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LETTER OF PROFESSIONAL ACCOMPLISHMENTS

1. Introduction

The main objective of this account is to present my professional accomplishment in my scientific and teaching work with emphasis on my publications following the award of my doctoral title in Economics in 2009. The text is organised as follows. In section 2, I briefly present my career. Section 3 is devoted to my scientific achievement, which encompasses a cycle of interrelated thematically publications. They are the basis for my application for habilitation in the field of Economics. In the publications presented, to the best of my knowledge, I provided both new insights into the field and presented new methodological developments. In section 4, I characterised my other scientific achievements, especially other peer-reviewed articles, teaching achievements and also international co-operation. The final section concludes the assessment of my scientific accomplishments with indices for scientific research impact.

2. Professional career

In 2004 I graduated from Warsaw School of Economics (WSE) in Economics with very favourable diploma results. I also completed required subjects in Quantitative Methods and Information Systems. Directly after my graduation I started working at the Department of Economics I at the Warsaw School of Economics but also intensified my co-operation with the Research Institute for Economic Development (RIED) at the Warsaw School of Economics. However, my co-operation with my alma mater dates back to 2001, when I started teaching as a

student assistant. Already at this point I had had the pleasure of conducting classes in Microeconomics and Macroeconomics at various levels. An important role at the Warsaw School of Economics was devoted to design, analysis and direction shaping of tendency surveys conducted at the Research Institute for Economic Development under the supervision of prof. dr hab. Elżbieta Adamowicz. Between 2004 and 2010 I was a co-author of the *State of the Household Survey* and since 2006 I have been co-responsible for the *Situation on the consumer finance market* study, for which, together with my colleagues from RIED, we managed to obtain funding and developed its methodology from scratch. My engagement with research on household financial behaviour led to my Ph.D. thesis entitled „The development of Polish household credit market”. I defended the thesis prepared under scientific supervision of prof. Adamowicz in June 2009 at Collegium of Economic Analyses at the Warsaw School of Economics.

Afterwards I continued my academic career as an assistant professor at the Department of Economics I at the Warsaw School of Economics. During the academic year 2011/2012 I took a sabbatical from teaching at WSE in order to pursue my scientific interests abroad (visiting fellow at Università degli Studi di Milano between January and August 2012 and short research visit at KOF Swiss Economic Institute in Zurich), but also started to work on my own research grant from the National Science Centre in Poland (title: „Forecasting and modelling economy with tendency survey data”). Following the evolution of my scientific interests in the direction of statistical modelling, I took an employment opportunity at the Institute of Statistics and Demography at WSE. At the same time, I continued in co-operation with RIED, actively participating in tendency survey research (between 2010 and 2015 as a leader in the *Survey in the banking sector*), conferences but also actively publishing in scientific journals published by RIED. For 4 months (October 2014 – January 2015) I worked at the International Association for the Evaluation of Educational Achievement, Research and Analysis Unit in Hamburg, where I applied statistical models to large educational assessment datasets. Starting from June 2015 I have been conducting research under my own grant (post-doc from the Marie Curie actions) at Università degli Studi di Torino, Dipartimento di Scienze Economico-sociali e Matematico-statistiche. In the project I am responsible for identification of household financial behaviour patterns on the financial market from the European perspective.



3. Scientific achievement

The subject of my scientific accomplishment for assessment is the series of publications titled: „Consumer and business tendency surveys – methodological aspects, elimination of response biases and the use of data in forecasting”. The publications comprise the following articles¹:

1. Białowolski, P., Kuszewski, T., Witkowski, B. (2015) Bayesian averaging vs. dynamic factor models for forecasting economic aggregates with tendency survey data, *Economics. The Open-Access, Open-Assessment E-Journal*, 9 (2015-31), Access <http://dx.doi.org/10.5018/economics-ejournal.ja.2015-31> - (IF 0.644², pts. 15³)
2. Białowolski, P. (2015) A Composite Indicator for Household Debt Demand, *Acta Universitatis Lodzianis. Folia Oeconomica*, No. 314, pp. 31 – 38 (pts. 6)
3. Białowolski, P. (2015) Concepts of confidence in tendency survey research: an assessment with multi-group confirmatory factor analysis, *Social Indicators Research*, Vol. 123, Issue 1, doi: 10.1007/s11205-014-0736-1 (IF 1.395, pts. 40)
4. Białowolski, P., (2015) Latent factor growth models for forecasting Polish GDP growth, inflation and unemployment using survey data, *Prace i Materiały IRG SGH*, Nr 96 (Analyzing and forecasting economic fluctuations), pp. 69-93 (pts. 6)
5. Białowolski, P. (2015) Survey-based household inflation expectations – Are they valid? A multi-group confirmatory factor analysis approach, *Prace i Materiały IRG SGH*, No. 96 (Analyzing and forecasting economic fluctuations), pp. 49-67 (pts. 6)
6. Białowolski, P. (2015) The influence of negative response style on survey-based household inflation expectations, *Quality and Quantity*, doi: 10.1007/s11135-015-0161-9 (IF 0.761, pts. 25)
7. Białowolski, P. (2014) Consumer confidence, durable goods purchase and unemployment forecast, *Ekonometria*, Nr 3(45), pp. 42-55 (pts. 9)
8. Białowolski, P., Węziak-Białowolska, D. (2014) External Factors Affecting Investment Decisions of Companies, *Economics. The Open-Access, Open-Assessment E-Journal*, 8(2014-11), pp. 1–22, <http://dx.doi.org/10.5028/economics-ejournal.ja.2014-11> (IF 0.644, pts. 15)
9. Białowolski P., Kuszewski T., Witkowski B. (2014) Bayesian Averaging of Classical Estimates in Forecasting Macroeconomic Indicators with Application of Business Survey Data, *Empirica. Journal of European Economics*, vol. 41 issue 1, pp. 53-68 (IF 0.462, pts. 15)
10. Białowolski, P. (2013) Expectations' Formation in Business Survey Data, *Prace i Materiały IRG SGH*, No. 93, pp. 5-28 (pts. 6)
11. Białowolski, P., Węziak-Białowolska, D. (2012) Priorytety płatności polskich gospodarstw domowych - zastosowanie podejścia eksploracyjnego w konfirmacyjnej

