AN ANALYSIS OF SELECTED ASPECTS OF E-COMMERCE BASED ON TECHNOLOGY ACCEPTANCE MODEL

Jarosław Banaś
Maria Curie Skłodowska University, Poland
jaroslaw.banas@umcs.pl

Abstract:
Technological development has contributed to transformation of the shopping experience. Consumers are willing to do their shopping using various technologies. This paper discusses the use of Internet as a tool for browsing offers and making online purchases. It has used a measuring model developed on the basis of the Technology Acceptance Model. For the purposes of the paper, the author defined the research problem and put forward three hypotheses that were verified using statistical tools. Data analysis was conducted using grouped data, descriptive statistics and structural equation modelling.
A survey given to 495 students allowed to conclude that the perceived ease-of-use and usefulness of Internet positively contribute to its use in online shopping. In a vast majority of cases, recorded values of the power of relationships between model variables were positive. Increased usefulness and ease-of-use result in increased use of the Internet for shopping-related activities. Additionally, the sample was divided into two subgroups differing in terms of time spent on using the Internet. In the group of less advanced users, lower average values of all variables were recorded. Also, values of indirect effects of usefulness and ease-of-use on the actual use of Internet for shopping purposes in the structural model are lower in the group less advanced Internet users.

Keywords: e-commerce, online shopping, technology acceptance model, structural equation modelling

1. INTRODRUCTION

Technological development entails changes in user expectations and habits. One of the elements affecting promotion of the use of technology and technological development is the use of the emerging effects of scale. Users are very quick in adapting useful and easy-to-use solutions to their personal needs. They expect intuitive and uncomplicated solutions making their life easier and providing them with entertainment.

Provision of the possibility to conduct buying and selling transactions via Internet has changed the image of trading once and for all. This was a real breakthrough. Nowadays, it is the consumer who chooses the most convenient way of communicating with the seller, which may take the form of a visit in a traditional store, shopping via Internet, mobile or even a text message. Multi-channel sales has become a standard.

E-commerce market share has grown year to year. According to eMarketer estimates, in 2012 global income from on-line sales could have grown by as much as 21.1%. This might serve as grounds for anticipating that (for the first time in history) it could exceed 1 trillion dollars. The estimates further anticipate that in 2013, e-commerce share will grow by another 18.3%, reaching the value of 1.3 trillion dollars (in 2012 - …, 2013). In recent years, Poland has observed dynamic e-commerce growth. "Global Perspective on Retail" report prepared by Cushman & Wakefield international consulting group, shows that in 2012 Poland scored 28. among over 100 studied countries (Baranowska-Skimina, 2013). In comparison to other European countries, Poland is also doing very well. The value of e-commerce is estimated to reach over 10 billion dollars in 2014. Annual growth estimated for about 16 per cent makes Poland and the Czech Republic one of the fastest growing markets in Europe (E-handel w Polsce, 2014).

This paper provides an analysis of elements affecting the use of Internet as a tool for browsing offers and making online purchases. The paper *Extending the Technology Acceptance Model and the Task-Technology Fit Model to Consumer E-Commerce* (Klopping & McKinney, 2004) served as the inspiration for drawing up the survey, doing the research and data analysis.

2. THE RESEARCH PROBLEM AND RESEARCH HYPOTHESES

The research problem addressed in this paper is:
Is Internet a useful and easy-to-use tool for browsing offers and making purchases?
Does perception of Internet as a tool depend on the user experience?
For purposes of finding the answer to thus formulated research problem, three hypotheses have been put forward:
H1. Perceived usefulness of Internet as a tool for browsing offers and making purchases has positive effect on its use.
H2. Perceived ease of using Internet as a tool for browsing offers and making purchases has positive influence on its use.
H3. There are differences in perceiving Internet as a tool for browsing offers and making purchases among groups differing in terms of length of using the Internet.

3. THE METHOD

Author's own research was conducted with the use of a survey. The vast majority of survey questions were taken from the paper referred to above (Klopping & McKinney, 2004, p. 48). The survey was conducted in a group of 512 students characterised by different age, length of using the Internet, length of using online shopping services etc. The paper presents results for 495 respondents[1]. For purposes of the analysis, the sample was divided into two subgroups, differing in terms of length of using the Internet.

