

Long-run Determinants of Export Supply of Sarawak Black and White Pepper: An ARDL Approach

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Malaysia is the fifth largest pepper exporter in the world. About 90% of the pepper produced in Malaysia is meant for export market. Malaysia exports both black pepper and white pepper in the international market. Sarawak Pepper is the trade name for pepper exported from Malaysia. This paper will explore and compare the long-run determinants of both black and white pepper in Malaysia by using the Autoregressive Distributed Lag (ARDL) Model. The paper concludes by providing some policy recommendations to Malaysian government to continue making Malaysia as one of the top pepper exporting countries in the international arena.

JEL Codes: P52, Q17 and Q18

1. Introduction

Pepper (*Piper Nigrum L.*), the King of spices, with its varied uses and dominance in the global spice trade, is the oldest and widely used spice in the world. It has occupied a position that is supreme and unique and is today a foreign exchange earner for several countries including Malaysia. Pepper has secured a pivotal position in food, pharmaceuticals, perfumery and cosmetic industries (Nybe and Peter, 2002). With the development of modern science and technology and greater awareness and demand among people for the use of natural products, particularly in food and pharmaceuticals, pepper indeed secured a better position and has a better prospect in the years to come.

Malaysia is the fifth largest pepper exporter in the world after Vietnam, Brazil, India and Indonesia. About 90% of the pepper produced in Malaysia is meant for export market. Malaysia exports both black pepper and white pepper in the international market. Sarawak Pepper is the trade name of pepper exported from Malaysia either in the form of black pepper or white pepper. Most of the pepper produced in Malaysia is from the state of Sarawak. In fact, pepper is still considered an important cash crop particularly in Sarawak, Malaysia. Changes in export supply of pepper would indirectly affect the income level and welfare of pepper farmers. This paper will explore the long-run

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relationship between the export supply of Sarawak Pepper and its determinants for both black pepper and white pepper in Malaysia by using the Autoregressive Distributed Lag (ARDL) model. Identifying determinants of export supply of Sarawak Pepper is imperative so that appropriate policy options can be recommended to the government to help Malaysia continue to be among the top pepper exporters in the international arena. After all, the welfare of more than 67,000 pepper farmers is at stake.

2. Literature Review

Mohammed (1993) in his study has analysed the performance of Malaysian pepper export. The supply equation was regressed upon the production of pepper, the trend variable (which captured the effect of the preferences of the producers for pepper growing) and the demand for Malaysian pepper export, while the demand function was regressed on price of pepper, real world income which was represented by the industrial production index and the production of pepper in Malaysia. The results of the study suggested that price of pepper was not an important determinant of the supply and export demand for pepper in Malaysia. The supply of pepper was determined by the demand while the export demand was dependent on the capacity to supply which was proxied by the quantity of production. Both of these variables had a positive relationship with their respective independent variables (Mohammed, 1993). In general, there is not much study done to find out the determinants of export supply of Sarawak Pepper. Most studies had been revolving around modelling and forecasting of Sarawak Black Pepper prices (Liew et al., 2003) or issues related to relationship between black pepper prices and white pepper prices (Habibullah and Baharumshah, 1994; Lau et al., 2008). Therefore, this paper is written to fill the research gap on determinants of export supply of Sarawak Black Pepper and Sarawak White Pepper.

3. Methodology

In this study, the ARDL cointegration procedure introduced by Pesaran et al. (1996; 2001) which preclude the possibility of estimating any spurious regression would be employed to find out the long-run determinants of export supply for both Sarawak Black Pepper and Sarawak White Pepper. This ARDL or bounds test approach is merely based on the estimation of unrestricted error correction model (UECM) and can be used to test for existence of long-run equilibrium relationship among the time series variables, as well as to estimate the long-run and short-run coefficients (Tang, 2003). Annual data for all related variables from 1980 to 2004 were collected from the Malaysian Pepper Board² (MPB) and Department of Agriculture, Sarawak for analysis in this study. First, the null hypothesis of no cointegration against the existence of long-run relationship between export supply of pepper and its determinants is tested for Sarawak Black Pepper and Sarawak White Pepper respectively. After various trials to test statistically to see if there exists long-run relationship between export supply and all the explanatory variables, the most parsimonious ARDL models for the export supply of Sarawak Black Pepper and Sarawak White Pepper are ultimately derived.

