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Survey-based household inflation expectations. Are they valid? A multi-group confirmatory factor analysis approach

Abstract

We present evidence that micro-level household inflation expectations are influenced by consumer confidence. To account for this impact, using multi-group confirmatory factor analysis, we measure the intertemporal consistency of a model comprising both consumer confidence and inflation expectations. We determine that the model exhibits the property of partial measurement invariance. Thus, we are able to account reliably for the influence of consumer confidence on inflation expectations and, simultaneously, to obtain corrected inflation expectations at the household level. It appears that, after correcting for the level of confidence, average inflation expectations at each point in time become significantly more similar to the average inflation expectations of professional forecasters and more correlated with average consumer confidence. Our analysis is based on household survey data from Poland's State of the Households' Survey (from 2000Q1 to 2012Q1), which is conducted in line with the European Commission's methodology.

Keywords: confirmatory factor analysis, consumer confidence indicator, consumer tendency surveys, inflation expectations, measurement invariance

JEL classification: C38, E31

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1. Introduction

The concept of confidence has a long history as a tool for forecasting main economic aggregates (e.g. Ang *et al*., 2007; Białowolski *et al*., 2014; Carroll *et al*., 1994; Costantini, 2013; Gil-Alana *et al*., 2012). These applications are a direct consequence of Katona's belief that the results of tendency surveys provide additional information on the current and future actions of respondents (Katona, 1946, 1947). Some authors have already identified the need to assess the individual-level reliability of data collected in consumer tendency surveys (Lemmens *et al*., 2007; Nahuis & Jansen, 2004). In this paper, we go even further and try to empirically verify not only the reliability but also the stability of the response patterns in data used for assessing the general economic situation in consumer surveys.

Stylized facts combined with basic economic knowledge imply that there should be a positive correlation between the general confidence about business climate and inflation. Smets and Wouters (2005), using the dynamic stochastic general equilibrium framework, show that the largest share of fluctuations in an economy can be attributed to demand-side processes. Thus, greater importance is expected for demand-side processes in driving inflation, as is a positive link between the general performance of an economy and inflation. The positive link was confirmed historically in business cycle literature (see e.g. Niemira & Klein, 1994; Zarnowitz, 1992). Nevertheless, the link appears to be missing in the perception of households responding to a tendency survey questionnaire. To the best of our knowledge, no analysis has been conducted to explain why household answers regarding inflation expectations and general confidence tend to differ from the stylized facts and whether there is a factor accountable for that difference. Therefore, in this article, we verify whether economic confidence can be held accountable for the 'misperformance' of household inflation expectations and whether, due to this confidence, household inflation expectations tend to be less related to economic fundamentals and the inflation expectations of professionals.

To reliably account for the influence of consumer confidence on inflation expectations, a constant and intertemporally comparable meaning (understanding) of the concept of consumer confidence needs to be ensured. If there is no constant meaning, comparisons of the values of the consumer confidence index might be unjustified, possibly leading to misinterpretations in intertemporal comparisons of the average level of inflation expectations. To mitigate this problem, we adopt a multi-group confirmatory factor framework to suggest a methodology for accounting for the influence of confidence on inflation expectations.

The standard application of multi-group confirmatory factor analysis (MGCFA) is oriented toward assessing the latent concept of equivalence, which is verified with the application of the concept of measurement invariance. Reliable comparisons of concepts between groups are possible only if the measurement invariance is ascertained. Standard empirical applications of the measurement invariance assessment are mostly aimed at the quality assessment of composite scores developed in social or medical studies with stress on scale adequacy assessments oriented toward conducting comparisons between subpopulations (Davidov *et al*., 2008). In rare cases, MGCFA has been used to assess concept equivalence between time points (see e.g. Białowolski & Węziak-Białowolska, 2013). However, to the best of our knowledge, this method has not yet been used for any applications in business or consumer tendency surveys or served as a tool for the correction of individual-level answers to survey questions related to inflation expectations and general confidence.

In the standardized European Commission questionnaire for consumer survey data (European Commission, 2006), household inflation expectations are reflected in the question concerning expected price changes in the forthcoming 12 months (see Appendix 1 - Q6). In every European Union country, surveys based on the standardized questionnaire are conducted; however, the inflation expectations of professional forecasters are still more popular for forecasting inflation.

The analysis of the influence of consumer confidence on the formation of inflation expectations conducted with multi-group confirmatory factor analysis enables us to answer the following questions:

1. Do households include their perception of consumer confidence in their inflation forecasts?
2. Can the developed measure of consumer confidence be expressed on a uni-dimensional scale?
3. Are households consistent in their answering patterns between periods (do households change their inflation expectations in reaction to changes in the consumer confidence consistently during all periods)?

