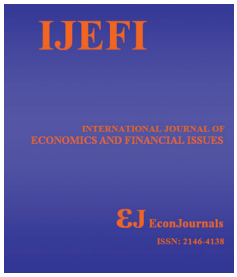

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How does the Increase in Electricity Price Change Behavior of Households in Craft Production? A Case Study in Craft Villages, BAC Ninh Province Vietnam

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ABSTRACT

The findings of the research on 120 production households in craft villages show that steel producers are more affected by electricity price increase rather than woodcarving one. This is because steel households use more high power machines which make electricity cost is approximate 25 times higher than that cost of woodcarving housholds and is accounted for 5% of total production cost. When electricity price increasing, craft households choose three main solutions to adapt including: Invest in new machines using less electricity power; change to produce in mid-night when electricity price is low; and move to make products which spend less electricity power. Base on auto regressive integrate moving average (ARIMA) (3,1,1) and ARIMA (1,1,4) models, the forecast for electricity demand of craft households in short term identify that if electricity price increases 7.5%, profit of steel households will decrease over 3 millions dong per month whereas profit of wood households is not significantly dropped.

Keywords: Electricity Price, Craft Production Household, Auto Regressive Integrate Moving Average Model
JEL Classifications: O1, O2, C5

1. INTRODUCTION

Using electricity is an indispensable demand in life, production and business. Electricity is energy for economic development. Electricity demand in the modern society keeps increasing, especially in production and business activities. Production is very hard to be performed without electricity. The more developed enterprises, the higher electricity consumption they have. However, in Vietnam electricity is a sort of "monopolistic product" that leads to usual price increases. In March 2015, because electricity price increased 7.5% (average price of 1,622.05 vnd/kWh), input cost raise up considerably in production enterprises, especially fields highly consuming electricity such as steel and cement productions (Tran, 2015). In steel production, for example, increased electricity price causes risk of crash to many enterprises. Full cycle to produce 1 tone of steel requires average 700 kWh of electricity. According to steel producers, 7.5% increase of electricity price makes about 80,000 Vietnam dong addition to production cost of 1 tone of steel. Therefore, with new electricity price, a medium size steel enterprise has to spend 1.2–1.3 billions of Vietnam dong per month for electricity. Therefore, the enterprises must increase their output prices to avoid loss (Le Thanh et al., 2015).

Even though electricity is a vital input factor for production, researchers up to now just mainly concentrate to study its impact in macroscopic scale such as: (1) A study of determing the impacts of increasing electricity price on citizen lives and its influences on the entire Vietnam economy (Nguyen et al., 2008); (2) a study of analyzing the impacts of increasing electricity price on the entire South Africa economy in which it was indicated that 60% increase of electricity price will increase 2.1% of CPI and reduce 0.9% of GDP (Miriam, 2009). In micorcosmic scale, a study in South Africa about the impacts of increasing electricity price on mining production showed that surface coal mining suffers less because it mainly uses diesel, while deep mining such as gold and diamond exploitations suffer more because they mainly use electricity that leads to higer production cost and lower competition ability (Global Green Growth Institute, 2014). Hence, it can be observed that determining the

impacts of increasing electricity price on production in Vietnam craft villages has not been cared by researchers.

Tu Son is a district of Bac Ninh Province, Northern Vietnam which has diversified craft production that occupies 70% of total industrial production value of the locale (Bac Ninh Department of Statistic, 2015). From early 2015, production in Tu Son craft villages especially steel and art woodcarving was down in comparing to earlier years. Some producers' stores are still full of unsold products with values of billions of Vietnam dong. In steel producing villages, the amount of unsold goods increases because of raised up input cost, especially electricity cost that lowers salability and causes losses to enterprises. Since the last increase of electricity price (2015), several enterprises have changed their working time to night time, equipped electricity-saving apparatuses, changed production types and reduced production sizes in order to lower production costs and maintain their incomes. Therefore, a study to find out "how does the increase in electricity price change behaviour of households in craft production" is necessary to evaluate the impacts of increasing electricity price on craft production activities in the locale.

The purpose of the study is to find out behaviors of craft production households against the fluctuation of electricity price, and to predict their electricity using demands. Based on that, some recommendations can be proposed to minimize the impacts of increasing electricity price on craft production in the studied area.

