**Sustainable Organic Agriculture: Opportunity for Thai-Rural Farmer Development**

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**Abstract**

This paper analyzed an opportunity of rural farmers in north of Thailand by interviewing 124 households which were 59 families from Tumbon-Santa Aumpor- Narnoi Nan province, 23 families from Tumbon-Banlao Aumpor-Mayjai Prayao Province, 22 families from Tumbon-Sritoi Aumpor-Mayjai Prayao Province, and 20 families from Tumbon-Parfak Aumpor-Mayjai Prayao Province during January 2012 – October 2012. Probit model was developed to answer some factors that impacted farm’s income. The results showed that the relationships between both organic and inorganic land and income level are positive. Most of the farmers were willing to change from conventional agricultures to organic agriculture but they did not have enough information and extension from government and private sectors. Comparing benefits and cost between conventional and organic agriculture found that organic agricultures provided better price and farmers will have better quality of live. Systems of knowledge and policies need to be developed and apply for peasants and farmers in north rural area in Thailand.

**Q13,** Conventional Agriculture, Organic Agriculture, Probit Model, Peasant, Farmer, Benefits and Costs, Policy, Extension

**Introduction**

Farmers’ incomes depend upon agricultural profits including costs of production also social quality. Various factors such as conventional land, organic land, organic productions, conventional productions, marketing, education, and age impact both life quantities and qualities in agricultural communities. Probit model predicts relationship between income by independent variables such as gender, age, family member, education level, inorganic area, organic area, and cost of production.

Supply chains of agricultural products are lost value between producers to consumers. Consumers usually spend high price of the products to exchange high quality of products. But the benefits from high agricultural prices do not for peasants directly. Organic agriculture is an example of high quality and high price products, which is possible for peasant to gain benefits, rising quality of life, and communities development. Reality, value of agricultural products has been lost during the supply chain among producers, middle markets, and consumers. In present, industrial agriculture is influence small agricultural communities. Peasants’ communities need to find the better ways to survive from these problems. Many economists, scientists, sociologist and others involved agriculture raise lots of questions who should receive benefits either peasants’ communities or large industries.

Price transmission is analyzed; values of product have been lost during harvesting, logistics, and marketing. Famous brands always take opportunity to get into the market easier than peasant and farmers’ products as we usually found as conventional agriculture products. In the present, organic products become high demand in the domestic and international markets Organic farmers’ group has been established and have power in the markets. This helps losing value of agricultural supply chain in the farms.

Mostly, organic peasants are small size and poor. Profits are revenue less costs are small positive, minus. Most peasants usually invest money from legal and illegal sources. The systems become cycle. Peasants could not pay investment, which make profits less and less also life quality become trouble. Productions of premium products are introduced into a premium agricultural market.

Peasants are expected become wealthy farmers who become leader in agribusiness and agro agriculture in near future. Government encourages peasants’ communities to do organic agriculture. Huge provinces have begun the new agricultural revolution. Actually, organic agriculture does not a new system; it has been with Thai-agricultural for a long time until industrialization. Chemical inspire peasants also farmers to increase productions. Organic agriculture disappeared.

Not only peasants become poor because of increasing production of costs as agricultural food become unhealthy. According to the event, increasing consumers prefer safety food while a global is industrialized. These consumers have changed eating behavior to non-poison food products. Safety food standards have been issue, governments began extension about non-poison agriculture and healthy food around countries.

Nan and Prayao are two provinces in the north, which more than eighty percent of populations are peasants and farmers. Agricultures grow on the hill. Organic agriculture, which help them survive in some season. Comparing organic agriculture and conventional agriculture, these provinces do not success in many factors. This research has collected agriculture in one Aumpor of Nan and three Aumpor in Prayao to investigate problems and better ways to solve and improve peasants’ communities in these areas.

**Literature Review**

Conventional agriculture and organic agriculture become an issue in term of sustainability. Sustainable agriculture defines as peasants have acceptable life quality, including economics, education, health, and society. The study of Goldberger (2011) showed conventional agriculture in Washington state during October – December 2007 were increasing economic status, in the opposite, social and environmental were destroyed (Goldberger, 2011). It appeared to be industrialized communities influence farmers changed their life styles while organic farmers appeared in small rural agriculture then communities based on agriculture had social activities together.