Only having confirmed the above statements we can calculate inflation expectations that are individually corrected for the consumer confidence level, investigate the coherence of inflation expectations with the responses of professional forecasters and the indicators of consumer confidence.

Thus, the paper features two innovative points. First, to the best of our knowledge, it is the first application of multi-group confirmatory factor analysis to tendency survey research. Second, it is the first attempt to account for consumer confidence in inflation expectations, simultaneously assuring that the concept of consumer confidence is equivalent between periods.

The paper is organized as follows. In section 2, household inflation expectations are assessed. The relation between inflation expectations obtained from household opinions and those obtained from the surveys of professional forecasters and the relation between inflation expectations and consumer confidence are investigated. Section 3 is devoted to the problem of measurement with respect to consumer survey data. It is shown how a multi-group confirmatory factor model can be employed to simultaneously account for changes in consumer confidence and inflation expectations. Section 4 provides details on the specifications and estimations of the measurement model for inflation and consumer confidence, as well as the discussion and results. Section 5 concludes the paper.

2. Household inflation expectations

The relation between consumer confidence and inflation expectations is initially verified using measures proposed in the European Commission guidelines (European Commission, 2006). The source of information on household inflation expectations in Poland is the State of the Households Survey, which has been conducted in line with the harmonized questionnaire since 1996 by the Research Institute for Economic Development, Warsaw School of Economics. On average, from 1996Q1 to 2012Q2, 765 post-questionnaires have been returned, with a response rate oscillating around 20%. The balances of responses to survey questions on inflation expectations and consumer confidence are presented in Figure 1. The balances of the positive and negative answers of the question concerning inflation forecasts are calculated in line with the formula:

$$BAL_{PRA.F} = f_1 + 0.5f_2 - 0.5f_4 - f_5, \tag{1}$$

where $\forall_{i\in\{1,2,3,4,5\}} f_i$ stands for the fraction of respondents who selected *i*-th option (see Appendix 1). A standard calculation of the consumer sentiment index (in line with EC methodology) is performed using the following formula:

$$CCI = \frac{BAL_{FS.F}+BAL_{GES.F}+BAL_{SAV.F}-BAL_{UNEMP.F}}{4}. \tag{2}$$

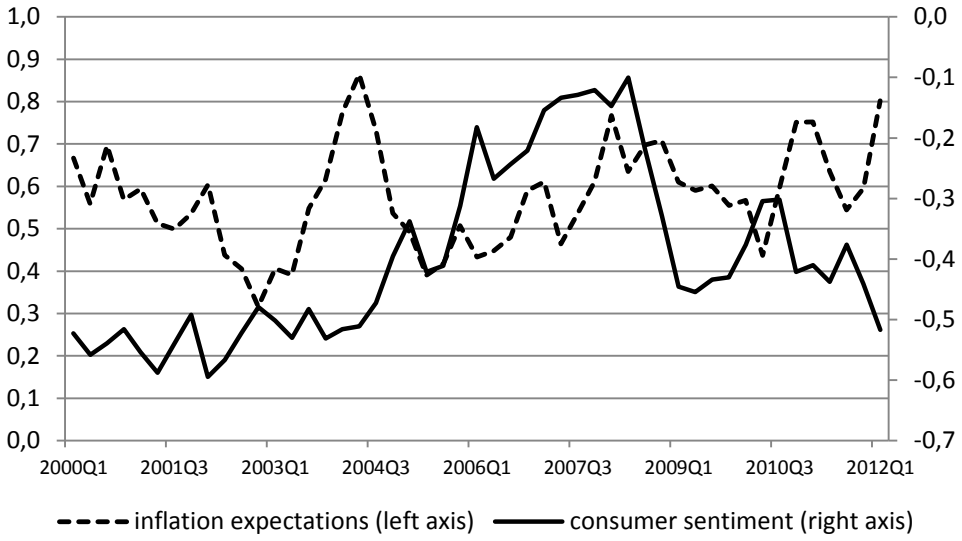

Figure 1. Inflation expectations and consumer sentiment calculated according to the European Commission's methodology.

Source: Research Institute for Economic Development, Warsaw School of Economics.

