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EC902 Econometrics A   Project

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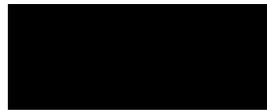
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Education expenditure by family: income effect, family type and number of children under age 18

Abstract: This essay examines the factors that would influence household's expenditure on children education. Parents education level, occupation status and especially income are found by empirical works to be highly relevant on education expenditure. Besides, average working hours, urban family and Hispanic origin are significant on education expenditure, too. On top of that, after controlling the number of children under 18 and family type, the analysis presented showed that number of children under 18 can be positively and negatively affect eduction expenditure and the marital status of family type is essential on education expenditure due to the income effect.

I. Introduction

Education is the heart of the economy development, education is one of the most important investments for any family that wish to shape their better future and next generations. Rosenzweig and Wolpin (1980) claimed that children in large families enjoy relatively small educational resources and show poor educational attainment. Qian and Smyth (2011) argued that the larger numbers of school-aged children in the household indicates higher levels of educational expense. Growing up with one parent is less likely to attain high education levels stated by Astone and McLanahan (1991). Educational attainment may be affected either positively by family structure based on Garasky (1995). This essay main focus is to explore the possible effects on how the number of children under 18 and family type (parents marital status) influence children education expenditure after controlling parents own characteristics (education and occupation) and allocation or origin.

The rest of the essay is organized as follows: Section II literature reviews the previous studies on the factors that would potentially affect households educational expenditure. Section III theoretical framework, Section IV introduce the data and its limitations as well as the estimation methods and models. The results are analysed in Section V, and Section VI conclusion and discussion of the findings about this essay.

II. Literature review

Garasky (1995) explained the effects of family structure on educational attainment. He found that family structure effects on educational attainment vary according to whether it is either the biological mother or father that lived with the child and also based on the age of the child. Kirchsteiger and Sebald (2010) investigated the impact of the cultural transmission of the importance parents attribute to the education of their children on human capital levels, incomes, well-being and education policies. They incorporated the transmission of attitudes towards education into an OLG-model. Omori (2010) asserted that the factors determining a household's educational expenditures are not the type of household it is, but rather household income, parental education, and parental occupation. He argued that children in married-couple households are no more advantaged than children in single-mother or cohabiting households with respect to the availability of books and other reading materials. He used OLS and Logistic estimations to investigated above findings Kan (2010) examined whether large family size has a negative impact on children's education, he used a non-parametric bounding method as well as an instrumental variables method to deal with endogeneity of family size. And he found that quantity-quality trade- offs in educational investments function is influenced by the sex of the child. And he showed that the large (small) family size has a strong negative (positive) impact on educational investments for girls very little impact on those for boys. Qian and Smyth (2011) examined factors affecting parent's expenditure on domestic and overseas education for their children. They used Tobit and ReLogit estimation for the study. They found that families with more resources, better human capital and higher social status are those who are able to spend vast sums of money on purchasing better quality education overseas. Mimura (2014) stated how family characteristics explain the variations in such expenditures differently in Japan and the United States. He used double-hurdle models to analyzed the probability of having expenditures on children's educations and the associated costs. He found that the present situation reinforces intergenerational economic inequality in Japan and the United States, and the current family economic burden discourages the improvement of birthrates in Japan.

The contribution of this essay. Firstly, compare to the previous studies this essay uses a more recent and larger scale dataset (see Section IV, data introduction). Secondly, this essay investigated the impact of number of children under 18 on educational expenditure is vary due to the households have consumption budget constraint, income.

III. Theoretical framework

Various literature shows that human capital model (Kirchsteiger and Sebald 2010; Becker 2009) and the economics of fertility (Bryant and Zick 2006) are well theoretical frameworks to explain the influences of household's education expenditure. Households spend money on children education now, is equivalent to human capital investment which might yield more productive future human capital and better future generations as return. And Mimura (2014) argued the economics of fertility interpreted children need parents spend certain amount of time and money. Thus parents face trade-offs when it comes to how much to spend and how to spend. Spend more money on education, for instance, pay for private tutoring lessons, means parents have more time to work, and vice versa. Higher working hours indicate higher income, results in higher education expenditure. Moreover, more investment in children education for low income households means less consumption on household daily expenses such as food, clothing, cars, holidays and so on. At last, Kirchsteiger and Sebald (2010) stated cultural transmission which is defined as transmission of preferences, values and norms of behavior through social interaction explains children attitudes and life are highly influenced by parents. Which means children from parents with higher education level and occupation status is tend to achieve higher education level and occupation status.