Demands for organic products were increasing in the market influence health concern from medium and high income communities. These groups of people are willing to pay more for quality products. Sustainable agriculture is based on health concerned products can survive in the market.

Next, quantity comparing between conventional and organic products, Ponti, 2012, showed that conventional agricultures provided higher yield than organic products. Production and processing are different; there is some gap between these productions (Ponti, 2012). Ponti, 2012, used meta-analysis to analyze the different crop yield between organic agriculture and conventional agriculture. More eighty percentages of organic productions were over than conventional agriculture, which were soybean, rice, and corn in several regions. Asia and central Europe had higher organic productions than conventional productions because of available manure and legumes in farm systems.

Not only, organic agriculture systems but also a market demand was an important indicator, Market mechanism predicted how sustainability of organic agriculture. Demand for organic food in the U.S.A, Europe, and others have been increased. Market share of these products including baby foods, dairy products, meats are expanding in every regions. A study of Thompson, 1998 said socioeconomics’ factors such as education, income, and age were indicator consumers’ purchasing attitudes and habit. Also, store promotions encourage consumers’ willingness to pay.

Also, Roitner-Schobesberger, 2008 and Darnhofer et al, 2008 found that most of consumers in Thailand purchased vegetables and fruits based on their expected quality. The studied collected data by interviewed 848 respondents’ consumers in older, higher education, and higher income prefer buying healthy food, either label said ‘organic vegetables’ or ‘pesticide safe’ were indifferent in their opinion in five supermarkets at the outskirts of Bangkok.

The study found that there were less than fifty percentages from 172 sample vegetable organic farms in Mahasarakham province, Thailand. Private sector such as NGOs and GOs encouraged lady leaders began to do agriculture without chemical pesticide and herbicide.

Organic promotions were supported organic policy, which has been began since 8th National Economics and Social Development plan 1997-2001 and has continued to 11th National Economics and Social Development plan 2013-2018 to reduce harmful pesticide and herbicide and improved health and environment in farm.

Also, the study of Kasem and Thapa, 2010 found that organic fertilizer had changed soil structure having plenty of nature nutrition in Nakornphatom province, Thailand. The research was investigated both mono cropping and system cropping.

Rising income for organic farmers was a major outcome, which has brought good quality of life in China and Brazil (Oelof, 2010). Perceptions of healthy productions have been increasing a global market. Farmers’ communities jointed together also can negotiate in the market.

Environmental issue and sustainable agriculture was close, Webster, 1997 studied several factors, including farm levels, regions, and managements. Profits and revenue impacted sustainable farms in Europe. Also, advantages of organic land usage were investigated. Financial decision was an important factor for sustainable organic agriculture (Casado, G, 2009; Pacini, 2001; Binder, 2010).

**Methodology**

This study was tested different costs between conventional and organic agriculture productions by comparing costs of production mean also income mean. The levels of satisfaction of farmers received organic agriculture information by several sources were comparing mean: lowest low medium high highest. Logistics and markets satisfactions between conventional and organic products were measured by comparing percentage mean. Probit model was used to measure an opportunity of increasing income by gender, age, family member, education level, inorganic area, organic area, and cost of production.

Two econometric models usually use discrete choice variables are the Probit model and the Logit model. The Probit model is based on standard normal distribution and the Logit is based on cumulative or logistic distribution (Greene, 2003). This study used the Probit model to estimate because the data is normal distribution. Probit model was used in this study; the model was a discrete response model. The estimation of the benefits from organic farmers to the communities by socio characteristics These explain the estimation of the peasant income relate to socio characteristics such as education organic farmer and costs of production This estimation presents expected signs of estimation equation, which also explains expected signs of the independent variables, which are impacted by the dependent variables.

Probit model is used for stochastic choice. Probit model is a good model for estimating ordinal number in that the responses cannot count as values and is frequently found in sociological surveys (Poirier, 1978; Winship, Mare, 1984). The Probit model has a normal distribution. The answers analyze qualitative responses from different types of choices, which consists binary response and multivariate response. Random effects are consistent for the Probit model, and the estimation for pooled data is consistent (Maddala, 1987). The probability of Probit model remains in [0,1]interval. A maximum likelihood method is used as the better estimation (Winship; Mare, 1984).