The correlation coefficient between inflation expectations and consumer confidence is at the level of -0.012 and not statistically significant while testing for positive correlation (P-value of 0.54). The opposite conclusion can be drawn for professional forecaster opinions on the Polish economy based on bankers' forecasts. According to the results of the Business Situation in the Banking Sector in Poland survey, there is a significantly positive relationship between expectations concerning the general situation in the economy and expected changes in the price level. This relationship is depicted in Figure 2.

In the case of professional forecasters (banks), the relationship between inflation expectations and general confidence is characterized by the correlation coefficient level of 0.317 (P-value of 0.026), which indicates that the perception of the demand factors plays an important role in the formation of inflation expectations among professionals. Taking into account the results of Scheufele (2011), we suspect that inflation expectations calculated using consumer survey data can be significantly biased because the respondents seem to rarely take into account demand-pulled processes. Instead, the respondents simply forget (or are unaware) that a better business climate is likely to stimulate inflation in the economy.

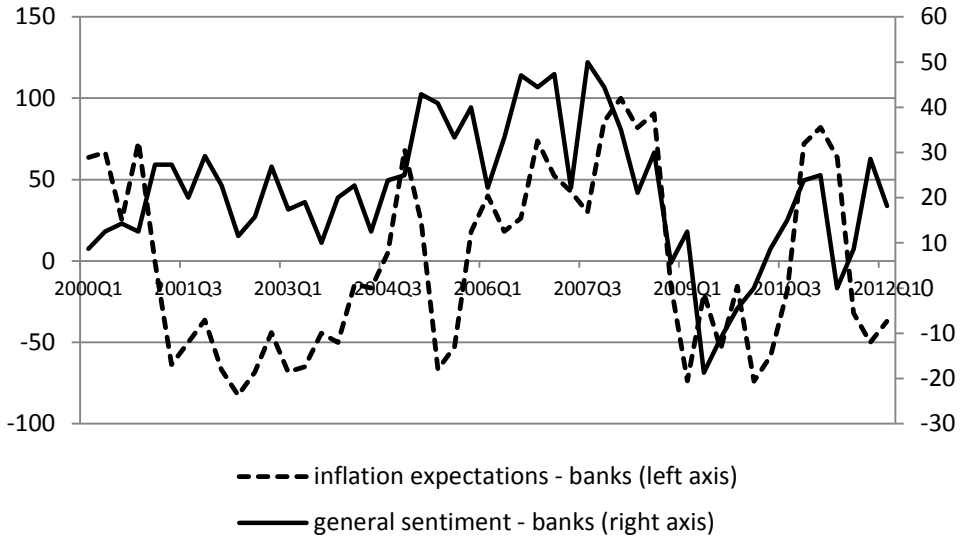

Figure 2. Inflation expectations and forecasts of the general economic situation according to professional respondents from the banking sector (12-month horizon).

Source: Research Institute for Economic Development, Warsaw School of Economics.

3. Model

We employ MGCFA to account for household inflation expectations and the level of confidence simultaneously. Contrary to the exploratory approach, in the confirmatory model it is required that hypothesis about the interrelations between the indicators are stated explicitly at the beginning of the analysis. It is required that in all periods the number of factors influencing analyzed measures is assumed and the correlation structure between the items is known. Our approach is an example of multi-group analysis in which the groups are time points (Białowolski, 2014; Coertjens *et al*., 2012; Vandenberg & Lance, 2000; among others). However, in the proposed multi-group confirmatory model, we assume that accounting directly for the confidence component present in inflation expectations is not possible because the concept of consumer confidence is latent and measured with more than one indicator.

The multidimensionality of consumer confidence is a direct consequence of the construction of the consumer survey, which includes questions from different areas that are related to the concept of confidence. Because consumer confidence is multidimensional, it should be verified for reliability and stability, which is achieved with MGCFA. To establish the

invariance of consumer confidence, the model of latent consumer confidence needs to exhibit the property of (at least a partial) measurement invariance, which is essential for comparing average values between groups (Millsap & Yun-Tein, 2004; Muthen & Asparouhov, 2002; Steenkamp & Baumgartner, 1998). In our case, the groups are the time points.

To check for the measurement invariance of the model of consumer confidence and inflation expectations, the following strategy was adopted. Initially, the theoretical background for accounting for confidence in inflation expectations was developed. Then, the choice of indicators in the model was justified. Finally, it was determined whether the model fits the data sufficiently well, and comparisons of the latent variables among the periods were made.