2. LITERATURE REVIEW

Vietnam is a low-income country with more than 80% of its population living in rural areas (Haughton, 2000). As a result, the history of Vietnamese national development is closely connected with the development of villages and craft villages that are typical of the social, economic, and cultural tradition of Vietnamese rural areas (Phuong, 2001). The industrialization of rural areas in Vietnam combined with the development of craft villages has made significant contributions to economic development and to changes in the national economic structure. The most important contribution is their role in increasing local income while providing employment to residents of neighboring villages (Digregorio, 1999). The Vietnamese government sees craft villages as an important rural development option and officially recognizes this in its socioeconomic development plan until 2010 (Phuong, 2001). The new conditions of the market economy have allowed many craft villages to develop and form clusters of industrial craft villages with a certain level of specialization and mechanization (Nguyen et al., 2004). This mechanization leads to the dependence of craft production households on electricity price. However, electricity is high monopoly sector and state ownership, so that each time the price increase has impacted on the production of craft households (Figure 1).

In supply side, electricity in Vietnam is distributed by Vietnam Electricity Corporation (EVN). In terms of structure, EVN consists of many small companies which have agencies in all 63 provinces and cities of the country. These agencies take responsibility to sell electricity to consumers. Consumers can be households or producers, they will pay progressive prices based on the amount of electricity used. Therefore, craft households who are considered as small producers and strongly affected by inputs' price will have to adapt to the increase of electricity price (Nguyen et al., 2008).

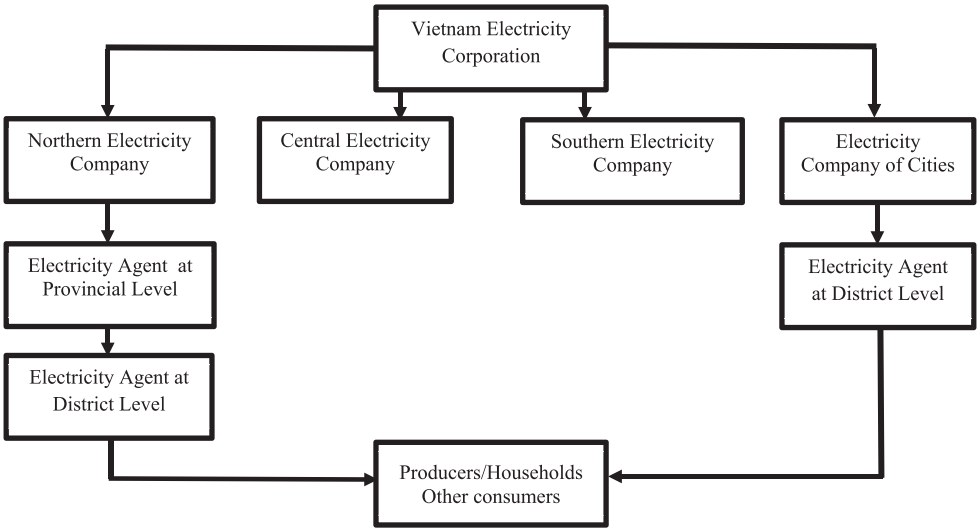
According to Sri (2014), craft household decision-making process in allocating input resource is influenced by factors including the level of wages, prices of their products on the market, type of work, technological and social structure. These factors may affect the type of production activity other than to be selected also affects the results obtained (Sri, 2014). In this paper, we argue that steel producing and woodcarving households have to change their production behaviour in terms of input (electricity and labor use), type of work and technology because their type of production activity is high electricity consumption.

3. DATA AND METHODOLOGY

3.1. Data Collection

To perform the above-mentioned purposes, the authors have gathered information about situation of craft production in 2

Figure 1: Electricity distribution in Vietnam



Source: Nguyen et al., 2008

typical craft production villages of Bac Ninh province that are steel producing Da Hoi village and woodcarving Huong Mac village. In each village, 60 production households were surveyed by using questionnaires which were typically designed for each type of production households. Besides, officers of electricity management department of Bac Ninh province and of the two villages were also interviewed to learn about management regime for electricity in the locales.

