survey about the level of employment in the Polish manufacturing industry (dotted line), along with the 3-state VP (continuous line) from March 1997 to December 2021

Source: Own calculation based on RIED data.

about the level of employment is given along with the 3-state VP. The details about the RIED surveys and RIED ICI are described in the next section. Here, only the visualisation of an exemplary HMM usage is presented as an argument for the suitability of this approach. All phases detected by the method based on the HMM and VP coincide with the values of the time series: for peaks states, 1 or 1/2 are assigned, and with a phase of lower level of employment states, 0 or 1/2 are associated. In general, 3-state HMMs give more accurate results compared to the 2-state HMMs. Adding more states is possible, but at the cost of greater computational complexity, lower stability of solutions and more difficult interpretation of the results. A maximum number of states is also strictly related to the length of the input time series.

The VPs for other, selected questions from the business tendency survey are presented in the Appendix. Selected interdependencies can be observed for answering some questions, but the VPs show that the questions carry significantly different information. An appropriate combination of them into an indicator is possible, as evidenced by the existence of the RIED ICI, which proves to be of leading nature. In the section with empirical analysis, alternative indicators are shown. They are based on the same input data, but a different construction methodology.

2. Construction of the HMM Signature Indicator

In this section, the procedure of the construction of the HMM Signature Indicator is given. Based on the description of the original procedure (Bernardelli, 2020), the stages of the algorithm will be presented, where the last stage is the added value of this article. This stage is changed compared to the original formulation. The whole procedure is split into 3 separate stages. The first one is concentrated on the construction of the reference signature, the second on the construction of the HMM Signature Indicator, and the third, on turning point identification.

At the beginning of the description regarding this procedure, the definition of the signature will be given. Let us assume that the VPs have been computed for the set of time series. Afterwards, the arithmetic means of states from VPs at each time point from the given set of points is calculated. The vector consisting of these arithmetic means is called a signature, while the length of the vector is called the size of the signature.

Stage 1 of the procedure concerns constructing the reference signature. The idea is to capture the pattern in the considered time series just before the peak or trough. For this to be achieved, some identification of historical turning points is needed. Based on those points, the steps of reference signature construction are as follows:

1. Select the set of time series. That set is an input, after which transformations become a component of the signature.
2. For each of the selected time series, perform the procedure described in (Bernardelli et al., 2021), using the HMM, VP, and Monte Carlo simulations to obtain the set of states. During this step, the number of states must be fixed. In the empirical analysis, for each of the input time series, 10,000 simulations are performed.
3. At each time point, calculate the arithmetic mean of states associated with this particular time point from every time series in the set.
4. Let n be the chosen size of the signature. Based on the reference set of turning points, calculate the reference signature that represents the image of the studied phenomenon (e.g. economic climate) observed at the turning point and n time points prior to this turning point. The output of this step is a vector with the length of $n + 1$, being a reflection of the situation directly before (n observations) and during the potential turning point. This vector is called a reference signature.

From the steps of the 1st stage of the procedure, it follows that to define a signature, it is necessary to set 3 parameters: the number of variables included in the signature, the size of the signature and of the HMM state space. To construct the reference signature, in addition, a set of reference turning points is needed.

At the end of the 1st stage, the reference signature is known, as well as the signatures at every time point, except for the first n observations.[1]

Stage 2 of the procedure leads to the construction of the HMM Signature Indicator. The values of this indicator are specified for each time point, apart from the first n points. At each time point, the signature is calculated and compared to the reference signature. The value of the indicator is only the value of the distance measure between these signatures. In particular, in the empirical analysis presented in this article, the root mean square error (RMSE) is used. The interpretation is straightforward, the RMSE measure indicates how similar the current situation (expressed in the form of a signature) is compared to the reference signature. The smaller the RMSE measure, the more similar the signatures, and the higher probability of being at a turning point.

Stage 3 of the procedure is the transformation of the calculated indicator into a set of turning points. This is the part of the procedure that differs from the original formulation, where the proposition of a new algorithm for turning point identification, based on the given time series, is given. This algorithm, however, turns out to be unnecessarily complex. Due to the fact, that this stage cannot be omitted, and the HMM Signature Indicator will probably not be a smooth function (or rather too volatile), existing algorithms cannot be applied directly or—to be more precise—the algorithms would identify too many turning points to be useful from a practical point of view. Therefore, a modification of this stage of the procedure was proposed. A detailed description can be summarised in the following steps:

1. Perform decomposition of the indicator into the cyclical and trend components. There are a few ways to achieve this goal, e.g. Seasonal and Trend decomposition using Loess (STL, see Cleveland, Cleveland, McRae, & Terpenning, 1990), Tramo-Seats decomposition (Dagum & Bianconcini, 2016), or X-13-ARIMA-SEATS decomposition (Sax & Eddelbuettel, 2018). In this procedure, the asymmetric Christiano-Fitzgerald filter (Christiano & Fitzgerald, 2003; Nilsson & Gyomai, 2011) of a time series was used. The following parameter values have been established:
   - 24 as a minimum period of oscillation for the desired component;
   - 144 as a maximum period of oscillation for the desired component;
   - drift and unit root in time series assumed.

   The cyclical component of the time series is passed on to the next step of this stage.
2. Use the Bry-Boschan routine (Bry & Boschan, 1971) to identify turning points in the cyclical component of the HMM Signature Indicator. This routine finds local extrema in the cycle series, ensuring alternating peaks and troughs, as well as phase and cycle length constraints. This method is

[1] For such observations, the signature can be calculated, but not for the whole range of times.

widely used, e.g. OECD applies a simplified version of the original Bry and Boschan routine, starting from December 2008 (see Federal Reserve Bank of St. Louis, n.d.).

A cyclical component of the exemplary HMM Signature Indicator (step 1) with turning points (step 2) is given in Figure 2. The performed computations resulted in the HMM Signature Indicator denoted by the HMM IND 1, which is described in the next section.

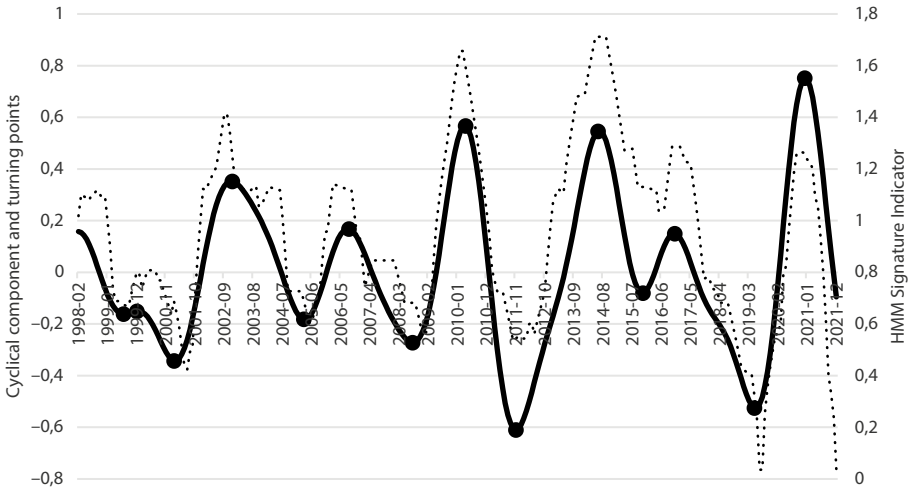

Figure 2. The HMM IND 1 (dotted line) along with the cyclical component (continuous line) and turning points (points) from March 1997 to December 2021
Source: Own calculation.

The proposed procedure of computing signatures, indicators and related turning points is a simplified and better methodologically justified variant of the original procedure. The modification involves the use of broadly-recognised decomposition methods and the Bry-Boschan algorithm. The procedure, as a whole, could be treated as a universal template to construct new indicators. The illustration of this procedure and the verification of leading properties are given in the subsequent section.

3. Empirical analysis

This section consists of 2 parts. In the first one, data characteristics are given, while in the second part, the construction of 2 exemplary HMM Signature Indicators is described. This section ends with a brief discussion of the results and a comparison with the reference RIED ICI time series.

Data used in the empirical analysis come from the business tendency survey in the Polish manufacturing industry, conducted monthly by the RIED. In this survey,[2] respondents evaluate changes in selected areas of economic activity, by answering 8 questions (in 8 versions: retrospective about the current situation, and perspective about the future):

- volume of production (prod);
- volume of total orders (order);
- volume of export orders (order);
- finished goods inventories (stock);
- selling prices of products (price);
- level of employment (employ);
- financial standing (fin);
- general economic situation in Poland (gen).

For every question, balances, as the difference between percentages of positive and negative answers, are calculated. An example of a time series comprising such balances is given in Figure 1 (for the question about the level of employment). Graphs of time series regarding stock, price, fin and gen, are shown in the figures included in the Appendix.

Since January 2013, the RIED ICI has been calculated as an arithmetic mean of 3 balances: production expectations, the current volume of total orders and finished goods inventories (with the negative sign). Turning points calculated via the Bry-Boschan algorithm, based on the cyclical component of this indicator, were used as reference turning points in the first stage of the procedure. Also, a comparison of the results has been carried out between the HMM Signature Indicators and the RIED ICI.

The data sample covers the period from March 1997 to December 2021. There is a number of possible combinations of questions, which can lead to more or less adequate indicators. In addition, the size of the signature is another parameter necessary to be taken into account. From all combinations, 2 sets of questions were chosen. A different set of questions than that used in determining the RIED ICI was intentionally applied. Two indicators that will be described later in this section were calculated using the following input data and parameters:

- HMM IND 1 (Figure 2): size of the signature: 12, questions used: finished goods inventories (stock), selling prices of products (price);
- HMM IND 2 (Figure 3): size of the signature: 18, questions used: level of employment (employ), financial standing (fin), general economic situation in Poland (gen).

[2] See RIED (n.d.).

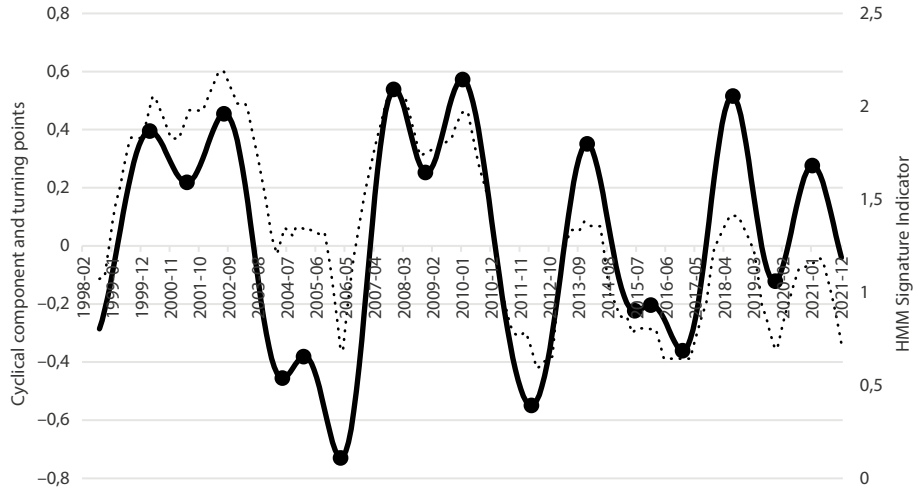

Figure 3. The HMM IND 2 (dotted line) along with the cyclical component (continuous line) and turning points (points) from March 1997 to December 2021
Source: Own calculation.

Two indicators differ from each other, both regarding size of the signature as well as the set of input time series. The results, however, are comparable (see Figure 4 and Table 1).

Based on the figures and the table, some conclusions may be drawn. First of all, despite the fact that both HMM Signature Indicators turned out to be quite smooth, a step with isolating a cyclic component is necessary. Without this step, each, even small change, would be considered as a turning point, which would lead to over-identification.

Secondly, all turning points detected by HMM IND 1 and HMM IND 2 have their counterparts in the RIED ICI, except the points at the beginning of the considered period, due to the shortening of the time series related to the size of the signature (the larger the size, the shorter the indicator). The number of turning points depends on the cyclical component which, in turn, is determined by the Christiano-Fitzgerald filter parameters (minimum and maximum period of oscillation).

The third remark concerns the time shifts between turning points identified on the basis of different indicators. The RIED ICI is recognised as a leading indicator. Meanwhile, both HMM Signature Indicators caught turning points much earlier than the RIED ICI (see Table 1). Only at the beginning of the considered period (HMM IND 1) or around periods where more turning points are identified according to the HMM IND 2, compared to the RIED ICI, were the turning points caught at a later time. It is, however, understandable, because just before the point was potentially caught too late, other turning points were located. Therefore, datings

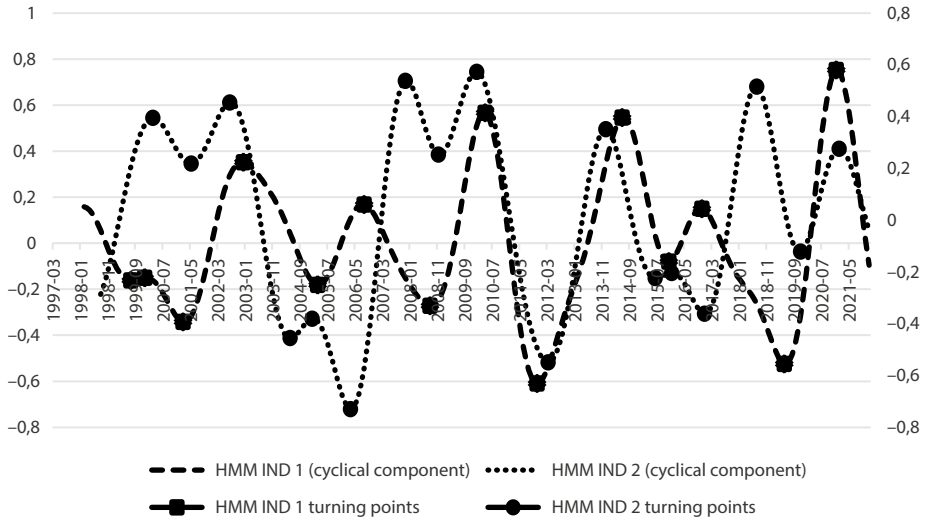

Figure 4. Comparison of the cyclical components regarding 2 HMM Signature Indicators with turning points identified according to the presented procedure. The HMM IND 2 (dotted line) along with the cyclical component (continuous line) and turning points (points) from March 1997 to December 2021

Source: Own calculation.

are still much before the actual shift in economic climate, and the overarching goal is fulfilled.

The fourth observation is related to the latest months in the analysed period. The RIED ICI at the end of 2021 still does not capture the peak and the last identified turning point is the trough in March 2020. Meanwhile, both HMM Signature Indicators have already registered another turning point (peak), just a month apart (HMM IND 1 in December 2020, and HMM IND 2 in January 2021). Thus, not only were all turning points caught much earlier, giving enough time for policymakers to take some action, but we also have an early warning signal of the impending deterioration of the situation.

The fifth conclusion is based on a comparison between 2 considered HMM Signature Indicators. The input time series was completely different, but the resulting sets of turning points were quite similar (see Figure 4). This suggests a certain redundancy of information contained in the responses to the survey questions. However, the graphs of differences between percentages of positive and negative answers to the questions from the RIED business tendency survey vary significantly, so instead of data redundancy, the cause should be sought in discovering non-obvious patterns in the raw data. The fact that there is no need to transform the input data is worth emphasizing.

Table 1. List of turning points in the Polish industry between the years 1997–2021, based on RIED ICI and HMM Signature Indicators (HMM IND 1 and HMM IND 2). For the corresponding turning points, the number of months between the dates is given. Negative values mean that the date of the turning point related to the corresponding HMM Signature Indicator is earlier than the date of the turning point related to RIED ICI

RIED ICI	Turning point	HMM IND 1	Shift [Mo.]	HMM IND 2	Shift [Mo.]
1998-12	Trough	1999-07	7	–	–
2000-03	Peak	1999-12	–3	2000-03	0
2001-08	Trough	2001-02	–6	2001-05	–3
2004-01	Peak	2002-12	–13	2002-07	–18
2005-06	Trough	2005-03	–3	2004-05	–13
–	Peak	–	–	2005-01	–
–	Trough	–	–	2006-03	–
2007-04	Peak	2006-08	–8	2007-11	7
2009-03	Trough	2008-08	–7	2008-11	–4
2010-11	Peak	2010-04	–7	2010-01	–10
2012-10	Trough	2011-11	–11	2012-03	–7
2014-08	Peak	2014-06	–2	2013-12	–8
2015-11	Trough	2015-11	0	2015-06	–5
–	Peak	–	–	2015-12	–
–	Trough	–	–	2016-12	–
2018-05	Peak	2016-11	–18	2018-07	2
2020-03	Trough	2019-05	–10	2019-11	–4
–	Peak	2020-12	–	2021-01	–

Source: Own calculations.

The proposed combinations of variables as input to the HMM Signature Indicator are probably not optimal, but chosen from thousands of possibilities. The difficulty is, nonetheless, found not in the procedure itself, but in the weakness related to the lack of hard data that can be used as a reliable reference series. Finding the right combination of variables, procedure parameters, but most of, all proper macro-economic data (instead of data from the business tendency survey), is a non-trivial task beyond the scope of this article, where empirical analysis was used as an illustration and validation of the proposed procedure.

Conclusions

The main objective of this paper was to present a modification of the original procedure described in (Bernardelli, 2020). With this modification, not only does the procedure not lose its effectiveness and versatility of application, but also, it becomes easier to define and more straightforward in usage. It applies the concept

of the Christiano-Fitzgerald filter to obtain the cyclical component of the indicator, and afterwards, the Bry-Boschan algorithm to calculate the turning points. The effectiveness of the proposed procedure is illustrated by empirical analysis conducted based on the business tendency survey in the Polish manufacturing industry, carried out monthly by the RIED. As a reference, turning points identified, based on the RIED industrial confidence indicator, were used. In the empirical analysis, 2 HMM Signature Indicators were constructed with the use of different input time series. Despite this, both showed leading properties.

The proposed procedure of turning point identification, exploring the idea of signatures, proved to be a flexible and universal approach depending on only a few parameters:

- input time series and related number of variables included in the signature;
- size of the signature;
- size of the HMM state space;
- set of turning points needed for the construction of the reference signature;
- range of oscillation period in the Christiano-Fitzgerald filter.

By setting these parameters, we obtain, on the one hand, an indicator with great potential to be a leading one, and on the other, turning point identification, which with high probability, may be treated as an early warning signal.

Following the remarks from the original article (Bernardelli, 2020), the list of concluding observations can be further extended.

- The proposed approach to indicator construction is flexible due to easily parameterisable input, but because of the large number of possible combinations, finding the optimal parameters may be computationally complex.
- A direct consequence of the HMM's low requirements, compared to the classical econometric methods, is wide applicability of the procedure for turning point detection. Signatures exploit the anticipated leading properties of the HMM. Therefore, the constructed indicators have great potential to be early warning signs.
- The signature, the HMM Signature Indicator and related turning points are easily interpretable within the scope of the business cycle theory.
- The signature concept is suitable for any type of data, both macro-economic and that derived from surveys. It can be also mixed in 1 signature. The presented solution is also resistant to incompatible data, e.g. shorter time series can be used with longer ones at the same time.

There are also many possibilities for generalisation or modification at almost every stage of the described procedure. Some examples are listed below:

- at the signature construction stage, instead of the classical arithmetic mean, the weighted mean can be implemented;
- there could be separate signatures for peaks and troughs. One reference signature would then be associated with the periods of relatively good conditions, while the other; with a worse situation;
- the RMSE measure of distance between the signatures may be replaced by a variety of measures;
- at the turning point identification stage, the asymmetric Christiano-Fitzgerald filter can be replaced by an alternative method of time series decomposition, such as: STL, Tramo-Seats or X-13-ARIMA-SEATS.

The next, natural step in research in this area will be verification of accuracy regarding indicators and turning points calculated following the procedure proposed in this article.

Appendix

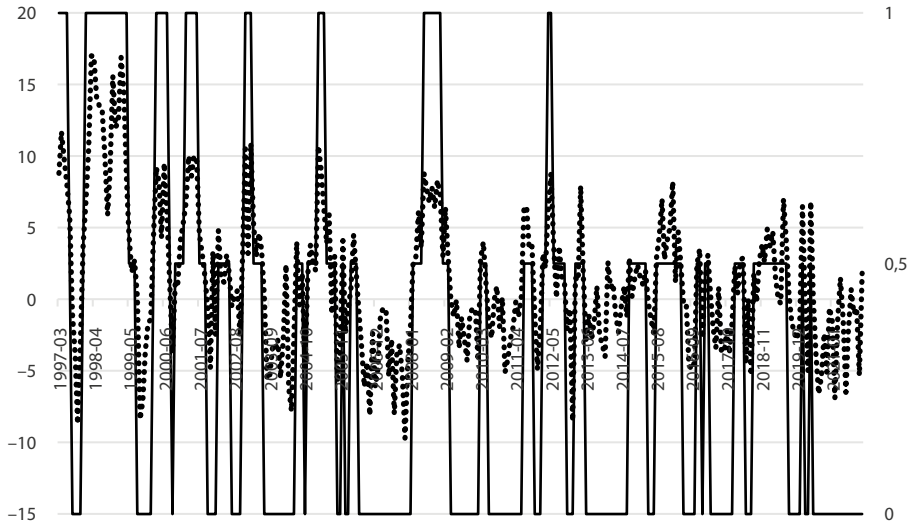

Figure 5. The difference between percentages of positive and negative answers to the question from the RIED business tendency survey about finished goods inventories in the Polish manufacturing industry (dotted line) along three the three-state VP (continuous line) from March 1997 to December 2021

Source: Own calculation based on RIED data.