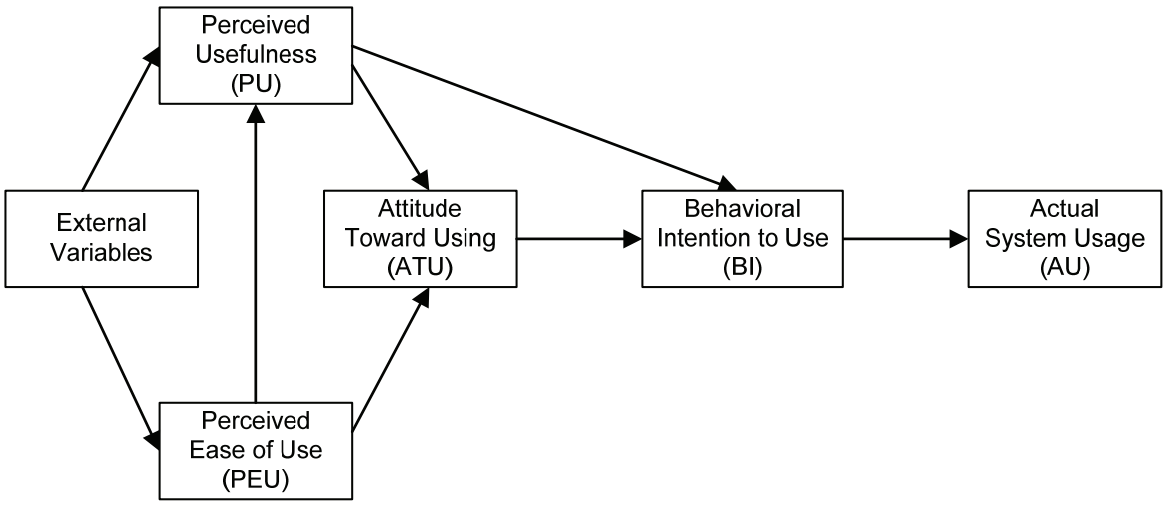
[1] This is a part of a broader study of students who use Internet to browse offers and make purchases. The sample was composed of 512 respondents. For purposes of this paper, the survey was given to 495 individuals who provided responses to all analysed statements. In addition, from the original version of the survey only those variables were selected that were essential to build this form of the model.

For the purpose of this paper, a measurement model based on the Technology Acceptance Model was developed. Data were analysed using grouped data, simple descriptive statistics and structural equation modelling (SEM).

4. TECHNOLOGY ACCEPTANCE MODEL

Technology Acceptance Model (TAM) was used by Davis to explain the usage of information technology. Several researches have validated TAM using different applications including e-mail, voice mail, word processing, micro-computers and more (Liu & Tucker & Koh & Kappelman, 2003, p. 600). The model is shown in Picture 1.

Picture 1: Technology Acceptance Model (TAM)



Source: Stoel & Lee, 2003, p. 366.

The basic form of Technology Acceptance Model is characterized by the relationship between variables: Perceived Usefulness (PU), Perceived Ease of Use (PEU), Attitude Toward Using (ATU), Behavioral Intention to Use (BI) and Actual System Use (AU). In this model:

- perceived usefulness is defined as *the degree to which a person believes that using a particular system would enhance his or her job performance*.
- perceived ease of use is defined as *the degree to which a person believes that using a particular system would be free of effort* (Davis, 1989, pp. 320).

Technology acceptance model may be widely applied to determine dependencies emerging during adaptation of IT systems by users. The model may be modified to adjust it to the studied question as effectively as possible. In this paper, the a model includes 12 measured variables and 5 latent variables (Picture 2). Specific variables describe:

