*Piotr Białowolski**

A COMPOSITE INDICATOR FOR HOUSEHOLD DEBT DEMAND

Abstract. A novel approach to construction of a leading indicator for household demand for debt, i.e., consumer credit demand index is presented. In order to derive a proper set of indicators, a theoretical background for the dimensions of the index is first described. With all dimensions of the index available, indicators are then sought using the State of the Household and consumer finance surveys. The dimensions are aggregated into a single index with a generalized mean which does not allow full inter-dimensional compensation. Lead properties of the index were then tested.

Keywords: consumer credit demand, consumer tendency surveys, composite indicators.

1. INTRODUCTION

The role of tendency surveys in forecasting macroeconomic aggregates is commonly acknowledged (Białowolski, Kuszewski, & Witkowski, 2010, 2014; Carroll, Fuhrer, & Wilcox, 1994; Costantini, 2013, among others). However, to the best of the author's knowledge, tendency survey data have not so far been used to develop an index to forecast household demand for debt. This article aims to fill in this gap, providing a methodology to determine factors responsible for the growth of total household debt and to construct an index.

Changes in household indebtedness are subject to various forces that can be mostly explained by an approach based on life-cycle permanent income theory (Friedman, 1957; Modigliani & Brumberg, 1954) or its extensions. According to the basic, life-cycle permanent income theory, crucial decisions about level of indebtedness or savings depend on the stage of life-cycle. However, exclusive application of life-cycle permanent income theory does not account for various factors relevant to short term fluctuations of indebtedness. There is a large proportion of households that suffer from strong constraint of liquidity (Attanasio, 1994; Crook, 2003). Further, Jappelli and Pagano (1989) demonstrated a major role for durable goods in the demand for credit. Consumption of durables can be substituted for consumption of other goods (Fauvel & Samson, 1991; Mankiw, 1985) but also, as durables yield utility in

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many consecutive periods, so their purchase can be easily postponed. Owing to this, demand for durables is subject to substantial fluctuation. Other factors influencing credit demand include factors associated with household confidence (Blanchard & Mankiw, 1988; Browning & Lusardi, 1996; Hall, 1978, among others). The strong negative influence of uncertainty has been shown to bear on household credit decisions. Therefore, there are four potential areas that should be included in analysis of the demand for debt. They comprise: (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 (consumer confidence).

The paper first presents a time-series analysis of the changing dynamics in the Polish credit market. Secondly, based on the four areas influencing credit demand, sub-dimensions of the index of consumer credit demand are proposed. Finally, it is checked whether the index can be incorporated to the time series model of consumer credit growth as an explanatory variable.

2. CONSUMER CREDIT IN POLAND – TIME SERIES ANALYSIS

Before consumer credit growth can be included as a benchmark variable for the consumer debt indicator, the autoregressive process underlying its growth should be investigated. Clements and Hendry (1998, p. 14) claimed that "survey information can be a useful adjunct within formal models (...) rather than as a substitute for econometric systems". Thus, a suitable starting point at this juncture was to investigate the time series properties for credit growth using integrated autoregressive moving-average models (ARIMA). Here, the final structure of the ARIMA model was derived in two steps. Firstly, by application of the Augmented Dickey-Fuller test (ADF), the quarterly growth rate of consumer credit series was tested negatively for presence of a unit root. Then, the best of the competing models was selected by application of the BIC.[1] The final model in specification ARIMA (4,0,0) was chosen by virtue of the lowest BIC and given by[2]:

$$\Delta c\_credit_t = \underset{(0.101)}{.571} \Delta c\_credit_{t-1} + \underset{(0.102)}{.390} \Delta c\_credit_{t-4} + \varepsilon_t \qquad (1)$$

In the final specification change in the rate of consumer credit growth in period t was positively affected by change in the consumer credit growth rate in the period $t-1$. Additionally, rate of consumer credit growth was also positively

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[1] Similar model selection pattern is applied by Ang et al. (2007).
[2] Values in parentheses represent standard errors of estimates.

related with growth of the aggregate prior four periods. Values for actual and fitted levels of growth rate for consumer credit were quite close, yet some part of the variability still needed explanation. The proposed index of consumer credit demand was intended to provide this.

3. SUBCOMPONENTS OF THE INDEX

3.1. Life-cycle factors

In order to obtain an index for sub-dimension of life-cycle components, age structure was combined with current values for the consumer debt characteristic for each group of interest. The number of household heads in Poland was established from Central Statistical Office data on the structure of the population and the Social Diagnosis Survey. The population structure for heads of household was obtained over the period 2000–2013 and from 2013 onwards estimates were based on probabilities of attaining household head status. The magnitude of debt in each group was measured relative to debt for those households with heads aged 45–59. This was established from the Social Diagnosis Survey on average indebtedness relating to consumer credit among Polish households. The average debt was 46 percent higher in households with heads aged 35–44. Households with heads under 34 years were less active. Their average value of consumer debt was around 28 percent more than the reference group. Activity with respect to consumer credit was much lower for older households with heads aged 60+. Those households had 50+ percent lower average consumer debt than those with heads aged 45–59. Applying the demographic structure for Polish households to average consumer debt, a subcomponent of the consumer credit demand index was obtained (see Figure 1).