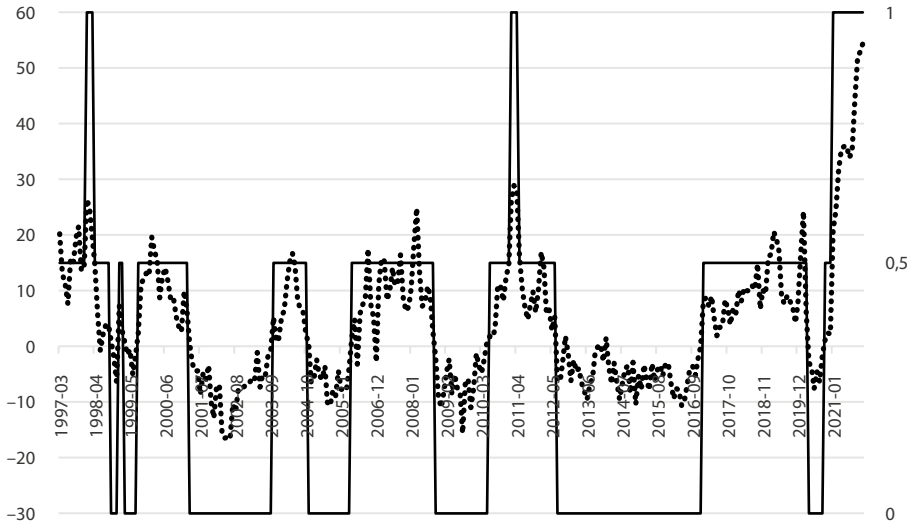

Figure 6. The difference between percentages of positive and negative answers to the question from the RIED business tendency survey about selling prices of products in the Polish manufacturing industry (dotted line) along with the 3-state VP (continuous line) from March 1997 to December 2021

Source: Own calculation based on RIED data.

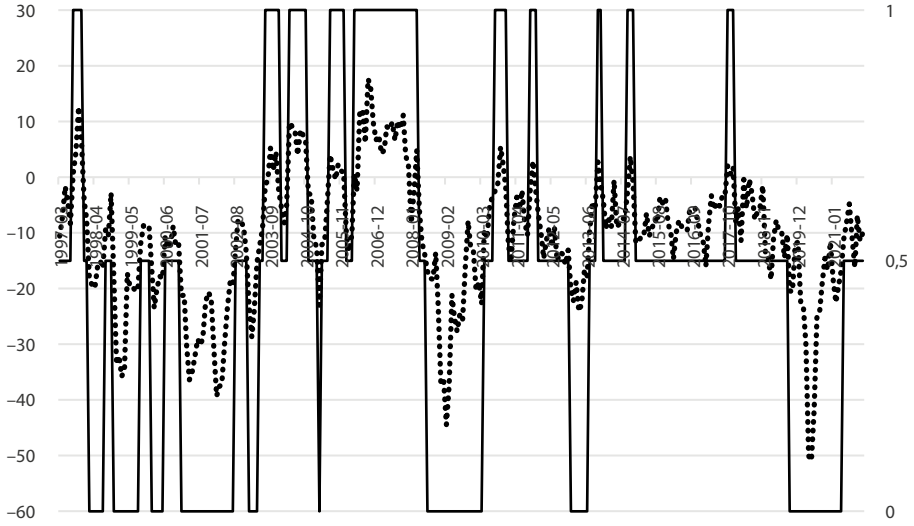

Figure 7. The difference between percentages of positive and negative answers to the question from the RIED business tendency survey about financial standing in the Polish manufacturing industry (dotted line) along with the 3-state VP (continuous line) from March 1997 to December 2021

Source: Own calculation based on RIED data.

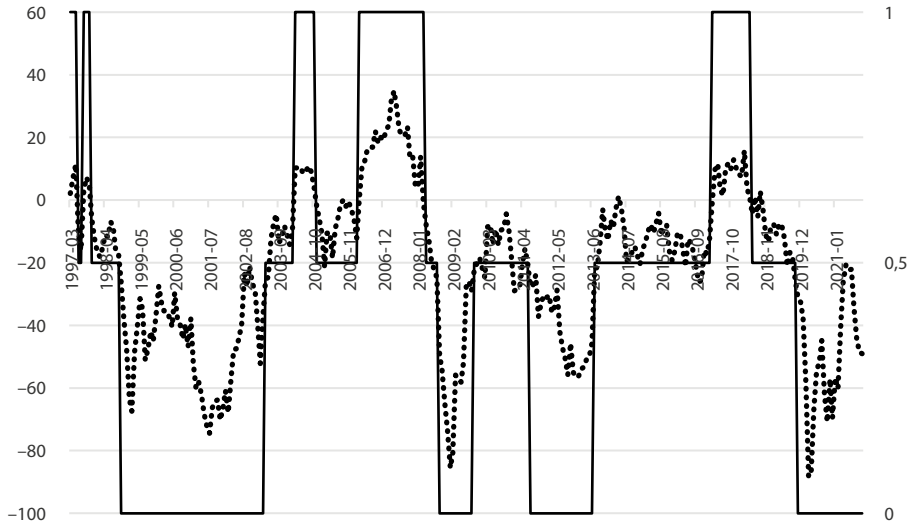

Figure 8. The difference between percentages of positive and negative answers to the question from the RIED business tendency survey about general economic situation in Poland (dotted line) along with the 3-state VP (continuous line) from March 1997 to December 2021

Source: Own calculation based on RIED data.

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MONETARY POLICY UNDER CONTINUOUS MARKET SENTIMENT REGIMES

https://doi.org/10.18559/978-83-8211-129-3/4

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Abstract

In this article, an econometric method is proposed for the analysis of monetary policy under regimes that include unobserved agents' economic sentiments. In the non-linear LVSTAR model, market sentiments do not directly influence monetary policy, however, agents' actions may change over the sentiments providing different reactions to economic shocks. The results indicate differences in the effectiveness of the monetary policy between the high and low economic sentiment regimes, while both countries react in a similar way to the sentiment. In general, during the low level of economic sentiment conducting monetary policy can become more challenging as the reaction time for the economy increases and the changes in monetary policy need to be more vital to take effect.

Keywords: economic sentiments, non-linear, vector autoregression, monetary policy.

JEL codes: C01, C39, C57, E27, E52.

Introduction

In this article, the author discusses a new method to set up the SVAR model via smooth-regime switching with exogenous variables for monetary policies. In the paper, the usefulness of publicly accessible financial sentiment indices in monetary policy modelling is closely examined. Moreover, analyses are carried out regarding the effects of obtained sentiments on the monetary policy following a similar approach to (Nalban, 2016), who studied the Romanian monetary policy transmission mechanism under different regimes, identified on the basis of a synthetic, survey-based economic sentiment indicator (Economic Sentiment Indicator). The obtained results allow to state that asymmetry of the monetary policy transmission exists under those regimes.

The monetary transmission mechanism (MTM) in the United States is well-studied (see e.g. a survey), however, the topic concerning the effects of the economic

Suggested citation:
Chojnowski, M. (2022). Monetary policy under continuous market sentiment regimes. In S. Białowąs (Ed.), *Economic tendency surveys and economic policy—measuring output gaps and growth potentials* (pp. 56–67). Poznań: Poznań University of Economics and Business Press. https://doi.org/10.18559/978-83-8211-129-3/4

This project was financed by the National Science Centre, Poland, grant No. 2017/25/N/HS4/02344.

sentiment on the monetary policy is less well-established. As far as the literature on the monetary transmission mechanism in Poland is concerned, it is already quite extensive. Recent contributions include (Chmielewski, 2016, 2018; Arratibel, 2014). Surveys regarding the MTM can be found in (Egert, 2009; Sznajderska, 2013). In the majority of studies, it has been found that a monetary policy shock is followed by a decrease in GDP (gross domestic product) and CPI (consumer price index), yet the evidence of these effects on the exchange rate is mixed. Nonetheless, non-linearities in the MTM in Poland remain explored only to a limited extent. The only study in which analysing MTM in Poland using non-linear VARs (vector autoregressions) is (Postek, 2011). He finds non-linearities of the effects of monetary policy shocks concerning phases of monetary policy and the business cycle. Other contributions related to non-linearities broad MTM context has been examined, albeit using different frameworks, can be found in (Łyziak, Demehuk, Przystupa, Sznajderska, & Wróbel, 2012; Chmielewski, 2016). Studies on asymmetries from some channels of the transmission mechanism of monetary policy include the following: (Chmielewski, 2018; Przystupa & Wróbel, 2011; Sznajderska, 2012).

It needs to be pointed out that regime-switching models based on sentiments can also be used in other applications. The concept is centred around the fact that sentiments can influence equilibrium in the general equilibrium framework (Angeletos, 2012; Benhabib, Wang, & Wen, 2013). Although (Fève & Guay, 2016) indicates that sentiments may have a limited effect on the macroeconomic fluctuations, while Chojnowski and Dybka (2017) have shown that economic sentiments can be used to forecast the exchange rate.

The contribution of this article to literature can be viewed from 2 angles. First, the estimation method of the LVSTAR model is presented, which, if possible, converges to stable solutions in both pure regimes. Such an assumption is consistent with the literature, in which it is stated that if sentiment reaches extreme values, the economy should be stable as everyone acts the same way (there is coordination among agents) (Taschereau-Dumouche & Schaal, 2015). The second area of our contribution is a more complex analysis of economic behaviour under the regimes defined by economic sentiment.

1. Global game approach

The foundations are set in the global games approach (Morris & Shin, 2000). Let us assume agents can perform 2 actions—to take credit or not. Even though agents are constraint to 2 actions, this game can be extrapolated to many other situations on the market. In the case of 2 players, if both invest the money they have borrowed, both get rewarded. If 1 of the players decides to restrain, s/he gets nothing, while the other one records a loss. Hence, if none of them invest, they gain nothing.

There are 2 Nash equilibria for this set-up: both invest, or both do not. Thus, if both players undertake the same action, there is a stable solution. Therefore, this game is also commonly known as the coordination game.

Let us consider now that information is not fully accessible, and the agents have received signals, which are distorted. In such a scenario, they have to decide whether they take the credit, depending on how much they trust their signal. Hence, if the signal is strong, they will invest, otherwise, they will refrain from any action. As long as the agents know that other players have received signals, they must guess what signal they might have received. Additionally, the player knows the others will try to guess what signal the player has received. The latter situation corresponds to second-order beliefs over other economic signals (first-order beliefs). The game mentioned above can be easily extrapolated to more players, where returns depend on the number of agents who invest.

Additionally, in all the scenarios given above, let us assume there exogenous shock also exists, influencing second-order beliefs—market sentiment. If sentiments are high, then everyone believes that others received a high signal as well, so that they will invest; hence, the agent is eager to take on credit to invest as well. Analogically, when sentiments are low, no one tends to invest. Therefore, market sentiments can change one's action without influencing macroeconomic fundamentals. Such factors are known as economic sunspots. This framework corresponds to the method of how sentiments are implemented into economic models (Angeletos & La'o, 2013).

The first-order signals x' depend on the total productivity factor of the competitor, whereas the second-order signal x'' depends on the first-order signals. Both signals are distorted by a random i.i.d white noise (x' and x''). Second-order belief is additionally distorted by a market sentiment. In the paper, this idea is expanded for multiple agents on the market. The signal transmits information about economic well-being. Therefore, the first order belief is an aggregation of everyone else's Total Productivity Factor, while second-order belief is an aggregation of competitors' first-order signal. Market sentiment influences second-order beliefs in the same way as in the Angeletos method. Thus, this framework can be constrained to the following equations:

$$x'_{i,t} = \sum TFP_{j,t} + \varepsilon'_{i,t}$$
$$x''_{i,t} = \sum x'_{j,t} + \xi_t + \varepsilon''_{i,t}$$

The RBC model with market sentiments in second-order beliefs is further discussed by (Angeletos, Collard, & Dellas, 2018). Their model assumed the output (Y_t) is linearly dependent on equilibrium output level Y_t and market sentiments ξ_{-t}. In this article, the author proposes an econometric model that incorporates the aforementioned assumption by introducing regimes under which the economy operates.

2. Monetary policy model

Analysis of the monetary policy in the United States and Poland is based on the approach proposed by (Peersman & Smets, 2001). Let us consider the VAR model with the following variables:

$$Y_t = \begin{bmatrix} y_t \\ p_t \\ i_t \\ s_t \end{bmatrix}$$

where y_t denotes the output, p_t is the consumer price index, i_t refers to the monetary policy while s_t is the exchange rate. The identification strategy is based on the Cholesky decomposition with the ordering as in equation 3.

The LVSTAR model is used in the proposed approach with regimes identified based on sentiment values. There are 2 regimes: the high and the low sentiment value regimes. First, the author identifies that the low-sentiment regime under the underlying VAR model is stable (i.e. all the roots of the companion matrix lie within the unit circle). Monetary policy analysis started in January 1980.

3. LVSTAR model estimation

The logistic, smooth threshold vector autoregressive model (LVSTAR) expands the LSTAR model for multivariate data. This model assumes 2 independent processes: VAR(P_H)—high regime and VAR(P_L)—low regime. The outcome in each period is a mixture of those 2 regimes. The threshold variable defines how much of each occurs.

The threshold variable is transformed by the transition function: $g(\cdot)$: $\theta \rightarrow [0,1]$. Then, the final model assumes following form:

$$Y_t = g(\theta_t)\left(\sum_{\tau=1}^{P_H} A_{(H,\tau)} Y_{(t-\tau)}\right) + \left(1 - g\left(\theta_t\right)\right)\left(\sum_{\tau=1}^{P_L} A_{(L,\tau)} Y_{(t-\tau)}\right)$$

Although the algorithm is still developing in the literature, which guarantees stable VARs in both regimes, in this article, the author takes advantage of the fact that the threshold variable is known as extracted market sentiment ($\theta = \xi$). Let us define function g as a cumulative normal distribution function with the mean $\overline{\mu}$ and standard deviation $\overline{\sigma}$. Hence $g = \Phi(\xi,\overline{\mu},\overline{\sigma})$. For the given values of $\overline{\mu}$ and $\overline{\sigma}$ transition function value is known, hence, the LVSTAR model becomes:

$$Y_t = \Phi\left(\xi_t, \bar{\mu}, \bar{\sigma}\right)\left(\sum_{\tau=1}^{P_H} A_{(H,\tau)} Y_{(t-\tau)}\right) + \left(1 - \Phi\left(\xi_t, \bar{\mu}, \bar{\sigma}\right)\right)\left(\sum_{\tau=1}^{P_L} A_{(L,\tau)} Y_{(t-\tau)}\right)$$

Let us further define $Y_{H,t} = \Phi(\xi_t, \bar{\mu}, \bar{\sigma}) Y_t$ and $Y_{L,t} = (1 - \Phi(\xi_t, \bar{\mu}, \bar{\sigma})) Y_t$. Then Y_t is a mixture of 2 VAR models:

$$Y_t = \left(\sum_{\tau=1}^{P_H} A_{(H,\tau)} Y_{(t-\tau)}\right) + \left(\sum_{\tau=1}^{P_L} A_{(L,\tau)} Y_{(t-\tau)}\right)$$

Moreover, VAR models can be solved row-by-row, leading to a linear model for each endogenous variable. Because values vary over time, it is unlikely that Y_H and Y_L are collinear. Hence, OLS can be used to estimate A_H and A_L. Let us set up an algorithm, which for given pairs of $\bar{\mu}$ and $\bar{\sigma}$ results in the sum of squared residuals. Then, by creating a grid, one can minimise the error of the LVSTAR model to obtain the optimal transition function.

As the algorithm mentioned above requires little computing power, it is possible to impose additional constraints that would satisfy theoretical assumptions.

The author has shown that extracted market sentiments can be used as a proxy variable, which divides the population into 2 groups. Recalling the game from section 2, it can be assumed that high regime represents a population that is likely to invest, hence, A_H represents how this population interprets the past. Then, the low regime represents the population, who does not like to invest, and analogically, A_L represents how those people interpret the past. Thus, if all people tend to either invest or not to invest, the economy is expected to be in Nash equilibrium and, by the second welfare theorem, in Pareto equilibrium. Therefore, VAR models defined by A_H and A_L should be stable and convergent.

Moreover, it is unlikely that all populations will choose the same action. Hence, a grid range can be limited, so transition function values are bounded from below (b) and above ($1 - b$). Then, the algorithm assumes the following form:

$$\left(\bar{\mu}, \bar{\sigma}, A_H^*, A_L^*\right) = \underset{\mu,\sigma,A_H,A_L}{\arg\max} \sum_{t=1}^{T} \left\| y_t - \tilde{y}_t \right\|$$

$$\forall_k y_t^k = \frac{Y_t}{sd\left(Y_t^k\right)}$$

$$\tilde{y}_t = \sum_{\tau=1}^{P_H} A_{H,\tau} Y_{t-\tau} + \sum_{\tau=1}^{P_L} A_{L,\tau} Y_{t-\tau}$$

$$Y_{H,t} = \Phi\left(\xi_t, \bar{\mu}, \bar{\sigma}\right) Y_t$$

$$Y_{L,t} = \left(1 - \Phi\left(\xi_t, \bar{\mu}, \bar{\sigma}\right)\right) Y_t$$

$$\forall_{r\in\{H,L\}} \max\left(roots\left(A_r\right)\right) < 1$$
$$\forall_{r\in\{H,L\}} rank\left(Y_r\right) \geq \kappa$$
$$\forall_t b \leq \Phi\left(\xi_t, \mu, \sigma\right) \leq 1 - b$$

For a given value of ξ_{-t}, it is possible to derive an IRF function by adding matrices A_H and A_L.

4. Data

In this research, models were estimated based on monthly data. All except for financial market variables are seasonally and, if necessary, calendar-adjusted.

Although the data for the United States are available for a very long period of time, the author decided to start analysis in 1980, after the collapse of the Bretton Woods system, that can be viewed as a new monetary policy era. The inflation rate measure is calculated with the Personal Expenditures excluding food and energy price index obtained from the Federal Reserve Economic Data (FRED) database. Next, the elective federal funds rate was used as the monetary policy measure (FRED), including the shadow rates computed by the Reserve Bank of New Zealand for the periods when non-standard monetary policy measures were used. The industrial production index was used as an output measure (FRED), and the Real Eleective Exchange Rate from the Bank for International Settlements was used. Last but not least, the Michigan Consumer Index was applied as an economic sentiment indicator.

It should be noted that both models with stationary and non-stationary variables are used in studies on the effects of monetary policy shocks employing VARs. In using the latter approach, the author follows (Sims, 1990), who indicates that even in the case of non-stationarity, classical methods give consistent estimates of VAR parameters. Furthermore, the author finds residuals to be stationary, suggesting long-run relationships in our set of variables. This makes using VARs in (log-)levels appropriate (Canova, 2007).

5. Results

In this section, results are presented regarding changes in inflation rate stemming from monetary policy and other macroeconomic variables under two different regimes: low and high economic sentiments. Results denoted as control show the standard VAR model without the thresholds as a reference point for our results.

In Figure 1, the probability is shown that, across time, the economy is in the higher regime. The results indicate clear signs of the dire economic sentiment on the US market in the early 1990s and during the Great Recession. A more extended period of high market sentiment can be seen during the "dot-com" bubble, switching between regimes after the bubble burst. The contrary happened during the Great Recession. Prolonged, low market sentiments kept the economy in the almost pure, "lower" regime.

Interestingly, the "neutral" value of high regime probability is within interval 0.6-0.8, which suggests the higher-regime is most prominent.

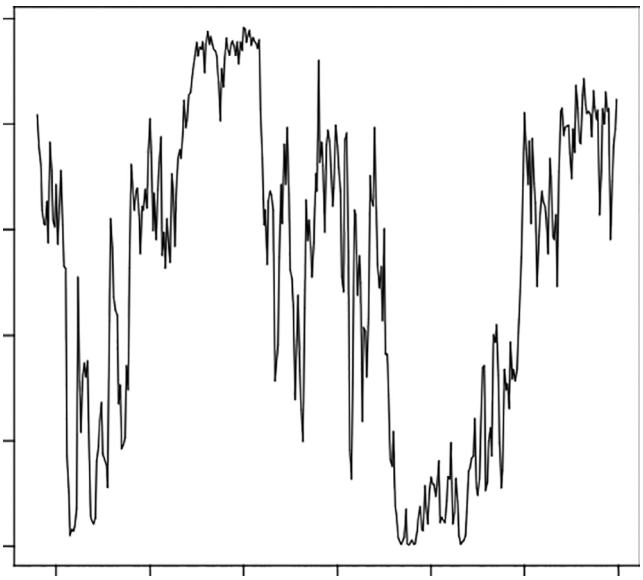

Figure 1. Probability of the higher regime
Source: Own research.

Let us examine the pure regimes. In Figure 2, the impact is presented of tightening of monetary policy on prices. In the "control" scenario, one can record a heavy price puzzle—after 6 months, there is a significant drop in prices. That behaviour is counter-intuitive and was discussed broadly in the with (e.g. Uhlig, 2005). In this article, we tackle the problem from a sentiment angle.

In the low, "recessionary" regime, the impact is more aligned with theory. Contrary to the control scenario, prices do not bounce back after a drop. However, the price puzzle is present in the high regime for all the examined scenarios. The results might suggest that consumer/investor sentiment can influence the effectiveness of the monetary policy, as the high regime overlaps with periods of over-optimism (e.g. dot-com bubble). More insight on irregularities of the CPI behaviour is noted by the GDP response.

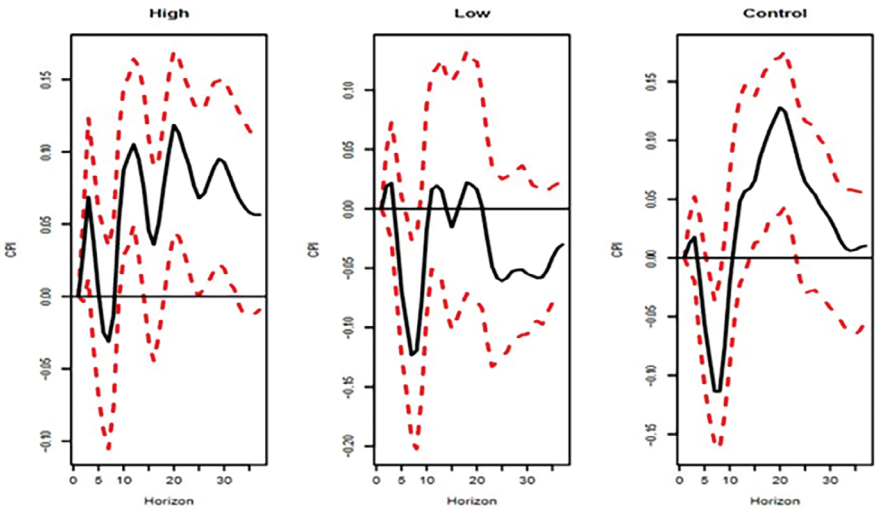

Figure 2. Impact of monetary policy shock on prices: 3-years projection
Source: Own research.