Therefore, in my model, according to above theories, some of my independent variables are income and working hours since there are money and time trade-offs on education expenditure. Parents educational attainments and occupational status because of the cultural transmission.

IV. Data and methods

Data and limitation. The data is from the Consumer Expenditure Survey (CE) 2012 interview data , it is provided by the U.S. Department of Labor, Bureau of Labor Statistics. According to Bureau of Labor Statistics, the Consumer Expenditure Surveys provide data on the buying habits of American consumers, approximately 7,000 households were interviewed quarterly on average in 2012-13. It collects data on up to 95% of total household expenditures including Consumer Unit (CU) characteristics, income and educational expenditure in details. Thus the CE is appropriate for my study topic. I merged FMLY file and one variable which is educational expenses from EXPN file, and 1096 observations are merged successfully.

These two files contains reference person (the first member mentioned by the respondent when asked for the interview) and reference person's spouse in the household. Because reference person does not differentiate among father, mother or other relatives, for example, auntie, uncle and so on. Hence I cannot investigate the effect of parent's gender on children's education expenditure. Furthermore, the education expenditure is a net CU education expenditure, it does not identity the expense on whom, it could be parents, children and relatives. However, conducted by U.S. Census Bureau, the householder, his or her spouse, and his or her sons and daughters comprised 87% of the population in 2010, hence I assume in my 1096 observations, education expenditure are mostly spent to children by their parents. At last, CE does not distinguish among biological, step, or adoptive parents and children, I assume there is no difference among these parents and children.

Measures. Due to the fact that at least one person in a household participated into the interview, to avoid dependency among independent variables, my essay is based on reference person. The education expenditure as dependent variable is measured in dollar, per household expenditure, it is the net amount of money spending on education. The key independent variables include the variables that I described in theoretical framework part such as income, working hours, Parents educational attainments and occupational status. Besides, household allocation, origin, family type, number of children under 18. Since children's well-bing is affected by two-parent and single-parent households due to the differences in different type of household income (Garasky,1995; Hanson and McLanahan, 1994), hence I include family type (the family is husband-wife type or single-parent type). And most of the children living with their parents were under 18 years old according to U.S. Census Bureau, and the education of children under 18 (schooling children) are more likely paid by their parents, therefore number of children under 18 is included. Like education expenditure, income is measured in dollar as well. Table 1 summarize the explanatory variables (n=1,096).

Table 1 Variables profile (mean and standard deviations for continuous variables and percentages for categorical variables)

| Variable names	Description of variables	Means/ standard deviations/ percentages
Education expenditures	Net amount paid for educational expenses	1286.417 (3061.816)

Income	Amount of household income after taxes	82816.32 (81487.96)
Education	Education of reference person	-
<high school	A self generated binary dummy variable where 1= less than high school qualification, 0 otherwise	6.30%
High school - college	A self generated binary dummy variable where 1 = high school to college qualification, 0 otherwise	75.46%
>graduate	A self generated binary dummy variable where 1 = graduate qualification or above,	18.25%
Occupation	Occupation of reference person	-
Manager	A self generated binary dummy variable where 1= manager, 0 otherwise	41.51%
Administrative	A self generated binary dummy variable where 1= administrative, 0 otherwise	18.98%
Service	A self generated binary dummy variable where 1= service, 0 otherwise	13.23%
others	A self generated binary dummy variable where 1= others, 0 otherwise	9.03%
Urban	A binary dummy variable where 1= family lives in urban,0 otherwise	96.00%
Hispanic	A binary dummy variable where 1= reference person is Hispanic, 0 otherwise	13.28%
Working hours/ week	Number of hours usually worked per week by the reference person	33.92 (18.24)
$\leq$ 34 hours/ week	A self generated binary dummy variable where 1 = to work $\leq$ 34	19.33%

	hours/ week, 0 otherwise	
> 34 hours/ week	A self generated binary dummy variable where 1 = to work > l34 hours/ week, 0 otherwise	80.67%
Number of children	No of children less than 18 in household	1.58 (1.18)
0 child age under 18	A self generated binary dummy variable where 1 =0 child age under 18, 0 otherwise	18.25%
1 child age under 18	A self generated binary dummy variable where 1 = 1 child age under 18, 0 otherwise	30.47%
2-3 children age under 18	A self generated binary dummy variable where 1 = 2-3 children age under 18, 0 otherwise	45.89%
4-8 children age under 18	A self generated binary dummy variable where 1 = 4-8 children age under 18, 0 otherwise	5.38%
Family type	Family type is based on relationship of members to reference person	-
Husband and wife type with schooling children	A self generated binary dummy variable where 1 = husband and wife family with schooling children, 0 otherwise	63.50%
Husband and wife type with non schooling children	A self generated binary dummy variable where 1 = husband and wife family with non schooling children, 0 otherwise	7.48%
Single parent with schooling children	A self generated binary dummy variable where 1 = single parents with schooling children, 0 otherwise	11.77%
Single parent with non schooling children	A self generated binary dummy variable where 1 = single parents with non schooling children, 0 otherwise	17.24%