3.2. Data Analysis

After gathering, data were analyzed by descriptive and comperative statistics methods to point out differences in behaviors of households in steel and woodworking groups. The data, then, were used in auto regressive integrate moving average (ARIMA) model to predict electricity using demand of the surveyed households. ARIMA model was proposed by Box-Jenkins in 1976 based on autoregressive model (AR) and MA. ARIMA is a quantitative forecast model with time, future value of forecasted variable depends on its moving trend in the past (Nguyen, 2010). Data of monthly electricity consumption of the enterprises from June 2011 to June 2016 were applied to ARIMA model to predict total electricity consumption of the enterprises in future. ARIMA is composed by autocorrelation model degree p (AR(p)) and moving average model degree q (MA(q)) (Do Quang et al., 2012).

AR (p) describes the linear dependence of delay values and random errors by below equation:

$$Y_t=\varphi_1 Y_{t-1}+\varphi_2 Y_{t-2}+\ldots+\varphi_n Y_{t-n}+\delta+\varepsilon_t \quad (1)$$

MA (q) describes a weighted linear function of current random errors and their delay values by below equation:

$$Y_t=\mu+\varepsilon_t-\theta_1\varepsilon_{t-1}-\theta_2\varepsilon_{t-2}-\ldots-\theta_q\varepsilon_{t-q} \quad (2)$$

ARIMA (p, d, q) combines the autocorrelation and moving average processes (1) and (2) into a common equation:

$$Y_t=\varphi_1 Y_{t-1}+\varphi_2 Y_{t-2}+\ldots+\varphi_n Y_{t-n}+\delta+\varepsilon_t-\theta_1\varepsilon_{t-1}-\theta_2\varepsilon_{t-2}-\ldots-\theta_q\varepsilon_{t-q} \quad (3)$$

4. RESULTS AND DISCUSSION

4.1. Review of Production Activities in Craft Villages in Bac Ninh Province

4.1.1. Machinery equipment

Equipment is indispensable for steel production. Modern equipment helps to speed up production process, to make better products in various forms such as construction steel, steel wire, shaped steel bar. In steel producing Da Hoi village, press and steel rolling machines are the most important and equipped in every household. Wire drawing and casting and wire cutting machines are less common and equipped in households if required by their production. In general, all machines used in steel production have high power (e.g. rolling and cutting machines have 150 kW power), long working time (average 10 h/day). Therefore, electricity consumption in Da Hoi village is significant. Meanwhile, equipment used in woodworking in Huong Mac village has low power (maximum power of 3 kW for bandsaw) and shorter working time (average 8 h/day). Thus, electricity consumption here is considerably lower than in Da Hoi.

It can be observed that the trend of using machines in production is not only in national factories but also spreads out to traditional handicraft production villages. Machines help handicraft households to increase their productivity, product quality. In the other hand, increase of machine use goes along with increase of cost due to higher electricity consumption, especially for Da Hoi village (Table 1).

4.1.2. Production cost

In order to clarify the contribution of electricity cost for production in the households, the authors calculated total average monthly cost of each group of households including material cost, labor cost and electricity cost. The results show that each steel producing household pays more than 27 millions of Vietnam dong for electricity (25 times higher than electricity cost of a woodworking household) that corresponds to a ratio of 5.2% of total production cost. In the woodworking households, this ratio is just 0.67%.

In comparison with Huong Mac woodworking households, electricity cost of Da Hoi steel producing households occupies significant proportion in their total production cost. That directly reduces their profit. Therefore, to reduce this cost the households apply many solutions such as investing new production technologies to save electricity, shifting production to low-load time, changing product type or even reducing production size (Figure 2).

4.2. Behaviors of Handicraft Households Against Fluctuation of Electricity Price

4.2.1. Changing production technology

As discussed above, machines or morden technologies help production households much, especially in hard works of steel production. However, limited capital is a difficulty that makes the households not be able to invest modern equipment even though they really want to. Data in Table 2 show that only 30% of steel producing households bought new electricity-saving machines (in

Table 1: Equipment in surveyed households

Equipment type	Steel households		Equipment type	Woodcarving households	
	Quantity (each)	Power (kW)		Quantity (each)	Power (kW)
Press machine	60	11	Bandsaw	42	3
Steel rolling machine	60	150	Plane machine	60	1.5
Casting machine	28	75	Sanding machine	60	1.2
Wire drawing machine	22	50	Drilling machine	15	1.2
Wire cutting machine	17	150	Mortising machine	21	1.5

Source: Household survey data

woodworking households this figure is 5%); most steel producing households (53.33%) and woodworking households (95%) kept their old machines. The households buying new machines explained that even though buying electricity-saving machines costs big amount of money, they can take the saving cost by reducing the amount of rented labor to compensate for bank loans. Briefly, the solution of applying electricity-saving technology is less preferred by the households because it requires big capital that most households in the handicraft villages are not able to deal with.