¹ Some publications are co-authored. Detailed description of contributions by authors is presented in Annex 4 – List of publications and information about lecturing and international cooperation and in Annex 5 – Authors' statement about the authorship.

² For journal articles published in 2015 I applied impact factor (IF) from the JCR 2014 list, as data for 2015 are not yet available. For other publications I apply IF from the year of publication.

³ Points from the Ministry of Science and Higher Education list have been calculated according to the list valid on the date of publication.

- analizie czynnikowej (Payment Priorities of Polish Households - Exploratory Approach in Confirmatory Factor Analysis), *Roczniki Kolegium Analiz Ekonomicznych*, No. 28/2012, pp. 179-196 (pts. 7)
12. Białowolski, P. (2012) Applicability of the Multi-Group Confirmatory Factor Analysis to Construction of Business Sentiment Indicators, *Acta Universitatis Lodzianensis. Folia Oeconomica*, No. 269, pp. 183 – 189 (pts. 5)
 13. Białowolski, P., Kuszewski, T., Witkowski, B. (2012) Macroeconomic Forecasts in Models with Bayesian Averaging of Classical Estimates, *Contemporary Economics*, Vol. 6 Issue 1 2012, pp. 60-69 (pts. 9)
 14. Białowolski, P., Kuszewski, T., Witkowski, B. (2011) Prognozy podstawowych wskaźników makroekonomicznych z użyciem danych z testów koniunktury (Forecasts of the main macroeconomic indicators with the use of tendency survey data), *Prace i Materiały Wydziału Zarządzania Uniwersytetu Gdańskiego*, No. 4/8, pp. 49-64 (pts. 5)
 15. Białowolski, P. (2011) Analiza formułowania ocen i prognoz przez gospodarstwa domowe z wykorzystaniem modelowania równań strukturalnych (Analysis of household assessment and expectation patterns in tendency surveys in the structural equation modeling framework), *Prace i Materiały Instytutu Rozwoju Gospodarczego SGH*, No. 87, pp. 141-164 (pts. 9)
 16. Białowolski, P., Węziak-Białowolska, D. (2011) Zastosowanie analizy klas ukrytych do identyfikacji wykluczenia gospodarstw domowych z rynku kredytowego (Identification of the household exclusion from the credit market with the latent class analysis), *Roczniki Kolegium Analiz Ekonomicznych*, No. 23/2011, pp. 159-174 (pts. 9)
 17. Białowolski, P., Zwiernik, P., Żochowski, D. (2011) Modelling Inflation Using Markov Switching Models: the Case of Poland (1992 - 2005), *Prace i Materiały Instytutu Rozwoju Gospodarczego SGH*, nr 86, s. 185-199 (pts. 9)
 18. Białowolski, P., Kuszewski, T., Witkowski, B. (2010) Prognozy kombinowane wskaźników makroekonomicznych z użyciem danych z testów koniunktury (Combined forecasts of macroeconomic indicators with application of tendency survey data), *Współczesna Ekonomia*, No. 4(16), pp. 41-58 (pts. 9)

The publications mentioned cover the following – sometimes overlapping – research topics:

1. Confidence indicators in tendency surveys as multidimensional and latent constructs - methodological aspects to measurement;
2. Interaction between dimensions of the tendency survey questionnaire;
3. Tendency survey data for forecasting main macroeconomic indicators;

All publications included in my main achievement had a primary focus on tendency survey data. My main goal was to create a basis for efficient use of tendency survey data for analysis and forecast of the economy. Unfortunately, achieving this is not possible without prior examination of the validity of information provided by these studies. Confidence indicators comprise the most widely used set of indicators to derive conclusions from the tendency survey data. Statistical properties of the indicators used were, however, at that time unexplored. This explains my interest in verifying their validity and comparability over time. As the tendency survey data are

often used in the form of aggregates, the micro-level information showing the relationship between different areas of the questionnaire is lost. Analysis of interactions was conducted in a number of my publications and served as a tool for a better understanding of how respondents perceive the functioning of the economy and, what structural interdependencies between different areas of economic activity (or understanding of the economy) are present in the micro-data. Ultimately, however, the essence of gathering tendency survey data is towards forecasting at the macro level, which is also reflected in a number of my works.