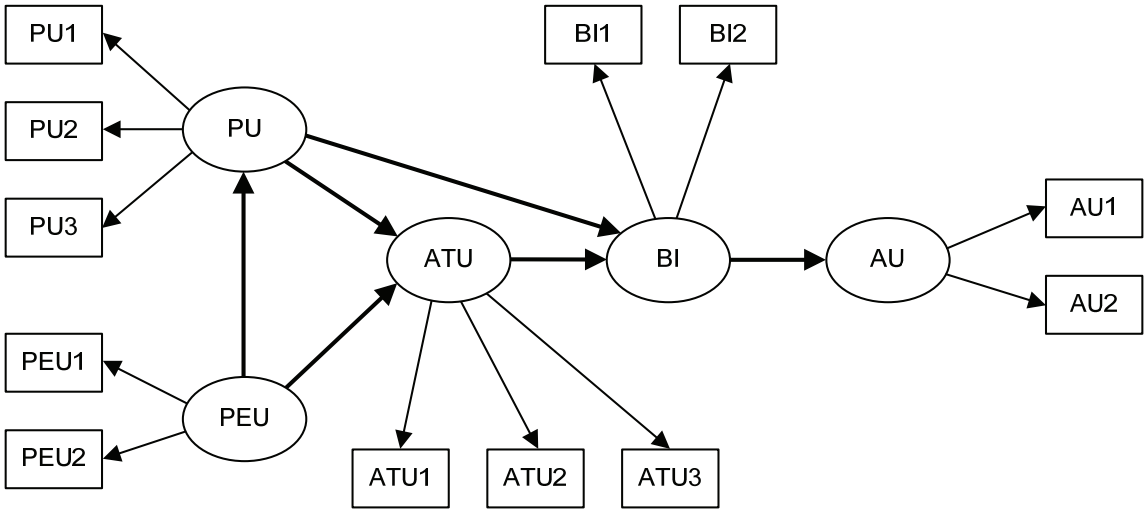
- perceived usefulness: PU1 – faster shopping, PU2 – easier shopping, PU3 – broader possibility of comparing offers,
- perceived ease-of-use[2]: PEU1 – ease of learning how to use Internet for shopping purposes, PEU2 – one can quickly learn how to use Internet for shopping purposes,
- attitudes toward using: ATU1 – it is good to use Internet for shopping, ATU2 – Internet is a safe tool for making purchases and browsing offers, ATU3 – user likes using the Internet for shopping-related activities,
- intentions to use connected with shopping-related activities: BI1 – it is good to expand the use of Internet due to economic benefits, BI2 - it is good to increase the use of Internet due to functional benefits,

[2] In order to make the structure of the survey more attractive, some statements were positive and other were negative. Statements pertaining to PEU1 and PEU2 were presented as negatives. The remaining statements in the model were positives. In order to make them more uniform, the author inversed the responses to PEU1 and PEU2 variables according to the pattern (1→5, 2→4, 4→2, 5→1).

- actual using: AU1 – number of shops, auction websites visited in a month, AU2 – average time spent weekly on activities related with online shopping.

Responses to statements related to PU, PEU, ATU and BI variables were given according to Likert five-point scale. AU variable was determined using a four-point response scale (see attachment related to the survey).

Picture 2: Research model – measurement and structural model



Source: Author's own study.

5. PERCEIVED USEFULNESS AND EASE OF USING INTERNET FOR E-COMMERCE PURPOSES – TAM-BASED MODELLING FOR THE ENTIRE SAMPLE

5.1. Basic descriptive statistics for model variables

Data analysis for the entire sample was begun from determining the mean values of individual variables (Table 1). In the group of (PU, PEU, ATU and BI) variables, the highest values were recorded for PU3, PEU2, PEU1 and ATU1, whereas the lowest for IU1 and IU2.

Table 1: Mean values and standard deviation for individual model variables

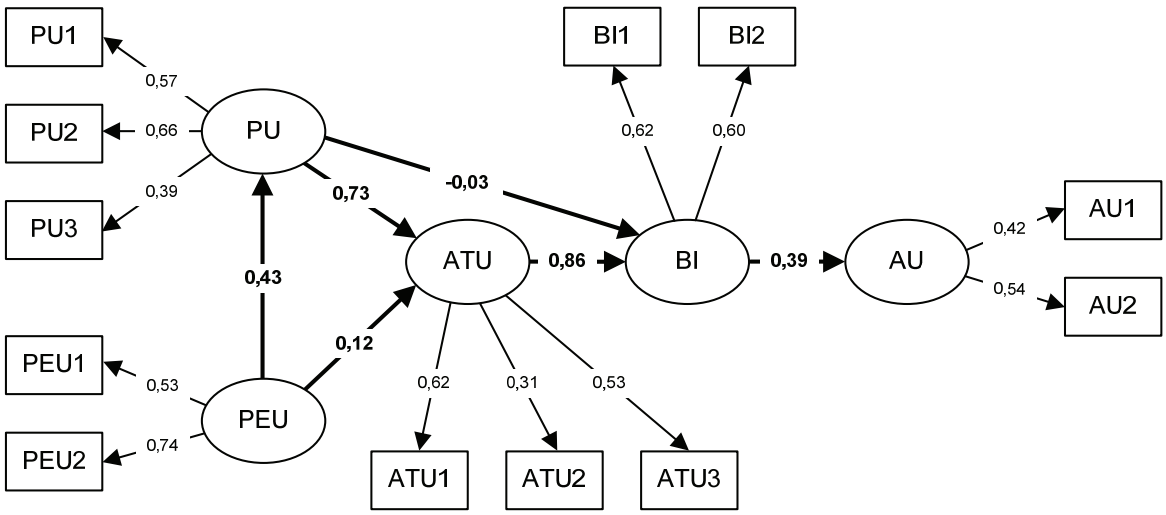
Variable	PU1	PU2	PU3	PEU1	PEU2	ATU1	ATU2	ATU3	BI1	BI2	AU1	AU2
Mean value	3,89	3,70	4,47	4,07	4,39	4,04	3,43	3,69	3,60	3,60	1,73	2,27
Standard deviation	0,97	0,98	0,82	0,90	0,86	0,80	0,91	0,91	0,86	0,77	0,74	0,91