4.2.2. Changing labor use and working time

Labor is an indispensable in production especially in craft villages. Statistical data from 60 steel producing households in Da Hoi village show that 100% of the households have to rent from 17 to 30 laborers depending on production size with average daily salary of 300,000 dong/person (one Euro equal to 27,000 Vietnam dong). In the woodcarving households, rented laborers are from 3 to 6 people with lower daily salary of 200,000 dong/person. In general, labor cost of a steel producing household occupies over 24% of total production cost. Therefore, to cut down production cost when electricity price increased, 70% of the households had to reduce number of rented laborers. Some of laborers, who are not able to work at night when the enterprise owners change working time to night time, quit the job by themselves. Electricity and labor costs in woodcarving households occupy only about 10% of total production cost. Therefore, the number of households in this group (16.67%) that had to cut down labor force is much less than the one in steel producing group.

In parallel with reducing laborers, the solution of changing working time to low-load time (especially night time) was applied by over 63% of the steel producing households. In night time, electricity is more stable than in daytime. Lower electricity price for night time helps the households to save considerable cost. Furthermore, when labor force is reduced, the households need to work at night to maintain production adequate to their contracts. In Huong Mac, this solution is not the first choice of the woodcarving households, only about 8% of the households applied it (Table 3).

4.2.3. Changing production scale and products

Production scale of the craft households in Huong Mac and Da Hoi villages is measured by quantity of products produced and sold in 1 year. Facing difficult situation resulted by higher production cost due to increasing electricity price, many households in Da Hoi (25% of the surveyed households) had to adapt by reducing production scale. In Huong Mac village, this figure is much less (8.33%).

Besides reducing production scale, changing product type or changing to make products that require less electricity consumption are good solutions for the households to survive in case input cost highly increases. Statistical data in the 2 villages show that over 23% of steel producing households choose to produce some items such as steel wire for construction, screw, bolt and nut that require less electricity to produce. In Huong Mac, this figure is over 18% (Table 4).

In summary, analysis of households' behaviors against electricity price fluctuation in the two craft villages points out that the steel producing households tend to reduce laborers and to change working time to low-load time to maximize cost saving. These solutions require no further investment and keep quantity and type of products to provide clients in signed contracts. Meanwhile, the woodcarving households suffer less from electricity price because their works consume less electricity than steel production. Therefore, there are only small proportions of the households applied the above-mentioned behaviors, of which changing to less electricity-consuming products is a solution most households selected.

Table 2: Households' behaviors about changing production technology

Behavior	Steel households (%)	Woodcarving households (%)
Keeping current machines	53.33	95.00
Selling old machine	16.67	0.00
Buying new electricity-saving machine	30.00	5.00

Source: Household survey data

Table 3: Households' behaviors about changing labor use and working time

Behavior	Steel households (%)	Woodcarving households (%)
Remaining laborers	30.00	83.33
Reducing laborers	70.00	16.67
Remaining working time	36.67	91.67
Changing working time to low-load time	63.33	8.33

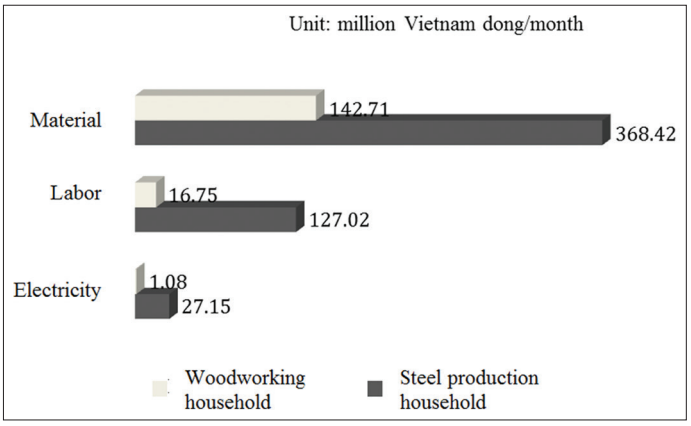
Source: Household survey data

Table 4: Households' behaviors about reducing production scale and changing products