A similar story can be told by examining the impact of monetary policy on output (see Figure 3). In low regime tightening, the monetary policy harms the economy, whereas the opposite can be recorded during the high regime of over-optimism.

More research needs to be done to explain this phenomenon confidently. There are several potential culprits, however. The first might suggest that monetary models need to be extended to include more variables, which theoretical models did not involve. Considering that the anomaly occurs during waves of optimism, expectations may play an essential role in shaping the final action of the agents. Additionally, the irrationality of agents causes misinterpretation of the interest rate increase implications.

Another explanation might come from the timing of the decision. When optimism starts to fade, and the cycle reaches its peak in business cycles, FED might prolong the prosperity period by lowering the interest rate. Nonetheless, the output falls because the pessimism error occurs, disregarding FED actions. Therefore, a VAR model picks the lowering interest rate to decrease GDP growth, which implies that increasing interest rate would further increase GDP.

The LSTVAR model provides analysis of the monetary policy impact of "pure" regimes and allows to analyse this influence in a "mixed" regime, given by any market sentiment values.

For graphical representation, the author uses 3-dimensional IRFs. On the x-axis, the time horizon is set, on the y-axis, the probability of a higher regime is labelled, and the value is represented by colours—the brighter the green, the higher the values; the brighter the red, the lower they are. For values close to zero, white or pale colour is plotted.

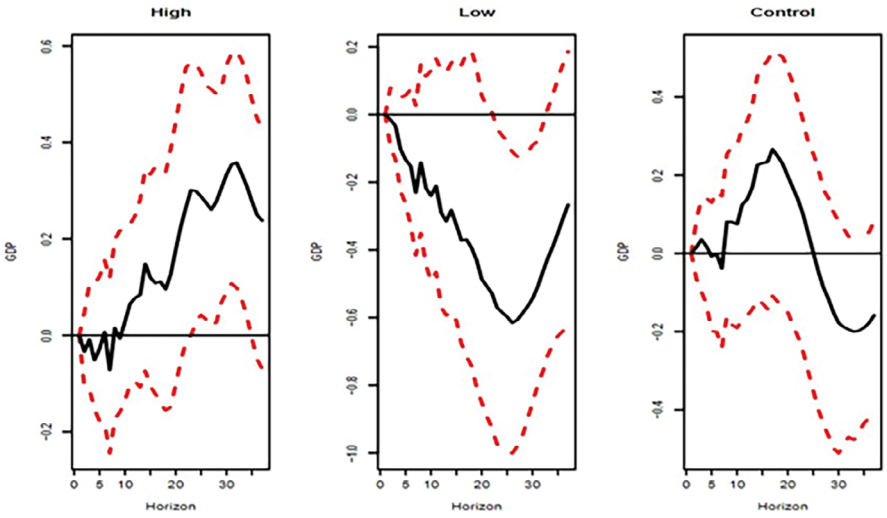

Figure 3. IRF—impact of monetary policy shock on output: 3-year projection
Source: Own research.

In Figure 4, the prominent price puzzle can be recorded for probability values of 0.15 and higher. Additionally, in this figure, the proper negative impact of monetary policy on output is also shown for a similar interval (0.15 or lower).

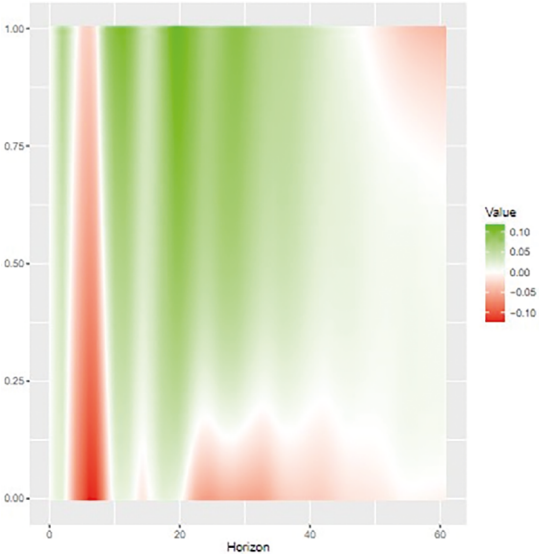

Figure 4. 3-D IRF—impact of interest rate on CPI: 5-year projection
Source: Own research.

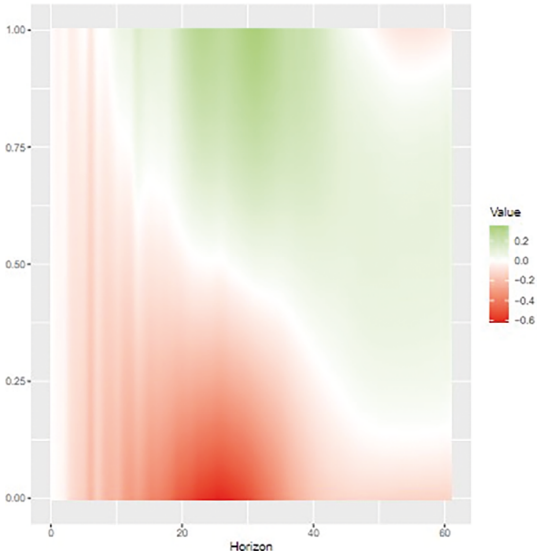

Figure 5. 3-D IRF—impact of interest rate on GDP: 5-year projection
Source: Own research.

Henceforth, for most periods, the economy demonstrates abnormal behaviour. The results suggest that a relatively small fraction of optimistic agents in the economy may deviate from the theoretical behaviour. However, more evidence needs to be claimed to prove such a statement, as mentioned earlier.

Conclusions

In this article, a novel method is presented for implementing market sentiments in monetary policy literature. The preliminary results show that tightening the monetary policy has varying impact on the economy, depending on values of customer confidence index. The proposed model differentiates 2 regimes—"high", which overlaps with expansion periods of the business cycle, and „low", overlapping with recession. During periods of recession, economic behaviours align with new-Keynesian theory models, whereas in higher regimes, they act counter-intuitively. The results may allow to suggest that the irrationality of economic agents can play a significant role in monetary policy effectiveness.

Moreover, the price puzzle also seems to be connected with market sentiments. In the lower regimes, the impact of interest rates on prices is negative. However, the higher probability of a "high" regime, the more persistent the price puzzle becomes.

Although the results presented in this article are preliminary and should be considered with caution, more research on this topic may bring more insight to policy planning and recession recovery programmes.

Acknowledgment: I would like to express my greatest gratitude to Maria Bolboaca, Piotr Dybka, and Mariusz Kapuściński for their invaluable comments and suggestions.

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PART 2.
SITUATION ASSESSMENT

DO SURVEY RESPONSES IN MANUFACTURING FLUCTUATE WITH BUSINESS CYCLE? EVIDENCE FROM POLAND

https://doi.org/10.18559/978-83-8211-129-3/5

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Abstract

As we are entering a post-SARS-CoV-2 slump in the economic activity, up-to-date analysis of the dynamics of economic phenomena during expansion and contraction phases of business cycles poses a very current and very important research problem for applied economists. In this paper, literature on dating Polish business cycles is briefly summarised, chronology of expansion and contraction phases is proposed on the basis of turning points established in previous research, and statistical properties of observed and expected changes in 8 fields of economic activity are presented and interpreted.

It is found that during contraction phases, absolute values of balance statistics are both lower, as measured by mean and median, and less volatile, as measured by standard deviation, than during expansion phases. This finding suggests that, in hard times, enterprises are less likely to form opinions or expectations much different from the consensus. As far as the depth of the downturns is concerned, the contractions associated with the financial crisis of 2008–2009 and the second half of 2012 appear worse, both with respect to observed and expected changes, than the slowdown of 2000–2002. Generally, excessive volatility (high-standard deviations, as compared to measures of central tendency) is noted in expansion phases, more often for observed changes than in the case of forecasts. Lower uncertainty is visible in contraction phases, particularly the one associated with the financial crisis of 2008–2009.

The results presented in this paper allow to suggest that the observed and expected balance statistics of survey responses exhibit different statistical properties depending on the phase of the business cycle. This finding could assist future research concerning the impact of the SARS-CoV-2 virus on the dynamics of economic activity.

Keywords: business cycles, survey data, expectations, non-response, manufacturing industry.

JEL codes: C10, C83, D84, E32, L60.

Suggested citation:
Tomczyk, E. (2022). Do survey responses in manufacturing fluctuate with business cycle? Evidence from Poland. In S. Białowąs (Ed.), *Economic tendency surveys and economic policy—measuring output gaps and growth potentials* (pp. 71–84). Poznań: Poznań University of Economics and Business Press. https://doi.org/10.18559/978-83-8211-129-3/5

Introduction

Now it is more true than ever: we are going through turbulent times. Consequences of the incoming (or, by the time you are reading this, current) post-SARS-CoV-2 crisis are difficult to evaluate at present, but they will surely change our economic environment for months or years. Adequate analysis regarding the dynamics of economic phenomena during expansion and contraction phases of business cycles will constitute a crucial part of macro-economic studies in the future.

The purpose of this paper is to identify turning points in Polish business cycles on the basis of published findings, and to analyse statistical properties of responses provided by respondents of the RIED (Research Institute for Economic Development of SGH Warsaw School of Economics) business tendency surveys. Since we are very possibly on the verge of a crisis, separate analysis of the responses, as the economy expanded and contracted in the past, may provide valuable insight as to behaviour of economic variables in the near future.

Expectations of economic agents have been included in this analysis for an important reason. Cyclical behaviour of macro-economic time series is now better—but still imperfectly—understood, and there is no doubt among the economists that psychological characteristics of the markets, including expectations of market participants, play an important part in shaping the business cycles. Expectations defined as credible forecasts—that is, forecasts reliable enough to constitute the basis for actions of economic agents (see Tomczyk, 2011)—influence decisions concerning, among others, levels of investment and pricing as well as employment policy of enterprises, as well as consumption decisions and labour supply of households. Therefore, expectations should be included in the analysis of business cycles, just as surely as observed behaviour of economic variables.

The paper is organised as follows. In section 1, literature on recording Polish business cycles is briefly summarised, and a chronology of expansion and contraction phases is offered on the basis of these findings. In section 2, the RIED database pertaining to business tendency surveys in manufacturing is described, and descriptive statistics of observed and expected changes in 8 fields of economic activity are presented and interpreted. Comments and conclusions follow in the last section.

1. Review of literature on the chronology of Polish business cycles

There is no need to elaborate on the importance of identifying business cycles for the purposes of understanding macro-economic dynamics. Dating back to the seminal 1946 book by Burns and Mitchell, economists generally agree that cycles

constitute a crucial input in the behaviour of economic variables. While relevance of business cycles for macro-economic analysis has been widely accepted, the definition of a cycle remains imprecise; economists do not agree on the length of the cycle itself or with regard to its individual phases, naming of the business cycle components, definitions of turning points, etc. Since the aim of this paper is neither to propose a new chronology of business cycles nor to introduce an updated definition of a cycle, these nuances will not be debated here. However, discussions of various definitions of business cycles, methods of identifying and dating the specific components, amplitudes of cycles in distinct sectors of the economy, analysing the cause-and-effect relationships within cycles etc., are extensively presented in the literature (for a recent definitive Polish publication, see Drozdowicz-Bieć 2012; for a handbook of business cycle analysis on the basis of survey data, see Goldrian 2007). For the purposes of this paper, business cycle is understood in its classical meaning introduced by Burns and Mitchell (1946, p. 5):

> Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration business cycles vary from more than one year to ten or twelve years; they are not divisible into shorter cycles of similar character with amplitudes approximating their own.

Analysis of business cycles has constituted an important branch of Polish macro-economic studies since the early 1990s. As a result, there are numerous publications concerning the dynamics, chronology, implications for economic policy, and other features of Polish business cycles. Needless to say, there is no agreement between the authors of the dating of business cycles in Poland. Depending on the period taken into consideration, the general approach to cycle analysis (classical or modern; see Krolzig & Toro, 2004), formal econometric and statistic methods used to model the cycles (spectral analysis or nonlinear time series modeling, including Markov switching models; see Oppenländer & Poser, 2018; Jaworski, 2015), statistical filters applied, level of aggregation of the data etc., they found different dating schemes for the business cycles in Polish economy.

In Table A in the Appendix, a summary is provided regarding the results obtained in the most influential papers on business cycle dating in Poland after 1997. It is clear that authors differ in their chronology of expansion and contraction phases (which, for the purpose of this paper, I define as the period from the lower turning point until the upper turning point, and from the upper turning point to the lower turning point, respectively). Cycles vary in length from 2 to 18 quarters, as determined on the basis of turning points, and the turning points themselves are

identified in different quarters by individual authors. However, a basic consensus emerges. The following expansion phases seem to have been identified by most researchers:

- Q3 2002—Q2 2004;
- Q2 2005—Q1 2008;
- Q4 2009—Q2 2011;
- Q1 2013—Q1 2020.

Also, the analysts appear to agree on the following contraction phases:

- Q2 2000—Q3 2002;
- Q1 2008—Q4 2009;
- Q2 2011—Q1 2013.

Data prior to April 2000 have been omitted from the subsequent analysis, as the authors do not concur on the details of business cycle dating. The period from July 2004 to March 2005 has been excluded for the same reason: there is no agreement on whether it should be classified as time of expansion or contraction. However, 4 expansion phases (with the total number of 177 monthly observations) and 3 contraction phases (with 51 monthly observations) remain available for the purpose of statistical analysis in the next section.

2. Results of empirical analysis

Since March 1997, the Research Institute for Economic Development of SGH Warsaw School of Economics (henceforth RIED), has conducted monthly business tendency surveys in manufacturing. The scope of the survey and variants of the answers are presented in Table B in the Appendix. Eight fields of economic activity are evaluated by the respondents with respect to changes they observe and expect for the next 3–4 months. On the basis of individual qualitative responses, balance statistics (that is, differences between the number of optimists—those who report or expect improvement—and pessimists), are calculated and presented in percentage points.

For the reasons explained in section 2, the starting point of the analysis is April 2000. The ending point is established for December 2019 to avoid the onset of the—very probable—post-SARS-CoV-2 crisis. In February and March of 2020, the first signs of deterioration concerning the macro-economic situation have already been visible, but the full analysis of the post-SARS-CoV-2 slowdown has to be postponed until the current phase of the business cycle ends.

In Table C in the Appendix, averages, medians and standard deviations for both observed and expected changes in balance statistics for 8 fields of economic

activity surveyed by RIED are presented, aggregated into expansion and contraction phases. It is clear that forecasts are typically more optimistic than observed changes, with 2 exceptions: question No. 04 (stocks of finished goods) and No. 06 (level of employment). This result is consistent with previous findings that expectations expressed in Polish business tendency surveys in industry are not unbiased or efficient with respect to available information, and hence, not Muth-rational (see Tomczyk, 2011). Excessive optimism remains a persistent—and, to my best knowledge, unexplained—feature of expectations cocnerning Polish industrial enterprises.

During contraction phases, absolute values of balance statistics are both lower, as measured by mean and median, and less volatile, as measured by standard deviation, than during expansion phases—again, with a single exception (question No. 05—prices). This finding suggests that there are few disagreements between the respondents as to the current or future course of the economy, and little uncertainty, with economy being "on the rocks". The lowest variation is observed in contraction phases for questions No. 06 (employment) and 08 (general situation of the economy). It appears that in these 2 fields of economic activity, respondents are the most congruent. Also in these 2 fields, for both observed and forecasted changes, high and highly negative balance statistics are noted, which imply that there is visible dominance of the pessimists over the optimists.

On the other hand, there is more volatility (as expressed by very high standard deviation as compared to measures of central tendency) during expansion phases for all the fields of economic activity analysed.

Still, there is only a limited use of statistics aggregated over the entire combined periods of expansion or contraction during the 2 decades of 2000–2019. To broaden the investigation, results broken down into 3 contraction phases and 4 expansion phases identified on the basis of the Polish literature on business cycles are presented in Table D. It seems that the contraction associated with the financial crisis (2008.04–2009.09) and the short downturn in the second half of 2012 (2012.07–2012.12) are deeper, both with respect to observed and expected changes, than the contraction of 2000.04–2002.06, with the sole exception of question No. 06 (unemployment), where the contraction of 2000-2002 seemed to make respondents the most pessimistic. Mixed results are obtained for questions No. 07 (financial standing of a company) and 08 (general business conditions).

For all business cycle phases, low absolute values for the average and median, suggesting lack of consensus or heavy fraction of "no change" responses, are noted in questions No. 04 (stocks of finished goods) and 05 (prices of goods produced). High absolute values of averages and medians, signifying consensus among the respondents, are visible for observed changes in questions No. 02 (level of orders) and 03 (level of export orders); it is clear, however, that a similar consensus does not extend to expectations. High absolute values of measures regarding central

tendency are discernible for both observed and expected changes in questions No. 06 (employment) and 08 (general business conditions). These results further suggest that when evaluating or forecasting employment and general standing of the economy, respondents tend to flock in one particular direction more easily that when asked about other aspects of their economic activity.

Only in a few cases is there a significant difference between the average and median, which may suggest that more of the data values are clustered towards one end of their range or a few extreme values are observed. This happens in expansion and contraction phases, and for observed and forecasted changes, there seems to be no clear pattern of incidence of extreme values with regard to balance statistics.

Generally, more volatility (high standard deviations, as compared to measures of central tendency) is noted during expansion phases, more often for observed changes than for forecasts. Lower uncertainty is visible in contraction phases, particularly the one associated with financial crisis of 2008–2009. Volatility seems generally lower for questions No. 06 (employment), 07 (financial standing) and 08 (general situation of the economy) than for the remaining aspects of economic activities; this finding points to the conclusion that the last 3 questions in the RIED survey are subject to the highest consensus among all the fields of manufacturing industry characteristics included in the questionnaire.

As the final stage of the empirical analysis, an attempt has been made to analyse response rates during expansion and contraction phases. The numbers of questionnaires sent and returned are available in the RIED database from January 2008,[1] and analysed from the beginning of the contraction of 2008.04. The average response rate for expansion phases is calculated at 25.28%, and for contraction phases –32.69%. Although not conclusive, this result suggests that during difficult times, the respondents are more willing to take part in a survey, perhaps in hopes of obtaining government assistance.

Conclusions

There are several general conclusions that may be drawn from breaking down the observations and expectations of the RIED manufacturing industry survey respondents into sub-periods, corresponding to expansions and contractions of the economy.

During contraction phases, absolute values of balance statistics are both lower, as measured by mean and median, and less volatile, as measured by standard deviation, than during expansion phases. This finding allows to suggest that in hard times, enterprises are less likely to form opinions or expectations much different

[1] There are 2 observations missing: for May 2010 and October 2014.

from the consensus. Also, when evaluating or forecasting employment and the general standing of the economy, respondents tend to remain in agreement to a higher degree than when asked to evaluate or forecast other aspects of their economic activity. As far as depth of the downturns is concerned, the contractions associated with the financial crisis of 2008–2009 and the second half of 2012 appear worse, both with respect to observed and expected changes, than the slowdown of 2000–2002. Generally, excessive volatility (high standard deviations, as compared to measures of central tendency) is noted during expansion phases, more often for observed changes than forecasts. Lower uncertainty is visible in contraction phases, particularly the one associated with financial crisis of 2008–2009.

Unfortunately, the time series available are excessively limited—and separate phases of business cycles too short—to extend statistical analysis to, for example, properties of expectations expressed in various phases of business cycles, rationality of expectations with respect to the cycle phase, or correlation of sentiments expressed in tendency surveys with other aggregated measures of economic activity during upturns and downturns. Still, the results presented in this paper seem promising for establishing that basic statistical properties of observed and expected balance statistics differ in periods of good and bad times. This finding could assist future research on the impact of the SARS-CoV-2 virus concerning the dynamics of economic activity.

To conclude, I would like to re-address the importance of expectations in explaining, modelling, and forecasting the course of economic business cycles. Modern economists generally agree that business cycles are more likely to reflect endogenous mechanisms rather than to simply respond to exogenous shocks (see Beaudry, Galizia, & Portier, 2020). Therefore, the inclusion of expectations—defined as forecasts reliable enough to constitute the basis for current decisions of economic agents—remains a crucial component of reliable business cycle analysis.

Appendix

Table A. Summary of business cycle dating in Poland (quarters)

Author(s)	Expansion phases	Contraction phases
Fic (2009) method: Markov switching models		Q1 1997—Q1 1999
	Q1 1999—Q1 2000	
		Q1 2000—Q1 2002
	Q1 2002—Q2 2004	
		Q2 2004—Q2 2005
	from Q2 2005	
Gradzewicz, Growiec, Hagemeier and Popowski (2010) method: Christiano-Fizgerald filter & other spectral analysis techniques		Q1 1998—Q4 1998
	Q4 1998—Q1 2000	
		Q1 2000—Q4 2002
	Q4 2002—Q1 2004	
		Q1 2004—Q2 2005
	Q2 2005—Q1 2008	
		from Q1 2008
Drozdowicz-Bieć (2012) method: Bry-Boschan procedure		Q1 1998—Q1 2002
	Q1 2002—Q1 2008	
		Q1 2008—Q1 2009
	from Q1 2009	
Adamowicz, Dudek, Pachucki and Walczyk (2012) method: Christiano-Fizgerald filter & Bry-Boschan procedure		Q1 1998—Q1 1999
	Q1 1999—Q1 2000	
		Q1 2000—Q3 2002
	Q3 2002—Q2 2004	
		Q2 2004—Q2 2005
	Q2 2005—Q1 2008	
		Q1 2008—Q4 2009
	from Q4 2009	
Skrzypczyńska (2013) method: Markov switching models & frequency filters	Q3 1997—Q1 1998	
		Q1 1998—Q3 1999
	Q3 1999—Q2 2000	
		Q2 2000—Q3 2003
	Q3 2003—Q2 2004	
		Q2 2004—Q4 2005
	Q4 2005—Q3 2008	
		Q3 2008—Q4 2011
	from Q4 2011	
Warżała (2014) method: Hodrick-Prescott filter & Bry-Boschan procedure		Q1 1997—Q3 1998
	Q3 1998—Q4 1999	
		Q4 1999—Q3 2001
	Q3 2001—Q4 2003	
		Q4 2003—Q1 2005
	Q1 2005—Q4 2007	
		Q4 2007—Q1 2009
	Q1 2009—Q4 2010	
		from Q4 2010

Table A - cont.