Source: Author's own study, N=495.

5.2. Model-based approach to dependencies between variables

As a result of SEM-based modelling, the following relationships between measured variables and latent variables were observed: PU→PU1-PU3, PEU→PEU1-PEU2, ATU→ATU1-ATU3, BI→BI1-BI2 and AU→AU1-AU2. In addition, relationships between latent variables in the structural model were observed as well: PEU→PU, PEU→ATU, PU→ATU, PU→BI, ATU→BI and BI→AU (Picture 3).

Picture 3: Relationships in the measurement model



Source: Author's own study.

PU latent variable is composed of three forces. Two of them exert a significant effect. The largest importance on the perceived usefulness is exerted by simplicity of online shopping (PU2; 0.66). Insignificantly smaller meaning on perceiving usefulness has quickness of online shopping (PU1; 0.57). The smallest significance (in the three-component set) has the ability to widely compare available offers owing to online communication (PU3; 0.39). Perceived ease-of-use with reference to online shopping influences the quickness with which users are able learn how to use it (PE2; 0.72). PEU latent variable is connected to the easy learning how to use Internet to browse offers and make purchases to a significantly lower extent (PEU1; 0.53).

Attitudes toward using tools offered by the Internet were determined by means of three variables. The statement that it is good to use the Internet for shopping purposes (ATU1; 0.62) exerts the highest importance on the structure of ATU latent variable. The statement that shop users like using the Internet for shopping purposes (ATU3; 0.53) has insignificantly smaller meaning on ATU. The statement that Internet is a safe tool for browsing offers and making purchases (ATU2; 0.31) exerts half the effect of ATU1 variable.

The latent variable, behavioural intention to use (BI), is affected by two variables from the measuring model. They refer to economic and functional benefits connected with online shopping. The largest significance is presented by the variable (BI1; 0.62) related to the statement that it would be very good to expand the use of Internet for shopping purposes due to economic benefits. Insignificantly smaller effect is exerted by (BI2; 0.60) variable related to expanding the use of Internet for shopping purposes due to functional benefits. BI1 and BI2 variables affect the structure of BI latent variable in a similar manner. The use of Internet for activities connected with browsing offers and making purchases (Actual Use, AU) was described through two variables:

- total number of sites (online shops and auctions) visited per month on average AU1,
- average amount of time spent weekly by individuals on online shopping activities AU2.

Model-based approach shows that structure of the variable is most significantly meaning on the time spent weekly on shopping (AU2; 0.54). Insignificantly smaller importance on the structure of AU latent variable is exerted by the number of visited sites (AU1; 0.42).

Interesting information is also provided by the analysis of direct relationships in the structural model. Perceived ease of using the Internet for shopping-related activities (PEU) influences the perceived usefulness (PU) by 0.43 and the attitude toward using the Internet (ATU) to general shopping activity by 0.12. Perceived usefulness (PU) affects the attitudes (ATU) by 0.73 and behavioural intentions to use the Internet (BI) by -0.03. Attitudes toward using the Internet (ATU) have impact on intentions (BI) by 0.86, whereas the latter ones influence the actual use (AU) by 0.39.

The analysis of direct relationships was complemented by the path analysis which also allows to determine direct relationships between variables. Relationship values are presented in Table 3.