Behavior	Steel households (%)	Woodcarving households (%)
Remaining production scale	75.00	91.67
Reducing production scale	25.00	8.33
Change to products consuming less electricity	23.33	18.33
Remaining existing products	76.67	81.67

Source: Household survey data

Figure 2: Electricity cost of a craft household



Source: Household survey data

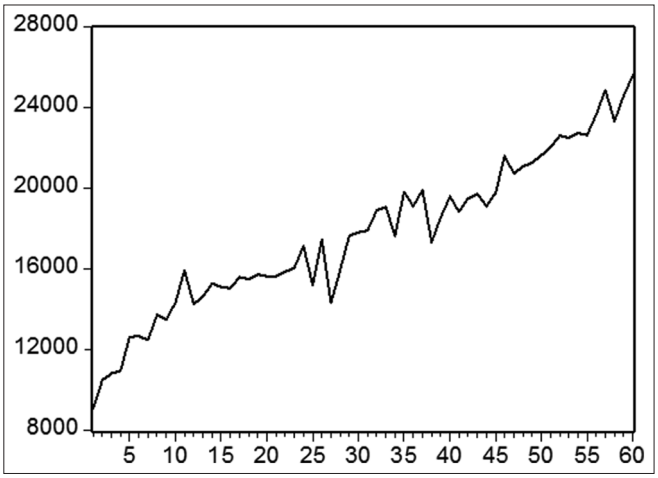
4.3. Predict Demand of Electricity Consumption and Impacts of Increasing Electricity Price on Production Activities of Craft Households

4.3.1. Predict demand of electricity consumption in craft households in Bac Ninh

Basically, methods in Vietnam to predict demand of electricity consumption are based on past data of electricity consumption and socio-economic variables such as GDP or gross added value of each economic field, population, electricity price. In general, forecasts are proposed based on socio-economic scenarios of individual locale or field (Nguyen et al., 2008). Currently, there is no forecast of electricity consumption available for craft households, especially for those in steel producing where electricity consumption is high. In this part, the authors present electricity consumption forecast for the craft households in Bac Ninh using ARIMA model.

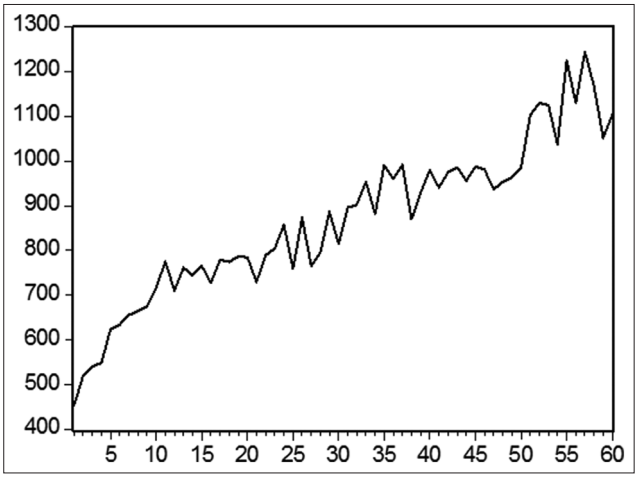
Figures 3 and 4 describe the variation of electricity consumption in 60 months (from June 2011 to June 2016) of steel producing and woodcarving household groups. The variations are not stable and tend to increase gradually. The consumption of steel producing group is much higher than the one of woodcarving group (Table 5).

Figure 3: Monthly electricity consumption of steel producing households from June 2011 to June 2016



Source: Household survey data

Figure 4: Monthly electricity consumption of woodcarving households from June 2011 to June 2016



Source: Household survey data

To define p, d, q coefficients of ARIMA model (as presented in the methodology), the authors analyzed the auto correlation and partial correlation graphs of electricity consumption series of the two groups. The results (Appendices 1 and 2) show that ARIMA (3, 1, 1) model is suitable to predict electricity consumption for steel producing households and ARIMA (1, 1, 4) is suitable to predict electricity consumption for woodcarving households.