Author(s)	Expansion phases	Contraction phases
Ulrichs, Błażej and Jędrych (2014) method: Christiano-Fizgerald filter & Bry-Boschan procedure		Q2 2000—Q3 2002
	Q3 2002—Q1 2004	
		Q1 2004—Q2 2005
	Q2 2005—Q3 2007	
		Q3 2007—Q2 2009
	Q2 2009—Q2 2011	
		Q2 2011—Q1 2013
	from Q1 2013	
Pawęta (2017) method: Bry-Boschan procedure	Q4 1996—Q4 1997	
		Q4 1997—Q4 1998
	Q4 1998—Q4 1999	
		Q4 1999—Q1 2002
	Q1 2002—Q1 2004	
		Q1 2004—Q2 2005
	Q2 2005—Q1 2007	
		Q1 2007—Q4 2008
	Q4 2008—Q3 2011	
		Q3 2011—Q4 2012
	Q4 2012—Q4 2015	
		Q4 2015—Q3 2016
	from Q3 2016	
Adamowicz and Walczyk (2018) method: Christiano-Fizgerald filter	Q3 1996—Q1 1998	
		Q1 1998—Q4 1998
	Q4 1998—Q3 2000	
		Q3 2000—Q4 2004
	Q4 2004—Q4 2007	
		Q4 2007—Q3 2009
	Q3 2009—Q2 2011	
		Q2 2011—Q3 2013
	from Q3 2013	

Source: Authors mentioned in the Table. If there is more than 1 cycle component analysed in a paper, the element with the highest level of aggregation is presented. I would like to thank Ms. Agata Szaniec for her assistance during tge early stages of research on Polish business cycle chronology.

Table B. Monthly RIED questionnaire in the manufacturing industry

		Observed within the last month	Expected for the next 3–4 months
q01	Level of production (value or physical units)	up	will increase
		unchanged	will remain unchanged
		down	will decrease
q02	Level of orders	up	will increase
		normal	will remain normal
		down	will decrease

Table B – cont.

		Observed within the last month	Expected for the next 3–4 months
q03	Level of export orders	up	will increase
		normal	will remain normal
		down	will decrease
		not applicable	not applicable
q04	Stocks of finished goods	up	will increase
		unchanged	will remain unchanged
		down	will decrease
q05	Prices of goods produced	up	will increase
		unchanged	will remain unchanged
		down	will decrease
q06	Level of employment	up	will increase
		unchanged	will remain unchanged
		down	will decrease
q07	Financial standing	improved	will improve
		unchanged	will remain unchanged
		deteriorated	will deteriorate
q08	General situation of the economy regardless of situation in your sector and enterprise	improved	will improve
		unchanged	will remain unchanged
		deteriorated	will deteriorate

Source: RIED database.

Table C. Descriptive statistics for observed and expected balance statistics; expansion and contraction phases aggregated

		exp $n = 177$	cont $n = 51$
q01-obs	avg	3.37	–9.74
	med	3.10	–8.10
	dev	10.91	12.63
q01-for	avg	8.83	1.91
	med	9.10	8.00
	dev	11.63	15.13
q02-obs	avg	–6.76	–23.85
	med	–7.40	–22.20
	dev	11.68	13.03
q02-for	avg	–0.08	–9.90
	med	–0.20	–6.00
	dev	11.66	15.23
q03-obs	avg	–9.26	–23.22
	med	–10.00	–21.30
	dev	10.18	13.70

Table C – cont.

		exp *n* = 177	cont *n* = 51
q03-for	avg	–3.00	–12.64
	med	–3.00	–8.30
	dev	10.72	18.08
q04-obs	avg	–0.01	3.32
	med	–0.20	3.20
	dev	3.87	4.00
q04-for	avg	–3.79	–2.52
	med	–3.90	0.77
	dev	2.84	3.27
q05-obs	avg	2.63	–2.03
	med	1.80	–4.40
	dev	9.03	8.67
q05-for	avg	6.20	2.78
	med	4.70	0.30
	dev	8.90	8.04
q06-obs	avg	–4.41	–25.65
	med	–2.90	–27.70
	dev	8.13	10.45
q06-for	avg	–6.73	–31.04
	med	–5.70	–35.60
	dev	9.35	11.40
q07-obs	avg	–5.81	–22.75
	med	–7.40	–21.20
	dev	8.45	9.44
q07-for	avg	–1.91	–11.54
	med	–3.30	–11.50
	dev	9.57	10.60
q08-obs	avg	–10.52	–49.40
	med	–10.90	–41.70
	dev	18.14	18.62
q08-for	avg	–11.42	–40.37
	med	–11.40	–41.70
	dev	15.81	16.70

Notation: see Table B; cont—contraction phase, exp—expansion phase, obs—observed changes, for—forecasted (expected) changes; avg—average, med—median, dev—standard deviation.
Source: Own work.

Table D. Descriptive statistics for observed and expected balance statistics; broken down into expansion and contraction phases

		cont 2000.04—2002.06	exp 2002.07—2004.06	exp 2005.04—2008.03	cont 2008.04—2009.09	exp 2009.10—2012.06	cont 2012.07—2012.12	exp 2013.01—2019.12
q01-obs	avg	–6.70	6.70	10.09	–14.39	2.97	–9.47	–0.30
	med	–7.40	7.25	11.30	–9.60	2.40	–6.20	0.50
	dev	10.28	11.16	10.69	15.60	11.58	9.47	9.04
q01-for	avg	8.74	12.03	19.16	–3.82	6.33	–11.67	3.41
	med	10.30	15.90	20.30	–6.50	9.70	–12.40	5.50
	dev	10.30	8.97	10.84	17.71	11.40	9.02	9.16
q02-obs	avg	–21.29	–4.83	3.04	–28.63	–9.59	–21.00	–10.39
	med	–21.40	–4.30	3.10	–25.65	–10.50	–20.85	–8.90
	dev	11.07	11.46	11.64	16.07	11.49	7.51	9.25
q02-for	avg	–3.26	2.91	12.46	–16.21	–3.74	–20.83	–4.87
	med	–4.00	4.75	13.50	–19.75	–0.50	–20.90	–2.20
	dev	9.39	8.49	10.92	19.34	11.22	8.01	8.38
q03-obs	avg	–15.65	–1.68	–0.55	–35.13	–13.50	–21.53	–13.50
	med	–16.80	–2.35	0.50	–38.70	–12.10	–22.40	–12.95
	dev	8.41	6.94	8.74	13.85	9.98	5.79	7.80
q03-for	avg	–2.89	5.28	8.90	–24.54	–8.62	–20.80	–8.26
	med	–2.60	6.85	9.10	–27.90	–6.20	–21.75	–7.70
	dev	7.12	7.43	6.72	15.80	10.23	7.74	6.86
q04-obs	avg	3.68	–0.03	–1.46	3.68	0.37	0.63	0.47
	med	3.30	–0.15	–2.15	4.85	–0.20	0.65	0.80
	dev	4.10	4.99	4.43	4.16	3.60	2.01	3.22
q04-for	avg	–0.97	–2.59	–3.78	–4.12	–3.98	–4.45	–4.07
	med	–0.60	–3.35	–4.25	–3.75	–3.80	–4.35	–3.80
	dev	2.92	3.08	2.99	2.49	2.74	3.70	2.70
q05-obs	avg	–1.64	–0.60	4.52	–2.12	7.10	–3.45	1.00
	med	–3.40	–3.45	6.70	–4.95	6.60	–4.35	–2.45
	dev	9.71	8.45	9.58	8.54	9.53	3.30	8.01
q05-for	avg	5.27	3.59	8.88	0.22	8.48	–0.77	4.90
	med	1.90	0.85	11.50	–1.70	8.40	–1.30	2.30
	dev	8.80	6.48	8.88	7.00	7.80	2.43	9.53
q06-obs	avg	–30.54	–15.24	–1.06	–22.58	–8.09	–12.80	–1.30
	med	–29.20	–16.70	1.15	–24.45	–6.90	–11.45	0.10
	dev	7.20	6.70	6.46	11.41	6.55	4.36	6.31
q06-for	avg	–38.13	–20.05	–1.61	–23.59	–12.55	–21.53	–2.83
	med	–37.50	–20.70	1.05	–24.20	–12.00	–22.45	–2.15
	dev	6.08	8.48	8.22	12.11	5.79	5.46	5.69
q07-obs	avg	–24.14	–6.99	2.96	–23.17	–7.94	–15.22	–8.40
	med	–22.40	–7.80	4.10	–22.05	–8.10	–14.40	–8.25
	dev	9.24	10.61	8.04	10.31	6.51	2.63	5.86
q07-for	avg	–8.14	0.05	11.36	–14.09	–3.75	–19.17	–7.44
	med	–9.80	0.60	11.50	–14.45	–3.30	–19.55	–6.60
	dev	7.94	7.02	6.46	13.54	5.74	3.95	6.36

Table D – cont.

		cont 2000.04—2002.06	exp 2002.07—2004.06	exp 2005.04—2008.03	cont 2008.04—2009.09	exp 2009.10—2012.06	cont 2012.07—2012.12	exp 2013.01—2019.12
q08-obs	avg	–53.69	–18.80	9.77	–42.98	–21.95	–49.38	–12.35
	med	–57.40	–17.70	13.65	–50.70	–22.50	–48.85	–11.10
	dev	13.38	16.90	13.90	25.77	9.19	5.38	15.83
q08-for	avg	–39.96	–12.45	7.68	–36.66	–20.52	–53.30	–15.75
	med	–40.50	–13.70	8.45	–37.20	–18.10	–53.40	–14.40
	dev	11.62	10.88	10.39	23.07	13.19	5.05	13.19

Notation: see Table B; cont—contraction phase, exp—expansion phase, obs—observed changes, for—forecasted (expected) changes; avg—average, med—median, dev—standard deviation.
Source: Own work.

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ANTI-INFLATION POLICY IN POLAND'S ECONOMY DURING THE PERIOD OF TRANSFORMATION AND INTEGRATION

https://doi.org/10.18559/978-83-8211-129-3/6

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Abstract

The aim of the article is to analyse the origin, course of inflation and scope of operation concerning the instruments of monetary and fiscal policy applied by the anti-inflation policy, as well as to evaluate their effectiveness for Poland's economy in the years 2000–2021. To measure the relationship between decisions in the area of stabilisation policy and inflation, the authors carried out an econometric analysis using the dynamic autoregressive model with distributed lags. The parameters of the model confirmed that among the applied tools of monetary and fiscal policies, an anti-inflation nature was found between the monetary policy instruments and prices, and also linking budget expenditures with price level. Changes in budget incomes, according to the obtained results, were not conducive to price stabilisation in our economy. Anti-inflationary policy was dominated by monetary policy instruments. The anti-inflationary significance of fiscal policy has been much smaller since the beginning of the transformation of the Polish economy. Its anti-inflationary role increased in the period of difficulties related to the COVID-19 pandemic, in particular at the time of a strong increase in budget spending in the environment of rising price level.

Keywords: inflation, fiscal policy, monetary policy, stabilization policy.

JEL codes: E30, E31, E52, E61, E62.

Introduction

It is assumed that the main aim of stabilization activities implemented in contemporary economies is to stabilize the value of money. Anti-inflation policies conducted in the area of price stabilisation are most frequently implemented by means of the central bank's monetary policy tools or by using fiscal policy instruments. The aim of this article is to analyse the genesis and course of inflation, as well as the scope of operation concerning the monetary and fiscal policy instruments applied

Suggested citation:
Barczyk, R. & Urbanowicz, Z. (2022). Anti-inflation policy in Poland's economy during the period of transformation and integration. In S. Białowąs (Ed.), *Economic tendency surveys and economic policy—measuring output gaps and growth potentials* (pp. 85–102). Poznań: Poznań University of Economics and Business Press. https://doi.org/10.18559/978-83-8211-129-3/6

by the anti-inflation policy, as well as to empirically evaluate their effectiveness for Poland's economy in the years 2000–2021. The article consists of two parts. In the first one, we discuss the origin of inflation processes and the policies to combat price increases, implemented by the National Bank of Poland (NBP) and fiscal bodies. The second part comprises results of econometric analysis regarding the anti-inflation impact of the monetary and fiscal policy tools applied in Poland's economy in the years 2000–2021. The selection of the period for analyses was dictated by access to empirical data characterising the inflation processes as well as the applied instruments of monetary and fiscal policies.

1. Genesis of inflation in the economy of contemporary Poland

In the initial years of the transformation period, the situation of Poland's economy was extremely complicated. Deep, demand-side market imbalance, initiated structural changes, and political chaos led to a rapid rise of prices for goods and services. At the same time, it was the period when monetarist economics dominated. In such conditions, this theoretical school was approved in order to explain the origins of inflation in Poland. This hypothesis originating from Say's law of market and Hume's works gave rise to the quantity theory of money developed by Fisher (Schaal, 1996, p. 287). Fisher dually interpreted the market process as acts of purchase and sales. Their global volume, as assumed by the monetarists, was presented as a product concerning the quantity of goods and the average price level, or as the global indicator of transactions. This condition is a tautology because both of its aspects express the same magnitude, i.e. the monetary sum of commodity transactions. As the resource of money in circulation is shaped exogenously by the central bank, it is independent of the price level, quantity of goods on the market and velocity of money circulation. This velocity is constant because it is determined by the institutional system. The volume of goods is also constant (especially under the assumption that the factors of production are fully exploited). Thus, the dynamics of inflation (price growth) depend on the total quantity of money in the economy.

When the monetarist approach is accepted, one can say that the anti-inflation policy should limit money supply on the market. This means that the central bank should conduct a restrictive policy (difficult money policy) and that the state budget should exhibit a tendency towards generating a surplus.

In accordance with the literature on the subject, in the initial years of economic transformation in Poland, during the rapid growth of incomes and increasing role of trade unions, the Keynesian concept of inflation could also be observed. As specified by Keynes, in an economy where no immediate increase of supply is possible,

an increase in one ingredient of the final demand (e.g. state expenditures) may lead to the emergence of unsatisfied demand which, in the absence of administrative barriers, may result in higher prices and thus, higher revenues for companies and lower real incomes for employees. A natural reaction to the lower real incomes is pressure for wage increase, which with a wage-price elasticity greater than or equal to one, will make this process repeatable. If under demand-pull inflation the authorities do not increase the money supply, then, an increase in the velocity of its circulation will be responsible for the fact that the financing of economic processes will take place in the conditions of price increases caused by the excess of demand over supply. An additional interpretation of Keynes's concept was provided by Kaldor, who said that after World War II, the most important role was played by cost-push inflation (Drabowski, 1987, p. 76). This interpretation has several variations that differ from one another with regard to the significance of individual factors causing cost increase. The best known is wage-push inflation according to which, the increase of prices is caused by trade unions aiming to increase wages (Welfe, 1993, p. 18). Moreover, it is assumed that trade unions, trying to maintain the existing level of nominal wages, want to make sure that the share of employees in the increasing revenues of companies will be grater, due to a higher labour productivity. At the same time, they want to boost the position of their company, as compared to other forms, striving to achieve full employment and opposing attempts to reduce nominal wages.

2. Anti-inflation policy in Poland between 2000–2021

The beginnings of anti-inflation policy are linked with the process of transformation, and the implementation of that policy occurred in very difficult conditions. Changes introduced in the banking system at that time were not only of institutional nature, but also involved the shape of monetary policy, its goals, instruments and strategy (Przybylska-Kapuścińska, 2007, pp. 104–110). In the initial years of transformation, the main aim of the monetary policy was to strengthen the Polish money. This goal was concretised in the yearly assumptions of the monetary policy presented to the Sejm (Polish parliament) (Pietrzak, Polański, & Woźniak, 2003, p. 141). Achieving this objective was to be facilitated by the money supply control strategy. At that time, the central bank was heavily dependent on the government. According to the provisions of the Act on the NBP, the central bank was obliged to cooperate with the Seym in the area of economic policy, being responsible for the correct functioning and development of the banking system. Moreover, the Act granted NBP an unlimited right to purchase Treasury securities, without specifying other forms of central bank lending to the government (Przybylska-Kapuścińska, 2007, p. 280). Breakthrough changes in

the shape of Polish monetary policy were introduced by 6 legal acts (Przybylska-Kapuścińska, 2007, p. 282):

- the Constitution of the Republic of Poland adopted on April 2, 1997 (Konstytucja RP z dnia 2.04.1997 r., Dz.U. 1997, nr 78 poz. 483);
- New act on the NBP of 29 August, 1997 (Ustawa z dnia 29 sierpnia 1997 r. o NBP, Dz.U. 2005, Nr 140 poz. 938);
- New Banking Law of August 29, 1997 (Prawo bankowe i ustawa o NBP z dnia 29 sierpnia 1997, Dz.U. 2005, Nr 140 poz. 939).

The Constitution of the Republic of Poland guaranteed independence of the central bank by giving it an exclusive right to emit money. Moreover, it established a new body, the Monetary Policy Council (MPC) and prohibited the NBP from the financing of budget deficit. According to the provisions of the Act on the NBP, binding until now, the aim of the NBP is still to maintain a stable level of prices. However, the strategy to achieve this aim is different. Since 1999, the NBP has started to use a direct inflation targeting strategy (DIT), which has been more and more frequently used worldwide from the beginning of the 1990s. The inflation target adopted in Poland has not been changed since the beginning of 2004 and it amounts to 2.5%, with a possible deviation of ±1 percentage point (NBP). Adoption of this strategy was suitable in view of Poland's integration with the European Union (EU) and its accession to the Eurozone in the future.

When using the DIT strategy, the monetary policy is focused on setting the level of short-term interest rates (optimal from the viewpoint of future inflation processes), which further determine the volume of credit demand, lending activity as well as money supply, and not directly controlling the chosen monetary aggregate (by shaping the monetary base, and the subsequent multiplier process). This goal is achieved by open market operations which are the most important instrument of the contemporary monetary policy, and by which, the central bank absorbs or provides liquid funds to commercial banks via specific instruments with predetermined yields and maturities.

On May 1, 2004, Poland joined the EU. As mentioned earlier, this decision paved the way for and implied Poland's obligation to participate in the subsequent stage of integration, i.e. membership in the Economic and Monetary Union. Since that moment, Poland has had the status of a country with derogation, which means that the NBP is a member of the ESCB (European System of Central Banks), nevertheless, it has no right to participate in the decision-making process or in creating the common monetary policy in the Euro area. This situation implies an obligation to meet the Maastricht nominal convergence criteria. These criteria are defined as monetary (inflation, long-term interest rate, exchange rate stability) and fiscal criteria (public finance sector deficit, public debt). At the same time, independence of the central bank should be ensured (Sobol, 2008, pp. 184–209). One

of the important monetary criteria is the high degree of price stability, which means that inflation should not be greater than 1.5 percentage points as compared to the average rate of inflation, measured by the harmonised index of prices for consumer goods in 3 of the EU countries with the lowest inflation. Another nominal requirement to be met by a given country before joining the Euro area is the long-term interest rate criterion. This condition is fulfilled when the average annual interest rate in the long-term (usually ten-year) treasury, bonded within 1 year before the assessment, does not exceed by more than 2.2 percentage points of the average interest rate in 3 of the EU countries with the lowest inflation rate. The exchange rate criterion is related to participation in the ERM II monetary mechanism for a minimum period of 2 years. In order to recognise the exchange rate as constant, the fluctuation parity of a country's currency in relation to the Euro, should be kept within the band of ± 15 percentage points, with no devaluation events taking place, which means that no "serious tensions" can occur on the currency market within that period. The fiscal requirements assume that public finances must be healthy, i.e. the budget deficit cannot exceed 3% of the GDP and the public debt cannot be higher than 60% of the GDP. At the same time, Poland is obliged to adapt its legislation concerning the NBP's operations to ESCB requirements and to harmonise its monetary policy instruments with those used by the ECB. As results from the empirical analyses conducted so far, the degree of convergence between those tools is relatively high (Sobol, 2008, pp. 197–209).

The year 2007 witnessed an outbreak of the world financial crisis which led to a recession in the Euro area, and the negative consequences of which were also experienced by the Polish economy. The recession in Poland's business activity meant a gradual slowdown of the GDP growth dynamics. In that period, stabilisation activities were undertaken, with the main role played by the Plan for Stabilisation and Growth prepared in 2008 (Plan Stabilności i Rozwoju, 2008). The chief goal of the monetary policy conducted in the years 2008–2009 was to increase liquidity of the banking system. Apart from this, on 14 October 2008, the NBP introduced the so-called Confidence Package (2008). Nevertheless, the anti-crisis measures from the area of monetary policy did not play any important part in the process of stabilising the actual sphere of Poland's economy. They were mainly aimed at calming down the banking sector and facilitating access to credit money. Thus, the Package was a kind of supplement to the main stabilisation measures resulting from the fiscal policy.

The second group of macroeconomic stabilisation policy tools and, *eo ipso,* anti-inflation policy, comprises fiscal instruments. In a somewhat narrowed sense, those instruments include (Owsiak, 2005, p. 561):

- budget expenses for the purchase of goods and services;
- dynamics and structure of transfer expenses;
- changes in the area of tax policy.

A public spending policy plays a significant stabilising role, because it directly determines changes in demand, not only for consumers, but also for investment goods. Indirectly, it may also influence the dynamics of their prices. The changes in consumer demand are conditioned by personal and social expenses or transfers. The demand for investment goods is shaped by material budget expenditures and subventions. Public revenues mainly depend on tax policy. They exert indirect influence on consumer incomes through the introduction of additional tax burdens or exemptions, and through changes in tax rates on the consumer goods, e.g. VAT or excise tax. The fiscal bodies may also influence the demand for investment goods through their tax policies. Investment bonuses and funds are important instruments in this area (Teichmann, 1988, pp. 247–251).

When implementing the anti-inflation policy, the state bodies should make an effort to limit public spending and increase revenues in order to reduce the size of budget deficit and generate a budget surplus. This should result in a decrease of money supply on the market and thus, be the factor restricting the dynamics of price increases.