Indirect effect of perceived usefulness PU on the actual use AU is 0.23. Increased by one individual leads to increased use by 0.23. H1 hypothesis is therefore confirmed.

Indirect effect of perceived ease of use PEU on the actual use AU is 0.14. Increased ease of use by one individual leads to increased use by 0.14. H2 hypothesis is therefore confirmed.

6. PERCEIVED USEFULNESS AND EASE OF USING THE INTERNET FOR E-COMMERCE PURPOSES – TAM-BASED MODELLING IN CASE OF DIVIDING THE SAMPLE INTO TWO SUBGROUPS

6.1. Basic descriptive statistics for model variables

In order to verify hypothesis *H3* related to differences in perceiving Internet as a tool for browsing offers and making purchases depending on the length of using the Internet, the author decided to divide the sample into two subgroups. Frequency distribution for this variable allowed to choose two groups with comparable number of observations. Therefore, the adopted division included individuals with up to 7 years of experience in using the Internet – group A, N_A=252, and individuals using the Internet for more than seven years, i.e. group B, N_B=243.

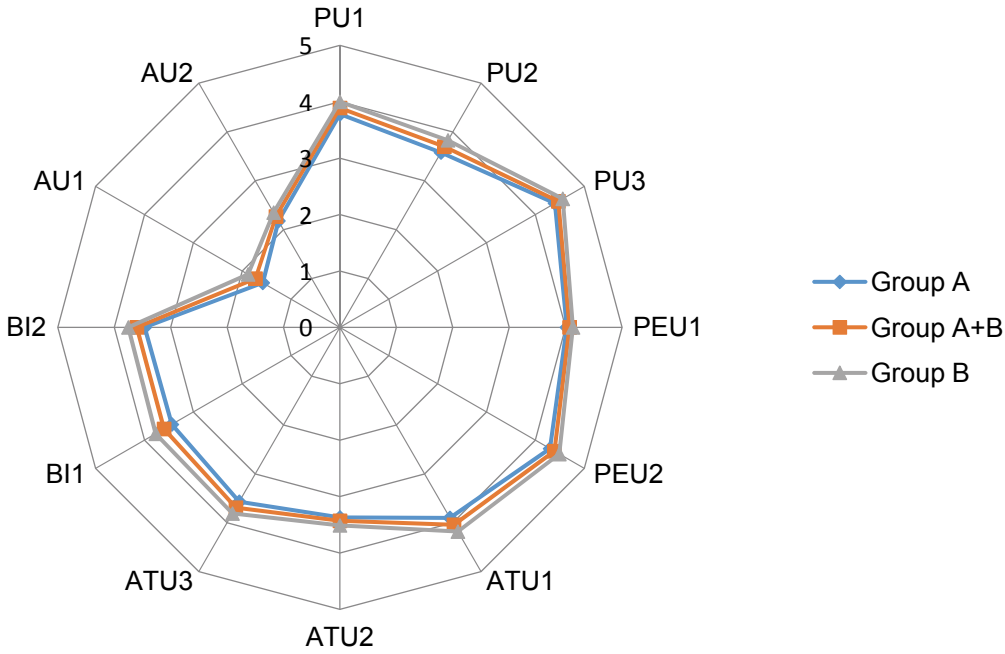
Table 2: Mean values and standard deviation for individual model variables (two subgroups)

Variable	PU1	PU2	PU3	PEU1	PEU2	ATU1	ATU2	ATU3	BI1	BI2	AU1	AU2
Mean value (group A)	3,78	3,58	4,40	4,02	4,30	3,90	3,37	3,57	3,44	3,46	1,58	2,18
Standard deviation (group A)	1,01	1,01	0,88	0,91	0,92	0,80	0,94	0,91	0,82	0,78	0,67	0,91
Mean value (group B)	4,00	3,83	4,56	4,13	4,49	4,18	3,51	3,81	3,77	3,75	1,88	2,35
Standard deviation (group B)	0,92	0,92	0,74	0,90	0,78	0,78	0,88	0,89	0,87	0,74	0,79	0,89
Difference between mean values (B-A)	0,22	0,25	0,16	0,11	0,19	0,28	0,14	0,24	0,33	0,29	0,30	0,17

Source: Author's own study, N_A=252, N_B=243.