The following part of the section is structured according to the above points and presents my scientific achievements.

3.1. Confidence indicators in tendency surveys as multidimensional and latent constructs - methodological aspects to measurement

The results of tendency surveys are often summarised in a single number – the confidence index. By definition they should be related to the situation within their reference areas and should predict changes in the behaviour of the sector reference series, i.e., gross value added in the case of the industrial confidence indicator and private consumption expenditures in the case of the consumer confidence indicator (European Commission, 2006, p. 24). In a commonly applied approach to confidence measurement, indices are calculated every period for every sector as a simple (or weighted) average of balances calculated for each of the predetermined questions. Balances, in turn, represent differences between the share of “positive” and “negative” answers for each question (European Commission 2006). As the aggregate information is obtained without investigating interactions between answers to questions on an individual (household, company) level, a few crucial questions concerning validity and reliability of confidence based on tendency surveys are left unanswered: (1) Do we really, with the chosen set of questions, capture a concept that can be associated with confidence? (2) How should we measure the concept of confidence – is it formative or reflective? (3) Is the set of confidence indicators (questions) coherent in each period of analysis? (4) Does the understanding of questions and the mode of answering in different time periods remain constant? Leaving these questions aside might lead to misinterpretation of the confidence indicators, as they might be neither reliable nor valid.

A need to assess the measurement issues in tendency surveys was clearly stated by Lemmens, Croux, and Dekimpe (2007) and Nahuis and Jansen (2004). However, to the best of my knowledge, my publications were the first attempts to investigate the issue. My first attempt

to investigate the issue was a conference paper "Confirmatory Factor Analysis in the Measurement of Consumer Confidence", which I presented in 2010 at the *Qualitative Survey Data: New Methods and Applications* conference organized by the KOF Swiss Economic Institute in Zurich. Subsequently, I developed the topic. In the article "Concepts of confidence in tendency survey research: an assessment with multi-group confirmatory factor analysis" I investigate the link between the formal definition of the confidence concept in tendency surveys and its measurement. I present arguments for the use of reflective measures in an assessment of the confidence level in both consumer and industrial indicators. By using multi-group confirmatory factor analytical approach (MGCFA) I demonstrate that the currently used set of indicators recommended by the European Commission methodology might be not appropriate to measure the concept of confidence consistently, both within and between periods. My conclusion holds true for the confidence indicator in the area of consumer tendency surveys and the tendency survey of the manufacturing sector. Consequently, I sought an alternative specification both for the consumer confidence index (my study "Consumer confidence, durable goods purchase and unemployment forecast") and business confidence ("Applicability of the Multi-Group Confirmatory Factor Analysis to Construction of Business Sentiment Indicators").

With respect to the consumer confidence index I proposed not only (1) a new set of questions, consistent with measurement of the concept but also (2) a novel method to calculate its values using multi-group confirmatory factor analysis. With data from the State of the Household Survey conducted at the Research Institute for Economic Development, I specified and estimated a model for consumer confidence, in which not only configural but also partial metric and partial scalar invariance were established. Partial metric and scalar invariance are essential to any claim that changes in the level of consumer confidence can be fully explained by changes in the magnitude of the latent variable (consumer confidence in our case). Hence, its existence justifies comparison of the mean of the latent variable (Steenkamp & Baumgartner, 1998).

With respect to the business confidence indicator I investigated two different specifications for the manufacturing sector confidence indicator – one based on a mixture of assessments and forecasts and a second based solely on forecasts. My results show that much better construct validity can be obtained with the set of indicators relating only to forecasts.

In my article "A Composite Indicator for Household Debt Demand" I developed an original approach to construction of a leading indicator for household debt demand using tendency survey data. In order to derive a valid indicator, I presented a theoretical background for the dimensions of the index identifying as potential areas of interest: (1) household

characteristics associated with life-cycle theory; (2) indicators associated with current demand for durables; (3) indicators associated with credit market exclusion; (4) indicators associated with uncertainty in the area of economic situation. With all dimensions of the index available, I operationalised it on a set of indicators using the State of the Household and consumer finance surveys. Subsequently I found that the newly created index is leading with respect to the dynamics of household debt.⁴

To sum up my achievements in the areas related to methodological aspects in confidence indicators in tendency surveys I would like to emphasise that at least three of my innovations to the state of knowledge in the field are featured.⁵ First, these articles are the only articles to date attempting to propose a formal definition of confidence in tendency surveys, describing the way in which it should be measured. Second, I was the first to conduct a check of the validity of the commonly used indicators for industrial and consumer confidence. Third, I was the first to search for inconsistencies between confidence indicators and provide revisions to them by either proposing alternatives to the set of questions used or by establishing intertemporal comparability of confidence indices for certain periods only.