Changes in the budget system introduced since the beginning of the 1990s were one of fairly important components of the transformation process in Poland's economy. Indirect discretionary taxes were introduced in the emerging system. Among them, the most significant role was played by the tax on goods and services (VAT) and excise tax. The group of taxes exhibiting the characteristics of automatic tools was dominated by direct taxes, with income taxes on individuals (PIT) and those on legal persons (CIT) being the most important. The VAT taxi is of key importance for shaping the public revenues in Poland, fulfilling, at the same time, a stabilising function in the area of demand for goods and services. Poland's accession to the EU in 2004 implied a necessity to reconstruct the VAT tax. This is why on May 1, 2004, a new act on the VAT came into force, including the Sixth VAT directive used in the EU (Act of January 23, 2004 on excise tax, Ustawa z dnia 23 stycznia 2004 r. o podatku akcyzowym. Dz.U 2004, Nr 29 poz. 257). After May 1, 2003, 36 amendments to the VAT act were introduced.

The excise tax introduced in Poland in 1993 is paid when purchasing specific goods. First of all, it exerts impact on prices and must be paid irrespectively of other taxes (Act of January 8, 1993 on VAT and excise, Ustawa z dnia 8 stycznia 1993 r. o podatku VAT i podatku akcyzowym, Dz.U. 1993, Nr 18 poz. 82). The rates of those taxes are flexible and the right to establish them belongs to the Ministry of Finance, which sets percentage or quota rates by regulations). As a consequence of Poland's accession to the EU, the excise tax system had to be changed (Act of 23 January 2004 on excise duty).

In the period of transforming Poland's economy, not only the system of indirect but also direct taxes was constructed, among which the most important role was played by income tax on individuals (PIT) and income tax on legal entities (CIT) introduced in the years 1991–1992 (Act of 26 July, 1991 about income tax on

natural persons, Ustawa z dnia 26 lipca 1991 r. o podatku dochodowym od osób fizycznych, Dz.U. 1991, Nr 80 poz. 350; Act of February 15, 1992, referring to income tax on legal persons, Ustawa z dnia 15 lutego 1992 r. o podatku dochodowym od osób prawnych oraz o zmianie ustaw regulujących zasady opodatkowania, Dz.U. 1992, Nr 21 poz. 86).

Personal income tax is characterised by universality of subjects as well as objects, and the introduction of that tax enables realisation of non-fiscal goals. Its rates have changed over time (Owsiak, 2005, pp. 683–700). The years 1992–1993 witnessed a mildly progressive 3-stage tax scale, which amounted to 20%, 30% and 40% for individuals from specified income groups. In 1994, the amount of that tax was higher because its rates went up to 21%, 33% and 45%, which increased its progressiveness. In 1997, the rates were lowered to the level of 20%, 32% and 44%, but they varied compared to those from 1992. Since 2009, Poland's economy has had only 2 rates of personal income tax, amounting to 18% and 32%, and in 2019, the so-called solidarity tax was introduced. The solidarity tax is paid by those who derive a yearly income exceeding PLN 1,000,000 and its rate is 4% of the excess amount. The personal income tax reform was connected with its specific role in the economic system.

In the years 1992–1996, the basic corporate income tax rate amounted to 40% and in 1997, it was reduced to 38%, being linear in nature. In 1998, that rate was lowered to 36% and in following years, further reductions were made. In 1999, the basic corporate income tax amounted to 34% and in subsequent periods—to 30%. In the years 2001–2002, that rate equalled 28% and in the following year, 27%. This process lasted until 2004, when the rate was dramatically reduced to 19%. For the small taxpayers, it was changed again in 2019.

The presented remarks concerning changes in the area of central taxes justify the statement that in the conditions of recurrent crisis phenomena in Poland's public finances, the introduced adjustments aimed, above all, at reducing the budget deficit and the public debt.

The undertaken actions were focused on budget expenditures and less attention was paid to improving the effects of tax revenues. The structure of budget spending was dominated by the realisation of social and political aims, with much less attention shifted towards economic stabilisation activities.

An essential factor having impact on macro-economic stabilisation, and thus inflation-related processes in Poland's economy, has been COVID-19 pandemic. It started at the end of December 2019 in Wuhan and rapidly spread across the globe. The first cases appeared in Poland at the beginning of March 2020. The disease has multi-aspect consequences which play a specific role in the sphere of economy. This is why stabilisation programmes defined as "anti-crisis shields" and the so-called financial package were introduced in Poland. Their chief aim is to stabilise the economy by employment protection, guarantee employee safety and enhance financial liquidity of companies. The total financial

outlays are expected to reach approximately PLN 212 bln, with the government cash component of PLN 67 bln, liquidity component of approximately PLN 75 bln, and the NBP liquidity package of approximately PLN 70 bln (Ustawa z dnia 31 marca 2021 r. poz. 568).

As individual companies received this version of the shield with some distrust, especially as regards organisation, forms and size of assistance and cash benefits, on 8 April, 2020, the government prepared and the Seym passed anti-crisis shield 2.0, followed by shield 3.0 (May 2020) and 4.0 (June 2020). The frameworks of stabilisation activities also include the financial shield, which is part of the anti-crisis shields and is provided by the Polish Development Fund and targeted at micro-firms, small businesses, medium-size and large enterprises. This project is expected to offer nearly PLN 100 bln, out of which the majority of the PLN 60 bln are non-returnable funds.

During the so-called second coronavirus wave, Poland adopted other stabilisation solutions, i.e. the sectoral shield of the Ministry of Economic Development, Labour and Technology, anti-crisis shields 5.0 (September 2020), 6.0 (December 2020) and 7.0 implemented on February 28, 2021. Moreover, in January 2021, the PDF (Polish Development Fund) approved financial shield 2.0 to support 38 branches of the economy with funds totalling PLN 35 bln. Those solutions, targeted mainly at micro firms and small businesses, introduced (among others) exemptions from paying social security contributions, additional one-off standstill benefits and PLN 5,000 as a subsidy for those entities. The regulations increased the number of economic branches which had access to the financial support of the state.

Due to the on-going coronavirus pandemic, on February 28, 2021, a subsequent shield: 8.0 came into force. It was targeted at companies of specific branches, hit by pandemic-related restrictions. That shield was a prolongation and extension of shield 7.0 and covered the following forms of aid:

- benefits for job protection;
- reassumed standstill benefits;
- subsidies to cover running costs of business operations;
- exemptions from paying social security contributions.

On April 26, 2021, the next shield: 9.0 was implemented, extending the state aid over 16 new branches. Moreover, since May 4, 2021, exemptions from contributions for March and April had been allowed. That regulation also included benefits for job protection and subsidies to cover the running costs of business operations.

One of the consequences of the COVID-19 pandemic in Poland was intensification of the inflation-related phenomena. On 25 November 2021, the Polish government decided to implement the so-called anti-inflation shield, the aim of which was to curb the dynamics of rising prices for fuels, energy and food. The fiscal activities planned in that area were as follows:

- from 20 December, 2021, the excise tax on fuels is to be lowered for the period of 5 months. Moreover, from January 2022 the tax on retail sales of fuels and the emission fee will also be reduced for a period of 5 months;
- the government will reduce the VAT for natural gas from 23% to 8% and change the excise tax on electric power for households; from March 2022 the VAT for electric energy will drop from 23% to 5%;
- the Polish government wanted to reduce the VAT for food to 0% but the European Commission did not accept this decision. Therefore, the government decided to introduce another form of social benefit called the "food allowance" for a period of 1 year.

In those conditions, the NBP made a decision to raise percentage rates as of 4 November, 2021. Currently the rates are as follows: reference rate 1.75%, *lombard* (pawnshop) rate 2.25% and deposit rate 1.25% per year.

As results from the analysis of all stabilisation programmes introduced in the period of the pandemic, their aim was to prevent the rapid growth of unemployment, curb the dynamics of decline in disposable incomes of consumers, especially those losing their jobs, to improve the liquidity of companies and reduce of the number of bankruptcies. Those activities should result in a slowdown in the rate of GDP decline. No other stabilisation goals were set, especially as regards inflation, state budget results or macro-economic equilibrium in foreign relationships.

The programmes are dominated by fiscal instruments, mainly covering the increase in expenditures on subsidies and consumer transfers, investment activities in the public sector, and health protection, especially to fight the coronavirus. This means that in those activities, much less attention was paid to the budget income sphere, which in consequence, leads to a rapid growth of budget deficit in relation to the GDP and an increase in public debt. The monetary policy conducted in the period of the pandemic mainly included lower interest rates for commercial banks and thus, lower interest rates for their lending and deposit operations. Moreover, facilitations in loan repayments were introduced, such as the extension of loan repayment periods and the loan guarantee system. Therefore, it may be stated that those activities did not restrict inflation processes but, to the contrary, they were a factor stimulating the dynamics of price growth.

As shown by the first assessments, the introduced anti-inflation measures may cause a drop in inflation within a short period, because the dynamics of the VAT and excise tax for electricity and gas could reduce it (Ogórek & Bryła, 2021, pp. 16, 17). Implementation of the food shield tax in the amount of PLN 5 bln, in turn, could lead to increased demand and wage pressures, which will accelerate inflation. Pro-inflation effects may also result from the implementation of *Polski Ład* (the Polish Deal). On the other hand, a delayed reaction to the climbing inflation on the part of the central bank may be unable to restrain the growth of wages and social benefits, which could reinforce inflation and therefore, make its control difficult in the long-run.

3. Empirical analysis regarding the role of anti-inflationary policy instruments in Poland between 2000–2021

In Figure 1, it is demonstrated how the inflation processes developed in Poland's economy in the years 2000–2021 compares to the NBP inflation target (1.5%–3%). A rough analysis proves that the inflation target was not always reached. Inflation slipped out of the allowed fluctuation band adopted by the NBP.

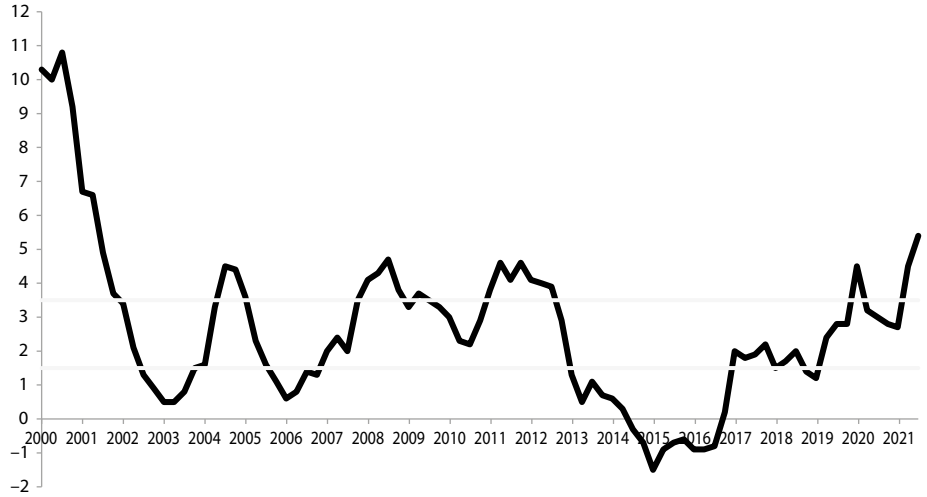

Figure 1. Development of inflation in Poland over the quarter I 2000—quarter III 2021 period, derived from the CPI on a quarterly basis (analogical period of the previous year = 100) compared to the NBP inflation target

Source: Authors' own calculations based on data from the Central Statistical Office.

The research covered 87 quarters. More detailed data analysis showed that during 54 quarters, the CPI inflation index reached values outside the inflation target; more precisely, for 26 quarters, it was above that level, and for 28 quarters, it was below the target, with 9 quarters of deflation observed in Poland. This means that in the analysed period, the NBP effectiveness in inflation targeting reached the level of 62%.

On the basis of econometric analysis, at the next stage of research, an attempt was made to assess the role of monetary and fiscal policy instruments in restricting inflation in Poland's economy.

Out of the available time series showing measurable effects in the area of price stability and reflecting anti-inflation policy measures (including monetary and

fiscal policies), the following data for the quarter I 2000-quarter III 2021 period were used in the analysis:

- index of price dynamics for consumer goods and services CPI calculated in quarterly terms (analogical period of the previous year = 100);
- NBP reference rate indicating changes in the yield on the NBP cash vouchers issued within the framework of open market operations (data presented in %, on a quarterly basis, according to the state at the end of the period);
- money supply dynamics index M3 calculated on a quarterly basis (analogical period of the previous year = 100)[1];
- budget incomes (data in millions PLN, presented on a quarterly basis, according to the state at the end of the period);
- budget expenditures (data in millions PLN, calculated on a quarterly basis, according to the state at the end of the period).

All the data were collected from the base of the Central Statistical Office (GUS).

An econometric analysis of the time series should be based upon correctly prepared empirical data. Due to this fact, the source material, broken down into quarters, was subject to decomposition. From the initial series of data, (i.e. CPI inflation dynamics indices, M3money supply dynamics indices, budget nominal incomes and expenditures), seasonal and random fluctuations were removed by means of the TRAMO/SEATS procedure, applied and recommended by Eurostat. As regards the variable characterising open-market operations, i.e. reference rate, no decomposition was necessary due to the specific nature of this variable, which is shaped administratively by the central bank (Kruszka, 2002, pp. 135–136). The next step of the research was to check whether the time series were stationary.

The stochastic process $\{x_t\}$, which generates dynamic numerical data, is stationary, when after a change at the beginning of the process $\{x_t\}$ from x_1 to x_m, the mean, variance and auto-covariances of the process $\{x_t+_m\}$, are the same as those in the process $\{x_t\}$. Non-stationarity of the variables means that it is impossible to perform reliable econometric modelling (conclusion formulating, forecasting) because significance tests of the explanatory variables are based, among others, on the assumption of time series' stationarity. The stationarity of the series was examined by means of the ADF (Augmented Dickey-Fuller test), with the level of significance set at 0.05. In some cases, the test results dictated a necessity to

[1] This choice was justified by research conducted by the European Monetary Institute, replaced in 1998 by the ECB). According to the results of those studies, narrow aggregates are easier to control by short-term nominal interest rates, however, they are volatile and thus, difficult to use in forecasting the future level of prices. As for wide money aggregates, it was found that, on the one hand, they are more difficult to monitor over a short period but, on the other, they possess more informative content, useful in forecasting the price level in the medium-term; besides, they were regarded as more stable (Szeląg, 2003, p. 25).

assume the null hypothesis and regard certain series as non-stationary. Due to this fact, the initial data were replaced with the first[2] or subsequent differences in their expressions to remove non-stationarity and conduct the ADF test again. The results of the ADF tests for the accepted series are presented in Table 1.

Table 1. Results of ADF test for the studied time series in Poland during the quarter I 2000—quarter III 2021 period

Variable	Designation of variable in model	ADF with trend and constant	ADF with constant	Conclusion
CPI	CPI	p = 0.4244	P = 0.08888	Non-stationary series
	dCPI (y)	p = 0.00605	p = 0.001585	Stationary series
Reference rate	STOPAR (s)	p = 0.03716	p = 0.01074	Stationary series
M3 Money supply index	M3	p = 0.2968	p = 0.1541	Non-stationary series
	d_M3(m)	p = 0.000957	p = 7.89e-005	Stationary series
Budget incomes	DOCH	p = 0.9504	p = 0.9973	Non-stationary series
	d_DOCH	p = 0.6569	p = 0.482	Non-stationary series
	d_d_DOCH	p = 0.2555	p = 0.086	Non-stationary series
	d_d_d_DOCH (d)	p = 8.832e-010	p = 1.203e-010	Stationary series
Budget expenditures	WYD	p = 0.5494	p = 0.89	Non-stationary series
	d_WYD	p = 0.7212	p = 0.3935	Non-stationary series
	d_d_WYD (w)	p = 0.004348	p = 0.0003684	Stationary series

Source: Authors' own calculations based on the results of the Gretl programme.

The assessment of impact exerted by the stabilisation policy on macro-economic variables is ambiguous, due to various interdependencies between the decisions of authorities and the course of economic processes. A full image of those dependencies would require construction of the structural macro-econometric model in order to identify which part of changes in basic macro-economic categories results from the impact of the stabilisation policy (Kokoszczyński, 2004, p. 180).[3] For both technical and methodological reasons, the construction of such models is not easy, therefore, in contemporary analyses (especially of the monetary policy impact on the economy), researchers use the methodology of multi-equation modelling, applying vector auto-regression models (VAR) in order to estimate the functions of response to the nominal impulse.[4] In this article, the authors made an attempt to measure the relationship between decisions in the area of stabilisation policy and inflation, using the dynamic autoregressive model with distributed lags—ADL.

[2] Differences assume the following form: $\Delta x_t = x_t - x_{t-1}$; where: x_t is the value of variable in period t, whereas x_{t-1} is the value of the variable in the earlier period.

[3] For more on structural models as an instrument to analyze monetary policy, see (Kokoszczyński, 2004, pp. 191–195).

[4] This model was proposed by Sims (1980). For more on the methodology of VAR models, see also: Charemza and Deadman (1997, Ch. 6).

This was justified by the authors' wish to find and analyse direct correlations between the chosen pairs of variables, with the omission of all indirect effects resulting each time from mutual links between both economic categories. When modelling the relationships between monetary and fiscal policies and inflation, an assumption was made that the explained variables' level, i.e. changes in CPI inflation index, depend on the current values of the explained variables and on their values from previous periods. Such a response to policy changes needs time, if all of the economic adjustments finally leading to price changes are to take place. As regards the monetary policy effects, in the subject-literature, it is shown that, usually, the maximum response of the most significant economic categories to changes in the monetary policy becomes visible in the medium-term, i.e. with a lag of 1–2 years (Noga, 2008, p. 66; Blanchard, 2011, p. 156). Therefore, an assumption was made that the level of the explained variable could depend on the values of the monetary and fiscal variables lagged by a maximum of 8 quarters.[5] Moreover, the level of the explained variable in the current period was considered to be dependent on their values in the previous period.[6] Adding the lags of the dependent variable to the model makes it possible to obtain considerable inertia of many economic phenomena and to obtain better measures of the estimated models' fit. This part of the econometric analysis was based on the ADL model for many variables:

$$y_t = \sum_{i=0} \alpha_1 s_{t-i} + \sum_{i=0} \alpha_2 m_{t-i} + \sum_{i=0} \alpha_3 d_{t-i} + \sum_{i=0} \alpha_4 w_{t-i} + \sum_{j=1} \beta y_{t-j} + \mu + \varepsilon_t$$

where:

y – the explained variable, i.e. change of CPI inflation index;
$s_{t-i}, m_{t-i}, d_{t-i}, w_{t-i}$ – explanatory variables and their lags (i.e. reference rate, money supply, budget incomes and expenditures);
$\alpha_1, \alpha_2, \alpha_3, \alpha_4$ – regression parameters with the explanatory variables and their lags: s, m, d, w;
y_{t-j} – lags of the explained variable;
β – regression parameter with lags of the explained variable;
μ – free expression in the model;
ε_t – residual component.

An application of the ADL-type model facilitates conducting multiplier analysis which allows to describe the short- and medium-term impact of a given exogenous variable on a given endogenous variable (Kozłowska & Szczepkowska-Flis,

[5] A lagged variable is understood as the one whose impact may become visible after a lag of 1–8 quarters. Therefore, it was assumed that the explained variable's current value (y_t) could have been influenced by the past values of explanatory variables from the previous period (from 1 (x_{t-1}) – + 8 (x_{t-8}) quarters).

[6] The explained variable's lags, analogous to the explanatory variables, were introduced in the models.

2010, p. 212). An effect of change in a given x for the current changes y is reflected by the short-term multiplier: $m_k = \alpha$, where: α is a parameter standing at a given x. If the change of x persists in the subsequent periods, its impact on variable y is described by the long-term multiplier: $m_d = \sum\alpha/(1 - \sum\beta)$, which defines the force and direction of a long-term relationship between the analyzed variables (Welfe, 2009, p. 203; Kozłowska & Szczepkowska-Flis, 2010, p. 212). As this research is focused on the analysis of those effects of monetary policy which could appear with a maximum lag of 8 quarters, the long-term multiplier was defined as the medium-term multiplier.

The estimation of regression coefficients was conducted by means of the Classical Least Squares method (CLS). An evaluation of diagnostic usefulness regarding the estimated models was based on determining the R^2 coefficient. Using the Student's t-test, statistical significance of parameters of the models was determined at the level of significance equalling $p = 0.05$. The normality of distribution concerning the residual component was verified via the Doornik-Hansen test. The verification of auto-correlation with regard to the residual component and its heteroscedasticity were omitted because the model was estimated along with the standard error resistance option. The results of the model's estimation are presented in Table 2.

Table 2. Estimation of the ADL model for inflation in Poland

Explained variable: d_CPI	**CLS estimation, observations used 2002:4–2021:3 (N = 76), standard error HAC**			
Explanatory variables	**Regression parameters: α and β**	**Standard error**	**Student's t**	**Value of p**
STOPAr_4	–0.116108	0.0354792	–3.273	0.0017
STOPAr_8	0.0765809	0.0245177	3.123	0.0027
d_M3_3	0.0925023	0.0218156	4.240	< 0.0001
d_d_d_DOCH_5	8.29672e–05	1.60111e–05	5.182	< 0.0001
d_d_WYD	0.000100220	3.85972e–05	2.597	0.0117
d_d_WYD_8	0.000129214	4.29451e–05	3.009	0.0038
d_CPI_1	1.09728	0.0857813	12.79	< 0.0001
d_CPI_2	–0.914434	0.127974	–7.145	< 0.0001
d_CPI_3	0.676828	0.136580	4.956	< 0.0001
d_CPI_4	–0.737523	0.107132	–6.884	< 0.0001
d_CPI_5	0.570351	0.0930785	6.128	< 0.0001
d_CPI_6	–0.187002	0.0881063	–2.122	0.0377
const	0.0981218	0.0740922	1.324	0.1902
Determination coef. R-squared	0.762623	Corr. R-squared		0.717409
$F(12, 63)$	45.43580	Value of p for test F		2.29e–26
Test for normality of residuals distribution, H0: random component demonstrates normal distribution; test statistics: Chi-square (2) = 2.00476 with p-value = 0.367005.				

