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Stunting in Eastern Indonesia: Determinants and Solution from Indonesian Family Life Survey

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ABSRACT

Stunting is considered as detrimental and worrying health problems in many developing countries. WHO in 2018 reported that Indonesia ranks 3rd as country with highest stunting prevalence in Southeast Asia and it is dominated in eastern region of Indonesia with the highest prevalence rate in East Nusa Tenggara (40.3%) This study aims to find determinants and solutions related to stunting of children aged 0-59 months in eastern region of Indonesia. Using 1093 samples of children aged 0-59 months from Indonesian Family Life Survey (IFLS) East 2012, this paper used logistic regression to find relationship between socio-economic factors and household characteristics to stunting dummy variable. This paper found that paternal education, birth order, quality of sanitation, maternal Body Mass Index (BMI), and relative wealth using Principal Component Analysis (PCA) are significantly correlated with stunting.
Keyword: Stunting, Toddler, IFLS, Indonesia, Logistic Regression

ABSTRAK

Stunting dianggap sebagai masalah kesehatan yang merugikan dan mengkhawatirkan di banyak negara berkembang. WHO pada tahun 2018 melaporkan Indonesia menempati urutan ke-3 sebagai negara dengan prevalensi stunting tertinggi di Asia Tenggara dan didominasi di wilayah timur Indonesia dengan angka prevalensi tertinggi di Nusa Tenggara Timur (40,3). Penelitian ini bertujuan untuk mengetahui determinan dan solusi terkait stunting pada anak usia 0-59 bulan di wilayah timur Indonesia. Menggunakan 1093 sampel anak usia 0-59 bulan dari *Indonesian Family Life Survey* (IFLS) Timur 2012, tulisan ini menggunakan regresi logistik untuk mengetahui hubungan antara faktor sosial ekonomi dan karakteristik rumah tangga terhadap variabel dummy stunting. Tulisan ini menemukan bahwa pendidikan ayah, urutan kelahiran, kualitas sanitasi, Indeks Massa Tubuh (BMI) ibu, dan kekayaan relatif dengan menggunakan Principal Component Analysis (PCA) berkorelasi signifikan dengan stunting.
Kata Kunci: Stunting, Balita, IFLS, Indonesia, Regresi Logistik

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INTRODUCTION

When a children aged below 5 years old having an impaired body growth and their physical development is unlike the others, this condition called as stunting (WHO, 2015). Stunting is considered as a very serious problem because it is associated with lots of negative impacts such as the slowing down of child's cognitive function, lower level of educational outcomes, lower income and greater risk to being poor in the future. In short, stunting decreases one's productivity and in the macro level, means national productivity also become lowered and way below the potential (Galasso, Wagstaff, Naudeau, & Shekar, 2016). Stunting occurs in many countries in the world, especially in developing countries including Indonesia.

According to reports from UNICEF (2019), despites of the declining trend of stunting prevalence since 2000, 1 out 4 children or more than 149 million children aged below 5 years old in the world are stunted in 2018. Indonesia itself ranked 2nd with the highest stunting prevalence between countries in Association of Southeast Asian Nations (ASEAN). To be specific, around 36.4% of children aged below 5 years old in Indonesia are stunted and according the standard by World Health Organization (WHO), because the prevalence rates is higher than 20%, Indonesia is classified as a nation with chronic malnutrition (Katadata, 2018a). According to report from KEMENKES (2018), stunting prevalence in Indonesia dominated and mainly occurred in Eastern Indonesia, with the highest prevalence rates is located in East Nusa Tenggara(42.6%) and the lowest is located in DKI Jakarta (17.7%) and Yogyakarta (19.8%). Efforts to reduce stunting prevalence rates is a vital agenda for every country, considering that in Sustainable Development Goals (SDGs), the targets that want to be achieved by all countries, specifically in goal 2 about ending hunger, achieving food security and improved nutrition, and promoting sustainable agriculture. Stunting itself becomes a target in point 2.2 which targeting that by 2030 the problem of malnutrition, including stunting will be reduced by 40% (United Nations, 2019).