4.2. Interactions between dimensions of the tendency survey questionnaire

Although forecasting applications for tendency survey data are well established in the literature (Ang, Bekaert, & Wei, 2007; Angevine, 1974; Batchelor & Dua, 1992; Białowolski, Kuszewski, & Witkowski, 2014; Carroll, Fuhrer, & Wilcox, 1994; Costantini, 2013; Curtin, 1982; Gil-Alana, Moreno, & De Gracia, 2012), very little attention was devoted to analysis of patterns and interactions within the tendency survey questionnaire. However, such an analysis might be beneficial in establishing how respondents perceive the economy and to check whether predictions made from them are somehow biased. Lack of such analysis hinders proper comprehension of results, precludes valid forecasting and finally, leads to difficulties in communicating results. Understanding the logic behind respondent answers was part of my research grants: (1) The post-doc award from the National Science Centre, and also (2) the

⁴ The results were mostly adopted for the construction of consumer finance barometer published jointly by the Research Institute for Economic Development and Conference of Financial Enterprises in Poland on quarterly basis since 2014.

⁵ Although application of the latent variable techniques to modelling confidence indicators was only started in my research, the importance of validity assessment at creation of this kind of indices had already been noted. With the results of my research I served as an invited speaker on the 12th Workshop on Composite Indicators organized by the European Commission Joint Research Centre, where I presented the article, „Concepts of confidence in tendency survey research: an assessment with multi-group confirmatory factor analysis”.

research grant from the National Bank of Poland within the scope of its 2nd competition for scientific grants.

In my post-doctoral scientific projects I investigated the issues of: (1) bias in inflation expectations, (2) interrelation between tendency survey questionnaire areas, (3) linkage between questions in the domain of household financial situation and (4) factors affecting company investment decisions. With respect to the above research topics the fundamental importance was ascribed to issues associated with measurement, specifically its validity and measurement invariance, i.e., intertemporal comparability of results between successive rounds of the questionnaire.

Bias in inflation expectations

Stylized facts combined with basic economic knowledge imply that consumer confidence should be positively related to inflation. Smets and Wouters (2005), using the Dynamic Stochastic General Equilibrium framework, show that the most fluctuation in an economy can be attributed to demand-side processes. Thus, greater importance is placed on demand-side processes in driving inflation, as there is a positive link between the general performance of the economy and inflation. This positive link has been confirmed historically in the business cycle literature (see e.g. Niemira & Klein, 1994; Zarnowitz, 1992). Nevertheless, the link appears missing in the perception of households responding to the tendency survey questionnaire.

In 2011 I started research on this topic during my research project funded by the National Bank of Poland. Preliminary results were presented in 2012 at the Centre for International Research on Economic Tendency Surveys (CIRET) conference in Vienna but also during a research seminar at the KOF Swiss Economic Institute in Zurich, which took place also in 2012. The final results were presented in the article "Survey-based household inflation expectations – Are they valid? A multi-group confirmatory factor analysis approach", where I provided explanations for this situation. Micro-level household inflation expectations were demonstrated to be positively related to individual level consumer confidence. To explain this influence I applied multi-group confirmatory factor analysis. By providing simultaneous measurement for both consumer confidence and inflation expectations in one model, I was able to account for the influence of consumer confidence on inflation expectations reliably, while maintaining intertemporal comparability of the concept of confidence. In this article, MGCFA was used for the first time to account for the influence of a complex concept (here consumer confidence) to survey questions

related to inflation expectations. With this approach I was able to show that (1) perception of consumer confidence has a significantly positive effect on individual inflation expectations, which implies that respondents better able to assess the economy tend to bias their inflation expectations downward; (2) change in consumer confidence during all periods affected to the same extent inflation expectations, i.e., a unit change in consumer confidence always translated into the same expected change in inflation expectations.

My second paper on this topic entitled, "The influence of negative response style on survey-based household inflation expectations" reported a different approach. Here, I examined survey-based household expectations about the economy, noting the presence of a group of respondents with a negative response style. In order to distinguish the households with this negative style I used multi-group latent class models, a novelty in this field. I was able to verify measurement invariance constraints. I showed that although the size of the group of households with the negative response style fluctuates between periods, the negative style pattern of responding is comparable intertemporally. In other words, mathematical representation of the model describing latent class membership can be applied to any wave of the survey. I also showed that income and age are the only significant determinants for the negative response style. Correcting for the presence of this group with negative response style allowed me to depict that (1) the respondents' inflation expectations become more consistent with inflation expectations of professional forecasters; (2) the correlation between inflation expectations and level of consumer confidence is significantly higher than for uncorrected series; (3) the answer pattern for inflation expectations has the properties of the Ball-Friedman hypothesis (Ball, 1992; Friedman, 1977), i.e., higher inflation is associated with higher inflation uncertainty.

Novelty of my work to the scientific field is manifested by: (1) providing individual level evidence on the missing link related to positive relationship between the general performance of the economy and inflation in the perception of households responding to the tendency survey questionnaire. Namely, I showed that corrected for negative response style respondent inflation expectations are more consistent with inflation expectations of professional forecasters; (2) proposing and application of a statistical techniques (MGCFA and multi-group latent class models) to account for those biases.

Interrelations between tendency survey questionnaire areas

Another under-investigated area in tendency survey research is associated with interrelations between questionnaire responses. Based on Katona's assumptions (Katona, 1946, 1947), respondents are believed not only to have an intrinsic knowledge of their own current and future situation but are also assumed to be able to assess the current and future general economic situation. Owing to this, tendency survey questionnaires are usually designed to cover four areas emerging from the two by two interactions: PRESENT and FUTURE, INDIVIDUAL (respondent's) and GENERAL (economic) situation.

