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Annotating Sales to Price Panel: An Economic Theory of Volume to Value Relation with Technology Assisted Education in Afghanistan

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ABSTRACT

Computer Assisted Education skills have opened a new era in the system of education around the globe and one of the building blocks in its adaptation in Afghanistan is the economic aspect of its acquisition and utilization which has weakened the process. In this paper, we test the significance of value to volume of the laptops being sold to and utilized by the students and lecturers at school and university levels throughout the period 2002 to 2014 paneling in five laptop retailing companies in Afghanistan. Using Pooled OLS Regression and Fixed Effect Models to test the impact of the panel data, the result shows a significant impact of the sales value on the sale volume of the laptops during the stated period of time. It is also found that the drop in price had increased the sale volume in the stated entities, while cash discount did not reflect a significant value to affect the sales volume overtime.

Keyword: Technology Assisted Education; Constructivist; Fixed Effect Model; Random Effect Model; Academia; Afghanistan

JEL Classification: B21; B23; C23; I22

1. INTRODUCTION

Utilization of technology assisted education (hereafter refers to as "TAE") is the pillar of advancement in the academic life of learners and lecturers. Mark & Kurt (2002) state that the use of TAE often change instructional practices overtime when technology is used by learners and lecturers, while they further suggest that the use of TAE by lectures play a role in their shifting towards more constructivist pedagogy. Despite spending substantial funds in restructuring the passive learning methodology driven by textbooks, notes and lectures from 1990s, most of the places still use the same old method (Kromhout, & Butzine, 1993) and Afghanistan was one of the stated places where the use of technology assisted approach to academia was underutilized till 2001. Ritchie and Wiburg (1994) argue that TAE is the major element of students' skills development and an effective base for their future task practices. Czaja, et.al. (2006) state that successful adoption of technology is becoming increasingly important to functional independence in education era. Since the early 1990s, most of the countries attempted to promote the importance of an information-based economy that requires knowledgeable and technically skilled workers in the media and by their legislation (Larry & Craig, 2001) though, many underdeveloped countries (e.g. Afghanistan, Pakistan, Bangladish, Tajikistan, Utopia, Nigeria, etc.) predicted the use of TAE as an operational challenge to their relevant economic situation and their labors capacity (Backer, et.al., 1999; Julie, et.al., 2008). Much of the literature in this field contributed on the importance of contextual factors such as the features and advantages of TAE being used in academia including support and networking of the education stakeholders (see; Little, 1990; Lave & Wenger, 1991; Minick, 1985; Stein & Brown, 1997; Putnam & Borko, 2000) while economic aspect of the TAE is somehow overlooked. This paper focuses on the economic aspect of TAE utilization in Afghanistan to investigate and document the trend of adoption to TAE on the data collected from five laptop retailing companies' overtime.

1.1 Statement of Research Question

Identical technological equipment like laptops for educational use by students and lecturers both at school and university levels has almost become an unavoidable requirement. But the sales price of brand new and used laptops is still a principle factor for the stated buyers. Of this, a question is raised that whether the trend in sales volume has an explanatory reason with trend in demanded value of the laptops?

1.2 Research Hypothesis

This study tests the following hypotheses:

Null Hypothesis

Laptop price is significant to explain the sales volume overtime with various retailers.

Alternative Hypothesis

The price is not a significant variable to explain the sales volume overtime with various retailers.

1.3 Research Limitation

This paper aimed to examine the economic variables that influence the use of TAE at school and university levels by lecturers and students. Since, the respondents were not randomly selected from the whole population; the result of the study may not be generalized to all the computer users in Afghanistan.

1.4 Research Delimitation

Although, this is very likely that the number of home and office computer users may affect the overall volume and value of laptops at the market, this study overlooked the stated issue. The remainder of the paper is organized as follow: section 2 discusses the research method, section 3 presents the results and section 4 concludes the paper and provides recommendation for future research in this field.

2. RESEARCH METHOD

2.1 Population and Sample

The population for this study was the laptop retailers among which, five laptop retailers have been selected across the capital city of the country, whose major portion of buyers were students and lecturers of the schools and universities.

2.2 Data and Questionnaire

A tabulate – type questionnaire was developed and distributed among the selected sample. The respondents were asked to state their price level including any type of allowance or cash discount provided at a specific price level with the quantity of laptops sold to students and lecturers of schools and universities during the year 2002 to 2014. The source of information being kept with the retailers and used for this study was a traditional sales register with rows and columns specifying the number, date, customer name, address, contact, type of goods and the related price with a separate column recording for any cash discount allowed supported by a carbon copy of the sales invoice attached with the particular page of the register.