Source: Authors' own calculations based on the results from the Gretl programme.

The results of estimations revealed a statistically significant relationship between monetary and fiscal variables, as well as the level of prices. Although the results allowed to indicated significant links between the most important instruments of monetary and fiscal policies as well as inflation, defining the role of stabilisation policy in the process of price stabilisation in Poland requires an answer to the question as to whether the changes introduced in the area of economic policy really exerted an anti-inflationary effect. Parameters of the estimated model were used in an attempt to assess the nature of relations between the variables from the area of stabilisation policy and inflation processes. Values of short- and medium-term multipliers were calculated for the individual variables, which proved to be statistically significant in the model (Table 3).

Table 3. Short- and medium-term multipliers for the variables explaining inflation processes in Poland in the quarter I 2000–quarter III 2021 period

Explanatory variable	Short-term multiplier	Medium-term multiplier
Reference rate	0	–0.0799334681496461
Money supply M3	0	0.19
Budget incomes	0	1.677799797775531e–4
Budget expenditures	0.000100220	4.639716885743175e–4

Source: Authors' own calculations.

Taking the direction of relations between the reference rate and the explained variable into account, it can be concluded that the interest rate policy-making was conducive to stabilising prices in Poland. A negative value of the medium-term multiplier means that raising (lowering) the reference rate resulted in a decrease (increase) of the price level. In other words, the relationship between those economic categories was negative. On the other hand, as shown by the estimated model, the direction of the impact regarding changes in money supply on changes in the CPI index was positive: an increase (decrease) in money supply entailed an increase (decrease) of CPI. Therefore, it seems that from the viewpoint of price stabilisation in Poland, the NBP's monetary policy direction was adequate. In the case of both variables, the values of medium-term multipliers are relatively small, which indicates that the relationship between the analysed economic categories is rather weak. This most likely results from the fact that the level of prices does not entirely depend on the central bank's policy. However, such a situation may also occur when under conditions of increasing inflation, the central bank raises interest rates by those less than required due to the rate of inflation, and vice versa. When comparing these results with the conclusions drawn from Figure 1, it may be presumed that, in some periods, the NBP policy was indeed not strong enough, i.e. the increases or decreases of interest rates turned out to be too low, a consequence of which was slipping of the CPI index outside the inflation target. As regards the

monetary variables, the values of short-term multipliers were equal to 0, which seems to be in agreement with the expectations. As mentioned before, the effects of the central bank's decisions become visible with a long delay.

The value of short-term multiplier for budget incomes also equalled 0. This means that there was no statistically significant relationship between the change in budget incomes and the current level of prices. The value of the medium-term multiplier for that variable turned out to be low and positive. This means that the growth of incomes in the budget was a signal of the growth in price dynamics (and vice versa) in Poland's economy. Therefore, it is possible to conclude that an application of such an instrument did not have anti-inflation characteristics. In the case of fiscal expenditures, both short- and medium-term multipliers reached non-zero, positive values. This indicates that the effects of the government's spending policy are noticeable the most quickly and they persist in the medium-term. The direction of the relationship is in agreement with expectations, i.e. an increase in expenditures was accompanied by an increase in price dynamics (and vice versa).

Thus, the parameters of the model confirmed the stabilising nature of the relationship between monetary variables and budget expenditures in the Polish economy.

Conclusions

The genesis of inflation processes in Poland was interpreted in various ways because, at that time, some explanations were based on monetarist economics (quantity theory of money), while others resulted from Keynesian economics (demand-pull or cost-push inflation). The anti-inflation policy conducted in Poland over the past years was characterised by certain volatility. In the first years of transformation, it played a very important role, but in the period of Poland's integration with the EU, it became of lesser importance and effectiveness. The activities undertaken in this area were dominated by monetary policy instruments, the role of which was relatively significant, especially after the establishment of the Monetary Policy Council. From the beginning of Poland's economic transformation, anti-inflation significance of the fiscal policy was much smaller. Its anti-inflation role increased in the period of difficulties related to COVID-19 pandemic, especially during the rapid growth of budget expenditures due to the escalating level of prices. These conclusions correspond with the results obtained from the econometric analysis conducted for Poland's economy. This analysis allows to indicate that among the applied tools of monetary and fiscal policies, an anti-inflation nature of the relationship was found between both of the monetary policy instruments and prices, and also linking budget expenditures with price level. Changes in budget incomes, in line with the obtained results, were not conducive to price stabilisation in our economy.

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RELATIONSHIP BETWEEN CYCLICAL FLUCTUATIONS IN THE BANKING AND THE SERVICES SECTOR IN POLAND

https://doi.org/10.18559/978-83-8211-129-3/7

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Abstract

The aim of the paper is to explore the relationship between the business tendency survey indicators for the banking sector and the sections and divisions of the services sector in Poland.

In the paper, the results are presented of analyses conducted on the basis of data from the business tendency surveys. The time range of analyses covers the period from the first quarter of 2003 to the first quarter of 2020. The data for the banking sector stem from the survey which is carried out quarterly by the Department of Market Research and Services of the Poznań University of Economics and Business. The data for the eleven sections and two divisions of the services sector (according to the Polish PKD code classification) were obtained from the survey conducted by Statistics Poland on a monthly basis. The monthly data were transformed into quarterly with the use of two formulas.

In the paper, the results are presented of cross-correlation analysis, in which the maximum length of lags and leads equal four quarters was adopted.

Keywords: banking sector, services sector, cyclical fluctuations, business tendency survey.

JEL codes: E32, G20.

Introduction

The theory of strategic complementarity between economic operators assumes that the increase in the economic activity of companies is a result of expectations that the other companies with which they cooperate will also increase economic activity. The dominant pessimistic expectations of entrepreneurs translate into the deterioration of conditions for not only one industry, but also affect the 'health' of other industries (Banerjee, 1992). Analyses on the number of hours worked have shown a high degree regarding concurrency of cyclical fluctuations for the sectors of the US economy. Improvement (or deterioration) of the economic situation occurred

Suggested citation:
Skikiewicz, R. (2022). Relationship between cyclical fluctuations in the banking and the services sector in Poland. In S. Białowąs (Ed.), E*conomic tendency surveys and economic policy—measuring output gaps and growth potentials* (pp. 103–112). Poznań: Poznań University of Economics and Business Press. https://doi.org/10.18559/978-83-8211-129-3/7

in most sectors of the economy almost simultaneously (Christiano & Fitzgerald, 1998). Similar findings about great similarity of cyclical fluctuations were obtained for branches of the industry sector in Poland. It is worth noting that the cyclical fluctuations of the food and light industries were found as leading in relation to other ones (Kijek, 2013).

The influence of financial development on economic growth was confirmed in many studies across countries (Christopoulos & Tsionas, 2004; Osborn & Sensier, 2002). In some bi-directional causal relationships between financial development and economic growth were found (Demetriades & Hussein, 1996; Hassan, Sanchez, & Yu, 2011).

The results of conducted analyses allow to state that the change in economic situation happens earlier in the banking sector than in section K of the services sector. This means that the observation of the economic situation in the banking sector makes it possible to anticipate changes that will occur with a slight delay in the entire financial sector (section K of the services sector) (Skikiewicz & Garczarczyk, 2018).

The abovementioned results encourage analysis of the relationship between the business tendency survey indicators for the banking sector and the sections and divisions of the services sector in Poland. This will allow to conclude whether the cyclical fluctuations in the banking sector are leading, coincident or lagged in relation to the cyclical fluctuations in the sections and divisions of the services sector.

1. Business tendency survey data used in analyses

1.1. Business tendency survey in the banking sector

The business tendency survey in the banking sector was initiated in the second quarter of 1992 by the team managed by Prof. Józef Garczarczyk at the Department of Market Research and Services of Poznań University of Economics and Business (Garczarczyk, Mocek, & Matusewicz, 2001). The survey has been conducted quarterly in the branches of commercial banks and headquarters of cooperative banks. The questions from the business tendency survey questionnaire for the banking sector were constructed with the use of 5-point scales. These scales allow to assess the direction and intensity of changes. Simple indicators (economic balances) are calculated for each question, based on the following formula:

$$\text{Balance} = 1 \cdot SP + 0{,}5 \cdot NP + 0 \cdot BZ - 0{,}5 \cdot NS - 1 \cdot SS$$

SP: percentage of responses indicating strong improvement/strong increase in the phenomenon;

NP: percentage of responses indicating slight improvement/small increase in the phenomenon;
BZ: percentage of responses indicating no change in the phenomenon;
NS: percentage of responses indicating slight deterioration/slight decrease in the phenomenon;
SS: percentage of responses indicating strong deterioration/strong drop in the phenomenon.

The main synthetic indicator for the banking sector is the PIKBANK index, which is calculated on the basis of 5 simple indicators (Garczarczyk, Mocek, Olejnik, Skikiewicz, 2006).

$$\text{PIKBANK} = \frac{\text{BOPS} + \text{BOWK} + (-\text{BOWN}) + \text{BOSF} + \text{BPSB}}{5}$$

BOPS: assessment of obtained financial means;
BOWK: assessment of given loans
BOWN: assessment of doubtful and loss loans;
BOSF: assessment of financial situation;
BPSB: forecast of balance sheet sum.

1.2. Business tendency survey in the services sector

The results of the business tendency survey conducted in the services sector by Statistics Poland are available for as many as eleven sections and twenty divisions of the services sector. The abovementioned business tendency survey in the services sector has been conducted since January 2003. The questions in business tendency survey questionnaire for the services sector are, in general, the same for each entity of the services sector, regardless of the section and division in which the business activity is classified (with only some exceptions introduced lately). The questions were built with the use of 3-point scales. These scales allow only to assess the direction of change (e.g. improvement, no change and deterioration).

The simple indicator (the economic balance) for each question is calculated based on the following formula:

$$\text{Balance} = 1 \cdot \text{P} + 0 \cdot \text{BZ} - 1 \cdot \text{S}$$

P: percentage of responses indicating improvement/increase for the phenomenon;
BZ: percentage of responses indicating no change for the phenomenon;
S: percentage of responses indicating deterioration/decrease for the phenomenon.

The main synthetic indicator for each section and division of the services sector is the general business climate indicator (GBCI). This indicator is calculated on the basis of 2 simple indicators—the balance for a diagnostic question regarding

the current general economic situation of the unit and the balance for a forecasting question, regarding the general economic situation of the unit in the future (in the next 3 month).

Analyses will concern the set of selected PKD sections and divisions of services sector which are presented in Table 1.

Table 1. Abbreviations for the general business climate indicator regarding the sections and selected divisions of services sector

Abbreviation	PKD sections and divisions
GBCI_H	Transportation and storage
GBCI_I	Accommodation and food service activities
GBCI_J	Information and communication
GBCI_K	Financial and insurance activities
GBCI_K64	Financial service activities, excluding insurance and pension funding
GBCI_K65	Insurance, reinsurance and pension funding, except compulsory social security
GBCI_L	Real estate activities
GBCI_M	Professional, scientific and technical activities
GBCI_N	Administrative and support service activities
GBCI_P	Education
GBCI_Q	Human health and social work activities
GBCI_R	Arts, entertainment and recreation
GBCI_S	Other services activities

Source: Own elaboration.

2. Methodology of analysis

Different frequencies of conducting business tendency surveys by Statistics Poland (monthly) and the Department of Market Research and Services at the Poznań University of Economics and Business (quarterly) required the data to be converted to a comparable form. The monthly data from surveys conducted by Statistics Poland was transformed into quarterly terms with the use of 2 formulas. According to the first formula, quarterly values were calculated as the average of monthly data for each quarter. The variables obtained by using the first formula have been marked with the symbol '_a' at the end of the abbreviations. According to the second formula, the value from the last month of each quarter was assumed as the quarterly value. At the end of abbreviations, for the variables obtained with the use of the second formula, the symbol '_l' was added.

The 'growth cycle' approach was applied in analyses. The values of economic balance range between –100 and +100 points and that is why the time series with economic balances are considered as a trend-free time series. This means, that there is no need to eliminate the long-term trend with the use of filters, such as the Hodrick-Prescott filter (Dudek & Walczyk, 2013).

The time series used in analyses have been seasonally adjusted with the use of ARIMA X12 procedure in Gretl program. The obtained seasonally adjusted variables with the cyclical component of the time series have been marked additionally with the symbol '_c'at the end of abbreviations.

The relationship between the cyclical fluctuations in the banking sector and the sections as well as divisions of the services sector was verified on the basis of the cross-correlations analysis. The four quarters were adopted as the maximum length of lags and leads (Nilsson & Gyomai, 2007). The conducted analysis allowed to classify the synthetic indicator of banking business tendency survey—PIKBANK—as leading, coincident or lagged in relation to the synthetic indicator of the business tendency survey—the general business climate indicator (GBCI) for each section and division of the services sector.

3. Analysis of relationship between PIKBANK and general business confidence indicator for the sections and selected divisions of the services sector

Among the eleven sections of the services sector, the following three were characterised by the highest similarity of cyclical fluctuations compared to the banking sector: section I (accommodation and food service activities), section J (information and communication) and section K (financial and insurance activities) (Tables 2 and 3).

Cross-correlation analysis indicates a strong relationship only between 2 variables—PIKBANK and BGCI_K, regardless of the formula used to obtain the quarterly values of the general business confidence indicator for section K of the services sector (financial and insurance activities). Moreover, it should be underlined that PIKBANK was found to be a leading indicator for section K of the services sector (Tables 2 and 3).

The relationship between PIKBANK and the general business confidence indicator for both divisions of section K—financial service activities, except insurance and pension funding (division 64) and insurance, reinsurance and pension funding, excluding compulsory social security (division 65), was found to be moderate and positive.

The same strength of positive correlations (moderate) was obtained for the following sections of the services sector: accommodation and food service activities (section I), information and communication (section J), professional, scientific and technical activities (section M), human health and social work activities (section Q). Furthermore, for section P (education), a moderate and positive

Table 2. Assessment of lead/lag regarding the banking business tendency survey indicator—PIKBANK—in relation to the general business confidence indicator (GBCI_l) for the sections and selected divisions of the services sector based on cross-correlation analysis in the period 2003 Q1–2020 Q1

Variables	Pearson's correlation coefficient	Lag (+) / Lead (–)	Significance
GBCI_H_l_c	0.3129	0	***
GBCI_I_l_c	0.5746	0	***
GBCI_J_l_c	0.6434	0	***
GBCI_K_l_c	0.7069	–1	***
GBCI_K64_l_c	0.6669	0	***
GBCI_K65_l_c	0.5909	–2	***
GBCI_L_l_c	0.2323	–4	*
GBCI_M_l_c	0.5124	0	***
GBCI_N_l_c	–0.3076	4	**
GBCI_P_l_c	0.3332	–1	***
GBCI_Q_l_c	0.4371	–4	***
GBCI_R_l_c	–0.2555	4	**
GBCI_S_l_c	–0.3264	4	***

Source: Own calculations based on data from the Department of Market Research and Services at the Poznań University of Economics and Business, as well as Statistics Poland.

Table 3. Assessment of lead/lag regarding the banking business tendency survey indicator—PIKBANK—in relation to the general business confidence indicator (GBCI_a) for the sections and selected divisions of the services sector based on cross-correlation analysis in the period 2003 Q1–2020 Q1

Variables	Pearson's correlation coefficient	Lag (+) / Lead (–)	Significance
GBCI_H_a_c	0.3049	0	**
GBCI_I_a_c	0.5475	0	***
GBCI_J_a_c	0.5978	0	***
GBCI_K_a_c	0.7067	–1	***
GBCI_K64_a_c	0.6696	–1	***
GBCI_K65_a_c	0.5774	–1	***
GBCI_L_a_c	0.2388	–4	**
GBCI_M_a_c	0.5244	–1	***
GBCI_N_a_c	–0.3218	4	***
GBCI_P_a_c	0.4216	–1	***
GBCI_Q_a_c	0.4813	–4	***
GBCI_R_a_c	–0.2159	3	*
GBCI_S_a_c	–0.3656	4	***

Source: Own calculations based on the data from the Department of Market Research and Services at the Poznań University of Economics and Business, as well as Statistics Poland.

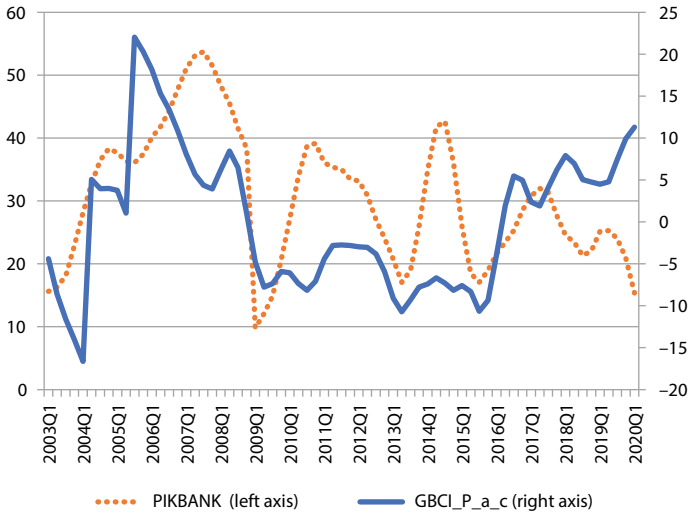

Figure 1. Cyclical component of the synthetic indicator—PIKBANK_c—and the general business climate indicator in section P in the period 2003 Q1–2020 Q1

Source: Own elaboration based on the data from the Department of Market Research and Services at the Poznań University of Economics and Business, as well as Statistics Poland.

relationship was found with PIKBANK in the case of the general business confidence indicator obtained with the use of the first formula (GBCI_P_a_c).

For the other five sections of the services sector (sections H, L, N, R and S), the relationship with PIKBANK is weak (Pearson's correlation coefficient was between 0.200 and 0.400), regardless of the formula used to calculate quarterly values of the general business confidence indicator (Tables 2 and 3).

In the case of three sections included in the service sectors (section N—arts, entertainment and recreation, section R—other services activities, and section S—administrative and support service activities), a negative and weak relationship was found with PIKBANK.

PIKBANK can be classified as a leading indicator in relation to the general business confidence indicator in the case of 4 sections of the services sector: section K—financial and insurance activities, section Q—human health and social work activities, section P—education, and section L—real estate activities, as well as and division 65—insurance, reinsurance and pension funding, except for compulsory social security. The same conclusion on the classification of PIKBANK as a leading indicator, in relation the abovementioned sections, can be made regardless of the formula used to calculate the quarterly values of the general business confidence indicator.

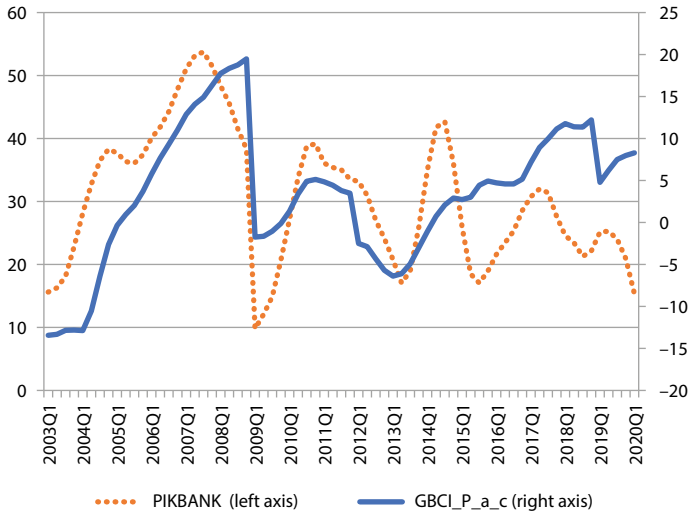

Figure 2. Cyclical component of the synthetic indicator—PIKBANK_c—and the general business climate indicator in section M in the period 2003 Q1–2020 Q1

Source: Own elaboration based on the data from the Department of Market Research and Services at the Poznań University of Economics and Business, as well as Statistics Poland.

In the case of section M, and division 64 of the services sector, the results depend on the formula used to calculate the quarterly values of the general business confidence indicator. PIKBANK was found to be a leading indicator in relation to the general business confidence indicator, for which quarterly values were calculated as the average of monthly data for each quarter (Table 3). In the case of another formula, when the value from the last month of each quarter was taken as a quarterly value of the general business confidence indicator, PIKBANK could be classified as a coincident indicator (Table 2).

Moreover, PIKBANK was found to be a coincident indicator for the general business confidence indicator (regardless of the formula used to calculate the quarterly values) concerning such sections as: section H—transportation and storage, section I—accommodation and food service activities and section J—information and communication.

In the case of 3 sections of the services sector, PIKBANK was found to be a lagged indicator in relation to the general business confidence indicator. The abovementioned three sections (sections N, R and S) were distinguished among the others with the negative values of Pearson's correlation coefficients.

Conclusions

The role of the banking sector in each economy is crucial. Banking business tendency survey indicators were found useful in forecasting models estimated for the main macro-economic indicators and the main indicators of the banking market (Garczarczyk, Mocek, Białowąs, & Skikiewicz, 2008).

The results of the analyses presented in this paper allow to conclude that the PIKBANK synthetic indicator from the business tendency survey conducted in the banking sector can be classified as a leading or coincident indicator in relation to the general business confidence indicator (GBCI) for eight of eleven sections of the services sector.

Regardless of the formula applied to transform monthly data for the synthetic indicator in the services sector, the results of cross-correlation analysis were very similar and changed only in some cases.

In the case of 9 sections of the services sector, the length of lead or lag concerning PIKBANK, in relation to the general business confidence indicator (GBCI), was the same regardless of the formula used to calculate quarterly values of the general business confidence indicator.

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FINANCIAL BEHAVIOUR OF HOUSEHOLDS IN EUROPEAN UNION COUNTRIES—SIMILARITIES AND DIFFERENCES IN THE 2004–2020 PERIOD

https://doi.org/10.18559/978-83-8211-129-3/8

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Abstract

Household financial behaviour reflects preferences concerning inter-temporal choice and strongly influences the whole economy. Allocating consumption, in time, households balance their exposure to liquidity risk and modify their ability to withstand financial shocks. Consumer sentiment is the main factor summing up all the preferences that shape the decision-making processes of households.