How these four areas interact in consumer tendency surveys has already been subject to investigation both with respect to European countries (Bovi, 2009) and Poland (Białowolski & Dudek, 2008). The results suggested that there might be a causal relationship between patterns of assessment and forecasts in the dimensions of the general economic and household situation. These interrelations were summarized in the mantra presented by Bovi (Bovi, 2009), "As usual, it has got worse than I expected. Especially for the OTHERS. Nevertheless, I think that it will get better. Especially for ME."⁶ This mantra clearly iterates the pertinence of the dimensions, space (ME and OTHERS) and time (PRESENT and FUTURE). Nevertheless, these studies were based on aggregate data. The need for a more profound, micro-level analysis with tendency survey data had already been emphasized (Paloviita & Viren, 2012).

Interaction between four areas resulting from micro-level data had never been investigated with respect to either consumer or business tendency data, preventing a deeper understanding of importance related to these issues. Consequently, I investigated the interrelations between answers in the four areas (current vs. future; individual vs. general) for households (article "Analiza formułowania ocen i prognoz przez gospodarstwa domowe z wykorzystaniem modelowania równań strukturalnych (Analysis of household assessment and expectation patterns in tendency surveys in the structural equation modelling framework)") but also for a tendency study in manufacturing industry (article "Expectations' Formation in Business Survey Data").

In my article, "Analiza formułowania ocen i prognoz przez gospodarstwa domowe z wykorzystaniem modelowania równań strukturalnych" interdependence between the responses of

⁶ Analysis conducted on the data from the State of the Households Survey (carried out by the Research Institute for Economic Development) by Białowolski and Dudek (2008) let us to formulate a different mantra applicable to Polish society "As usual, it has got worse than I expected. Especially for ME. Nevertheless, I think that it will get better. Especially for OTHERS."

respondents in the State of the Households survey in Poland was investigated. In this study multi-group confirmatory factor analysis proved useful as a means to determine whether respondents provided consistent answers to the questionnaire in the areas of: current situation of the household (CSHH), current situation in the economy (CSGE), forecasted situation for the household (FSHH) and the forecast economic situation (FSGE). I showed that for three of the four areas (except CSHH) it was possible to select a set of questions to consistently evaluate the area of interest. Therefore, I proposed and estimated a structural model with which I showed that household responses to questions concerning FSHH were interrelated with responses in each of the other three areas. Strong interdependence between individual respondents' answers in the areas of (1) CSGE and FSGE, but also (2) CSGE and CSHH was identified. I verified stability of the interrelations between the areas, concluding that a unit change in opinions in one area translates in all periods with the same magnitude on other areas.

In the article "Expectations' Formation in Business Survey Data" I adopted a slightly modified approach to modelling responses in time (PRESENT vs. FUTURE) and space (INDIVIDUAL vs. GENERAL). I also used a different dataset, namely Survey in the manufacturing sector. In this case performing a validity check of the factor structure with multi-group confirmatory factor analysis (MGCFA) required the use of estimators designed for categorical data. I established valid sets of indicators in the areas of current company assessments and expectations. The concept that I introduced here also ensured intertemporal comparability of measures. In order to define period specific relations between the factors I proceeded with a structural equation modeling (SEM) framework showing that most answers in the area of current assessments and expectations of companies were in line with the stylized facts. I also demonstrated that the companies' response pattern did not change during the financial crisis. In the scope of analyses I managed to identify a different mantra for the manufacturing companies operating in Poland: "When it gets better in the economy, it gets even better for ME and I have a chance to increase MY prices; it will also get better tomorrow, but not as much as today."

In my scientific activity I also pursued investigation into interrelations between confidence indicators, the unemployment forecast and durable goods purchase. In my article "Consumer confidence, durable goods purchase and unemployment forecast" I showed that respondents characterised by higher level of consumer confidence were more optimistic regarding the labour market situation and also more willing to increase purchase of durables. By using the structural equation framework I positively verified intertemporal stability between consumer confidence and the two areas. I showed that association between the confidence and durable goods purchase was constant throughout study periods (2000Q1 - 2013Q4), while a stable relation between

consumer confidence and unemployment forecasts was only confirmed for the period 2009Q1-2013Q4.

To the best of my knowledge, investigation of structural interrelations within responses in tendency survey data was first proposed in my articles. My results depict complexity of processes underlying expectation formation. I also identify areas in which coherent and valid response patterns exist. Finally, I am the first one who provides a link between stylized facts often reported at the macro level and their micro-level representation in responses to the tendency survey questionnaire, e.g., better assessment of company's financial situation in comparison to other firms leads to higher propensity to price increase.

Linkage between questions in the domain of household financial situation

Within the framework of the *Situation on the consumer finance market study* conducted jointly by the RIED and Conference of Financial Enterprises, for which I developed the methodology and have co-authored the quarterly report from the outset in 2006, research of various special topics from the field of household financial behaviour has been undertaken. Beyond the quarterly report oriented towards assessment of the general situation in the household finance area, various special topics had gained attention.