The results of ARIMA model in Tables 5 and 6 show that the differring from zero of the coefficients bears statistical meaning. Based on that, ARIMA (3, 1, 1) and ARIMA (1, 1, 4) models were used to predict average monthly electricity consumption in short-term. The forecast numbers are presented in Table 7.

Comparison between forecast and actual numbers collected in July 2016 reveals that the forecast is quite match to actual consumptions. The difference between forecast and actual numbers in steel producing group is about 3%, in woodcarving group is about 6%. Thus, the two ARIMA models can explain the variation in electricity consumption of both groups.

4.3.2. Analyzing the impacts of increasing electricity price on production activities of craft households

Forecast from the above ARIMA models show that electricity consumption in the both groups tends to increase in short-term. Therefore, if electricity price keeps increasing, the production activities of the households will be affected considerably, especially the steel producing households. Figure 5 provides some information about the households' evaluation about difficulties they may face when electricity price increases.

According to the surveyed data of 120 households in the two villages, 86.67% of steel producing households avouched that increasing electricity price resulted in their higher production cost and lower profit. In the woodcarving group, 53% of the households affirmed this statement. Besides the impact on profit, increasing electricity price also forced the households, especially steel producing ones, to shift to night work that led to difficulty in hiring labor. Furthermore, working in the same time frame of many households made the electricity unstable, and therefore, made their production difficult and low efficiency.

Table 5: Results of ARIMA (3, 1, 1) for steel households

Parameter	Estimation coefficient	P
Constant	21.63	0.00
AR (3)	0.21	0.06
MA (1)	−0.83	0.00

Source: Household survey data, ARIMA: Auto regressive integrate moving average

Table 6: Results of ARIMA (1, 1, 4) for woodcarving households

Parameter	Estimation coefficient	P
Constant	10.14	0.00
AR (1)	−0.56	0.00
MA (4)	−0.21	0.05

Source: Household survey data, ARIMA: Auto regressive integrate moving average

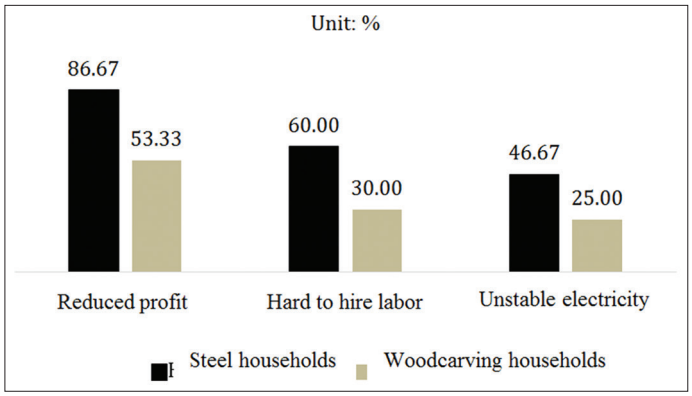
In order to have better view about the impact of increasing electricity price on the production of the surveyed households, the authors estimated the additional cost per month each household has to pay for electricity in scenarios of electricity price increasing 7.5%, 10%, 15% and 20%. The results in Table 8 show that each steel producing household has to additionally pay at least 3.033 million dong/month in the 7.5% scenario and at most 6.424 million dong/month in the 20% scenario (Table 8). Additional cost for a woodcarving household is insignificant. Thus, assuming that other input and output parameters are unchanged, these additional costs reduce the households' profit accordingly.

4. CONCLUSION REMARKS

4.1. Conclusion

Studying the households' behaviors against electricity price fluctuation in the craft villages of Bac Ninh province reveals that most steel producing and woodcarving households equip modern machines to increase productivity and product quality. Comparing to woodcarving households, a steel producing household equips machines with much higher power and longer production time (average of 10 h/day) that leads to electricity cost of over 27 million dong/month (occupying 5% of total production cost) which is 25 times higher than the cost a woodcarving household has to pay. When electricity price increases, we find three main solutions that craft households applied to deal with this issue: (i) Investing electricity-saving technology (selected by 30% of steel producing households and 5% of woodcarving households); (ii) saving electricity cost by shifting works to low-load time frame, especially at night time (most steel producing households) selected this solution); and (iii) reducing product quantity and changing to products that require less electricity. Furthermore, the authors identify that ARIMA(3, 1, 1) and ARIMA(1, 1, 4) models are suitable for predicting electricity consumption in short-term of both two group of households. Based on the forecast, if electricity price keep increasing 7.5%, each household in steel producing group will loss over 3 million dong per month while woodcarving households suffer insignificantly.