The financial services sector has been internationalised over the past few decades, gradually leading to unification of the supply and further, to the unification of the financial behaviours of households. However, even within the EU, important differences in financial behaviour can be anticipated between consumers living in various countries.

The aim of the paper is to estimate the relationship between economic sentiment and the shaping of household saving rate and household debt-to-income ratio. The ESI (Economic Sentiment Indicator) was used as a measure of cyclical fluctuations in the economy. Another aim of the paper is to find similarities and differences of financial behaviour in the case of households in European Union countries. We find that country segments are highly interpretable. Our conclusions feature implications, both academic and managerial, and directions for future research.

The data used in analysis stem from Eurostat and the European Commission. The analyses cover only 19 of the European Union countries due to the limited availability of data for some countries. Analyses include the 2004–2020 period.

We used the following statistical methods for analysis: correlation analysis, Ward method and ANOVA.

Keywords: financial behaviour of households, economic sentiment.

JEL codes: D12, I31.

Suggested citation:
Białowąs, S. & Skikiewicz, R. (2022). Financial behaviour of households in European Union countries—similarities and differences in the 2004–2020 period. In S. Białowąs (Ed.), *Economic tendency surveys and economic policy—measuring output gaps and growth potentials* (pp. 113–125). Poznań: Poznań University of Economics and Business Press. https://doi.org/10.18559/978-83-8211-129-3/8

1. Literature review

Household financial behaviour reflects preferences concerning inter-temporal choice and strongly influences the whole economy. Allocating consumption, in time, households balance their exposure to liquidity risk and modify their ability to withstand financial shocks. Nofsinger (2012) proved that household behaviours strengthen the economic cycles. During booms, the rising debt and shrinking saving rate spur economic growth. In a recession, households repay debts and increase savings, which slows down an already weak economy. The consumer sentiment can be considered as the leading factor summing up all the preferences shaping household decision-making processes, however, the results on this relation are somewhat mixed.

Consumer sentiment is based on the psychological constructs of optimism (and as a reversed construct, pesimism). Optimism denotes a positive attitude towards life, perceiving the world as a positive place, and positive expectations about the future (Scheier & Carver, 1985) following (Puri & Robinson, 2007). The economic sentiment is influenced by psychological factors and the above relationship is among the areas of growing interest for researchers. Values professed in a society were found to have a statistically significant relationship with the level of consumer confidence index in European countries (Błoński & Skikiewicz, 2013). The impact of life satisfaction on consumer confidence was positively verified by Sekizawa, Yoshitake and Goto (2016). A study conducted on a set of 16 European Union countries proved that there is a strong or even very strong, statistically significant relationship between the overall degree of life satisfaction and consumer confidence indicator. Moreover, in general, only a slightly weaker strength of the correlation was found between satisfaction of life and economic sentiment indicators, concerning savings over the next 12 months and savings, at present (Skikiewicz & Błoński, 2018).

In economics, optimism is often equalled with consumer sentiment, which is a great leading indicator concerning the condition of the overall economy (Santero & Westerlund, 1996). It is a relatively persistent attitude over time which sets it apart from temporary and fast-changing trends (Weinstein & Klein, 1996). Therefore, continuous research on consumer sentiment was started as early as the 1940s in the US and is conducted in almost all countries across the world today. The increased interest of economists in the influence of consumer sentiment on behaviours dates back to the publishing of Psychological Economics by Katona (1975). According to the Curtin study in 2007, consumer sentiment surveys were conducted in at least 45 countries worldwide (Curtin, 2007).

Considering financial behaviours, it must be noted that optimism is equated with overconfidence, leading to irrational decisions (Odean, 1998; Bernardo

& Welch, 2001; Malmendier & Tate, 2005; Puri & Robinson, 2007).[1] In research, it is also indicated that optimists are more willing to take risks, and more likely to underestimate risks (Gervais, Heaton & Odean, 2011; Balasuriya, Muradoglu & Ayton, 2010). There are studies, however, in which it is indicated that such a correlation is very weak (Lim, Hanna & Montalto, 2011).

The influence of consumer sentiment on saving is also ambiguous. As shown by G. Katona, optimism decreases the likelihood of saving. If people feel optimistic about the future, they feel new needs, satisfying which leads to a lower savings rate. On the other hand, a pessimistic bias makes the need for the possession of new goods lower, and the rate of savings higher (Katona, 1975).

Nonetheless, it must be noted that the latest research has led to quite contrary findings, showing quite a reverse relationship. Optimistic households are more eager to save than pessimistic ones (Rha, Montalto, & Hanna, 2006; Yuh & Hanna, 2010). The same is true about non-economic optimistic bias—persons who think they will live longer than the statistical average are more likely to save (Puri & Robinson, 2007).

Research on the correlation between consumer sentiment and saving was also carried out for Poland (Białowąs, 2013). Optimism proved to be a substantial determiner in attitudes towards saving, thus, becoming an element of the saving attitudes model. In this case, according to Gianotten and van Raaij, consumer sentiment was an aggregate of opinions and outlooks on households' financial condition and readiness to buy major durable goods.

The relation of consumer sentiment and consumption has been analysed by many researchers, among others, Carroll, Fuhrer and Wilcox (1994), Ludvigson (2004), Meïihovs and Rusakova (2005), Cotsomitis and Kwan (2006), Malgarini and Margani (2007), Çelik and Özerkek (2009), Barnes and Olivei (2013), Bruno (2014). Their results support the hypothesis that consumer confidence helps to predict spending. On the other hand, Fuhrer (1993), Fan and Wong (1998), Goh (2003), and Cotsomitis and Kwan (2006) suggest that confidence effects on consumption are weaker when predicting consumption in comparison to the other determinants.

The approach of international studies focused on countries, as basic units of analysis, has good academic tradition (Douglas & Craig, 1992; Steenkamp & Ter Hofstede, 2002). The procedure usually includes international segmentation, typically consisting of a preliminary screening of countries to identify which are, potentially, the most interesting (Kotabe & Helsen, 2001, p. 220) or the international segmentation is used for grouping the selected countries (Helsen, Jedidi, & Desarbo, 1993).

[1] In the behavioural approach, overconfidence is identified as a separate category and belongs to cognitive biases (Thaler & Shefrin, 1981).

2. Economic Sentiment Index versus household saving rate and household debt-to-income ratio in the European Union from 2004 to 2020

The data used in this paper stem from Eurostat (variables concerning financial behaviour of households) and the European Commission (Economic Sentiment Index). Among variables, concerning the financial behaviour of households the 2, considered most important and available for a relatively large set of countries, were chosen: household saving rate and household debt-to-income ratio. The above-mentioned variables were available on a yearly basis. To obtain comparable values of the Economic Sentiment Index (ESI), which is available on a monthly basis, average values of the ESI were estimated for each year. These data were used in the analysis presented in the paper.

In the 2004–2020 period, the Economic Sentiment Index assumed values between 77.8 and 111.3 points. The lowest value of this indicator was observed in 2009, while the highest, appeared just 2 years earlier, i.e. in 2007. This means that the economic situation in the European Union deteriorated deeply and rapidly in 2009 compared to earlier years. In the years 2014–2016, ESI indicated significant improvement of the economic situation, compared to previous years, and considered values within the range of 104.0 to 105.7 points.

The shaping of household saving rate within the years 2004–2020 is different than ESI (Figure 1). The highest value of the household savings rate was observed

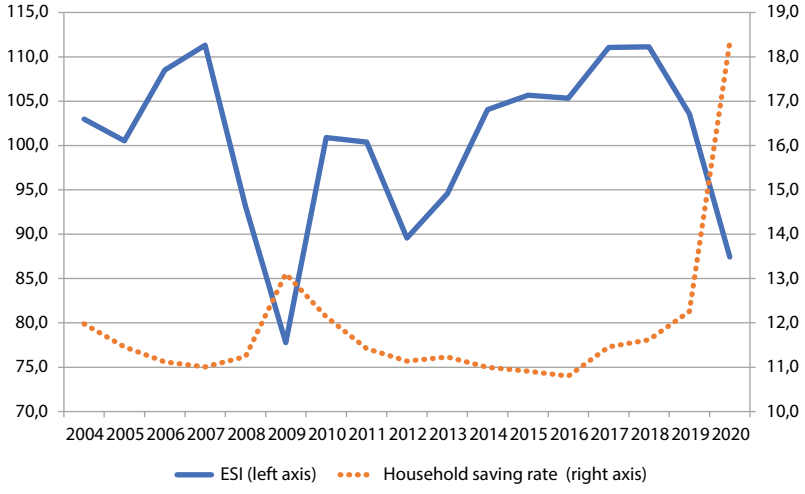

Figure 1. Economic Sentiment Index versus household saving rate between 2004–2020

Source: Own calculations based on Eurostat and European Commission data.

in 2020 and totalled 18.3. The lowest value appeared in 2016 and amounted to 10.8. Pearson's correlation coefficient between these 2 variables assumed the value of –0.498, which means that between the Economic Sentiment Index and the household savings rate, there is a moderate negative relationship. An increase of Economic Sentiment Index leads to a decrease in the household saving rate.

Household debt-to-income ratio showed an upward trend in the years 2004–2010 and then, in following years, demonstrated a downward trend (Figure 2). The house-

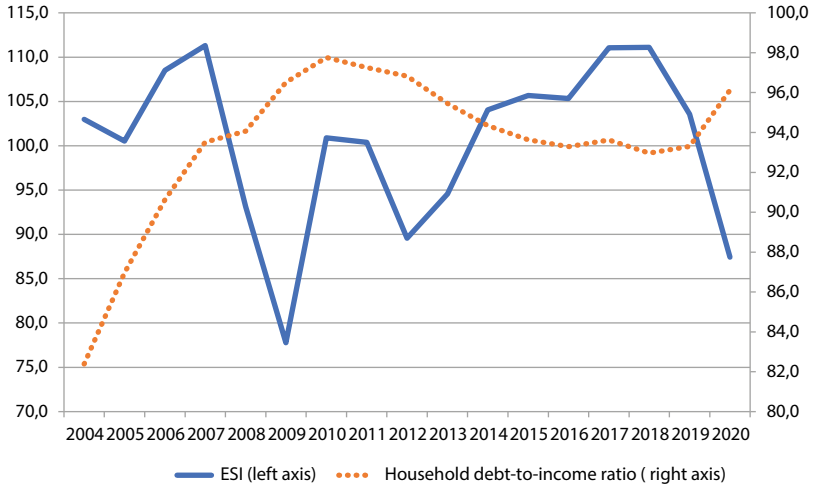

Figure 2. Economic Sentiment Index versus household debt-to-income ratio between 2004–2020

Source: Own calculations based on Eurostat and European Commission data.

hold debt-to-income ratio assumed the highest value in 2010 (97.8), just a year after the lowest value of the ESI. The lowest value of household debt-to-income ratio could be observed in 2004 and amounted to 82.4. The relationship between Economic Sentiment Index and household debt-to-income ratio is negative and weak, as indicated by the value of Pearson's correlation coefficient, equal to –0.359.

3. Segmentation of countries

Based on the above analysis, we decided to compare financial behaviour of households in European Union countries for 2 periods of worst economic situation: 2009 and 2020, and in the period of significant improvement of economic situation: 2016. Data availability for 2009, 2016 and 2020 was reduced to 19, the number of European Union countries concerned in the analysis.

Segmentation of European Union countries was conducted on the basis of 2 variables: household saving rate and household debt-to-income ratio (see Figure 3). These variables were standardised. Euclidean distance was applied as a measure of distance between the objects. The Ward method, which belongs to the methods of cluster analysis, was used to obtain homogenous groups of countries characterised by similar household financial behaviour. This method is based on an algorithm, in which the clusters subject to the merger are selected, so that when they are combined, the smallest possible variance increment is obtained. The results of many analyses indicate the highest efficiency of Ward's method, compared to the other hierarchical cluster analysis methods in the creation of homogeneous clusters (Ferreira & Hitchcock, 2009; Ketchen & Shook, 1996). In Ward's method, the objects grouping result is a dendrogram. The groups of objects (segments) can be obtained by cutting off the longest branches of the dendrogram (so-called whiskers).

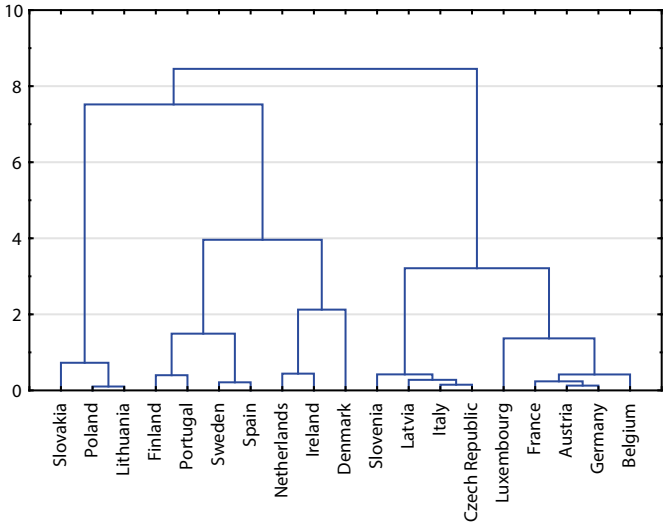

Figure 3. Dendrograph: 2009
Source: Own calculations based on Eurostat data.

For 2009, we obtained three segments of countries. The numbers of segments were given in ascending order of the average savings rate of households.

Segment 1 includes three countries: Lithuania, Poland and Slovakia. The countries in segment 1 distinguish themselves through the lowest average household savings rate (6.0) and the lowest average household debt-to-income ratio (43.4) (Table 1 and Table 2). In all the other countries (in segments 2 and 3), both indicators are, on average, at a higher level.

The highest average household debt-to-income ratio (172.0) and relatively low average household saving rate (11.9) can be observed in segment 2, which covers

Table 1. Segments of countries: 2009

Segment 1	Segment 2	Segment 3
Lithuania	Denmark	Belgium
Poland	Ireland	Czech Republic
Slovakia	Spain	Germany
	Netherlands	France
	Portugal	Italy
	Finland	Latvia
	Sweden	Luxembourg
		Austria
		Slovenia

Source: Own calculations based on Eurostat data.

Table 2. Average values of segmentation variables: 2009

Number of segments	Household saving rate	Household debt-to-income ratio
1	6.0	43.4
2	11.9	172.0
3	15.6	77.2

Source: Own calculations based on Eurostat data.

the following countries: Denmark, Ireland, Spain, the Netherlands, Portugal, Finland and Sweden.

The highest average household saving rate (15.6) and relatively low average household debt-to-income ratio (77.2) describe countries in segment 3, which are: Belgium, Czech Republic, Germany, France, Italy, Latvia, Luxembourg, Austria and Slovenia.

In order to check if there is a statistically significant difference between segments, one-way analysis of variance (ANOVA) was conducted. The results of the analysis showed that, in the case of both segmentation variables, there is a statistically significant difference between the average values of the household savings rate and the household debt-to-income ratio in the obtained segments (Table 3).

A similar analysis was conducted for all the 19 European Union countries on the basis of data for 2016 and three segments of countries were obtained, which are, to some extent, similar to segments for 2009. Some similarities and differences were found between the results for 2009 and 2016 (see Figure 4 and Tables 4–6).

Table 3. ANOVA for segmentation variables: 2009

Variables	*F*-test value	Statistical significance *p*-value
Household saving rate	23.6	0.000017
Household debt-to-income ratio	13.6	0.000348

Source: Own calculations based on Eurostat data.

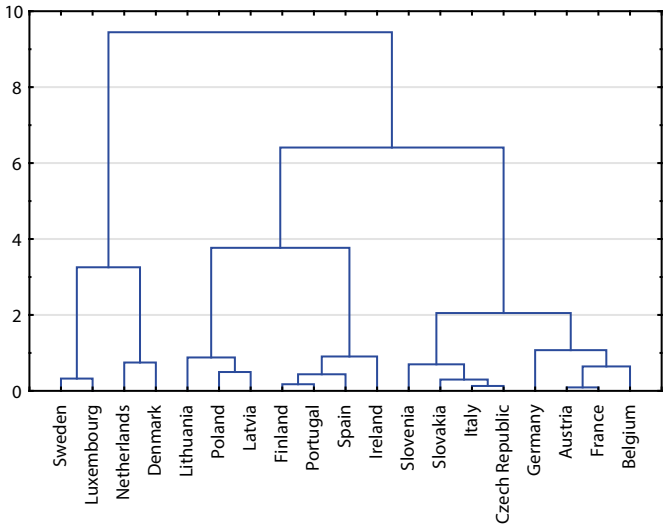

Figure 4. Dendrograph: 2016
Source: Own calculations based on Eurostat data.

Table 4. Segments of countries: 2016

Segment 1	Segment 2	Segment 3
Ireland	Denmark	Belgium
Spain	Luxembourg	Czech Republic
Latvia	Netherlands	Germany
Lithuania	Sweden	France
Poland		Italy
Portugal		Austria
Finland		Slovenia
		Slovakia

Source: Own calculations based on Eurostat data.

Table 5. Average values of segmentation variables: 2016

Number of segments	Household savings rate	Household debt-to-income ratio
1	4.7	85.9
2	15.6	194.2
3	12.4	73.5

Source: Own calculations based on Eurostat data.

Table 6. ANOVA for segmentation variables: 2016

Variables	*F*-test value	Statistical significance *p*-value
Household savings rate	19.0	0.000059
Household debt-to-income ratio	18.2	0.000075

Source: own calculations based on Eurostat data.

Segment 3, in 2016, which includes nine countries, resembles, to some extent, segment 3 in 2009, and covers seven of the same countries. In the case of the other segments, there is a more noticeable change for the number and set of countries.

Moreover, it is worth noticing that the average value of household saving rate is the lowest for the countries from segment 1, both in 2009 and 2016. The average value of the household debt-to-income ratio is the highest for the countries from segment 2, both in 2009 and 2016.

The results of ANOVA allowed to indicate that in 2016, the differences between the average values of the segmentation variables were statistically different at the following level of significance: alpha = 5%.

The results of analysis conducted for the year 2020, which is the period of the COVID-19 pandemic, characterised by economic slowdown, cause a higher extension of the results for the year 2016 than obtained for 2009. The set of countries in 2 of the 3 segments (segments 1 and 3) is almost the same, and in 1 segment (segment 2), is exactly the same as obtained for the 2016 (see Figure 5 and Tables 5–9).

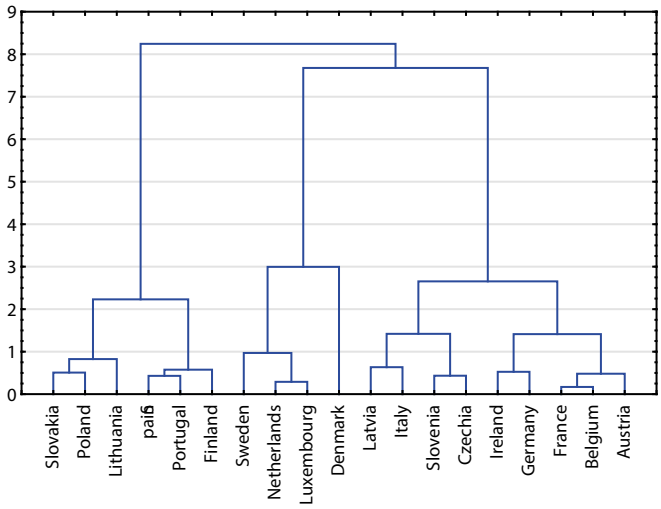

Figure 5. Dendrograph: 2020
Source: Own calculations based on Eurostat data.

Taking the average values of segmentation variables into consideration, we can find some similarities to the results for 2009. The average value of household savings rate is the lowest for the countries in segment 1 and the highest for the countries in segment 3 (the same as in 2009). Also, the average value of household debt-to-income ratio is the highest for the countries from segment 2 (the same as in 2009).

Table 7. Segments of countries: 2020

Segment 1	Segment 2	Segment 3
Finland	Denmark	Austria
Lithuania	Luxembourg	Belgium
Poland	Netherlands	Czech Republic
Portugal	Sweden	France
Slovakia		Germany
Spain		Ireland
		Italy
		Latvia
		Slovenia

Source: Own calculations based on Eurostat data.

Table 8. Average values of segmentation variables: 2020

Number of segments	Household savings rate	Household debt-to-income ratio
1	12.1	78.8
2	19.6	188.3
3	20.8	76.1

Source: Own calculations based on Eurostat data.

Table 9. ANOVA for segmentation variables: 2020

Variables	*F*-test value	Statistical significance *p*-value
Household savings rate	13.4	0.000387
Household debt-to-income ratio	26.4	0.000009

Source: Own calculations based on Eurostat data.

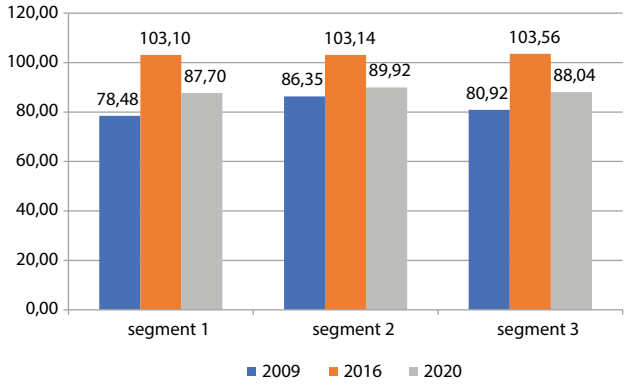

Figure 6. Average values of Economic Sentiment Index in segments for 2009, 2016 and 2020

Source: Own calculations based on Eurostat and European Commission data.

ANOVA enables the conclusion (the same as for the previous periods) that the differences between average values of both segmentation variables are statistically different at the following level of significance: alpha = 5% (Table 9).

For all 3 periods (2009, 2016 and 2020), the lowest average values for the Economic Sentiment Index were obtained in segment 1, gathering the countries with the lowest household saving rate and the lowest (in 2009) or relatively low (in 2016 and 2020) household debt-to-income ratio.

The highest average values of Economic Sentiment Index for the years 2009 and 2020 were obtained in segment 2, which can be characterised by the highest household debt-to-income ratio and relatively high household savings rate (see Figure 6).