Methods and Models. Annually education expenditure of each household is estimated by using an ordinary least squares regression analysis. Both of education expenditure and income are taken natural logarithms to reduce biased results, since the distribution of these two variables are not normally distributed as showed below.
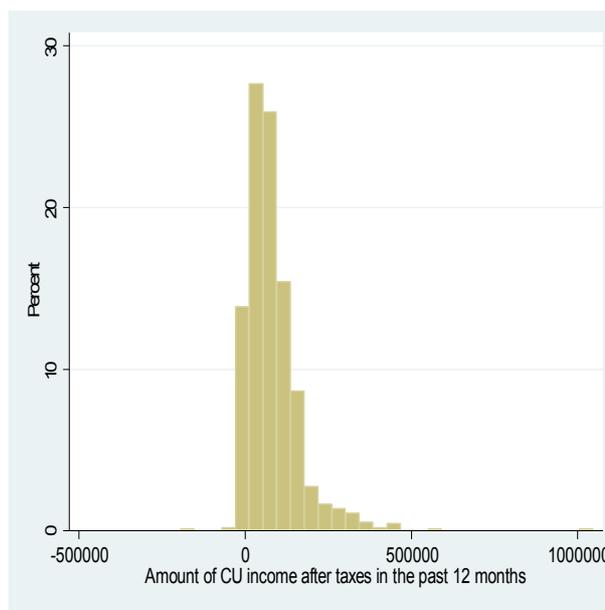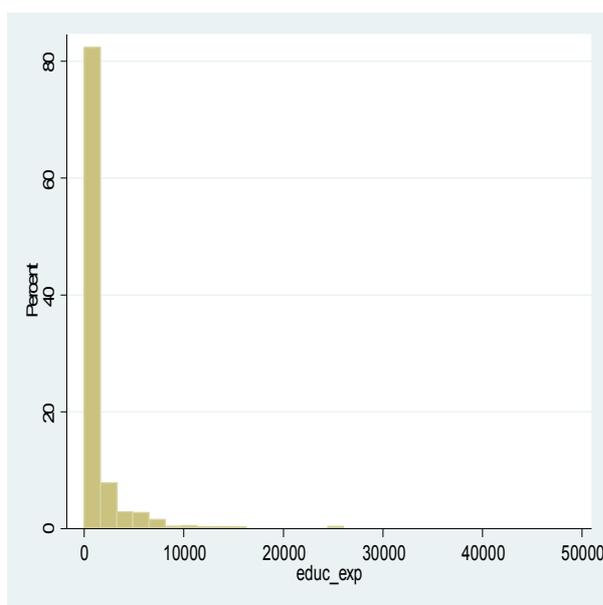
An ordinary least squares regression analysis has been used to estimate numbers of household expenditures articles, for example, private tutoring expenditure in South Korea by Kang (2010), education, entertainment, books, apparel expenditures by Omori (2010), and food at home by Paulin and Lee (2002).

My basic model:

$$lneduc\_exp= \alpha+\beta1lnincome+\beta2educ+ \beta3occupoation+\varepsilon i$$

I replace education category with its binary dummy variables, so as occupation. Then I add one category binary dummy variables each time to see what the key explanatory variable is and the change of coefficients and standard deviations. But mainly, I focus on the effects of number of children under 18 and family type . The models also use robust standard errors to control the heteroscedasticity problem.

Table 2 OLS Results of Expenditure for Education

	Model 1 (OLS)	Model 2 (OLS)	Model 3 (OLS)	Model 4 (OLS)
income	.169 (.053)	.153 (.051)	.144 (.056)	.111 (.050)
[1]High school-college degree	.995 (.205)	.646 (.210)	.360* (.230)	.352* (.225)
[1]Graduate	1.275 (.243)	.897 (.248)	.615 (.267)	.631 (.262)
[2]Manager	.392 (.127)	.344 (.125)	.172* (.154)	.121* (.148)
[2]Administrative	.077* (.141)	.045* (.139)	-.093* (.164)	-.126* (.159)
[2]Others	-.191* (.164)	-.173* (.163)	-.396 (.183)	-.354 (.177)
[3]Urban		1.412 (.209)	1.440 (.238)	1.307 (.241)
[4] Hispanic		-.449 (.140)	-.468 (.143)	-.405 (.140)
[5]>34 hours/ week			.343 (.142)	.294 (.135)
[7] 1 child age under 18				.788 (.177)
[7] 2-3 children age under 18				1.09 (.169)
[7] 4-8 children age under 18				1.25 (.252)
[8] Husband and wife type with schooling children				.634 (.152)
[8] Husband and wife type with non schooling children				.416 (.205)
[8] Single parent with non schooling children				-.062* (.207)