Figure 5: Difficulties in craft households when electricity price increases



Source: Household survey data

4.2. Remarks

Craft households' behaviors against increasing electricity price are demonstration supporting the analyses of negative impacts of increasing electricity price on not only national economy but also individual economic field. Therefore, in order to minimize such negative impacts, the authors would propose below recommendations.

For Central organization: Government and related Ministries should study a intinerary of increasing electricity with reasonable amount for enterprises as well as producing households to have enough time for preparation of technology, labor and production input in order to save electricity.

For local authorities: Locales having handicraft villages (in this case Bac Ninh province) should enhance quality of electricity source, maintain stable electricity providing and restrict cutting off electricity in peak-hours to reassure handicraft households and enterprises.

For craft households: Households working in high power-consuming such as steel production should have strategy to invest electricity-saving machines and reduce using old machines that consume too much electricity. Besides, rearrangement of logical

Table 7: Forecast of average monthly electricity consumption of craft households

Month	Steel producing households		Month	Woodcarving households	
	Forecast (kWh)	Actual (kWh)		Forecast (kWh)	Actual (kWh)
7/2016	16537	15953	7/2016	734	688
8/2016	17089	-	8/2016	776	-
9/2016	17387	-	9/2016	819	-
10/2016	18004	-	10/2016	876	-
11/2016	18364	-	11/2016	917	-

Source: Household survey data

Table 8: Impact of increasing electricity price on electricity cost for production of craft households

Anticipated increase rate (%)	Steel households (million dong/month)	Woodcarving households (million dong/month)
7.5	3.033	0.153
10	3.709	0.180
15	5.067	0.234
20	6.424	0.288

Source: Household survey data

production plan including working time, labor use and product type is also a good solution to reduce electricity consumption and to minimize profit loss due to electricity price increase.

REFERENCES

Bac Ninh Department of Statistic. (2015), Craft Village Development Report; 2014.

Digregorio, M. (1999), Report on the Environment of Development in Industrializing Craft Villages. Hanoi, Vietnam: Center for Natural Resources and Environmental Studies.

Do Quang, G., Vu Thi, H., Ly Thi, L.P., Nguyen, T.T. (2012), Arima model for forecasting foreign tourist travel to Vietnam. Journal of Science and Development Hanoi University of Agriculture, 10(2), 264-370.

Global Green Growth Institute. (2014), The Impact of Electricity Price Increases on the Competitiveness of Selected Mining Sector and Smelting Value Chains in South Africa. Available from: http://www.gggi.org/the-impact-of-electricity-price-increases-on-the-competitiveness-of-selected-mining-sector-and-smelting-value-chains-in-south-africa/.

Haughton, J. (2000), Ten puzzles and surprises: Economic and social change in Vietnam, 1993-1998. Comparative Economic Studies, 42, 67-92.

Le Thanh, T., Nguyen, C.H. (2015), Doanh nghiệp lo đối phó với giá điện tăng (Enterprises are coping with the increase of electricity price). Available from: http://www.kinhdoanh.vnexpress.net/tin-tuc/doanh-nghiep/doanh-nghiep-lo-doi-pho-voi-gia-dien-tang-3155310.html.

Miriam, A. (2009), The Impact of Electricity Price Increases and Rationing on The South African Economy. Available from: https://www.gtac.gov.za/Research%20Repository/The%20Impact%20of%20Electricity%20Price%20increases%20and%20Rationing%20on%20The%20South%20African%20Economy%20The%20Potensial%20Energy%20Savings%20A%20Review.pdf.

Nguyen, D.T., Bui, T., Dao, N.T., Nguyen, N.T. (2008), Estimating the Impacts of Electricity Price Increase on Households' Expenditure and The Country Economy. Working paper CS-02/2008, Research center for Economics and Policy, Vietnam National University of Hanoi.

Nguyen, N.T. (2010), Methods for Data Analysis in Financial Research Using Arima. Unpublished Graduated Thesis. Vietnam National University of Hanoi.