2.3 Data Analysis

The data collected herein, consists of five laptop retailing companies denoted with CC where each of them has been serially coded like 1001, 1002, 1003, 1004 and 1005. Sales volume is treated as dependent variable (DV) while price value ($) and cash discount allowed are the independent variables (IVs). To begin with, we test the relationship between sales and the explanatory variables (price and cash discount) by applying Pooled OLS Regression Model, neglecting the cross section and the time series nature of the data using the following equation:

$$Sales = \beta_0 + \beta_1 price + \beta_2 discount + \varepsilon \tag{1}$$

Since, the problem with pooled regression model is that it doesn't distinguish between different retailers in our sample and deny the heterogeneity or individuality that may exist among the five retailers; we apply the fixed effect model by the following equation:

$$\begin{aligned} Salesccy &= \beta_0 + \beta_1 price_{ccy} + \beta_2 discount_{ccy} + \beta_k price_{k,ccy} \\ &+ \beta_k discount_{k,ccy} + y_2 E_2 + ... + y_n E_n + \bar{O}_2 \bar{T}_2 + ... \bar{O}_t \bar{T}_t + u_{ccy} \end{aligned} \tag{2}$$

Where sales is the DV, CC represents the retailer and y is the year. β_k is the coefficient for the IVs while u_{ccy} is the error term. We use the FE model to analyze the impact of variables that vary overtime (see, Baltagi, 1985; Wooldridge, 2013). The fixed-effects model controls for all time-invariant differences between the individuals, so the estimated coefficients of the fixed-effects models cannot be biased because of omitted time invariant characteristics (Reyana,

2007). Since, it is believed that differences across the retailers have some kind of influences on DV; we test the random effect model to analyze the effect by applying the following equation:

$$Sales_{ccy} = \beta\chi_{ccy} + \alpha + u_{ccy} + \varepsilon_{ccy} \quad (3)$$

In the above equation, u_{ccy} represents the between-retailers error and ε_{ccy} is the error within the entity. In random effects model it is assumed that the entity's error term is not correlated with the predictors which allows for time-invariant variables to play a role as explanatory variables (Reyana, 2007b). Being neat in selecting the appropriate model of either fixed or random (see, Greene, 1983), the following hypothesis was developed to be tested:

H_0: Random Effect Model is appropriate.

H_A: Fixed Effect Model is appropriate.

For testing the above hypothesis, the Breusch and Pegan Test (though, most use Hausman instead) is applied with a 95% confidence level (see, table 4) to investigate which model is best fit for our study. As a last step in statistical analysis of our data herein and to apply one of the above models, Pesaran CD Test is also applied to check whether the residuals are correlated across the retailers as cross sectional dependence leads to some degree of biasness in the test, for the purpose of which, we test the H_0: There is no serial correlation in the residual. In case the residual exist, we apply the Modified Wald test for heteroskedasticity with H_0: The residuals are homoscedastic.

3. Results

As stated in section 3.3, table 1 shows the statistical result of pooled GLS regression model.

Table (1): Pooled OLS Regression Model

Sales U	Coef.	Std. Err	t	P>|t|	[95% Conf. Interval]	
Price	-12.96358	3.468159	-3.74	0.000***	-19.88606	-6.041108
Discount	-10.68122	5.225138	-2.04	0.045**	-21.11064	-.2517982
Constant	11709.18	2282.704	5.13	0.000***	7152.886	16265.48

***<0.01, **<0.05, *0.10
Sample: 5 Groups
Observation: 70

Since, the p-values for price and discount (IVs) are 0.000 and 0.045 being <0.05 respectively, it is understood that they are significant variables to explain the DV being the sales of laptops by units. But we still do not accept the result of the model since the assumption with it is that all the retailers are the same, which in reality they are not (see, graph 1), so we will further our statistical test as mentioned in section 3.3 by applying the fixed effect and random effect models (see, table 2 and table 3).