Probit model was analyzed variables that influence farmers moving from conventional and organic agriculture. The equation follow;

$$Y= β\_{0}+β\_{1}X\_{1}+ β\_{2}X\_{2}+…+β\_{n}X\_{n}$$

where,

$$Y= Income level$$

$$β\_{0}=Constant$$

$$β\_{i,…,n }= Coefficient of variables, i = 1,…, n $$

$$X\_{i,…,n }= Dependent variables, i = 1,…, n $$

There variables are gender, age, family member, education level, inorganic area, organic area, and cost of production

The estimated model is;

$$INCOMEIL= β\_{0}+β\_{1}GEN+ β\_{2}AGE+β\_{3}MEM+β\_{4}EDU+β\_{5}INORG+β\_{6}ORG+β\_{7}COST$$

where,

$$β\_{i,…,n }= Coefficient of variables, i = 1,…, n $$

$$X\_{i,…,n }= Dependent variables, $$

$$i =GEN, AGE, MEM, EDU, INORG, ORG, COST $$

These variables are INCOMEIL = Income level, GEN = gender, AGE = age, MEM = family member, EDU = education level, INORG = inorganic area, ORG = organic area, COST = cost of production

**Data**

This study collected information by interview 124 families, which were 59 families from Tumbon-Santa Aumpor- Narnoi Nan province, 23 families from Tumbon-Banlao Aumpor-Mayjai Prayao Province, 22 families from Tumbon-Sritoi Aumpor-Mayjai Prayao Province, and 20 families from Tumbon-Parfak Aumpor-Mayjai Prayao Province during January 2012 – October 2012. Other information were retrieved from the Department of Internal Trade, Ministry of Commerce, Costume department, Ministry of finance, the office of agricultural economics, Ministry of Agricultural and Cooperative, Thailand. Also, Greenet and Talaadthai information were used.

**Results**

The Probit model was used to estimate the parameters that influence income levels of surveys areas. Table 1 explained descriptive statistic of variables, which were age family member, education, organic area, inorganic area, and costs of productions.

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| **Table 1:** Descriptive statistic of variables |
| **Variables** | **Means** | **Maximum** |
| Age | 4.21 | 7 |
| Family Member | 4.94 | 12 |
| Education | 2.84 | 6 |
| Organic Area | 3.084 | 30 |
| Inorganic Area | 10.454 | 45 |
| Cost of Production | 44,929 | 1,440,000 |
| **Source:** Estimated from a Probit model, data from survey of Tumbon-Santa Aumpor- Narnoi Nan province, Tumbon-Banlao Aumpor-Mayjai Prayao Province, Tumbon-Sritoi Aumpor-Mayjai Prayao Province, and Tumbon-Parfak Aumpor-Mayjai Prayao Province, Thailand, January 2012 – October 2012. |

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| **Table 2:** Price of Organic and Conventional Agricultural Products |
| **Products** | **Price (Baht)** |
|  | **Organic** | **Conventional** |
| Hom Mali Rice | 68 | 35.5 |
| Brown Hom Mali rice | 57 | 29.6 |
| Homnil Rice  | 75 | 70 |
| Red Brown Hom Mali Rice | 75 | 30 |
| Soybean | 42 | 30 |
| **Source**: Greennet. (2013, October). Greennet Products. Retrieved from <http://www.greennet.or.th/product/rice>; Talaadthai . (2013, October). Price of Rice. Retrieved from <http://www.talaadthai.com/price/default.php?gettid=18&maxdate>= |

Table 2 shows price of different types of rice, which have been the most export value of Thailand. Also, soybean is an important of food ingredient. This showed that organic products had price higher than normal products. The more farmers received information, the more value added in the products, this was a good solution for farmers to survival in agriculture community.