Conclusions

The financial behaviour of households changes with cyclical fluctuations in economic situation. Analyses conducted in the paper proved that there is a significant relationship between Economic Sentiment Index and variables describing the financial behaviour of households, such as household saving rate and household debt-to-income ratio.

Both abovementioned variables describing the financial behaviour of households were used as segmentation variables to obtain homogenous groups of countries in the years of the worst economic situation (2009 and 2020), and the year of analysis with a much better economic situation (2016). The segments of countries obtained for all the periods analysed were, to some extent, similar.

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THE PROPENSITY OF POLISH HOUSEHOLDS TO CONSUME AND SAVE WITHIN THE CONTEXT OF THE COVID-19 PANDEMIC

https://doi.org/10.18559/978-83-8211-129-3/9

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Abstract

The aim of this paper is to analyse changes in the propensity to consume and to save in Polish households by means of qualitative indicators of consumer sentiment. The available data made it possible to observe the evolution in attitudes over the course of more than 20 years in Poland including the period of COVID-19 pandemic. The presented results also include an analysis of the changes in the level of household uncertainty, which can be observed in the assessments and forecasts of both their own financial situation and the country's economic condition.

Taking into account the fact that consumer demand is the most important element of GDP, the obtained results do not indicate a quick return of the Polish economy to a path of dynamic growth. Among households, not only has the willingness to buy durable goods decreased, but at the same time, the uncertainty related to their own financial situation has grown.

Keywords: propensity to save, consumption, COVID-19, uncertainty.

JEL codes: D12, D14, E21.

Introduction

Household confidence indicators are a type of statistical information that is often used to describe and forecast consumer sentiment. This is primarily to help assess the future development of consumer demand, which, alongside investment, is one of the key factors determining the economic situation in a country. In short, interest in data on consumer sentiment stems from the belief that consumer attitudes and expectations, which depend on their perception of the current situation, later translate into decisions regarding consumption, its volume and structure (Bovi, 2004; Souleles, 2001). According to Howrey (2001, p. 198), personal consumption in a state of equilibrium depends on the will to consume, which can be measured by the confidence index. It also depends on consumer capabilities, which are

Suggested citation:
Jankiewicz, J. (2022). The propensity of Polish households to consume and save within the context of the COVID-19 pandemic. In S. Białowąs (Ed.), *Economic tendency surveys and economic policy—measuring output gaps and growth potentials* (pp. 126–136). Poznań: Poznań University of Economics and Business Press. https://doi.org/10.18559/978-83-8211-129-3/9

determined by their disposable income. Thus, there is a kind of correlation here. The level of disposable income, beyond the existing taxation system, is shaped by the state of the economy and directly by the situation in the labour market. If new jobs are created and real wages are not reduced by inflation, the finances of many households improve and this affects their sentiment. In such conditions, it is easier to make decisions about buying new household appliances, cars, etc.

Consumer confidence indicators are also used to construct more sophisticated indices describing the state of the economy, and often they are part of complex indices anticipating changes in economic conditions. Examples of the latter include the Leading Indicator Composite Index, which is developed and published by the US Department of Commerce (Kwan & Cotsomitis, 2004, p. 138) and the Economic Sentiment Indicator used by the European Commission (Silgoner, 2007, p. 202).

Returning to the factors that play a key role in shaping consumer sentiment, in addition to the fairly obvious condition of consumer finances, other elements are also indicated; including data relating to the state of the economy. However, research conducted in this context shows that a significant proportion of household members simply do not follow the changes in the main macroeconomic aggregates. A telling example is the research conducted in the USA in 2007 and 2009, which showed a relatively poor knowledge by American household representatives about the state of their country's economy (Curtin, 2010, p. 7). It should be noted that the research took into account such basic aggregates as GDP dynamics, the inflation rate and the unemployment rate. What is more, the data for the analyses was obtained during the time of the so-called Great Recession. Thus, it turns out that even the occurrence of a very significant negative economic shock did not significantly increase the demand for such information. One of the reasons for such an attitude towards macroeconomic data may be the effort (cost) that it takes to observe and interpret basic macroeconomic figures (Jankiewicz, 2013, p. 702). Some consumers may simply fail to see a link between their financial situation and fluctuations in such measures as gross domestic product.

The analysis presented in this paper uses consumer confidence indicators to examine changes in the propensity to consume and save in Polish households in the face of an abnormal and dramatic situation which brought multifarious uncertainty into people's lives: the global COVID-19 pandemic.

Subsequently, the article presents the statistical material which was used for the calculations. Next, the state of the Polish economy is described using information on GDP dynamics and the development of the composite IPSOS Consumer Confidence Index. In the subsequent part, regression equations are estimated using simple indicators of household sentiment, which describe the financial situation of these units and their propensity to consume and save. Measures of income elasticity regarding consumption and saving are also constructed. Lastly, the indicator for

the elasticity of substitution between consumption and saving is used to summarise the results in the final section.

1. Household confidence indicators

In Poland, there are at least several institutions that conduct regular household confidence surveys. Needless to say, the individual research programmes differ in terms of methodology, sample size, and the structure of the questions. One of the most important among these research centres is GfK Polonia, whose data are supplied to Eurostat and presented in the online database of this institution.[1] Confidence surveys are also conducted by the Central Statistical Office and published on its website. Next, there is the Research Institute of Economic Development (RIED) at Warsaw School of Economics (WSE), which has a long history of research and analysis related to the description of consumer sentiment. Another source of valuable data is the research institute IPSOS. Firstly, this company offers a very long time series of confidence indicators, dating back to December 1991; and secondly, an equally important advantage of their data is that IPSOS has not changed either the set of questions used for the surveys, or their order, since that time. In view of these advantages, the calculations presented later in this study are based on information obtained from IPSOS research centre.

As in most consumer sentiment surveys, the areas dealt with by IPSOS representatives include both macro- and microeconomic issues. The first group includes questions about the economic situation in the country; some of which ask for the respondents' diagnosis and some for their predictions about the future (Appendix A1). The second group includes questions about the financial situation of the household, as well as the respondents' attitudes; or more precisely their intentions regarding consumption and saving. This group of questions also consists of both the respondents' diagnoses and forecasts (Appendix A2). The surveyed group consists of representatives of households aged 15 and over.

A drawback that is worth mentioning in the context of the analysis performed is the fact that the presented calculations made use of indices calculated on the basis of the responses of the entire surveyed population. Dividing the respondents (and consequently the responses) according to income groups would undoubtedly have increased the precision of the results presented. Unfortunately, access to such detailed information was not possible. Therefore, the presented results should be read with some caution.

[1] GfK Polonia conducts its surveys according to the recommendations of the harmonised EU programme and they have been available in this version since May 2001.

The basic time series that were used to construct the elasticity indicators were balance statistics as described by Anderson (1952, pp. 1–17). These are the differences between the percentages of positive and negative responses, with a value of '100' added in the case of IPSOS data:

$$dB_t = (dP_t - dN_t) + 100 \quad (1)$$

where:

dB_t – balance,
d – stands for 'diagnosis',
dP_t – positive answer option measured as percentage points of total answers over the period from t–12 to t,
dN_t – negative answer option measured as percentage points of total answers over the period from t–12 to t.

In order to achieve the originally formulated aim of the analysis, from among the available simple indicators calculated according to formula (1), information from responses to the following questions was subsequently used:

- Q5: How would you rate the financial situation in your household in comparison to the situation 12 months ago?
- Q8: Is now a good time to buy durable goods?
- Q11: In your opinion, is it worth saving money in the current situation?

The balance sheets calculated on the basis of the responses to question 5 are treated later in the paper as information that, at least indirectly, describes changes in household income.

2. The economic situation and the Consumer Confidence Index

For many years after the beginning of the social and economic changes in 1989, Poland did not experience what is known as a technical recession: a contraction of real GDP for two consecutive quarters. It was close to such a situation in the first months of 2013; however, even taking into account the later revisions of the estimates announced by the Central Statistical Office in 2016, it is difficult to unequivocally treat this period as a recession in the Polish economy. In the period covered by the analyses, i.e. between January 2000 and March 2021, one clear recession consistent with the aforementioned definition can be identified. It was triggered by the global COVID-19 pandemic, and more specifically by attempts to combat this threat. These included periodic lockdowns, which meant, among other things, that many service outlets and companies were unable to operate.

Due to its global character, this phenomenon contributed to a disruption, and in some cases breakdown, of existing supply chains, resulting in further curtailment of economic activity, also in manufacturing companies.

Figure 1 shows changes in gross domestic product at constant prices, expressed as value increases from the corresponding period of the previous year equal to 100. Two key periods from the point of view of the analysis presented have been shaded: firstly, the time of the great economic crisis, marked in the years 2008–2009; secondly, the period from the declaration of a pandemic in Poland (March 2020) until the end of the presented series of values, i.e. March 2021.

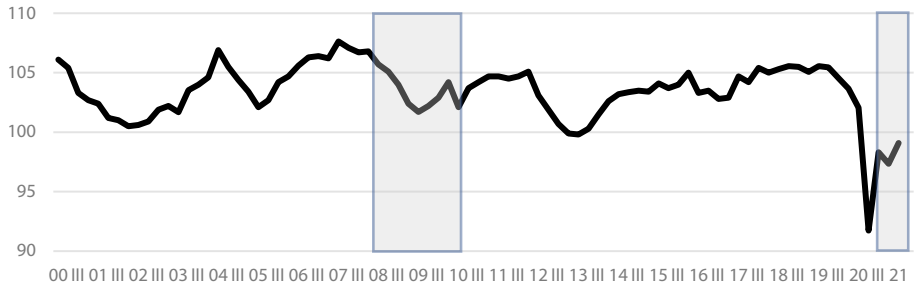

Figure 1. Polish GDP at constant prices, growth rates; equivalent period from previous year = 100.
Source: (www.stat.gov.pl)

For comparison with the results of consumer confidence surveys, Figure 2 presents the values of the composite Consumer Confidence Index (WOK—Wskaźnik Optymizmu Konsumentów) published by IPSOS. WOK is an arithmetic mean of the values of five simple indicators (calculated on the basis of answers to questions 2, 3, 5, 6, 8).

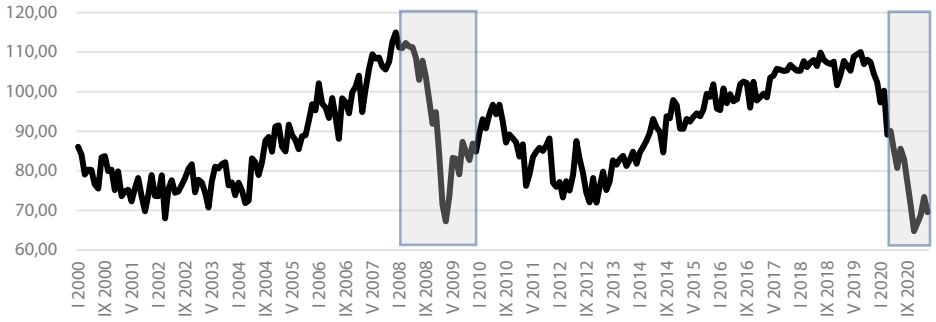

Figure 2. Consumer Confidence Index by IPSOS
Source: IPSOS.

Even just a simple comparison of the GDP and WOK series shows that consumer sentiment significantly declined both in the years 2008–2009 and during the COVID-19 pandemic. It is worth remembering that during the former of these periods Poland was dubbed a "green island" because it was one of the few economies that experienced a significant reduction in GDP growth but no absolute GDP decline during the global crisis. However, this crisis is clearly visible in consumer sentiment. One can speculate that, apart from the actual financial impact on households, a psychological effect may also have been at work in this case. The media were outdoing each other at that time in terms of negative information and ominous forecasts, with the words "crisis" and "recession" being all over the front pages.

3. Propensity for saving and consumption

The simple indicators mentioned in the second section, presented in the form of balance statistics, were then used to estimate the values of the parameters in regression equations. This was done to confirm that the expected relationships existed between them (Bürkl, 1996, p. 39; Jankiewicz, 2014, p. 125). The general form of the multiple regression equations whose parameters were estimated can be written as follows:

$$dC = \alpha_0 + \alpha_1 dY + \alpha_2 dS + \varepsilon \quad (2)$$

$$dS = \beta_0 + \beta_1 dY + \beta_2 dC + \delta \quad (3)$$

where:

dC – current propensity for consumption,
dS – current propensity for saving,
dY – current household income.

The results of the estimations are presented in Tables 1 and 2.

The presented estimations seem to confirm the usefulness of the selected types of confidence indicators for further calculations. In the case of both regression equations, the dY variable plays the most significant role in describing the dependent quantity (dC or dS). On this basis, it can be assumed that the financial

Table 1. Parameters of the regression function with the dependent variable *dC*

Coefficient	Parameter	t-Statistic	*p*	Partial correlation
Intercept	82.91	48.82	0.00	–
dY	0.51	16.84	0.00	**0.67**
dS	–0.18	–9.17	0.00	–0.44
$F(2, 348) = 158.69$ $R^2 = 0.47$				

Source: Own calculations based on IPSOS data.

Table 2. Parameters of the regression function with the dependent variable *dS*

Coefficient	Parameter	*t*-Statistic	*p*	Partial correlation
Intercept	110.40	11.33	0.00	–
dY	1.50	25.41	0.00	**0.81**
dC	–1.10	–9.17	0.00	–0.44
$F(2, 348) = 349.18$ $R^2 = 0.67$				

Source: Own calculations based on IPSOS data.

situation and its assessment in households is an important factor that influences the propensity of respondents to consume and save. In order to examine the role of this factor more closely, in the next step of the analysis the elasticity coefficients were calculated and traced. Income elasticity of consumption and saving was calculated according to the following formulas:

$$E_C = \frac{dC}{dY} \tag{4}$$

$$E_S = \frac{dS}{dY} \tag{5}$$

However, using them in this way, i.e. according to the definition of the elasticity coefficient, is only possible on the assumption that *dY*, *dC* and *dS* describe percentage changes (Bürkl, 1996, p. 41). Changes in the values of the coefficients constructed in this way are presented in Figure 3.

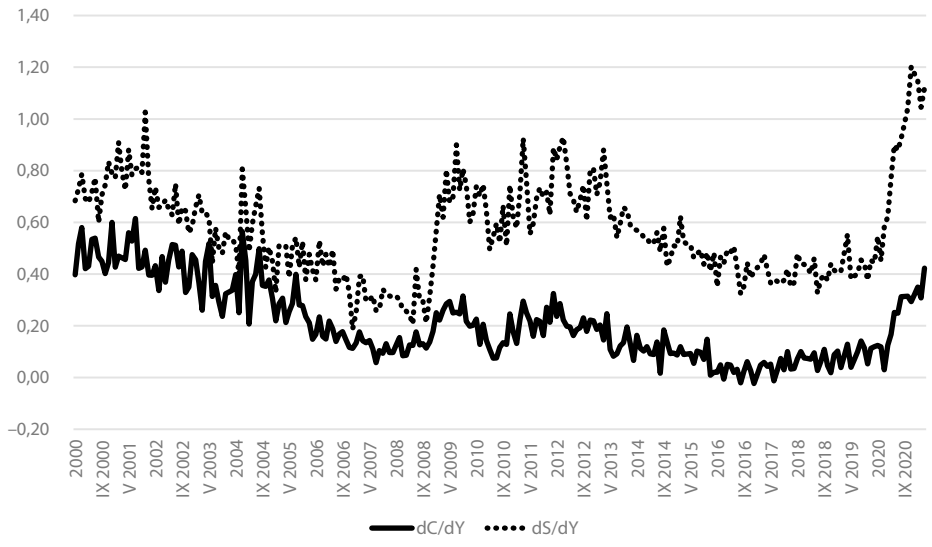

Figure 3. Income elasticity of consumption and saving
Source: Own calculations based on IPSOS data.

What is immediately visible is the fact that throughout the analysed period the propensity to save exceeds the propensity to consume. The opposite situation occurred only in the first half of the 1990s (Jankiewicz, 2014, p. 126). Moreover, this difference between saving and consumption increased after the great crisis of 2008–2009.

In the years 2002–2007 the propensity to consume decreased. Then, in the period between 2008 and 2013, it oscillated around a relatively constant level, only to decline again in the next three years. The propensity to save, in turn, increased until 2001–2002, after which it began to decline markedly until 2007, when this tendency ceased. Figure 3 clearly shows how much of a shock to households was the 2008–2009 global crisis. The propensity to save, based on the belief that one should accumulate funds as a precautionary measure, increased exponentially at that time. Moreover, it apparently left a "mark" in the minds of respondents until 2013. Another shock was connected with the outbreak of the COVID-19 pandemic, which is illustrated by an even larger increase in the *dS/dY* relationship than that which occurred nearly a decade earlier. In this case, one can assume that uncertainty was even greater than during an admittedly severe but nevertheless periodically occurring economic crisis.

Starting from the first quarter of 2020, a marked increase in the propensity to consume can also be observed. Interest rates were generally very low at this time, and banks virtually stopped offering term deposits. In addition, this was accompanied by the phenomenon of accelerated price growth—inflation—which exceeded the inflation target laid down in the National Bank of Poland Act. At least some Poles began to notice a decline in the real purchasing power of money. This, in turn, accelerated some consumers' decisions about purchasing durable goods; and on the property market it even triggered a situation that soon came to be called a "speculative bubble".

The observed changes in the relationship between the propensity to consume and the propensity to save sparked an interest in examining one more relationship. In the last step of the analysis, the elasticity of substitution between consumption and saving was assessed:

$$\frac{dC}{dS} \tag{6}$$

If the value of this coefficient exceeds 100, it means that the propensity to consume is greater than the propensity to save. If, on the other hand, there is a $\frac{dC}{dS} < 100$ relationship, then the propensity to save prevails over the propensity to purchase durable goods in households. The values of coefficient (6) are shown in Figure 4.

Throughout the analysed period the elasticity coefficient (6) remains below 100, which could be expected after analysing the series in Figure 3. However, using

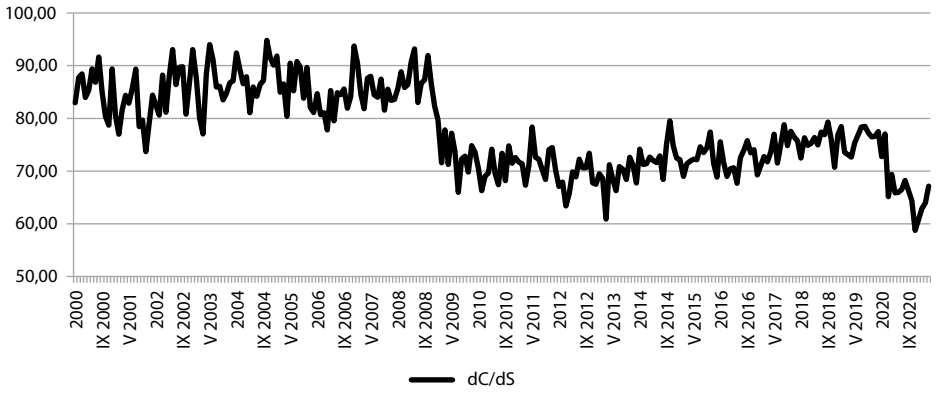

Figure 4. Elasticity of substitution between saving and consumption of Polish households

Source: Own calculations based on IPSOS data.

the presented measure helps to clearly see another interesting phenomenon. In the years 2000–2008, this coefficient, which earlier most frequently oscillated between the values of 80–90, began to take significantly lower values due to the great economic crisis. Moreover, one can easily notice that the impact of the global crisis of 2008–2009 left its mark on Poles' propensity to consume and save in the long term. Even though a slight upward trend in the value of the elasticity coefficient can be observed between 2013 and 2020, Figure 4 presents a definite long-term change that was prompted by the global economic crisis.

The impact of the COVID-19 pandemic was similar in this respect. It contributed to a dynamic reduction in the value of the coefficient. Thus, the question arises whether this time the change will also be long-term. However, because the causes and course of the negative events in the pandemic were different from those during a "normal" economic crisis, it is possible that the *dC/dS* relationship will return to its previous levels much faster this time.

Conclusions

The deterioration of the socio-economic situation during the COVID-19 pandemic was by definition the result of different causes and affected by different mechanisms compared to classic market turbulence. However, the calculations presented and the comparisons of selected indicators show that changes in consumer sentiment, particularly in the propensity to consume and save, were largely very similar in the pandemic to those that occurred in response to the Great Recession. Uncertainty related to a deteriorating situation, regardless of the causes of this deterioration,

contributed to a marked increase in the propensity to save. And it can be assumed that during the pandemic the degree of uncertainty, and thus the level of anxiety about the future, was probably even greater than usual. After all, the situation that developed was unprecedented in the world. At the same time, however, the changes brought about by the efforts to control the spread of the virus were accompanied by inflation. The policy of commercial banks that virtually stopped offering deposits at an adequate interest rate, significantly reduced the ability of households to protect the purchasing power of their finances. This, in turn, partially cancelled out the impact of the growing propensity to save on the *dC/dS* ratio.

Appendix

A1

Q1: Do you think things in our country are going in the right direction or are they taking a turn for the worse?
Q2: How would you assess the change in the economic situation in Poland over the last 12 months?
Q3: How do you think the economic situation in Poland will change in the coming months?
Q4: In your opinion, will unemployment in Poland increase or decrease over the next 12 months?
Q9: Looking at what is happening now, do you think that over the next 12 months prices will change (6 possible answer options, ranging from 'will rise even faster than now', through 'difficult to say', to 'will be lower').

A2

Q5: How would you rate the financial situation in your household in comparison to the situation 12 months ago?
Q6: What do you think the financial situation in your household will be in 12 months' time?
Q7: What is the current financial situation in your household?
Q8: Is now a good time to buy durable goods?
Q10: Do you think you will be able to save any money within the next 12 months?
Q11: In your opinion, is it worth saving money in the current situation?

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www.stat.gov.pl

The reviewed book shows the strong position of Polish science and it seems to be the area of interest of the broad scientific community, decision-makers. I am sure that the reviewed book could be successfully used for educational purposes in higher education, as a source of inspiration and an example of conducting research by young researchers and an important and useful source of data for practitioners, managers at various levels, government officials and the scientific community.

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eISBN 978-83-8211-129-3