The Government of Indonesia already made various efforts to reduce stunting through socialization to promote healthy life or in a form of social protection programs. One of the efforts carried out including 1) for pregnant and childbirth mother, counseling program about early breastfeeding initiation (IMT) and exclusive breastfeeding is held to avoid the costs of non-exclusive breastfeeding associated with the disease (Sihaloho, Larasati, Pitriyan, & Siregar, 2018; Sihaloho, Rahma, Senja, Pitriyan, & Siregar, 2019; Siregar, Pitriyan, & Walters, 2018); 2) for toddler, supplementary feeding program and early stimulation and also ensuring optimal health services; 3) for school age children, revitalizing school health (UKS), organizing *Program Gizi Anak Sekolah* (PROGAS), and conducting school as a smoke and drug free areas to ensure healthy environment; 4) for teenager, increasing the socialization about

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clean and healthy life and also reproductive health education; 5) for young adult, socializing and giving services about family planning program (KB), and also about clean and healthy life (CNN Indonesia, 2019). Despites of all the efforts, stunting prevalence rates in Indonesia still categorized as high.

Stunting in general reflects the poor growth accumulated since the prenatal and postnatal periods of a child because of poor nutrition and health (Mostafa Kamal, 2011). Stunting occurs because the lack of consumption of nutritious foods, low vitamins and minerals intake, and because of the poor diversity of food and animal protein sources. Other than that, stunting can also occur due to an infection in the mother, teen pregnancy, mental disorder of the mother, short child pregnancy spacing, and hypertension. Other factors that could leads to poor growth of children such as the lack of access to healthcare, including access to sanitation and clean water (Depkes, 2018). These conditions even more so and very likely to occur in Eastern Indonesia, with the low availability of doctors and also poor quality of sanitation resulting in a higher incidence of stunting compared to other regions (Katadata, 2018a, 2018b).

There are several other studies that have tried to explain the relationship between individual, household, and community characteristics and the incidence of stunting. Chirande et all (2015), using case study of Tanzania found that low education level of mother, small size at birth, and unimproved source of drinking water is one of the prominent risk factors that increase the likelihood of a child being born stunting. Study in Bangladesh by Mostafa Kamal (2011)found that birth order, household wealth, paternal education level and the quality of sanitation become valuable predictor that correlated to the likelihood of a child become stunted. Using case study of Indonesia from IFLS 5 dataset, Indrastuty (2018)found that the prevalence of toddler stunting is significantly correlated with mother's employment status, types of residence, sanitation, and level of household wealth.

Although there are already previous studies that describe the determinants of stunting prevalence among toddlers, but there are remain inconsistencies in the significance level of the variables among different samples. The used of sample from IFLS 5 by Indrastuty (2018) also cannot fully describe the real parameter of stunting determinants in Indonesia because the contrasting characteristics between household in Eastern area and Western are of Indonesia where household from Eastern Indonesia are less prosperous compared to the Western Indonesia. Therefore, the study aims to find out the determinants and solutions related to stunting prevalence in children aged 0-59 month in Eastern Indonesia. We hope that this study could contribute in related literature, building awareness of all groups of people about the seriousness of stunting problem in Eastern Indonesia, and we also hope that this study can be used as a basis for government

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consideration in conducting policies in the future.

METHODOLOGY

Data that has been used in this study is collected from Indonesian Family Life Survey (IFLS) East 2012. IFLS East is a large scale multi-topic household and community survey living conditions in eastern provinces in Indonesia that conducted by Survey Meter on behalf of The National Team for the Acceleration of Poverty Reduction (TNP2K), Poverty Reduction Support Facility (PRSF), and Australian Aid (AusAID) in 2012. IFLS East questionnaire originated from the 4 waves prior survey IFLS that already done by RAND Corporation in 1993, 1997/1998, 2007, and 2010.

IFLS East covers approximately 10,000 individuals who are members of 2,500 households that spreads over 7 provinces in eastern Indonesia, namely: East Nusa Tenggara, East Kalimantan, Southeast Sulawesi, Maluku, North Maluku, West Papua, and Papua. As well as the general IFLS, IFLS East covers household and community level survey. Information contained in household data includes: household expenditure; asset; income; employment and retirement experience; transfers of money, goods, and time between generations; individual health; utilization of health services; living innovation settings in cognitive, health, and subjective well-being. For the communities and facilities survey contained characteristics information of 99 villages include history, economic infrastructure, community infrastructure and facility components such as visit to health services and school to gathering data about the quality, availability, and cost to utilize the facilities.