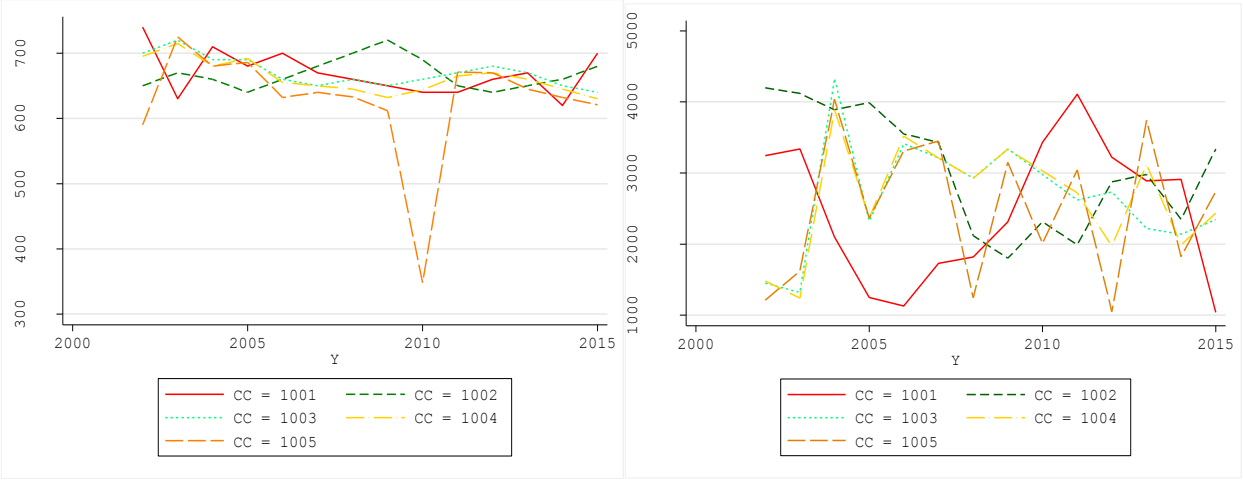

Figure (1): Panel Data Graph

The above figure represent the trend in sales volume towards the sales value throughout the concerned period under study. The corresponding sales value declares the increase and decrease in the volume of computers across the entities.

Table (2): Fixed Effect Model

Sales U	Coef.	Std. Err	t	P>|t|	[95% Conf. Interval]	
Price	-13.35576	3.465541	-3.85	0.000***	-20.28109	-6.430433
Discount	-12.62512	6.593009	-1.91	0.060	-25.8002	.5499545
Constant	12032.03	2280.703	5.28	0.000***	7474.411	16589.65
Sigma_u	207.45046					
Sigma_e	723.10514					
rho	.07604598	(fraction of variance due to u_i)				

***<0.01, **<0.05, *0.10
Sample: 5 Groups
Observation: 70
F test that all u_i=0: F(4, 63) = 1.11
Prob > F = 0.3610

The fixed effect model represents a p-value of F statistics of 0.0001 being <0.05 which means that the model is nicely fitted and coefficient of the IVs with negative sign represents that the test is not against the economic theory of sales and price. On the other hand, the p-value of t statistics for price is 0.000 which shows that this IV is significant to explain the DV. It is understood that when the price goes down the sales units go up and vise – versa. The probability of t statistics for discount is not significant since it shows a value of >0.05 and we know that this IV is not significant to explain the DV or in other words, the increase or decrease in the value of cash discount (what the data presents here) has not a significant impact over the increase or decrease in sales volume overtime. We shall now apply the random effect model to investigate its results on whether it provides the anticipated outcome (see, table 3).

Table (3): Random Effect GLS Regression

Sales U	Coef.	Std. Err	t	P>|t|	[95% Conf. Interval]	
Price	-12.96358	3.468159	-3.74	0.000***	-19.76105	-6.166116
Discount	-10.68122	5.225138	-2.04	0.041**	-20.9223	-.440135
Constant	11709.18	2282.704	5.13	0.000***	7235.164	16183.2
Sigma_u	0					
Sigma_e	723.10514					
rho	0	(fraction of variance due to u_i)				

***<0.01, **<0.05, *0.10
Sample: 5 Groups
Observation: 70

Table 3 shows a corresponding probability value of Wald Chi2 <0.005, p-values of 0.000 and 0.041 being <0.05 for both price and discount to be significant to explain our DV respectively. Meaning that random effect model is also a nicely fitted model of our test to conclude but, we run the Breusch and Pegan Test to rationally select between either of fixed or random effects models (see, table 4).

Table (4): Breusch and Pagan Lagrange Multiplier test for random effects

Variables		Var	sd = sqrt(Var)
	Sales U	683867.8	826.963
	E	522881	723.1051
	U	0	0
	Test:	Var(u)	0
		chibar2(01)	0.000***
		Prob > chibar2	1.000

***<0.01, **<0.05, *0.10
Predicted Variable: Fixed effect and Variable effect

Since, the p-value for the test is more than 0.05, we cannot reject the null hypothesis rather we accept it and we conclude that the fixed effect model is appropriate for our statistical test on the basis of which we further continue our test to

investigate whether there is any serial correlation in the residuals by applying the Pesaran CD test for sectional-correlation as follow:

Pesaran's test of cross sectional independence = 2.701

Probability Value = 0.0069***

Average absolute value of the off-diagonal elements = 0.342

The probability value of the test indicates 0.0069 which is less than 0.05 and it means that there is serial correlation in residuals. So, we cannot reject the null hypothesis and we accept it as there is autocorrelation in the residuals. To further test this, we apply the Modified Wald test for GroupWise heteroskedasticity to test the following hypothesis:

H_0: The residuals are homoscedastic.