Table 2 presents average values of model variables for two measured subgroups. In case of all variables, mean values recorded for group B were higher than in group A. This serves as the grounds to state that there are differences in perceiving Internet as a tool for browsing offers and making purchases, depending on the length of using the Internet. Comparison of all variable values in the analysed groups is also presented in the chart below (Picture. 4).

Picture 4: Comparison of average values of model variables on a radar chart

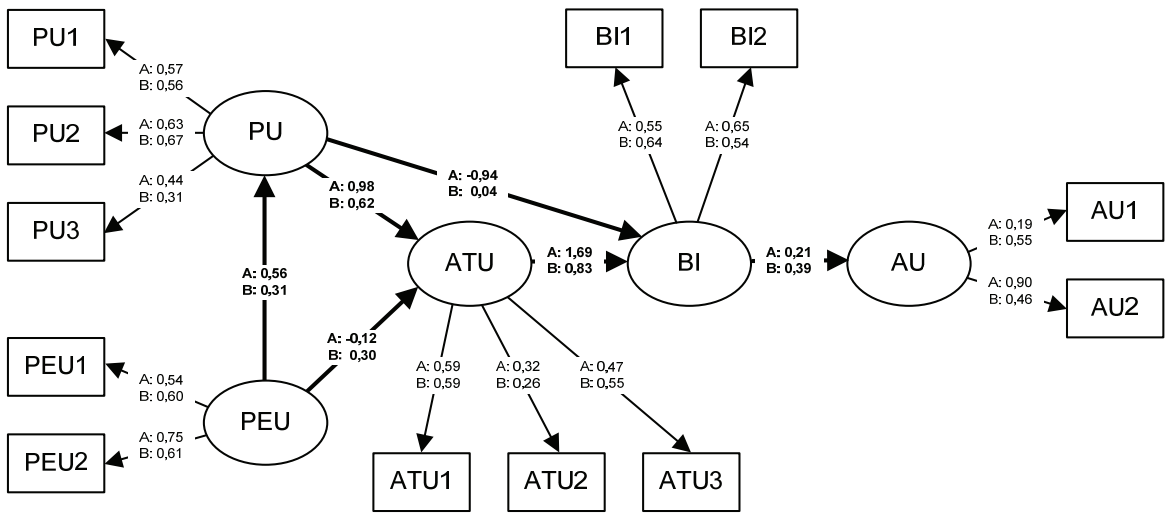


Source: Author's own study, N=495, N_A=252, N_B=243.

6.2. Model-based approach to dependencies between variables

Modelling results for groups A and B are presented jointly in Picture 5.

Picture 5: Relationships in the measurement model for groups A and B



Source: Author's own study, N_A=252, N_B=243.

Table 3 presents indirect effects observed between PEU→AU and PU→AU estimated for groups A and B. As a result of conducted analyses, it may be stated that effects in group B are more powerful than in group A. Growth of perceived ease of use (PEU) by one individual affects growth of the actual use AU in group A by 0.04. In group B, it is four times as high and amounts to 0.16. Similarly, growth of perceived usefulness PU by one individual leads to the growth of actual use AU in group A by 0.15, and in group B by 0.22.

To sum up, it may be stated that there are differences in perceiving Internet as a tool for browsing offers and making purchases in groups of users differing in terms of length of using the Internet. H3 hypothesis was confirmed.

Table 3: Indirect effects in models

Groups/Effects	PEU→ATU	PU→BI	PEU→BI	PU→AU	PEU→AU
Group A	0,4288	0,7162	0,1983	0,1504	0,0416
Group A+B	0,4339	0,5978	0,3603	0,2331	0,1405
Group B	0,4922	0,5546	0,4209	0,2163	0,1642

Source: Author's own study.

Table 4 presents fit indices for three analysed models. Adopted threshold values for specific indices are as follows: GFI ≥ 0.90; AGFI ≥ 0.80; NFI ≥ 0.90; NNFI ≥ 0.90; CFI ≥ 0.90; RMSR ≤ 0.10; RMSEA ≤ 0.05. Results obtained for the entire sample are insignificantly higher than indices obtained for the sub-models. This results from the reduced number of cases considered in subsequent analyses, without reducing the number of variables. Obtained values of fit indices exceed threshold values in vast majority. Only RMSEA insignificantly exceeds theoretical threshold values. To conclude, obtained fit indices reflect very good matching of data and models.