Sample that has been used in this study is 1,093 children aged 0-59 month taken from IFLS East in 2012. To answer the research question that arise, specifically to find risk factors or determinant that affect children who live in eastern Indonesia to become stunted. Stunting variable generated by converting height and weight data of the children into z-scores and then comparing it to the reference child data from WHO. A child defined as stunted if the height-for-age score is lower than 2 standard deviations of WHO Child Growth Standards Media. Other than that, we used several individual and household data as the independent variables including gender, birth order, paternal and maternal education, Mother's Body Mass Index (BMI), type of location of residence, and household wealth index that generated from assets ownership using Principal Component Analysis (PCA).

This study used the modified model from previous studies done by Chirande (2015), Indrastuty (2018) and Mostafa Kamal (2011) that is using individual level and household level characteristics as the independents variables and stunting variable as the dependents, which in econometrics model can be written as:

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$$stunting_i = \beta_0 + \beta_1 birthOrder_i + \beta_2 fatherEduc_i + \beta_3 motherBMI_i + \beta_4 motherEduc_i + \beta_5 male_i + \beta_6 urban_i + \beta_7 ImprovedSanitation_i + \beta_8 WealthIndex_i + u_i$$

Where $stunting_i$ is the dummy variable for stunting (1=stunted; 0=no), $birthOrder_i$ is the variable for the birth order of child i, $fatherEduc_i$ and $motherEduc_i$ is a variable for parental education of a child i where 1 is primary school, 2 is junior high school, 3 is senior high school and 4 is higher education. $motherBMI_i$ is a variable that classified the BMI mother of child i. $male_i$ is the dummy variable for child's gender. $urban_i$ is the dummy variable for living in urban area. $ImprovedSanitation_i$ is the dummy variable for good quality of sanitation. And $WealthIndex_i$ is the variable for relative wealth index where 1st quintile is the poorest and 5th quintile is the richest.

Analysis technique that we used to answer the research question is Logistic Regression with Maximum Likelihood Estimator. Logistic regression model is one of the model that can be used to predict the probability of a dichotomous event or binary dependent variable.[15] This model is chosen because our dependent variable is dichotomous (1=stunted, 0=not stunted) and give better result than the Ordinary Least Square (OLS) method. Software used to analyze the dataset is STATA 14.

RESULT

In this section, we will discuss about the distribution of the data and as well as the proportion of occurrence of toddler stunting and individual, parents, and household characteristics variable. Table 1 shows there are 377 (34.49%) from the total sample of 1,093 children aged 0-59 month that are stunted. The samples used include 517 females (47.3) and 576 males (52.69%) children aged 0-59 month who lived in eastern Indonesia.

Most children aged 0-59 months who lived in eastern Indonesia have mothers with primary school as their highest education level, specifically 408 children. And in total, 50% of them did not take high school education or higher. For the father's education, we can see that most children have fathers with senior high school as their highest education level, specifically there are 371 people (33.94%). Although, on average the level education between the mothers and the fathers are not quite different, but it is indicating that male tend to have higher education than the females (gender inequality in education exists).

From the summary statistics of the sample, the mothers, on average, have Body Mass Index (BMI) of the third category, which is around 18.5-25 or normal. Nevertheless, there are still children who have mothers that

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classified as overweight (35.22%), and also the one who classified as underweight (10.34%). For the sanitation quality, we can see that most of the sample, specifically 656 children (60.02%) lived in the household with poor quality or unimproved sanitation.

To seek deeper information and understanding from the sample we have, cross tabulation analysis is conducted between the stunting dummy variable and other variable that seen in Table 2. From parents' characteristics, it is seen that children who were stunted tended to be born from parents with low level of education. This can be seen in Table 2 that a toddler who has a father with only primary education and no schooling has a higher prevalence of stunting (46.91% and 59.37%% respectively) compared to higher education group (20.52%). Furthermore, children who lived in low-income families (1st & 2nd quintile) also tend to have a higher prevalence of stunting compared to families with higher income. Stunting also tends to occur in children born with a mother who is also malnourished; this can be seen from the high prevalence rate that is 59.37% and 46.91% in the group of mothers with a BMI classified as lacking in nutrition.