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| **Table 3:** The Probability of levels of income estimated by Probit Model |
| **Parameter** | **Estimate** | **Standard Error** | **Pr > ChiSq** |
| Intercept | -0.3913 | 1.5983 | 0.8066 |
| GEN | 0.4969\*\*\* | 0.4003 | 0.2145 |
| AGE | -0.0118 | 0.2428 | 0.9612 |
| MEM | -0.1042\*\* | 0.1116 | 0.3505 |
| EDU | -0.0240 | 0.1965 | 0.9028 |
| INORG | 0.0204\* | 0.0284 | 0.4716 |
| ORG | 0.0115 | 0.0331 | 0.7278 |
| COST | -0.00001\*\*\* | 0.0000 | 0.1998 |
| \*\*\*Denotes Significance at 0.2 level \*\*Denotes Significance at 0.3 level \*Denotes Significance at 0.5 level |
| **Source:** Estimated from a Probit model, data from survey of Tumbon-Santa Aumpor- Narnoi Nan province, Tumbon-Banlao Aumpor-Mayjai Prayao Province, Tumbon-Sritoi Aumpor-Mayjai Prayao Province, and Tumbon-Parfak Aumpor-Mayjai Prayao Province, Thailand, January 2012 – October 2012. |

According to the regression estimated by Probit Model as shown in table 2 found that gender and inorganic area were positive impact on levels of income at 0.2 and 0.5 significant level, respectively. Opposite, member family and costs of agricultural productions were negative impact on income level at 0.3 and 0.2 significant level, respectively.

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| **Table 4:** Percentage of Received Organic Agriculture Information |
|  | **Percentage of Information** |
| **Level** | **Organic Agriculture Information** | **Organic Agriculture Extension from Government** | **Organic Agriculture extension from Private Sector** | **Organic Agriculture Extension from Internet** | **Organic Products Market Satisfaction** | **Organic Products License Satisfaction** |
| 1 | 7.08 | 18.3 | 40.7\* | 60.5\* | 6.96 | 19.5 |
| 2 | 17.7 | 41.7\* | 21.2 | 20.2 | 34.8 | 30.1 |
| 3 | 55.8\* | 34.8 | 32.7 | 15.8 | 43.5\* | 43.4\* |
| 4 | 19.5 | 5.22 | 5.31 | 3.51 | 14.8 | 7.08 |
| \*Denotes Maximum levels of percentage  |
| **Source:** Estimated from a Probit model, data from survey of Tumbon-Santa Aumpor- Narnoi Nan province, Tumbon-Banlao Aumpor-Mayjai Prayao Province, Tumbon-Sritoi Aumpor-Mayjai Prayao Province, and Tumbon-Parfak Aumpor-Mayjai Prayao Province, Thailand, January 2012 – October 2012. |

Considering this table, farmers receive organic agriculture information in different. The information extensions were provided in different sources. These became serious problems which farmers did not receive organic agriculture information including extensions. The table showed satisfaction scale from farmers who were organic producers, conventional producers, and interested organic producers. Government policy supported organic agriculture but they did not provide sufficient information such as production process, extension, marketing also organic standard license. This agriculture has been developed from small farmers, which increased income and life quality in both Thailand and other countries. Agriculture industries looked forward to opportunity to increase value in agriculture products while policy had less support. Thus, industry agricultures were more power in food and farmer communities.

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| **Table 5:** Comparing between Organic products and Conventional products Information SatisfactionPercentage |
| **Level of satisfaction** | **Percentage of Information** |
| **Productions** | **Logistics** |
|  |  | **Fresh Market** | **Super Market** | **Organic Market** |
| 1 | 6.31 | 13.3 | 58.9\* | 50.5\* |
| 2 | 27.9 | 20.4 | 17.9 | 24.8 |
| 3 | 45.9\* | 38.9\* | 20.5 | 27.6 |
| 4 | 19.8 | 27.4 | 2.68 | 4.76 |
| \*Denotes Maximum levels of percentage |
| **Source:** Estimated from a Probit model, data from survey of Tumbon-Santa Aumpor- Narnoi Nan province, Tumbon-Banlao Aumpor-Mayjai Prayao Province, Tumbon-Sritoi Aumpor-Mayjai Prayao Province, and Tumbon-Parfak Aumpor-Mayjai Prayao Province, Thailand, January 2012 – October 2012. |

Table 5 shows that the farmers satisfy organic products and logistic to a fresh market but they did not impress the products to supermarket and organic market. These results showed that small farmers choose to logistic their products to fresh market or local market instead of distributing to industrial market such as super market and organic market.

Both conventional and organic agriculture has been in monopoly market system, which depended upon major market. Small farmers always had problems with the connection between farms and markets. Most of them distributed their products in local markets with cheap prices. Organic agriculture will be an opportunity to raise cheap products of production to premium price of productions in local market also a major market.