3.1. MGCFA model for consumer confidence and inflation expectations

In the adopted approach, MGCFA, the model is estimated with a weighted least squares estimator for all of the time periods simultaneously. Consumer confidence is treated as a latent phenomenon that is reflected by a set of proxies (questions). The formal structure of the estimated model for *N* proxies (questions), one latent variable operationalizing consumer confidence (*CCI*), one latent variable operationalizing hidden inflation expectations (*INF*) and *T* time periods can be given by the following:

$$\forall_{t\in T}\boldsymbol{q}^t = \boldsymbol{\gamma}_1^t CCI^t + \boldsymbol{\gamma}_2^t INF^t + \boldsymbol{\varepsilon}^t, \tag{3}$$

where, in all time periods, $\boldsymbol{q}^t$ is the $N\times1$ vector of question answers, $\boldsymbol{\gamma}_1^t$ is the $N\times1$ vector of factor loadings for consumer confidence, $\boldsymbol{\gamma}_2^t$ is the $N\times1$ vector of factor loadings for the inflation expectations and $\boldsymbol{\varepsilon}^t$ is the $N\times1$ vector of measurement errors. In this specification, to ensure the identification of the model, one element of the $\boldsymbol{\gamma}_1^t$ vector (factor loading) is set to 1. It is usually the first element of the vector. Because it is assumed that inflation expectations are measured only by one proxy (one question), for one element of $\boldsymbol{q}^t$, inflation expectations from the survey questionnaire, the corresponding error term in $\boldsymbol{\varepsilon}^t$ is set to 0, and the corresponding element of $\boldsymbol{\gamma}_2^t$ is set to 1. All other elements of $\boldsymbol{\gamma}_2^t$ are equal to 0 because it is assumed (and later verified) that 'hidden' inflation expectations do not influence any other questions' responses. Additionally, $E(\boldsymbol{\varepsilon}^t) = 0$ and $\forall_{t\in1,\dots,T,p,q\in1,\dots,N,p\neq q} cov\left(\boldsymbol{\varepsilon}_p^t, \boldsymbol{\varepsilon}_q^t\right) = 0$. Additionally, identification of the MGCFA model requires that the number of estimated parameters is lower or

equal to the number of pieces of information in the input correlation matrix in each period (Brown, 2006, p. 24).

Because it is assumed that the answers to all the questions except inflation expectations are measured on a categorical scale, thresholds indicating a switch between one category and another are estimated, implying that, for the *i*-th respondent, scoring on the latent variables CSI_i^t * and INF_i^t * (question answers) is determined by the following:

$$\begin{gathered} \forall_{t\in 1,\ldots,T, p\in 1,\ldots,N} q_{p,i}^t = m \\ \text{if} \\ v_{p,m-1}^t < \boldsymbol{\gamma}_{1,p}^t CCI_i^{t^*} + \boldsymbol{\gamma}_{2,p}^t INF_i^{t^*} < v_{p,m}^t, \end{gathered} \tag{4}$$

In equation (4), *m* stands for an answer category in the *p*-th categorical indicator variable, which can have a value ranging from 0 to M_p (recoded automatically by Mplus 6.1 (Muthén & Muthén, 2012) in which the estimation was conducted), $v_{p,m}^t$ represents the *m*-th estimated threshold for the *p*-th categorical indicator variable with two predefined thresholds: $v_{p,0}^t = -\infty$ and $v_{p,M_p+1}^t = +\infty$. $\boldsymbol{\gamma}_{1,p}^t$ and $\boldsymbol{\gamma}_{2,p}^t$ represent the estimated factor loadings associated with the *p*-th categorical response variable in period *t*.

Without any additional assumptions, the model specified with (3) and (4) does not allow for time comparisons of the latent variable mean (*CCI*) or for a reliable account of consumer confidence in inflation expectations (*INF*). To check for the possibility of time comparisons for the means of these two concepts (*CCI*, *INF*), the estimated multi-period measurement model must fulfil the following three conditions (Steenkamp & Baumgartner, 1998):

- configural invariance,
- metric invariance, and
- scalar invariance.

If all of these conditions are fulfilled, then full measurement invariance of the latent phenomenon can be established (Davidov, 2008), and the latent values can be directly compared between groups. In the model of consumer confidence and inflation expectations, it means that the concept of consumer confidence has constant meaning throughout all of the periods of analysis. Additionally, only in such the case the influence of consumer confidence on inflation expectations can be reliably eliminated from the data on inflation expectations.