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In the absence of a consistent theoretical framework in literature on the export supply of pepper, this study tries to formulate a fairly general model specification for export supply of pepper in Malaysia by incorporating all the potential exogenous variables that would better explain pepper export in Malaysia. Equation (1) and Equation (2) below are the error correction representations of ARDL models for export supply of Sarawak Black Pepper and Sarawak White Pepper respectively:

$$\Delta Xb = a_0 + \sum_{j=1}^n b_j \Delta Xb_{t-j} + \sum_{j=1}^n c_j \Delta Ipb_{t-j} + \sum_{j=1}^n d_j \Delta Yb_{t-j} + \sum_{j=1}^n e_j \Delta Stkb_{t-j} + \beta_1 Xb_{t-1} + \beta_2 Ipb_{t-1} + \beta_3 Yb_{t-1} + \beta_4 Stkb_{t-1} + \varepsilon_t \quad (1)$$

$$\Delta Xw = a_0 + \sum_{j=1}^n b_j \Delta Xw_{t-j} + \sum_{j=1}^n c_j \Delta Ipw_{t-j} + \sum_{j=1}^n d_j \Delta Ipb_{t-j} + \sum_{j=1}^n e_j \Delta Ge_{t-j} + \sum_{j=1}^n f_j \Delta Yw_{t-j} + \beta_1 Xw_{t-1} + \beta_2 Ipw_{t-1} + \beta_3 Ipb_{t-1} + \beta_4 Ge_{t-1} + \beta_5 Yw_{t-1} + \varepsilon_t \quad (2)$$

where

- Xb = Export of black pepper measured in tonne per year
- Xw = Export of white pepper measured in tonne per year
- Ipb = International prices (= Average FOB prices) of black pepper measured in US dollar per tonne and converted into Ringgit Malaysia per tonne by using official exchange rate
- Ipw = International prices (= Average FOB prices) of white pepper measured in US dollar per tonne and converted into Ringgit Malaysia per tonne by using official exchange rate
- Yb = Domestic supply of black pepper production measured in tonne per year
- Ge = Actual government expenditure on pepper projects and pepper subsidy scheme each year (measured in Ringgit Malaysia)
- $Stkb$ = Stock of black pepper stored from previous production measured in tonne
- ε_t = Error term to capture all other unexplained factors in influencing the export supply of black pepper and export supply of white pepper respectively in Malaysia.

In addition, a dummy variable to capture the effects of introduction of steam sterilization plant in 1998 at the Malaysian Pepper Board Kuching, Sarawak to produce Mikrokleen value added pepper (D4) and the trend variable (T) to capture changes in tastes and preferences by consumers in the importing countries towards black or white Sarawak Pepper had also been included in the models for analysis.

4. Findings and Discussion

After testing the null hypothesis for no cointegration, results³ of the calculated F-statistics confirm a cointegrating relation between the export supply of black pepper and

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its determinants comprising of the international price of black pepper (lpb), domestic supply of black pepper production (Yb) and the stock of black pepper ($Stkb$). In addition, the results also indicated that there is evidence of cointegration relationship among export supply of white pepper (Xw), international price of white pepper (lpw), international price of black pepper (lpb), government expenditure (Ge) and domestic supply of white pepper (Yw). Once the cointegration is confirmed, estimation for the long-run coefficients of the export supply of black pepper and the export supply of white pepper functions are then carried out respectively. Given the small number of observations, this study has restricted the lag structure to a maximum of three periods. The results of the analysis show statistically significant and negative coefficients for error correction term (ECT) in both export supply of black pepper and export supply of white pepper models. This further reinforced the finding that there exists unique stable long-run relationship between export supply of pepper and its determinants in Malaysia in both black pepper and white pepper cases respectively. The empirical results of these long-run coefficients for both export supply of black pepper and export supply of white pepper are given in Table 1.