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| **Table 6:** Changing Conventional agriculture to Organic Agriculture Opinion |
| **Decision** | **Percentage of Changing** |
| Change to Organic Agriculture | 28.1 |
| No Change to Organic Agriculture | 17.5 |
| No Decide to Organic Agriculture | 54.4\* |
| \*Denotes Maximum levels of percentage |
| **Source:** Estimated from a Probit model, data from survey of Tumbon-Santa Aumpor- Narnoi Nan province, Tumbon-Banlao Aumpor-Mayjai Prayao Province, Tumbon-Sritoi Aumpor-Mayjai Prayao Province, and Tumbon-Parfak Aumpor-Mayjai Prayao Province, Thailand, January 2012 – October 2012. |

Table 6 showed that more than fifty percentage of population survey did not decide to change from conventional agriculture to organic agriculture. According to the results, we found that information, supporting from other government and private sectors, and market impact the decision.

**Discussion**

A different between organic productions’ cost and conventional productions’ cost shows that farmers who do organic products expect to pay less also they would receive advantages in term of environment, health and society. Thai-Agricultures have opportunity based on natural resources, lands, and other agricultural factors but management system do not supported. Continuous of organic policies are failed, farmers are hardly to adjust themselves. Nowadays, health and environmental concern becomes a major in agricultures. Producers try to change to green agricultures the same time as several safety food policies are encouraged by government academics, and private sector. A problem of process is a connection or a network between farmers, knowledge, and consumers are lost.

Organic markets are expanding in Thailand, Asia, Europe, and U.S.A., Demand of safety foods are increasing. Agricultures in Thailand are a major supply in both conventional products and organic products. As this reason, this should be the first opportunity for Thai –agriculture. Opposite, connections along supply chain of productions are not perfectly filled. Either small peasants or small farmers in long distance province have lost in many steps during the supply chain.

Based on surveys of 124 families which collected 59 families from Tumbon-Santa Aumpor- Narnoi Nan province, 23 families from Tumbon-Banlao Aumpor-Mayjai Prayao Province, 22 families from Tumbon-Sritoi Aumpor-Mayjai Prayao Province, and 20 families from Tumbon-Parfak Aumpor-Mayjai Prayao Province during January 2012 – October 2012, the studies show that more than fifty-five percentage of farms received organic agriculture information, organic products market, and organic products license in high satisfaction, forty-one percentage received organic agriculture extension from government in medium satisfaction but most of them received organic agriculture extension from private sector and from internet. These results indicate that peasants or farmers, who live far from center of province, are hardly to get in the information in different sources. These are challenges for them to become green producers.

Probit Model is used to estimate factors that impact income of farmer in observed area. We found that larger agriculture with chemical or conventional increase income level of farmers. This indicates that farmers are familiar with chemical or conventional agriculture and lacks of organic extension in this area.

Hence, production and logistics systems in different market are fulfilled supply chain of the producers. Satisfied levels of productions and logistic to fresh markets are forty-five in high while logistic to supermarkets and organic markets are low.

According to these surveys, we found that farmers do not have enough information and some resources to change to organic agriculture as shown. About fifty-four percentages of the respondents do not decide to change their farm from conventional to organic agricultures.

Major challenge organic agricultures especially in rural communities are information and extension. Yield and prices of productions in the market are important factors. Thus, government should have serious policies whose farmers have connection and become practical. Process of production will be control in quality of inputs and quality of products. Demand in the market will follow quality. As the results, green agricultures raise quality of rural community and become sustainable agriculture.

**Conclusion**

This study shows that the satisfaction of 124 respondents which were 59 families from Tumbon-Santa Aumpor- Narnoi Nan province, 23 families from Tumbon-Banlao Aumpor-Mayjai Prayao Province, 22 families from Tumbon-Sritoi Aumpor-Mayjai Prayao Province, and 20 families from Tumbon-Parfak Aumpor-Mayjai Prayao Province in receiving green agriculture by using Probit model and average levels of satisfication, This results shows that most of farmers do not have enough information and extension from government and private sectors. It seems that rural area will lost productions’ factors, which fulfill supply chain in production process.