However, if the fit of the model (3) with constraints ensuring full measurement invariance is unsatisfactory, full measurement invariance

cannot be established. In such circumstances, to reliably conduct mean comparisons, it might be sufficient to impose partial measurement invariance. In practice, this limitation means that the equality of factor loadings and intercepts is ensured for two items only (see Byrne *et al*., 1989; Steenkamp & Baumgartner, 1998), or, as explained by Muthén & Asparouhov (2002, p. 10), a 'majority of the variables should have both threshold and loading invariance so that the factors not only are in the same metric technically, but so that it is also plausible that the variables measure factors with the same meaning in the different groups or at the different time points'. Assuming that equality is assured for two items, it can be presented formally as follows:

$$\exists_{n_1,n_2\in 1,\ldots,N;n_1\neq n_2}\forall_{t_1,t_2\in 1,\ldots,T;t_1\neq t_2;m\in 1,\ldots,M_p} q_{p,i}^{t}(v_{n_1,m}^{t_1} = v_{n_1,m}^{t_2} \wedge v_{n_2,m}^{t_1} = v_{n_2,m}^{t_2} \wedge \boldsymbol{\gamma}_{n_1}^{t_1} = \boldsymbol{\gamma}_{n_1}^{t_2} \wedge \boldsymbol{\gamma}_{n_2}^{t_1} = \boldsymbol{\gamma}_{n_2}^{t_2}). \quad (5)$$

The model fit, which is necessary to assess model invariance at a given level, can be conducted assuming different levels of rigidity. The most basic (and simultaneously the most rigid) approach is the assessment of the value of the χ^2 statistic, which provides information on deviations in reproductions by the model of the sample variances and covariances, and can be described as a measure of absolute goodness-of-fit. Although it seems to be the most correct approach, it is rarely used in applied research as a sole index of fit (Brown, 2006) because the value of the χ^2 statistic tends to be inflated by the sample size, and the models are routinely rejected, even when the differences among the covariance matrices based on the sample and implied by the model are negligible (Brown, 2006, p. 81). A less stringent approach to evaluating the model fit is based on an assessment of the values of the descriptive fit statistics (relative goodness-of-fit). The most popular goodness-of-fit indices are the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA) and Standardised Root Mean Square Residuals (SMRM). Certain rules were developed for each of these descriptive fit statistics. These guidelines are mostly based on simulations (e.g., Chou & Bentler, 1995; Kaplan, 2009).

In this paper, an approach based on descriptive fit statistics is adopted. A discussion on the issue of model fit based on descriptive fit statistics is conducted in Steenkamp & Baumgartner (1998), Hu & Bentler (1999), Marsh *et al*. (2004), and Davidov (2008), among others. In this study we adopt the following descriptive goodness-of-fit statistics: the CFI, TLI and RMSEA. To accept the model and the values of the latent variables (*CCI* and *INF*) generated by the model, it was assumed that all three goodness-of-fit statistics

(CFI, TLI and RMSEA) have to lie within an acceptable range; that is, CFI and TLI are above 0.9 (Hox, 2002, p. 239), and RMSEA is below 0.08 (Browne & Cudeck, 1993). An acceptable fit must be obtained for the model with at least partial measurement invariance.

The model fit can be evaluated with one of two alternative strategies. In the first strategy, one starts with full invariance constraints, and when the fit is not acceptable, a search for possible improvements by the sequential relaxing of factor loadings and thresholds is made. The second approach is to begin without any constraints and impose them sequentially until the fit deteriorates significantly (Millsap & Yun-Tein, 2004). Although the second approach allows measurement invariance to be verified at different levels, it is more complicated, leaves more space for discretionary decisions and requires a definition of 'significant deterioration in the fit of the model'. Thus, the first approach was adopted with the following strategy. The analysis starts from the model with full measurement invariance, but if the acceptable fit based on descriptive fit statistics is not obtained, then the factor loadings and thresholds are sequentially relaxed. This procedure continues until an acceptable fit is obtained. If an acceptable fit is not reached, then the procedure stops at the model with the minimum partial measurement invariance condition defined by (5).

3.2. The choice of indicators for the consumer confidence

Accounting for the influence of confidence in inflation expectations requires that consumer survey-based information on inflation expectations contains information on both consumer confidence and 'hidden' inflation expectations. According to the European Commission, a standard set of questions is used to construct consumer confidence indicators. Consumer confidence is calculated as the average of the balances of the answers to four questions: the financial situation of the household (FS.F), the general economic situation (GES.F), unemployment in the economy (UNEMP.F), and the savings of the household (SAV.F). This measure of consumer confidence does not include information on inflation expectations, which is of central interest in this paper. However, the verification of the model fit and measurement invariance for the consumer confidence index with application of the standard set of questions performed on the dataset from the State of the Households Survey, conducted by RIED, showed that partial measurement invariance of the confidence concept cannot be ensured (Białowolski, 2014). The analysis of problems encountered during the estimation of the model in the standard specification showed that a possible source of difficulties might be the choice of indicators. The examination led to the conclusion that the