One of my research topics was related to household payment priorities. The research, conducted jointly with Dorota Węziak-Białowolska resulted in an article "Priorytety płatności polskich gospodarstw domowych - zastosowanie podejścia eksploracyjnego w konfirmacyjnej analizie czynnikowej (Payment Priorities of Polish Households - Exploratory Approach in Confirmatory Factor Analysis)". In this study we used a completely novel technique, namely Exploratory Approach in Confirmatory Factor Analysis (E-CFA). At this time E-CFA was a novel approach to modelling latent variables with very little use, and to the best of my knowledge, had not been previously applied to household finance. We showed that payment priorities form three groups: (1) housing maintenance, (2) credit commitments, and (3) other liabilities. Additionally, by investigating the influence of socio-economic characteristics of households on attitudes to different payment priorities, we established that household attitudes differed significantly with respect to payment obligations depending on the level of education of a household head, their age and disposable household income per capita.

Another issue, subject to analysis in the field of household finance, relates to liquidity constraints and financial market exclusion. Liquidity constraints within the household sector lead to discrepancies between actual consumption path and the one predicted by the life-cycle theory



(Hall, 1987). Liquidity constraints, although appearing as a unidimensional concept, are not given to easy identification. Literature studies also show that there is no single definition of liquidity constraints (por. m.in. Attanasio, 1994; Crook, 2003).

In the article “Zastosowanie analizy klas ukrytych do identyfikacji wykluczenia gospodarstw domowych z rynku kredytowego (Identification of household exclusion from the credit market with the latent class analysis)” co-authored by Dorota Węziak-Białowolska, we acknowledged that (1) the problem of credit market exclusion is fuzzy and cannot be defined with certainty and (2) there is no agreement in the literature concerning the determinants for credit market exclusion. In order to overcome these issues we adopted a latent class approach to determine the scale of exclusion in Poland. With data from the *State of the Household Survey* and the *Situation on the consumer finance market* study, which contain information on household income, debt servicing, possession of credit, arrears and barriers for incurring debt, we showed that three classes of consumers were prevalent on the Polish credit market with one group perceived as potentially excluded. Additionally, we investigated changes with time in the share of households excluded from the credit market. Our estimates showed that exclusion from the financial market between 2008 and 2010 remained stable in the range 30-35%. Our contribution was also to show that the number of households excluded from the credit market did not increase during the financial crisis.

To the best of my knowledge, both analyses are novel to the field of household finance. It was the first time, when latent class analysis was used to assess the scale of liquidity constraints. Additionally the E-CFA approach was completely novel to household finance.

Factors affecting investment decisions of companies

Another topic investigating interrelations between questionnaire areas was related to factors affecting investment decisions of companies. In the article “External Factors Affecting Investment Decisions of Companies”, which was co-authored by Dorota Węziak-Białowolska, we made an attempt to investigate the importance of certain external factors on the investment decisions made by Polish companies.⁷ To this end, we used data from the study *Portfolio of receivables of Polish companies*.⁸ In our analysis we examined (1) the importance of factors influencing

⁷ This article turned out to be highly successful with almost 13,000 downloads in 20 months. Currently the article is on the 4th place of the most downloaded articles in the journal (out of more than 300 articles already published there).

⁸ In 2009 I personally developed the methodological approach used in this study. Since then I have been responsible for writing the quarterly report from this study.

investment decisions of companies in Poland; (2) the relationship between branch, company size and investment factors. This allowed our evaluation of the relative importance of investment factors on the scale of investment reductions among Polish companies. Grouping of factors conducted with exploratory and confirmatory factor analysis highlighted the presence of two factors related to the investment decision process: (1) macroeconomic factors, and (2) law-related factors, with the relative importance of the former below that of the latter. By application of the structural equation modelling framework we also showed that companies assigning higher importance to any of the two factors actually faced more drastic investment reductions.

4.3. Tendency survey data for forecasting main macroeconomic indicators

The most natural application of tendency survey data is in forecast of the main macroeconomic aggregates – GDP, inflation and unemployment (Darne, 2008; Dudek & Walczyk, 2004; Rünstler & Sédillot, 2003). The data can be especially useful in short-term forecasting (Bańbura, Giannone, & Reichlin, 2010). My work in this area was oriented on discovery of the most efficient applications of tendency survey data to forecasting.

In my recent article entitled, “Latent factor growth models for forecasting Polish GDP growth, inflation and unemployment using survey data” I introduced a completely novel application to the field, namely latent factor growth models. Models with this specification require respondent-level information to assess evolution of a period specific latent factor responsible for response pattern with respect to certain questions. I used this approach to predict main macroeconomic aggregates with individual level responses to the business tendency survey in the manufacturing sector conducted at the RIED. To the best of my knowledge, it was the first attempt to use this for forecasting and the first approach to its use with tendency survey data. I showed that this data can be used to predict the unexplained part of GDP growth, inflation rate changes and unemployment rate fluctuations using a latent factor growth model. I demonstrated that responses to questions relating to the general economic situation, inflation and employment were explained by a latent growth factor, which was confirmed by model fit measures. I also showed that the estimates of growth factor scores can be applied to short-term forecasting GDP growth, inflation and unemployment rate.