Constant	2.890	2.125	2.365	3.24
R²	0.094	0.125	0.117	0.189
N	1006	1006	848	848

[1] Reference class: less than high school　　　　[2] Reference class: service
[3] Reference class: rural　　　　　　　　　　　　[4] Reference Class: non-Hispanic
[5] Reference class: equal or less than 34 hours/week
[7] Reference class: 0 child age under 18
[8] Reference class: single parents with schooling children
* non significant at 0.1 level
The rest coefficients are all significant at 0.05 level

V. Results

Table 2 shows the estimates of the natural logarithm of annually educational expenditures. The analysis focus on model 4 and then I compare model 4 to model 2 to investigate the effects of number of children age under 18 and family type. In model 4, high school to college degree, manager, administrative and single parents with non-schooling children are insignificant. Income has positive effect on education expenditure, for every1 proportional increase in household income, there are proportional 11.1% increase in children education. Compare to the parents who have less than high school degree, graduated parents are spend proportionate 63% more on education expenditure this applies the culture transmission theory that I mentioned in the theoretical framework part. Parents who work as broad other occupations spend proportional 35.4% less than the parents who work in service on their children education. Urban households spent proportional 130.7% more than rural households. This might be explained that urban areas are relatively more developed, which means relatively higher living expenses, higher income and more education resources compare to rural areas. Hence there is huge difference on education expenditure between urban households and rural households. And Hispanic parents spend proportional 40.5% less than non-Hispanic parents, this might reflect the fact that 25.6% of Hispanic people below poverty rate (U.S. Census Bureau, 2012). The average annual working hours per week for America is 34 based on OECD. It is not surprise to see that those parents who work more than 34 hours a week spend proportional 29.4% more on their children education compare to those who work less than average 34 hours per week. As there are time and money trade-offs when it

comes to children education. For family which has 1 child age 18 spent proportional 78.8% more on education compare to no kid family, and the more children under 18 is a family, the more the family spends on education. The coefficient change from 4-8 children age under 18 variable to 2-3 children age under 18 variable is smaller than the coefficient change from 2-3 children age under 18 to 1 child age under 18. As the number children age under 18 increase, the marginal education expenditure for each child might be less, as the children can share the same school books, other reading materials, private tutorial lessons and so on. Husband and wife type family with schooling children spend proportional 63.4% more than single parent family with schooling children. The economic benefit of two-parent family is clearly seen based on the U.S. Census Bureau income and earning statistics: in 2012, married-couple households' median income was $75.694, however, single-mother and single-father households were $48,634 and $34.002 respectively. What is more, only 6.3% of married-couple families lived in poverty, while average 23.65% of single-parent families lived in poverty.

In model 2, without controlling for the children under 18 and family type about parents marital status. Only administrative and others occupations are showed to be insignificant to education expenditure. Moreover, compare to model 4 to model 2, household spend 4.2% less on education , and graduated degree parents spend 26.6% less, urban families spend 10.5% less, Hispanic origin spend 4.4% more on education.

VI. Conclusion and extension

The analysis from this essay suggest that higher income, higher educational attainment, and higher occupational status all show strong positive relationship to education expenditures. Apart from that, number of children under 18 and family type about parents marital status are significant to education expenditure as well. The greater numbers of children under 18 in the household implies larger levels of expenditure on education as a whole. But the marginal expenditure per child's education is lower if the number of children is larger. In my data, the mean income of households is $82816.32, however, the median income of family households in 2012 was $64,053 according to U.S. Census Bureau. The mean income in my data is 22.7% higher than the average households income. Hence, the more schooling children in the family, more money is likely to spend on education. However, if household's income is limited, budget constraint is not enough to meet the demand, more children in the family means family has no choice but cut the money spending on each child's education. In this case, education expenditure will decrease instead of

expanding. Married-couple families are likely to spend more than single-parent families as higher incomes are earned by two-parent family compare to single-parent families generally. Even though parents or single-parent have high income due to the high education attainments and occupation status, however, in a large number of schooling children family, each child enjoy less education expenditure compare to small number of schooling children family under a certain budget constraint, despite the fact that parents would spend greater amount of money on education in large number of schooling children households a whole. Unless, the family's income is too high to care about the education expenditure. Otherwise, the quantity-quality trade-offs with respect to educational inputs shows that each child's education is negative related to family size (Li and Zhang, 2007; Kang, 2010). Therefore, the number of children under age 18 could be positively and negatively affect children's education expenditure.