indicators are a mixture of those connected to the household situation (FS.F and SAV.F), on the one hand, and those connected to the general economic situation (GES.F and UNEMP.F), on the other hand. Consequently, in this paper, we decided to define consumer confidence with a set of indicators related to perspectives on the economy (i.e., general economic situation forecasts - GES.F, unemployment forecasts - UNEMP.F, inflation expectations - PRA.F) and to two additional items that refer to the current climate and significantly affect the future performance of the economy (i.e., the general climate for making major purchases - MP.S, the general climate for saving - SAV.S). The initial choice of indicators was motivated by the fact that this set of five questions refers to the situation of the economy and not that of a specific household. Additionally, it comprises the largest possible set of indicators oriented towards future developments of the economy rather than to the past.

4. Results

The starting point of the analysis was the fully constrained MGCFA model of consumer confidence and inflation expectations. Since not all of the answer categories were present in all periods for the questions of GES.F, UNEMP.F and SAV.S, the most optimistic answer categories were combined with the second most optimistic ones. In the case of GES.F, the answer 'get a lot better' was combined with 'get a little better'. In the case of UNEMP.F, 'fall sharply' was combined with 'fall slightly', and, in the case of SAV.S, 'a very good moment to save' was combined with 'a fairly good moment to save' (see Appendix 1). Additionally, it was assumed that answers to the question concerning inflation expectations were measured on a linear scale, which is usually an acceptable assumption when there are five or more answer categories. The two-factor model was estimated for the sample ranging from 2000Q1 to 2012Q1 with the additional assumption of zero correlation between the latent variables (*CCI* and *INF*). The zero correlation constraint has been imposed on the individual level for the entire sample. This assumption implies that for a given respondent, any deviation from the average with respect to the confidence indicator is not correlated with any deviation from the average of the same respondent with respect to inflation expectations. However, it does not imply that the correlation between two time series representing averages of the general sentiment and the averages of the inflation forecasts is zero. The estimation procedure and basic fit statistics are presented in Table 1.

Table 1. Estimation of the MGCFA models for simultaneous inflation expectations and consumer sentiment

Model	χ^2 (df)	CFI	TLI	RMSEA
1. Baseline (full measurement invariance)	**4292.009 (677)**	**0.756**	**0.824**	**0.092**
2. Partial measurement invariance – free factor loading and thresholds UNEMP.F	2431.865 (533)	0.872	0.882	0.075
3. Partial measurement invariance – free factor loading and thresholds SAV.S	**3193.011 (581)**	**0.824**	**0.851**	**0.084**
4. Partial measurement invariance – free factor loading and thresholds MP.S	4413.440 (581)	0.742	0.782	0.102
5. Partial measurement invariance – free factor loading and thresholds GES.F	3526.405 (533)	0.798	0.814	0.094
6. Partial measurement invariance – free factor loading and thresholds UNEMP.F SAV.S	**1739.036 (437)**	**0.912**	**0.902**	**0.069**
7. Partial measurement invariance – free factor loading and thresholds UNEMP.F MP.S	2260.258 (437)	0.877	0.862	0.081
8. Partial measurement invariance – free factor loading and thresholds UNEMP.F GES.F	1849.234 (389)	0.902	0.876	0.077

Note: Best models at each stage of analysis are highlighted.
Source: calculations in Mplus.

The results provided in Table 1 clearly depict that the baseline model with full measurement invariance was not acceptable due to the lack of a proper fit. The presented goodness-of-fit measures were clearly beyond the acceptable range presented in section 3.1. Models 2-5 were estimated with relaxed constraints on the factor loading and corresponding thresholds for one indicator in each equation. In specifications 2 and 3, an improvement in the model fit was noted, which is best visible in lower RMSEA and higher CFI and TLI. However, in neither of these specifications was the gain sufficiently high to establish partial measurement invariance. The largest improvement in the model fit was observed for the model with relaxed constraints for the indicator of unemployment forecasts, which implies that for each period, the correlation matrix calculated for the indicators can be replicated with the estimated model sufficiently well. However, between periods, the average level of unemployment forecasts changes relatively to the average of the latent variable (consumer confidence), and the strength of the relation at the individual level between the consumer confidence and the unemployment forecasts also differs.