H_A: The residuals are heteroskedastic.

Modified Wald test for GroupWise heteroskedasticity in fixed effect regression model

H_0: sigma(i)^2 = sigma^2 for all i

chi^2 (5) = 1.59

Prob>chi^2 = 0.9024

The result shows that the p-value of the Modified Wald test is 0.9024 meaning that this is >0.05 which is desirable in this context on the basis of which we cannot reject the null hypothesis rather we accept it and conclude that the residuals are not heteroskedastic.

4. CONCLUSION

Technology assisted education is the foundation for better learning and teaching. This process is strengthened when both students and lecturers are facilitated with the required computers. Though, the world had adapted to TAE since 1990s, Afghanistan stepped in the process in 2002. This study examine the economic aspect of the TAE process from the view of sales volume of laptops to the value at which it is sold over a period of 13 years from 2002 to 2004. The statistical analysis and findings document that on the basis of the economic theory of demand, the sales price being the independent variable has a significant impact over the sales unit or dependent variable to students and lecturers overtime. It is also found that greater units of laptops have been sold while price of the item dropped. Therefore, we can conclude that the process of rationale adoption to TAE is significantly depending upon the economic capacity of the buyers (lecturers and students) who are counted as the prime factor to promote and sustain the TAE in Afghanistan.

AVENUE FOR FUTURE RESEARCH

This paper overlooked many other limiting principles to TAE and only considered the economic aspect of it, while further studies are encouraged to investigate the factors like social promotion, government intention, skills development and skills transformation for the TAE adoptability in the country.

REFERENCES

Baltagi, B. H. (1985). Pooling cross-sections with unequal time-series lengths. *Economics Letters 18*, 133-136.

Becker, H., Ravitz, J., & Wong, Y. (1999). Teacher and teacher-directed student use of computers and software. *Irvine: Center for Research on Information Technology and Organizations, University of California, Irvine; University of Minnesota, Center for Research on Information Technology and Organizations* , (Rep. No. 3).

Czaja, Sara J.; Charness, Neil; Fisk, Arthur D.; Hertzog, Christopher; Nair, Sankaran N.; Rogers, Wendy A.; Sharit, Joseph . (2006). Factors predicting the use of technology: Findings from the center for research and education on aging and technology enhancement. *Psychology and Aging 21(2)*, 333-352.

Greene, W. H. (1983). Simultaneous estimation of factor substitution, economies of scale, and non-neutral technical change. In *In Econometric Analyses of Productivity, ed. A. Dogramaci* (pp. 121–144). Boston: Kluwer.

Julie Mueller, Eileen Wood, Teena Willoughby, Craig Ross, Jacqueline Specht. (2008). Identifying discriminating variables between teachers who fully integrate computers and teachers with limited integration. *Journal of Computer and Education 51*, 1523-1537.

Kromhout, O. M., & Butzin, S. M. (1993). Integrating computers into the elementary school curriculum: An evaluation of nine project CHILD model schools. *Journal of Research on Computing in Education. 26(1)*, 55-69.

Larry Cuban & Craig Peck. (2001). High Access and Low Use of Technologies in High School Classrooms: Explaining an Apparent Paradox. *American Educational Research Journal 38(4)*, 813-834.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge, UK: Cambridge University Press.

Little, J. W. (1990). *Teachers as colleagues. In A. Lieberman (Ed.), Schools as collaborative cultures: Creating thefuture now (pp. 165-193).* New York: Falmer.

Mark Windschitl and Kurt Sahl. (2002). Tracing Teachers' Use of Technology in a Laptop Computer School: The Interplay of Teacher Beliefs, Social Dynamics, and Institutional Culture. *American Educational Research Journal 39(1)*, 165-205.

Minick, N. J. (1985). Vygotsky and Soviet activity theory: New perspectives on the relationship between mind and society. *Unpublished doctoral dissertation*, Northwestern University, Evanston II.

Putnam, R. T., & Borko, H. (2000). What do new views of knowledge and thinking have to say about research on teacher learning? . *Educational Research 29(1)*, 4-15.

Reyana, Oscar Torres. (2007). Panel Data Analysis: Fixed and Random Effects using stata (v.4.2). *Data and Statistic Services, Princeton University*, 1-40.

Ritchie, D., & Wiburg, K. (1994). Educational variables influencing technology integration . *Journal of Technology and Teacher Education. 2(2)*, 143-153.

Stein, M. K., & Brown, C. A. (1997). Teacher learning in a social context: Integrating collaborative and institutional processes with the study of teacher change. In E. Fennema & B. S. Nelson (Eds.). *Mathematics teachers in transition*, 155-191.

Wooldridge, J. M. (2013). *Introductory Econometrics: A Modern Approach 5th Ed.* . Mason AH: South-Western.