The other strain of work in the field of forecasting with tendency survey data is associated with my co-operation with Bartosz Witkowski and Tomasz Kuszewski. Together, we explored the possibility of short-term atheoretical forecasting with tendency survey data using Bayesian averaging and dynamic factor models. A historical analysis points to two major approaches to

economic modelling and forecasting. One group of models is based on inclusion of stylized facts from macroeconomic theory and thus causal effects are incorporated in the model, while the other group of methods is atheoretical, based only on the observed properties of the time series. The origins of atheoretical approach can be traced back to a brief comparison between seven structural models of the US economy and simple ARIMA forecasts (Cooper, 1972), which pointed to the lack of significant advantages from the structural approach. Further points in favour of this approach were made by Sims (1980).

In studies entitled “Bayesian Averaging of Classical Estimates in Forecasting Macroeconomic Indicators with Application of Business Survey Data”, “Macroeconomic Forecasts in Models with Bayesian Averaging of Classical Estimates”, “Prognozy podstawowych wskaźników makroekonomicznych z użyciem danych z testów koniunktury (Forecasts of the main macroeconomic indicators with the use of tendency survey data)” and “Prognozy kombinowane wskaźników makroekonomicznych z użyciem danych z testów koniunktury (Combined forecasts of macroeconomic indicators with application of tendency survey data)” we developed a methodology designed for short-term forecasting of the key macroeconomic indicators using business and consumer tendency survey data. We estimated a large set of models in autoregressive specification with regressors selected from business and household survey data. Our methodology in these studies was based on the Bayesian Averaging of Classical Estimates (BACE). We undertook research oriented at creating a family of models that would enable quick and precise forecasts for changes in the economic environment with respect to GDP growth, inflation and unemployment. My contribution to the work covered mostly preliminary selection of time series used for analysis, literature review but also interpretation of the results. I also contributed in scientific verification of the approach during conferences. I presented the results during the CIRET conference in 2010 in New York but also on two occasions during national conferences (2011 and 2012). Owing to the increasing knowledge and experience in the field our methodological approach was constantly augmented. The time series used for forecasting was constantly modified, the impact of deterministic and stochastic seasonality was examined but also various approaches to Bayesian averaging were tested. Consequently, we managed to propose an intuitive procedure which facilitated accurate forecasts with relatively little engagement from the forecasters. We proposed an intuitive procedure for incorporating both types of seasonality in the forecasting process. All approaches concluded with comparison of the accuracy of forecasts. Forecasts generated by our models never proved inferior with respect to other forecasts – mostly structurally based models, which generally require much greater work effort.

In our recent article “Bayesian averaging vs. dynamic factor models for forecasting economic aggregates with tendency survey data” we compared forecast quality from two families of atheoretical models – Bayesian averaging and dynamic factors. The novelty associated with my input to the paper was to prepare methodological approach but also to implement the dynamic factor model framework into atheoretical forecasting with tendency survey data. I also presented the results during the Multivariate Statistical Analysis conference in Łódź in 2014. Since models yielded multiple forecasts for each period, we selected the best approach to combine them. The conclusions from our study showed that although results did not vary significantly, the best performance was observed from Bayesian models adopting the frequentist approach. Forecasts of the unemployment rate were generated with the greatest precision, followed by rate of GDP growth and the Consumer Price Index. We concluded that although these methods are atheoretical, they provide reasonable forecast accuracy, no worse than that expected from structural models. A further advantage of our approach logically follows. As much of the forecast procedure can be automated, much influence from subjective decisions is avoided.

In my research activity on forecasting the main macroeconomic aggregates with tendency survey data covered modelling of inflationary processes. My paper co-authored with Piotr Zwiernik and Dawid Żochowski entitled “Modelling Inflation Using Markov Switching Models: the Case of Poland (1992 - 2005)” presents a novel approach to modelling and forecasting inflation. We investigated inflation in Poland during the transition period by examining the potential application of Markov Switching Models to explain the inflation generating process. Based on the Ball-Friedman hypothesis (Ball, 1992; Friedman, 1977), we confirmed that variation of inflation was higher during periods of high inflation. Apart from univariate Markov Models, we also used a model that incorporated leading information from the Future Inflation Indicator (FII) published by the Bureau of Investment and Economic Cycles. Indeed, we found that lagged values of FII included as exogenous variables significantly improved the model fit. Our analyses advocated the use of the non-linear approach since model performance was significantly better than with simple univariate Markov Model.

4. Other scientific achievements in the form of publications, lecturing and international cooperation

Since June 2015 I have been conducting research at the University of Turin under a grant entitled „Assessment of household debt possession patterns – European comparative perspective”. The project is financed within the 7th Framework Programme of the European Union (FP7-PEOPLE

COFUND no. 609402 – “2020 Researchers: Train 2 Move” (T2M)). My main research activities funded by the award comprise: (1) survey-based segmentation of household presence on the financial market; (2) evaluation of institutional and socio-economic factors for shaping segments of the credit market for households in the European countries; (3) meta-analysis of factors shaping financial behaviour of households.