Organic agricultures in Thailand still have opportunity to increase productions also market in domestic and international. Environmental and health concern are increase markets demand. High education and high income requests good quality products. Thus, the better controlled organic products are quality. Once organic agricultures increase economic and quality of small farmers, better Agriculture will be sustainable in Thailand.

**References**

Connor, D. J. (2008). Organic agriculture cannot feed the world. Field Crops Research, 106,

187-190.

Connor D. J. (2013). Organically grown crops do not cropping system make and nor can

organic agriculture nearly feed the world. Field Crops Research, 146, 145-147.

Ellen J. L., Rodolfo, V. C., & Nayga Jr., M. (2011). Consumers’willingness to pay for

organic chicken breast: Evidence from choice experiment. Food Quality and Preference, 22, 603-613.

Gopal B. T., & Rattanasuteeakul K. (2011). Adoption and extent of Organic vegetable

farming in Mahasarakham province, Thailand. Applied Geography, 31, 201-209.

Greene, William H. (2003). Econometric Analysis (3rd ed). New Jersey: Prentice-Hall,

Greennet. (2013, October 16) Greennet Products. Retrieved from <http://www.greennet.or.th/product/rice>

Griffiths, W. E., Hill, R. C., & Judge, G. G. (1993). Learning and Practicing

Econometrics. New Jersey: John Wiley & Sons, Inc..

Hossein, A., Schoonbeek S., & Mahmoudi, H. (2011). Organic agriculture and sustainable

food product system: Main potentials. Agriculture, Ecosystems and Environment 144, 92-94.

Jessica, R. G. (2011). Conventionalization, civic engagement, and the sustainability of

organic agriculture. Journal of Rural Studies, 27,288-296.

Lueg J. E., Ponder, N. Beatty, S. E., & Capella, M. L. (2006). Teenagers’ use of alternative

shopping channels: A Consumer Socialization perspective. Journal of Retailing, 82(2), 137-153.

Maddala, G. S. (1987). Limited Dependent Variable Models Using Panel Data. The

Journal of Human Resources, 22(3), 307-338.

Marvin T. B., Hooker, N. H., Haab,T. C.,& Beaverson, J. (2007). Putting their money where

their mouths are: Consumer willingness to pay for multi-ingredient, processed organic products. Food Policy, 32, 145-159.

Michelsen, J. (2009). The Europeanization of organic agriculture and conflicts over

agricultural policy. Food policy, 34, 252-257.

Meike J., U. Hamm. (2012). Product labeling in the market for organic food: consumer

preferences and willingness to pay for different organic certification logos. Food quality and preference, 25, 9-22.

Myles O., Hohh-jensen, H., & Abeu, L. S. (2010): “Certified organic agriculture in China

and Brazil: Market accessibility and outcomes following adoption.” Ecological

Economics, 69, 1785-1793.

Office of the National Economic and Social Development Board. (1997). National Economic

and Social Development Plan 1997-2001.

Office of the National Economic and Social Development Board. (2013). National Economic

and Social Development Plan 2013-2018.

Ponti T., Rijk, B., Ittersum, M. K. (2012). The crop yield gap between organic and

conventional agriculture agricultural Systems, 108, 1-9.

Poirier, D. J. (1978). A Curious Relationship between Probit and Logit Models. Southern

Economic Journal, 44(3), 640-641.

Rattanasuteerakul, K., Gopal, B. T. (2012). Status and financial performance of organic

vegetable farming in northeast Thailand. Land Use Policy, 29, 456-463.

Roitner-Schobesberger, B., Darnhofer, I., Somsook, S., & Vogl, C. R. (2008). Consumer

perceptions of organic foods in Bangkok, Thailand. Food Policy, 33, 112-121.

Sukallaya, K., & Gopal, B. T. (2011). Crop diversification in Thailand: status, determinants,

and effects on income ad use of inputs. Land Use Policy. 28, 618-628.

Talaadthai . (2013, October). Price of Rice. Retrieved from <http://www.talaadthai.com/price/default.php?gettid=18&maxdate>=

Tranter, R.B., Bennett, R., Costa, M. L., & Cowan, C. (2009). Consumers’ willingness to pay

for organic conversion grade food: Evidence from five EU countries. Food Policy. 34, 287-294.

Winship, C., & Mare, R. D. (1984). Regression Models with Ordinal Variables. American

Sociological Review, 49(4), 512-525.