Table 1: Long-Run Supply Elasticities of Export Supply of Sarawak Pepper in Malaysia

Black Pepper Export Supply Model (Equation 1)		
Dependent variable: Xb	Model Selection Criterion (SBC)	
	(1,3,0,2)	
Regressors	Coefficient	T-Ratio
lpb	0.32497*	2.1602
Yb	1.0128***	9.5101
$Stkb$	0.10465**	2.4633
$D4$	-0.24497**	-2.6717
T	0.22356**	2.6776
Constant	-3.8032*	-2.1228

White Pepper Export Supply Model (Equation 2)		
Dependent variable: Xw	Model Selection Criterion (SBC)	
	(2,1,1,1,0)	
Regressors	Coefficient	T-Ratio
lpw	2.7167***	3.7566
lpb	-2.9883***	-3.6712
Ge	-0.12222	-1.201
Yw	0.42927*	2.106
T	0.26473***	3.5354
Constant	8.1235***	3.0922

Notes:

*** Denotes statistical significance at 1% level

** Denotes statistical significance at 5% level

* Denotes statistical significance at 10% level

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The varied results obtained for both models have a number of implications for designing and embracing effective government policies to enhance the export supply of pepper to improve the welfare of all stakeholders in the pepper industry in Malaysia. For the export supply of black pepper, it can be concluded from the ARDL long-run coefficient results shown in Table 1 that except for dummy variable that captures the introduction of sterilization plant (D4), the positive coefficients of all other explanatory variables show that the long-run movement in international price of black pepper (*lpb*), domestic supply of black pepper production (*Yb*), stock of black pepper (*Stkb*) and changes in taste and preference in importing countries (T) have positive significant impacts, though with different magnitudes, on the exports of black pepper in Malaysia. The domestic supply of black pepper production (*Yb*) has the greatest positive effect (1.01) on export supply of black pepper in Malaysia, followed by the international price of black pepper (0.32) and the stock of black pepper gives the least positive significant effect (0.10) on the long-run export supply of black pepper in Malaysia. On the other hand, for the export supply of white pepper, with the exception of government expenditure (*Ge*) variable, all other variables are significant and the coefficients are consistent with a priori expectations too. As measured by the magnitude of their coefficients, the long-run ARDL result shows that international price of the competing commodity of black pepper (*lpb*) has the dominant but negative effect on the long-run export supply of white pepper with coefficient equal to -2.99 , followed by international price of white pepper (2.72), domestic supply of white pepper (0.43) and the trend variable (T) that captures changes in taste and preferences of the pepper importing countries (0.26).

From the results shown in Table 1, the export supply elasticities with respect to changes in the international pepper price of 0.32 for black pepper and 2.72 for white pepper in long run indicate that the export supply of black pepper in Malaysia is inelastic but is elastic for white pepper in the long run. A 1% increase in the international price of pepper will cause black pepper export to increase by only 0.32% but will cause white pepper export to increase by 2.72% in the long run. The positive relationship found between the international pepper price and the export supply of both black and white pepper in the long run is in conformity with economic theory. However, the negative elasticity of white pepper export supply with respect to black pepper price in the long run can be explained by the inherent nature of black pepper as a competing product for white pepper. When international price of black pepper increases, more black pepper will be supplied and exported in the market, causing the export supply of white pepper to reduce, *vice versa*. However, international price of white pepper does not seem to affect export supply of black pepper significantly in Malaysia. This might be explained by more cumbersome procedure involved in producing white pepper as compared to black pepper. White pepper production would normally involve more work by soaking the ripe pepper berries in the flowing stream/ stagnant tank water for about seven days before washing and drying them to become white pepper. This causes most farmers prefer to produce black pepper thus reducing export supply of white pepper when the price of black pepper increases significantly, not vice versa.

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One possible reason to explain significant difference in price elasticities of export supply between black and white peppers is that most pepper farmers who produce black pepper are relatively poorer. Thus, they normally sell their black pepper directly after they process them. As pepper exporters get the supply of pepper from pepper farmers, the behaviour of pepper farmers would very much influence the export supply of pepper in the market. So, even though there is a drastic change in the international price of black pepper, the export supply of black pepper does not change significantly. However, most pepper farmers who produce white pepper are more affluent farmers. They could buy more expensive seedling which could yield bigger pepper berries for producing white pepper. Besides, they could also use more fertilizer to ensure that pepper berries are big enough to produce white pepper. After these farmers processed the white pepper and if the price of white pepper is not good enough, they could afford to keep their white pepper in store and to sell them when the price of white pepper is high enough. Consequently, the price elasticity of export supply of white pepper is larger.