Using individual level characteristics, we can see in Table 2 that although the differences are not too significant, the higher the order of child births, the higher the stunting prevalence rate. Viewed from household or community level characteristics, the prevalence of stunting is tending to be higher in household with poor sanitation quality, compared to household with good sanitation quality (38.87% and 27.91%). Stunting also tends to occur with a child who lives in rural are (39.03%) compared to one who lives in urban are (22.97%)

From the results of logistic regression and divided into 4 models to test the consistency of the model, it is found that birth order, father's education. Mother's BMI level, location of residence, sanitation quality with a certain level of significance affect the probability of a child aged 0-59 months in eastern Indonesia to be stunted. Econometrics analysis is carried out by discussing the results of logistic regression and interpretations calculated from looking at the marginal effects of the regression.

For individual level characteristics, the results of the calculation of the marginal effect in Table 3 above show that with a 10% significance level, the probability of a 4th child to be stunted is 10.3 percentage points greater than the child who was born first. Although only the 4th child item is significant and only in the first model, we can see that the larger order of children tends to increase the likelihood of the children being stunted. Researchers did not find any significant effect from the child's gender variable.

For parental level characteristics, it is found that parental education, especially father's education is significantly affected whether a child would be stunted or not. With 10% significance level, children who have a father with a junior high school education have 18.1 percentage points lower probability of

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being stunted than those whose father is not in school. This shows that the higher the level of parental education, the lower the probability to become stunting. Researchers found that mother's education did not have a significant effect. In addition, children born to a mother with normal BMI (18.5-25) and over nutrition (>25) have a lower probability to become stunted at 18.4 and 24.9 percentage points respectively compared to those born from mothers with malnutrition. Children who are in families with higher income (5th quintile) also have a lower probability of 12 percentage points to be stunted compared to children who lived in low income families (1st quintile).

For household and community level characteristics, it is found that children who were in household with good sanitation quality had a 5.52 percentage points lower probability to become stunted compared to children who lived with poor sanitation quality. Children who live in urban areas also have 14.2 percentage points lower probability to become stunted than those who live in rural areas.

DISCUSSION

The results from logistic regression that already shown in previous sections show that birth order is one of the important variables to explain the causes of stunting, which children who born with higher order (3 and 4) are more likely to experience stunting compared to lower order. This is in accordance with Rahman (2016) which says that this can occur because children who are later born tend to be unwanted children compared to the beginning, so that they get lower intake and check-ups both prenatal and post-natal. In addition, when there are more children, the allocation of resources in the form of money or food will be less for each child. The challenge in overcome this is due to the high birth rate, according to the data from BPS[17] that many of the provinces in eastern Indonesia have high population growth above the national average.

Parental education is also an important factor in influencing the probability that a child will experience stunting. This can be explained because the more education parents, their literacy will also become better regarding nutrition problems and children's needs, thereby reducing the possibility for children to be stunted. Even though the results of the analysis is only significant from father's education variable, while maternal education is not. This is the same as the results found in Indrastuty (2018) and also other studies, this is because the level of mother's education is an indirect factor that affects stunting (Rukmana, Briawan, & Ekayanti, 2016). Another thing that can explain is because the education of a woman (in this case a mother) in eastern Indonesia is not very significant, in other words there is a gender inequality in access to education in eastern Indonesia (Bappenas, 2012).

Most of the stunting cases that occur are associated with poor maternal nutrition, this is consistent with the result of the logistic regression and also in line with previous studies (Chirande et al., 2015; Mostafa Kamal, 2011). Nutrition is very important for children,

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even from before the birth so that the condition of a mothers with poor nutrition (lower BMI) can increase the probability of stunting (CNN Indonesia, 2019). This problem is even worse in eastern Indonesia where in recent years problems related to malnutrition are centered in eastern provinces (Purnamasari, 2018). Of course, this is also related to level of income, where families with high income levels will get better access to health facilities and nutrition so as to avoid stunting.