A further search was conducted in the set of models with free factor loadings and thresholds with respect to unemployment forecasts, and free thresholds and factor loading with respect to one additional item (question). The specifications are given in Table 1 (models 6-8). The best fit was obtained for model 6, with free factor loadings and thresholds associated with unemployment forecasts and the savings climate. For this model, all descriptive fit statistics were within the acceptable range. Given the results, the link between latent consumer confidence and the indicators of the general economic situation (GES.F) and climate for making major purchases (MP.S) was constant both within period and between periods for all periods of the analysis. However, for the indicators of unemployment forecasts (UNEMP.F) and the climate for saving (SAV.S), there was only an established link for each time point; between periods, the strength of the relation between consumer confidence and the two indicators was allowed to vary. The estimated model can be presented by the following system of equations:

$$\begin{cases} GES.F^t = 1 \cdot CCI^t + \varepsilon_1^t & \text{thresholds: -1.129, -0.427, 0.452} \\ MP.S^t = \underset{(0.053)}{0.676} \cdot CCI^t + \varepsilon_2^t & \text{thresholds: -1.528, 0.703} \\ PRA.F^t = -\underset{(0.037)}{0.621} \cdot CCI^t + 1 \cdot INF^t & \\ SAV.S^t = \gamma_4^t \cdot CCI^t + \varepsilon_4^t & \\ UNEMP.F^t = \gamma_5^t \cdot CCI^t + \varepsilon_5^t & \end{cases}$$

Assuming that the household inflation expectations indicator is reflected both by consumer confidence (*CCI*) and hidden inflation expectations (*INF*), all the results prove to be as expected. There is a positive relationship between the consumer confidence index and the expected answers concerning the climate for major purchases. A better perception of consumer confidence implies a better climate for major purchases. There is an additional positive relationship between *CCI* and the expected answer to the question concerning the savings climate, and there is a negative relationship between *CCI* and expectations concerning unemployment growth. However, these relationships prove to be unstable over time γ_4^t and γ_5^t vary between periods. Nevertheless, the positive estimate of γ_4^t for all time periods indicates a positive relationship between *CCI* and the savings climate in all of the periods, whereas the negative estimate of γ_5^t indicates that consumer confidence negatively affects unemployment perspectives.

The influence of the consumer confidence index on the expected value of the answer to the survey question concerning inflation expectations is also observed. If consumer confidence improves by 1 point, then consumers are expected to change their answer concerning inflation expectations by 0.621 points in the direction of lower inflation. Due to the fact that *CCI* is measured in the metrics of the question concerning the general economic situation, an improvement by 1 point implies a decrease in the value of *CCI*. A negative change in the value of *CCI* implies however a positive change in the *E*(*PRA.F*) by 0.621 for each point change in *CCI* and this in turn implies lower inflation expectations. Thus, the influence of consumer confidence on inflation expectations is confirmed. This finding implies that consumers with more optimistic perceptions of the general economic situation are more likely to limit their inflation expectations and that consumer confidence is reflected in the household responses to the survey question on inflation expectations.

With the proposed approach, because partial measurement invariance was achieved, the averages of consumer confidence (*CCI*) and hidden inflation expectations (*INF*) can be computed and compared for all time points. Figure 3 shows the values of the new indicator of consumer confidence, which are compared to the average values of inflation expectations.

The relationship between the average level of consumer confidence (*CCI*) and hidden inflation expectations (*INF*) is significantly altered once the influence of individual confidence is eliminated from the individual perception of inflation expectations. Compared to the relationship between raw time-series presented in Figure 1, the value of the correlation coefficient between the two series increased from -0.012 to 0.549 (P-value 0.003). After the confidence component is eliminated from the data, household hidden inflation expectations (*INF*) are positively related to consumer confidence, which means that a better business climate is more likely to result in an outburst in inflation. Household inflation expectations, after correcting for the influence of consumer confidence, are also more consistent with the inflation expectations of professional forecasters (banks), which is confirmed by the correlation coefficient between the two inflation expectation time series at the level of 0.663. It should be underlined that the correlation coefficient between consumer inflation expectations calculated with the standard balance method and inflation expectations of professional forecasters is 0.37 and is substantially smaller (P-value for the difference 0.066).