3.2. Credit market exclusion

The most comprehensive approach to the problem of credit market exclusion was offered by Crook (2003).[3] Analysis of the scale of credit market exclusion among Polish households using this approach was conducted in October 2007

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[3] This approach is based on responses to three survey questions: (Q1) In the past 5 years, has a particular lender or creditor turned down any request you or your spouse / partner made for credit, or not given you as much credit as you applied for? (Q2) Were you able to obtain the full amount you or your spouse / partner requested by reapplying to the same institution or by applying elsewhere? (Q3) Was there any time in the past five years that you or your spouse / partner thought of applying for credit at a particular place, but changed your mind because you thought you might be turned down?

with the consumer finance survey conducted jointly by the Research Institute for Economic Development and Conference of Financial Enterprises in Poland. The total proportion of households excluded from the market then amounted to 21.3%. However, the study of market exclusion was conducted only once and quarterly data are needed for the consumer credit demand index. Factors influencing exclusion were determined using the logistic regression model (Gruszczyński, 2002). The final specification for the logistic regression model not only included household debt service but also barriers against obtaining credit (Białowolski, 2014c). Results were used to determine the mean proportion of households excluded from the credit market from 2007 until 2013 (see Figure 1).

3.3. Demand for durables

In the State of the Household Survey/consumer finance survey the batch of question items related to durable goods purchase comprised: household forecasts for general durable goods purchase, car purchase and house/apartment refurbishment. It appeared that the two goals – durables and renovation – comprised around 2/3 of total consumer debt, which underlines the importance of their inclusion to the index. In addition, each item which referred to either durable goods or major purchase was accompanied by a question on finance mode for the purchase, including credit. In order to obtain values for the sub-dimension of the index, balances for each of the questions referring to major purchases were first calculated. In the case of questions with five response categories (demand for durables) and in the case of questions with four response categories (intentions to purchase a car, intentions to make renovation) the following formulas were applied:

$$BAL_5 = f_1 + 0.5f_2 - 0.5f_4 - f_5, BAL_4 = f_1 + 0.5f_2 - 0.5f_3 - f_4 \qquad (2)$$

where f_i represents respondents selecting i-th answer category. For items regarding mode of finance for purchases, the sum was calculated for respondents who intended to finance major purchases either wholly or partially from credit. Each of six aggregates (three items and respective intentions to purchase and to use credit) was later standardized and those standardized responses were then summed (see Figure 1).
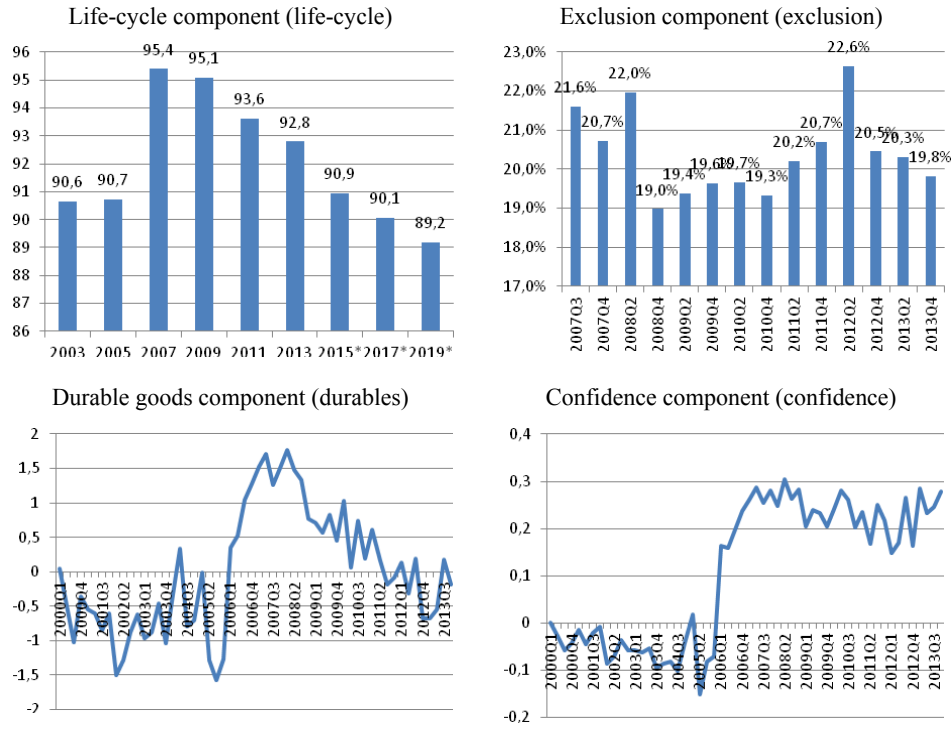
Figure 1. Evolution of the sub-components for the consumer credit demand index.