The quality of sanitation or human waste disposal facilities has a significant relationship that affects the probability of the occurrence of stunting in children. Children who live in households with poor quality and unprotected sanitation have higher probability to become stunted. This is also consistent with Torlesse et all (2016) that in addition to lack of nutrition, stunting can also be caused by the absence of clean water or poor sanitation quality so that there is no absorption of nutrients in digestion.

Through the analysis above, it can be inferred that there should be effort to reduce the prevalence of stunting, especially in eastern Indonesia. Policy suggestions that can be done are 1) improving socialization related to the Family Planning (KB) program in eastern Indonesia, given the high rate of population growth and also association between birth order and stunting; 2) Increasing access to education in eastern Indonesia, based on the analysis, only a small proportion of the population can go to a higher level of education, this is very important considering the relationship between parental education and stunting, Not only access to education, equality and opportunities for women also need to be considered; 3) Improving the quality of sanitation in eastern Indonesia; 4) Providing assistance programs in the form of funds or nutritional intake subsidies for pregnant women in eastern Indonesia given the importance of nutrition to prevent stunting even before the child is born.

CONCLUSION

Stunting is a serious problem in various countries, especially in developing countries. In addition to health problems that occur, on a macro scale, stunting results in a decrease in national economic productivity so that it will be below its potential. Indonesia, as one of developing country is classified by WHO as a country with poor nutrition is very concerned and intends to reduce the prevalence rate of stunting. Most of the stunting cases in Indonesia are dominated in eastern Indonesia. Although there have been several studies that have tried to look at the factors that cause stunting in Indonesia, no one has ever used a sample specifically from eastern region. This study aims to find out the determinants and solutions related to stunting problems of children age 0-59 months taken from Indonesian Family Life Survey (IFLS) East 2012. The method used in this paper is logistic regression to see how socio-economic factors and household characteristics influence stunting variable that is a dummy.

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It is found that birth order, father's education, level of mother's BMI, types of residence; sanitation quality and relative wealth index are significantly correlated with the probability of children to become stunted in eastern Indonesia. Solution that can be done to reduce the prevalence of stunting are 1) Improving socialization about Family Planning (KB) program; 2) increasing the access to education and gender equality; 3) increasing the quality of sanitation; 4) Providing assistance programs in the form of funds or nutritional intake subsidies for pregnant women in eastern Indonesia.

Although there are still shortcomings and also opportunities of further research that can be done, we hope that this paper can be useful and used by the government as a basis for making policies in the future.

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Tabel 1. Summary Statistics of Variables

VARIABLE	n	Percentage	Mean	SD	Min	Max
Stunting			0.345	0.476	0	1
Stunted children	377	34.39%				
Children who are not stunted	716	65.5%				
Birth Order			2.942	1.518	1	5
1st Child	257	23.51%				
2nd Child	237	21.68%				
3rd Child	195	17.84%				
4th Child	120	10.97%				
5th Child or more	284	25.98%				
Father's Education			2.257	1.116	0	4
No schooling (reference)	33	3.01%				
Primary school	326	29.8%				
Junior high school	212	19.39%				
Senior high school	371	33.94%				
Higher education	151	13.81%				
Mother's BMI			3.219	0.704	1	4
< 17 (reference)	32	2.92%				
≥ 17 & < 18,5	81	7.41%				
≥ 18,5 & < 25	595	54.53%				
≥ 25	385	35.22%				
Mother's Education			2.048	1.150	0	4
No schooling (reference)	54	4.94%				
Primary school	408	37.32%				
Junior high school	190	17.38%				
Senior high school	313	28.63%				
Higher education	128	11.71%				
Child's Gender			0.526	0.499	0	1
Female (reference)	517	47.3%				
Male	576	52.69%				
Type of Residence			0.282	0.45	0	1
Rural (reference)	784	71.72%				
Urban	309	28.27%				
Sanitation Quality			0.399	0.49	0	1
Unimproved/poor sanitation (reference)	656	60.01%				
Improved sanitation	437	39.98%				
Relative Wealth Index			2.994	1.447	1	5
1st Quintile (poorest) (reference)	230	21.04%				
2nd Quintile	220	20.12%				
3rd Quintile	206	18.84%				
4th Quintile	200	18.30%				
5th Quintile (richest)	237	21.68%				