Nguyen, V.H., Shashi, K., Virginia, M. (2004), The contribution of social capital to household welfare in a paper recycling craft village in Vietnam. Journal of Environment and Development, 13(4), 371-399.

Phuong, D.B. (2001), Bảo tồn và phát triển các làng nghề trong quá trình công nghiệp hóa (Restoring and developing handicraft village in the process of industrialization). Hanoi, Vietnam: Social Science Press.

Sri, H. (2014), Model of household economic behavior bamboo creative industry: A preliminary study. Procedia – Social and Behavioral Sciences, 115, 1-11.

Tran, T.N. (2015), Tăng giá điện, nhiều doanh nghiệp thép, xi măng có nguy cơ đổ vỡ (Electricity price increase, many steel enterprises are going to collapse). Available from: http://www.vnsteel.vn/noi-dung/tin-tong-hop/tang-gia-dien-nhieu-doanh-nghiep-thep-xi-mang-co-nguy-co-do-vo/default.aspx.

APPENDICES

Table A.1: Serial correlation of monthly electricity consumption of steel producing households

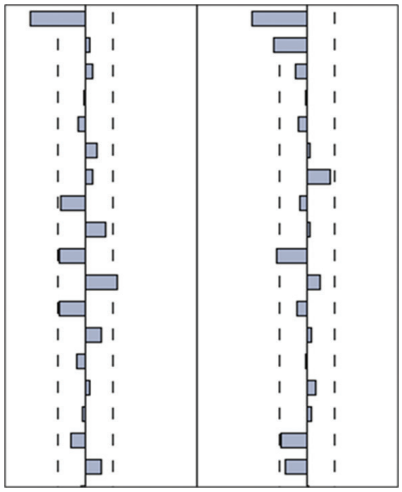
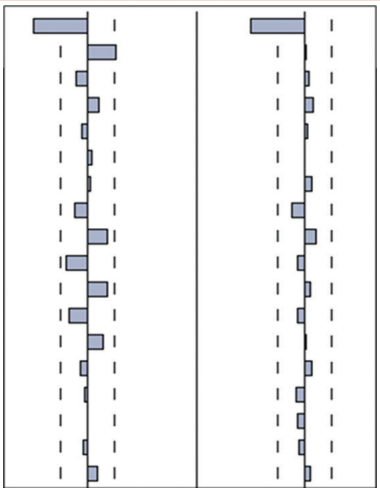
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
		1-0.517	-0.517	16.588	0.000
		2 0.039	-0.312	16.682	0.000
		3 0.063	-0.110	16.935	0.001
		4-0.011	-0.012	16.942	0.002
		5-0.073	-0.088	17.293	0.004
		6 0.109	0.032	18.107	0.006
		7 0.072	0.092	18.461	0.010
		8-0.103	-0.071	22.244	0.004
		9 0.104	0.072	24.946	0.003
		10-0.094	-0.108	29.237	0.001
		11 0.100	0.092	35.989	0.000
		12-0.125	-0.097	40.594	0.000
		13 0.095	0.035	42.396	0.000
		14-0.075	-0.016	42.846	0.000
		15 0.040	0.086	42.980	0.000
		16-0.021	0.045	43.018	0.000
		17-0.138	-0.145	44.659	0.000
		18 0.143	-0.110	46.458	0.000

Table A.2: Serial correlation of monthly electricity consumption of woodcarving households

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
		1-0.512	-0.512	16.272	0.000
		2 0.269	0.009	20.844	0.000
		3-0.112	0.040	21.645	0.000
		4 0.102	0.078	22.322	0.000
		5-0.051	0.030	22.489	0.000
		6 0.035	0.007	22.581	0.001
		7 0.026	0.058	22.628	0.002
		8-0.096	-0.117	23.578	0.003
		9 0.098	0.102	26.172	0.002
		10-0.102	-0.058	29.128	0.001
		11 0.107	0.050	31.764	0.001
		12-0.080	-0.058	34.239	0.001
		13 0.079	0.014	35.982	0.001
		14-0.063	0.066	36.305	0.001
		15-0.030	-0.085	36.308	0.002
		16 0.007	-0.057	36.384	0.003
		17-0.045	-0.052	36.555	0.004
		18 0.091	0.053	37.276	0.005