3.4. Uncertainty (consumer confidence)

Multi-group confirmatory factor analysis was used to obtain a measure of consumer uncertainty reflected in the set of responses to the consumer questionnaire. The formal structure of a model with N proxies (questions), one latent variable describing consumer confidence – CCI (as only one confidence measure was assumed) and T time periods can be represented by the formula:

$$\forall_{t \in T} \mathbf{q}^t = \boldsymbol{\tau}^t + \boldsymbol{\gamma}^t CCI^t + \boldsymbol{\varepsilon}^t, \tag{3}$$

where for all time periods $\mathbf{q}^t$ is $N \times 1$ vector of responses, $\boldsymbol{\tau}^t$ is $N \times 1$ vector of intercepts, $\boldsymbol{\gamma}^t$ is $N \times 1$ vector of factor loadings and $\boldsymbol{\varepsilon}^t$ is $N \times 1$ vector of measurement errors. A multi-group version of the confirmatory factor analysis was applied to verify whether the concept of confidence assessed in the study maintained reliably constant meaning over the entire analysis period. The

standard set of items (questions), which were used for measurement of consumer confidence, proved not to be coherent (Białowolski, 2014a). As an alternative, consumer confidence was based on the set of household items (Białowolski, 2014b). Model fit was assessed using the commonly used close fit indices – CFI, TLI and RMSEA (see Brown, 2006 for guidelines). A model with full measurement invariance, allowing latent variable mean comparisons (Steenkamp & Baumgartner, 1998) was characterized by: CFI=0.904, TLI=0.926, RMSE=0.068, which implied full metric and scalar measurement invariance following the commonly adopted guidelines. Values for the uncertainty index are presented in figure 1 together with other subcomponents of the consumer credit demand index.

4. AGGREGATION

For aggregation of the composite index, the generalized mean formula[4] was used with α = 0.5. Prior to aggregation, all values of sub-indices were standardized to variables with a mean of 50 and standard deviation 10. The final formula for the index took form:

$$Index1_t = \left(\frac{\sqrt{life-cycle_t} + \sqrt{confidence_t} + \sqrt{durables_t} + \sqrt{exclusion_t}}{4} \right)^2 \quad (4)$$

The index was calculated using the formula above[5]. The Index for consumer demand remained low until 2005. Then it climbed rapidly, peaking in the fourth quarter of 2007. It remained high until the third quarter 2008 and then dropped sharply. The decline halted for about a year in 2010 and then a further, gradual decline was observed. In the fourth quarter 2012, the index bounced back and has since, gradually increased.

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[4] The generalized mean formula with power α can be described by the following formula

$$mean = \left(\frac{\sum_{i=1}^{N} x_i^\alpha}{N} \right)^{1/\alpha}$$

[5] Due to lack of data, for the period 2000Q1 – 2013Q4 a slightly modified index specification was adopted – based on the alternative formula:

$$Index1_t = \left(\frac{\sqrt{life-cycle_t} + \sqrt{confidence_t} + \sqrt{durables_t}}{3} \right)^2$$

The final step of analysis included the consumer credit demand index with the time series model in order to test lead properties of the index. For the final model the specification with the consumer credit demand index lagged by two quarters was selected proving its significant contribution to explaining credit growth variation and also its leading properties. This specification yielded the best result in terms of the information criterion (BIC) and performed better in comparison with the model without the consumer credit demand index included. The final model can be represented by the following formula:

$$\Delta c\_credit_t = \underset{(0.007)}{.014}\,CCI_{t-2} + \underset{(0.095)}{.483}\,\Delta c\_credit_{t-1} + \underset{(0.100)}{.438}\,\Delta c\_credit_{t-4} + \varepsilon_t$$

5. CONCLUSIONS

This paper initiates discussion about how an index for consumer credit demand should be calculated. Four crucial dimensions describe how demand for consumer credit is created and justify the calculation of an index. This novel index demonstrated lead properties for a time series of quarterly consumer credit growth.

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KONSTRUKCJA WSKAŹNIKA ZŁOŻONEGO POPYTU NA KREDYT GOSPODARSTW DOMOWYCH

Streszczenie. W tym artykule prezentujemy podejście do budowy wyprzedzającego wskaźnika popytu na kredyt gospodarstw domowych. W celu prawidłowego określenia wymiarowości wskaźnika podejmujemy analizę teoretyczną jego komponentów, a następnie dobieramy pytania z ankiety badania kondycji gospodarstw domowych i badania consumer finance celem oceny przebiegu zmian w wyselekcjonowanych obszarach. W kolejnym kroku dokonujemy agregacji wymiarów i dołączamy nowopowstały wskaźnik, jako zmienną objaśniającą do modelu ARIMA. Pokazujemy, że wskaźnik pozwala wyjaśnić istotną część wariancji zmian na rynku kredytu dla gospodarstw domowych.

Słowa kluczowe: popyt na kredyt gospodarstw domowych, badania koniunktury konsumenckiej, wskaźniki złożone.