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Table 2. Cross-Tabulation Analysis

VARIABLE	Children aged 0-59 months			
	Stunted		Not Stunted	
	n	%	n	%
Birth Order				
1st child (reference)	85	33.07	172	66.92
2nd child	82	34.59	155	65.4
3rd child	63	32.30	132	67.6
4th child	52	43.33	68	56.66
5th or more child	95	33.45	189	66.54
Father's Education				
No schooling (reference)	18	54.54	15	45.45
Primary school	143	43.86	183	56.13
Junior high school	67	31.6	145	68.39
Senior high school	118	31.8	253	69.19
Higher education	31	20.52	120	79.47
Mother's BMI				
< 17 (reference)	19	59.37	13	40.62
≥ 17 & < 18,5	38	46.91	43	53.08
≥ 18,5 & < 25	216	36.3	379	63.69
≥ 25	104	27.01	281	72.98
Mother's Education				
No schooling (reference)	24	44.44	30	55.55
Primary school	168	41.1	240	58.88
Junior high school	73	38.42	117	61.5
Senior high school	91	29.07	222	70.92
Higher education	21	16.4	107	83.59
Child's Gender				
Female (reference)	176	34.04	341	65.95
Male	201	34.89	375	65.1
Type of residence				
Rural (reference)	306	39.03	478	60,96
Urban	71	22.97	238	77.02
Sanitation quality				
Unimproved sanitation (reference)	255	38.87	401	61.12
Improved Sanitation	122	27.91	315	72.08
Relative Wealth Index				
1st quintile (reference)	93	40.43	137	59.56
2nd quintile	99	45	121	55
3rd quintile	74	35.92	132	64.07
4th quintile	71	35.5	129	64.5
5th quintile	40	16.87	197	83.1

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Table 3. Marginal effect of logistic regression model

VARIABLE	Model 1	Model 2	Model 3	Model 4
Birth Order				
2nd child	0.0304	0.0152		
	(0.0421)	(0.0426)		
3rd child	-0.0133	-0.00742		
	(0.0445)	(0.0446)		
4th child	0.0838	0.103*		
	(0.0524)	(0.0540)		
5th or more child	-0.0348	0.00390		
	(0.0411)	(0.0406)		
Father's Education				
Primary school	-0.0847		-0.0745	
	(0.0891)		(0.0905)	
Junior high school	-0.181**		-0.167*	
	(0.0917)		(0.0931)	
Senior high school	-0.120		-0.105	
	(0.0928)		(0.0941)	
Higher education	-0.174*		-0.161	
	(0.102)		(0.103)	
Mother's BMI				
≥ 17 & < 18,5	-0.114		-0.111	
	(0.105)		(0.106)	
≥ 18.5 & < 25	-0.184*		-0.179*	
	(0.0949)		(0.0947)	
≥25	-0.249***		-0.250***	
	(0.0966)		(0.0962)	
Mother's Education				
Primary school	0.0112		0.0169	
	(0.0652)		(0.0649)	
Junior high school	0.0261		0.0382	
	(0.0721)		(0.0713)	
Senior high school	-0.0458		-0.0407	
	(0.0737)		(0.0721)	
Higher education	-0.125		-0.116	
	(0.0845)		(0.0831)	
Child's Gender	0.0128	0.00837		
	(0.0278)	(0.0288)		
Types of residence	-0.0582			-0.142***
	(0.0399)			(0.0369)
Sanitation Quality	0.0336			-0.0552*
	(0.0351)			(0.0328)
Relative Wealth Index				
2nd quintile	0.0692		0.0751*	
	(0.0446)		(0.0444)	
3rd quintile	0.00101		0.00393	
	(0.0448)		(0.0444)	
4th quintile	0.0413		0.0400	
	(0.0500)		(0.0484)	
5th quintile	-0.120**		-0.125***	
	(0.0535)		(0.0472)	
Observations	1,093	1,093	1,093	1,093