During the period 2011 – 2015, I have led a „Sonata” project, funded by the National Science Centre (title: Modelling and Forecasting Economy with Tendency Survey Data). This culminated in a series of publications in international and Polish journals (items 2, 3, 4, 5, 7, 8, 10, 19 in section II in the record of scientific achievement). In 2011, I was also awarded a research grant by the National Bank of Poland (title: “Forecasting inflation with consumer tendency survey data. Application of the multi-group confirmatory factor analysis”). In both of these projects I employed statistical modelling techniques to account for biases in tendency survey data and for forecasting. In 2014 I was one of the three contributors to the project "Forecasting main macroeconomic indicators using Bayesian averaging and dynamic factor models based on the tendency survey data". It was financed within the scope of the 5th competition for scientific grants by the National Bank of Poland. Between December 2014 and May 2015 I was employed as an external expert in the BIOPAMA project (Biodiversity and Protected Areas Management). I was advising the European Commission Joint Research Centre on the construction and evaluation of the statistical properties of composite indicators used in the study.

Interest in the tendency survey research, due to their empirical character, encouraged me to devote significant attention to popularization of the results. In consequence I regularly participated in conferences promulgating the results from ongoing projects relating to the state of the economy, as well as presentation of forecasts. These projects were (1) quarterly assessments based on the results of the *Situation on the consumer finance market* study - carried out by the RIED and the Conference of Financial Companies in Poland (2) quarterly assessment of receivables carried under the project *Portfolio of receivables of Polish companies* - a project supervised by me and jointly led the National Debt Register and the Conference of Financial Enterprises in Poland (3) quarterly assessment of the situation in the banking sector - a tendency survey led by me in 2010-2015 and carried out by the RIED. In all the projects I was responsible for the development and presentation of results, as well as interpretation of the results in the context of the contemporary economic situation in Poland. Participation in these projects bore fruit in numerous publications mainly in the form of quarterly reports from surveys (items (1) and (2) listed in Section F in the record of scientific achievement - Annex 4). However, I also tried to turn more results from these

projects into scientific publications (items (22) and (24) in point II.A in the record of scientific achievement).

In addition, since 2006, I worked with the Conference of Financial Companies and other financial market institutions, analysing the situation of the financial sector and its links with the real economy. This activity gained particular importance during the financial crisis, from which the effects were felt by both consumers and financial services providers. The result of this collaboration was a series of reports popularizing the research results (positions (3) (5) (6) (7) (9) (10) (12) (13) in point F in the record of scientific achievement - Annex 4), but also a scientific publication (item (26) at the point II.A in the record of scientific achievement).

Since 2009 I have been also a member of the Social Diagnosis team. My role in this project is oriented on analysis of the financial behaviour of households. Similarly to the above-described activities, also in this project I endeavoured to make my participation yield not only a contribution to the reports and monographs that reach a very wide audience - even outside the scientific community, but also to make it visible in the form of scientific articles (item (20) at the point II.A in the record of scientific achievement). With the project I have also repeatedly reached into the business community presenting research findings at conferences in the sector.

The quality of my publication record is also reflected in the constantly growing number of review requests I have been receiving. I was reviewer of one project from the National Science Centre, and also four articles from journals present on the JCR list: Public Opinion Quarterly, Journal of Economic Psychology, Journal of Applied Statistics and Social Indicators Research. I also reviewed one article for Studia Oeconomica Posnaniensia.

Parallel to my scientific activities, I actively participated in educating students at the Warsaw School of Economics. I conduct lectures and classes at both undergraduate and graduate level (Macroeconomics (lectures in Polish and English), Microeconomics (lectures in Polish and English), Microeconomics II (lectures and classes), Microeconomics III (classes), Macroeconomics II (lectures and classes), Macroeconomics III (classes), Development Economics (lectures) Market Analysis quantitative methods (lectures and classes)). I have also supervised three masters and two undergraduate students with their theses.

In addition to research, teaching and popularization, I have actively participated in the organization of many projects. In 2010, I was vice-chairman of the organizing committee of the 4th Wakar Seminar, which was held at the Warsaw School of Economics. In academic year 2010/2011 I was an active member of the selection committee. This committee was tasked not

only to recruit but also to prepare for reform of the recruitment process for all types of studies at the Warsaw School of Economics. Currently I am responsible for organization of a two-day workshop on. "Financial Literacy and Pension-related Communication for Better Retirement and Long-Term Financial Decisions." This will be held at the Collegio Carlo Alberto in Moncalieri, which since 2006 has hosted hundreds of international speakers, including Nobel Laureates, and leaders of financial institutions.

5. Indices of scientific research impact (after the Ph.D.)

My publication record after the Ph.D. comprises:

- a) 24 peer-reviewed articles in journals, out of this number 17 was written in English and 6 is present in journals from the JCR list,
- b) 8 chapters in a monography,
- c) Ca. 80 reports (author or co-author) describing the current economic climate in Poland from the perspective of tendency survey results; 14 reports on specific issues related to credit market operation.

Indices of scientific research impact:

- Total impact factor from the Journal Citation Reports list: 5.148
- Total number of points for publications published after Ph.D. according to the journal list published by the Polish Ministry of Science and Higher Education: 318 pts. (150 pts. for publications in journals from the A list)
- Total number of points for book chapters: 32 pts.
- Hirsch Index (Web of Science): 2
- Total citations (Web of Science): 5
- H-index (google scholar): 9

My 10 papers were presented at international conferences (all in English), all but one were presented by me. At Polish conferences I presented five of my papers myself.



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