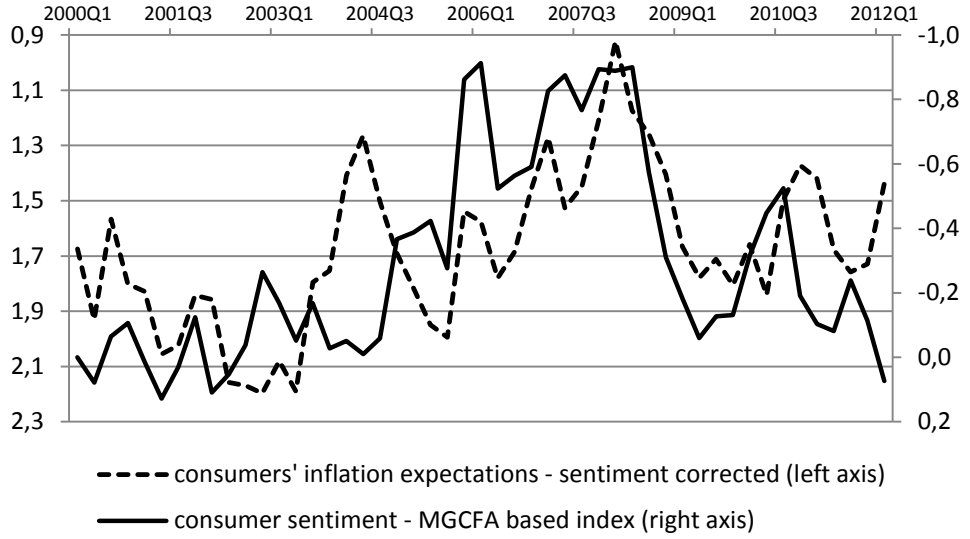

Figure 3. Estimated average values of the consumer sentiment index and inflation expectations obtained with multi-group CFA.

Source: own computation.

5. Conclusions

This paper presents an innovative application of the multi-group confirmatory factor analysis of interrelations between concepts in tendency surveys. We present an approach to consistently account for influence of confidence on household inflation expectations. The data regarding inflation expectations appear to be prone to biases because consumers include additional information in their assessments. With multi-group confirmatory factor analysis, it was indicated that this information is associated with consumer confidence, which was thus established as an important factor influencing household inflation expectations. The relationship between consumer confidence and inflation expectations on an individual level has been estimated, and its constant character could not be falsified, which leads us to the conclusion that, on average, in all periods, the individual level of consumer confidence affects individual inflation expectations to the same extent. With the proposed methodology, we obtained not only the averages of inflation expectations for each period but also the individually corrected inflation expectations.

After accounting for the influence of confidence, the indicators of inflation expectations provide inflation expectations that are more consistent

with those of professional forecasters. Additionally, the inflation expectations prove to be more consistent with consumer confidence, which makes them more reliable on theoretical grounds because consumers are expected to be more aware of the demand-pulled part of the inflation process.

Although this paper provides an innovative application of multi-group confirmatory factor analysis, it is only a preliminary check of the relation between consumer confidence measures and their influence on inflation expectations. This paper provides arguments that consumer sentiment might have an influence on inflation expectations and verifies this connection for Polish consumer tendency survey data, showing also that the established relation can be perceived as constant between periods. Future research should establish whether the same can be stated for data from other countries that conduct consumer tendency survey research with similar methodologies.

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Appendix 1. Selected questions with answers in the standardized consumer questionnaire.

Question number and code	Question wording	Answer categories (representing also scale points)
Q4 (GES.F)	How do you expect the general economic situation in this country to develop over the next 12 months? It will...	1.0 'get a lot better' 2.0 'get a little better' 3.0 'stay the same' 4.0 'get a little worse' 5.0 'get a lot worse'
Q6 (PRA.F)	By comparison with the past 12 months, how do you expect that consumer prices will develop in the next 12 months? They will…	1.0 'increase more rapidly' 2.0 'increase at the same rate' 3.0 'increase at a slower rate' 4.0 'stay about the same' 5.0 'fall'
Q7 (UNEMP.F)	How do you expect the number of people unemployed in this country to change over the next 12 months? The number will...	1.0 'increase sharply' 2.0 'increase slightly' 3.0 'remain the same' 4.0 'fall slightly' 5.0 'fall sharply'
Q8 (MP.S)	In view of the general economic situation, do you think that now it is the right moment for people to make major purchases such as furniture, electrical/electronic devices, etc.?	1.0 'yes, it is the right moment now' 2.0 'it is neither the right moment nor the wrong moment' 3.0 'no, it is not the right moment now'
Q10 (SAV.S)	In view of the general economic situation, do you think that now is...?	1.0 'a very good moment to save' 2.0 'a fairly good moment to save' 3.0 'not a good moment to save' 4.0 'a very bad moment to save'

Source: *The state of the households survey*, Research Institute for Economic Development, Warsaw School of Economics.