In conclusion, income is an essential determination in children education expenditure, the effect of number of schooling children on education expenditure could be positive and negative. The marital status of family type is significant on education expenditure due to the income effect.

One extension that I would consider if I have more time, is to explore the possible effects of consumption expenditure (like daily expenses, such as food, clothing, holiday, cars properties) on education expenditure, because under the certain budget constraints (income level) in a period (a year), when households choose to invest in human capital (if the cost of human capital is large enough), they might giving up the chance to enjoy more quality food or clothing, vacations, bigger properties and cars. I would be interest to investigate the trade-offs between education and daily consumption expenses.

References

Astone, N. M., and S. S. McLanahan. (1991) "Family Structure, Parental Practices, and High School Completion" *American Sociological Review* 56(3): 309-20.
Becker, G. S. (2009). *Human capital: A theoretical and empirical analysis, with special reference to education.* University of Chicago Press.
Bryant, W. K., & Zick, C. D. (2006). The economic organization of the household (Vol. 978, No. 0-80146). Cambridge University Press.
Consumer Expenditure Survey (CE) 2012 interview data. U.S. Department of Labor, Bureau of Labor Statistics
DeNavas-Walt, C., Proctor, B. D. & Smith, J. C. (2013) "Income, Poverty, and Health

Insurance Coverage in the United States: 2012, Current Population Reports" U.S. Census Bureau, P60-245.

Lofquist, D., Lugaila, T, O'Connell, M. & Feliz, S. (2012) "Households and Families: 2010 " U.S. Census Bureau.

Garasky, S. (1995). The effects of family structure on educational attainment.*American Journal of Economics and Sociology*, *54*(1), 89-105.

Kang, C. (2011). Family Size and Educational Investments in Children: Evidence from Private Tutoring Expenditures in South Korea*. *Oxford Bulletin of Economics and Statistics*, *73*(1), 59-78.

Kirchsteiger, G., & Sebald, A. (2010). Investments into education—Doing as the parents did. *European Economic Review, 54*(4), 501-516.

Lino, M. (2000). Expenditures on Children by Families: 1999 Annual Report.

Li, H., & Zhang, J. (2007). Do high birth rates hamper economic growth?. *The Review of Economics and Statistics, 89*(1), 110-117.

Medina-Muñoz, D. R., & Medina-Muñoz, R. D. (2012). Determinants of expenditures on wellness services: The case of Gran Canaria. *Regional Studies, 46*(3), 309-319.

Mimura, Y. (2014). Family Characteristics and Educational Expenditures in Japan and the United States. *Japanese Economy, 40*(1), 5-28.

Omori, M. (2010). Household expenditures on children, 2007-08. *Monthly Labor Review, 133*(9).

Paulin, G. D., & Lee, Y. G. (2002). Expenditures of single parents: How does gender figure in. *Monthly Lab. Rev., 125*, 16.

Qian, J. X., & Smyth, R. (2011). Educational expenditure in urban China: income effects, family characteristics and the demand for domestic and overseas education. *Applied Economics, 43*(24), 3379-3394.

Rosenzweig, M. R., & Wolpin, K. I. (1980). Testing the quantity-quality fertility model: the use of twins as a natural experiment. *Econometrica: journal of the Econometric Society, 48*(1), 227.

Temple, J. (2001). *Growth effects of education and social capital in the OECD countries*. Centre for Economic Policy Research.

Thomson, E., Hanson, T. L., & McLanahan, S. S. (1994). Family structure and child well-being: Economic resources vs. parental behaviors. *Social Forces, 73*(1), 221-242.

Weiss, H. B., Mayer, E., Kreider, H., Vaughan, M., Dearing, E., Hencke, R., & Pinto, K. (2003). Making it work: Low-income working mothers' involvement in their children's education. *American Educational Research Journal, 40*(4), 879-901.

ZIOL-GUEST, K. M., DeLeire, T., & Kalil, A. (2006). The Allocation of Food Expenditure in Married-and Single-Parent Families. *Journal of Consumer Affairs, 40*(2), 347-371.