Table 4: Fit indices of TAM model for the entire sample and for two sub-models

Fit index	Model (Group A+B)	Model (Group A)	Model (Group B)
Goodness of Fit Index (GFI)	0,95	0,94	0,93
Adjusted Goodness of Fit Index (AGFI)	0,92	0,90	0,88
Normed Fit Index (NFI)	0,93	0,91	0,90
Non-Normed Fit Index (NNFI)	0,93	0,93	0,92
Comparative Fit Index (CFI)	0,95	0,95	0,94
Root Mean Square Residual (RMSR)	0,041	0,047	0,046
Root Mean Square Error of Approximation (RMSEA)	0,068	0,062	0,074

Source: Author's own study, N=495, N_A=252, N_B=243.

7. CONCLUSION

The paper presents model-based approach to selected aspects of e-commerce. Total number of respondents was 495. Hypotheses put forward in the paper were confirmed. H1 and H2 hypotheses were confirmed by finding relationships between model variables and through analysis of direct and indirect effects. Perceived ease of use and perceived usefulness affect (to a various extent) actual use of Internet for browsing offers and making purchases.
In addition, the sample was divided into two sub-groups according to their experience of using the Internet. H3 hypothesis was confirmed. There are differences in perceiving Internet as a tool for browsing offers and making purchases among groups differing in terms of length of using the Internet.

REFERENCE LIST

1. Davis, F.D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, pp. 319-340.
2. W 2012 r. wartość globalnego rynku e-commerce po raz pierwszy przekroczyła 1 bln USD. (2013, February 6). Retrieved from http://www.wirtualnemedia.pl/artykul/w-2012-r-wartosc-globalnego-rynku-e-commerce-po-raz-pierwszy-przekroczyla-1-bln-usd.
3. Baranowska-Skimina, A. (2013, July 5). Handel internetowy na świecie. Retrieved from http://www.egospodarka.pl/96392,Handel-internetowy-na-swiecie,1,39,1.html.
4. E-handel w Polsce bije kolejne rekordy. (2014, February 21). Retrieved from http://www.forbes.pl/e-handel-w-polsce-bije-kolejne-rekordy,artykuly,171731,1,1.html.
5. Klopping, I. M., & McKinney, E. (2004). Extending the Technology Acceptance Model and the Task-Technology Fit Model to Consumer E-Commerce. *Information Technology, Learning & Performance Journal*, Vol. 22 Issue 1, pp. 35-48.

6. Liu, S-P., & Tucker, D., & Koh, C. E., & Kappelman, L. (2003). Standard user interface in e-commerce sites. *Industrial Management & Data Systems*, 1003/8, pp. 600-610.
7. Stoel, L., & Lee, K. H. (2003). Modeling the effect of experience on student acceptance of Web-based courseware. *Internet Research: Electronic Networking Applications and Policy*, Volume 13 Number 5, pp. 364-374.

APPENDIX

Statements included in the survey.

Please tick the degree to which you agree with the following statements:

1 – strongly disagree
2 – disagree
3 – neither agree nor disagree
4 – agree
5 – strongly agree

Studied question:	*1*	*2*	*3*	*4*	*5*
Internet makes me shop much more quickly.	☐	☐	☐	☐	☐
Using Internet makes shopping easier for me.	☐	☐	☐	☐	☐
Internet gives me extensive possibilities of comparing different offers.	☐	☐	☐	☐	☐
Learning how to use Internet for shopping related-activities is hard.	☐	☐	☐	☐	☐
Learning how to use Internet for shopping-related activities took me a long time.	☐	☐	☐	☐	☐
Using Internet for shopping-related activities is a good solution.	☐	☐	☐	☐	☐
Internet is a safe tool for browsing offers and making purchases.	☐	☐	☐	☐	☐
In general, I like using Internet for shopping-related activities.	☐	☐	☐	☐	☐
I believe that it would be very good to expand the use of Internet for shopping purposes due to economic benefits.	☐	☐	☐	☐	☐
I believe that it would be very good to expand the use of Internet for shopping purposes due to functional benefits.	☐	☐	☐	☐	☐

How many online shops, auction websites etc. do you visit monthly on average?	1-2 ☐	3-5 ☐	6-20 ☐	>20 ☐
How much time do you spend weekly on activities related to online shopping?	0-5 min. ☐	6-15 min. ☐	16-60 min. ☐	>60 min. ☐

How long have you been using the Internet? _____ years