In addition, the output elasticities of black pepper export supply and white pepper export supply at 1.01 and 0.43 respectively in the long run reveal that export supply is about unitary elastic for black pepper but is rather inelastic for the white pepper in Malaysia. This implies that for every 1% increase in the domestic supply of pepper output, export supply of black pepper would increase by about 1% but export supply for white pepper would increase by less than 0.5%. A plausible explanation for this difference could be that most pepper exporters are more interested in making bigger profit. However, as the supply of pepper for export is from the farmers. As compared to farmers who produce white pepper, most farmers who produce black pepper are relatively poorer. Thus, these farmers who produce black pepper could not afford to store pepper awaiting for higher price to sell once they have processed their pepper. They would sell their pepper products directly after processing them. Thus, when there is increase in pepper production in black pepper, there will be a more drastic increase in black pepper export compared to white pepper. Besides that, the stock of pepper and the introduction of steam sterilization plant are significant determinants of export supply of black pepper but not white pepper. This could probably be explained by the real scenario in the pepper industry where not many pepper farmers in Malaysia process white pepper to be stocked as most of the pepper farmers particularly in Sarawak are poor. This would thus affect the stock of pepper kept by the exporters for export market. The stock coefficient of 0.10 in the long-run black pepper export supply model implies that the export supply elasticity of black pepper with respect to black pepper stock is very inelastic. The stock of black pepper stored would positively and significantly affect the black pepper export supply in the international market in the long run. The reason is that pepper stock is normally kept for the long-term use in the export supply of black pepper. The export supply of black pepper will increase in the long run particularly when pepper price starts rocketing up.

Nonetheless, in contrast to a priori expectation, D4 dummy variable has shown an inversely related relationship between the introduction of a sterilization plant in MPB and the long-run export supply of black pepper in Malaysia. The initial intention of building

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the sterilization plant at MPB headquarters in Kuching is to come out with more value added pepper that can meet more stringent food safety and cleanliness requirements set by the importing countries. Despite that, it is evidently found that the introduction of steam sterilization plant does not help to increase the export supply of black pepper in Malaysia. One possible reason of getting a negative coefficient for D4 is that international pepper prices for black pepper are in the downwards trend after its peak in 1998. This negative impact of declining international pepper prices on pepper export might outweigh the benefit of installing the sterilization plant in MPB to come out with more value added black pepper to be supplied for export market. From the interview carried out with the MPB officers, it was told that the steam sterilization plant is under-utilized, particularly during low pepper price period. Furthermore, since the introduction of steam sterilization plant in 1998, pepper prices have not risen dramatically. This might cause shortage of pepper supplied by pepper farmers in Malaysia to be processed in the steam sterilization plant. So, even though there is a new technology being installed with the initial intention to process more value-added pepper products that can meet stricter food safety and environmental requirements set by the consumers from the pepper importing countries, the desired outcome has so far yet to be reached as there is not enough supply of pepper from farmers. A closer study on the steam sterilization plant project might have to be carried out so that MPB and related agencies can nip the identified problem in the bud.

Helping farmers to produce in a more productive way and inculcating pepper farmers with the entrepreneurship mindset are probably prerequisites for pepper industry in Malaysia to stay competitive. Suppose Malaysian pepper farmers were to stay with their closed-minded hearts and do not want to be exposed or are unwilling to use the advanced methods being introduced to them, then no matter how good the technology has been invested to process the value-added pepper such as the steam sterilization plant built in 1998 at MPB, Kuching, Sarawak would ultimately come in vain as well. Thus, it is important to inculcate entrepreneurship mindset among Malaysian pepper farmers to come out with high value-added pepper products so that the farmers will continuously get the high premium price for the pepper that they produce. This could somehow guarantee a constant supply of pepper from farmers for Malaysia to export its quality pepper products to overseas market. It is interesting to note that the trend variable which captures changes in taste and preferences of consumers in the importing countries is highly significant and has positive sign in both export supply models. This implies that consumers in both black and white pepper importing countries have generally shifted their taste and preference either towards Sarawak Pepper. Knowing that Malaysia has great potential to expand its pepper export market, MPB, in particular should initiate to improve the present situation. MPB should ensure that every cent invested is worth its value to improve the export earnings of pepper in Malaysia by fully utilizing its sterilization plant. MPB should also intensify its research and development strategies so that the benefit gained from the huge investment made in the sterilization plant in MPB always outweighs the negative impact of unpredictable and highly volatile international pepper price.

5. Summary and Conclusion

In summary, the results of the data analysis above verify some economic theories but at the same time also refute the other a priori expectations with strong empirical foundation. With respect to the export supply of black pepper in Malaysia, the results suggest that export supply of black pepper in Malaysia is primarily affected by international price of black pepper, domestic supply of black pepper production, stock of black pepper, introduction of steam sterilization plant in MPB and changes in taste and preference of consumers in the pepper importing countries. The empirical results for export supply of white pepper, however, show that international price of white pepper, international price of black pepper, domestic supply of white pepper and the trend variable that captures changes in taste and preference among consumers in the pepper importing countries are deemed significant factors attributable to the changes in white pepper export supply in Malaysia. The positive output elasticity of black pepper and white pepper export supply in Malaysia reveals the fact that Malaysian government policies should be directed to enhance the productivity and efficiency of pepper production in Malaysia. As we can see the great potential of higher demand of pepper and pepper products for a near future, the relevant ministries should therefore create a conducive environment for these pepper farmers to venture and further improve their pepper planting scheme. Besides that, Malaysia should continue to exploit its comparative advantage as worldwide greatest strength in pepper research by intensifying its pepper research to come out with a more capital-intensive method of cultivating pepper besides coming out with a more pest-resistant hybrid so that Malaysia will still be among the top pepper producers and pepper exporters in the world for the next few decades. This is crucial to ensure continuous supply of both Sarawak Black and White Pepper in the international market.

In addition, the positive coefficient of trend variable that captures changes in taste and preference among consumers of both black and white Sarawak Pepper by pepper importing countries evidently highlights the necessity of Malaysian government effort to continuously increase the availability and the credibility of Malaysian pepper products in international market. In fact, Sarawak pepper has gained prominent acknowledgement as consistent and reliable quality pepper products in the international market due to the mandatory requirements to grade the pepper based on certain standard criteria before they are exported to the importing countries. However, in order to sustain in this highly dynamic and competitive world, Malaysian government should adopt policies that would make its pepper products remain attractive even with more aggressive international competition. To further enrich the credibility of its pepper products, Malaysian government should invest more in R&D to further strengthen mandatory requirements to grade Sarawak Pepper besides developing more value-added pepper products in Malaysia for the niche markets. The related agencies such as Malaysian Pepper Board and Department of Agriculture should therefore take the initiative to get the certification from the international body for the labelling purpose of its high quality pepper products.

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Among the determinants of export supply of pepper from Malaysia, international pepper price appears to be the most consequential external factor. Not only the total revenue of Malaysia particularly for the state of Sarawak is influenced by the up and down of pepper export earnings resulting from the highly unstable pepper prices, the high volatility of international pepper price is undoubtedly the most detrimental to pepper farmers' lives as pepper farming is the sole source of livelihood for majority of the pepper farmers in Sarawak. As a consequence, in order to help these pepper farmers to get rid of episodes of hard times without enough food, enhancing market competitiveness by educating these pepper farmers to produce only market-accepted value added pepper products is no longer an alternative. The market-oriented mindset should thus be inculcated in all pepper farmers' hearts. This put a greater burden to the extension workers both from the MPB and the Department of Agriculture to educate these poor pepper farmers. Since most pepper farmers particularly in Sarawak are poor, Malaysian government should provide necessary assistance in terms of education and better technology for more lucrative pepper production in Malaysia. In short, the highly volatile pepper price in the international market further proffers the need for developing and producing higher-quality pepper products. By producing the value added cleaner and safer-to-consume pepper in Malaysia, it will not only enhance the market competitiveness of Malaysian pepper products (Sarawak Pepper) in the international market, the pepper farmers will ultimately be guaranteed a better livelihood at the end of the day.

End-Notes

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².Malaysian Pepper Board is the new name for Pepper Marketing Board from 1st January 2007.

³.Constraint by the space available, the results are not reported in this paper. Nevertheless, they are available upon request.

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