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Economic Efficiency of Chili Pepper Producers in the Volta Region of Ghana

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Introduction

Chili pepper (*Capsicum annuum*) is a rife agricultural commodity which is widely cultivated and consumed in Ghana. The importance of this spice to Ghanaians can be seen in its presence in almost all dishes in Ghana. In the past, the crop was generally cultivated for domestic consumption, but in recent times it has gained importance as an export commodity due to surges in world demand. Export growth and diversification is an essential catalyst for economic growth and development (O'Connell, 2008). This is because of the vital role exports play in poverty reduction through foreign exchange and employment generations. In Ghana, the export of chili pepper falls under non-traditional exports. Non-traditional exports however, have been identified by the Ghanaian government as a major contributor to Ghana's strategy of achieving middle-income status by 2020 (Kasalu-Coffin et al., 2005). Although the traditional exports of cocoa and gold are still vital for economic growth and foreign exchange generation, diversification of export is required for accelerated economic growth and poverty reduction, and diversification into the horticultural export sector has the ability to produce the needed accelerated economic growth (Kasalu-Coffin et al., 2005). Chili pepper cultivation in Ghana is mainly a smallholder activity and provides income for farmers and all other agents involved in its production and marketing. The potential of chilies to improve the rural lives of smallholder farmers in Ghana has long drawn the attention of various international development agencies such as the German Society for International Cooperation, the German Development Service and the United States Agency for International Development who have put in place various measures to increase its production for export. The Millennium Development Authority (MiDA) has put in place interventions such as the provision of credit facilities for chili pepper producers, training of farmers in business planning and value chain approaches, land tenure facilitation to ensure tenure security for land users and the facilitation of access to land for domestic chili cultivation for export (MiDA, 2010). In spite of these numerous interventions, the average yield of chili pepper in Ghana is still low (8.30 Mt/ha) with the achievable yield being 32.30 Mt/ha (MoFA, 2014) indicating that chili farmers in Ghana are operating way below their potential. Meanwhile with the current level of technology and resource endowment, it is still possible for these resource poor farmers to close this yield gap and this can be done through improvements in their efficiency of production. Although a plethora of efficiency studies exist in literature, much of these studies focus on technical rather than allocative and economic efficiencies. However, it is only through substantial gains in overall economic efficiency that significant gains in output can be achieved (Bravo-Ureta and Pinheiro, 1993). This is because, it is possible for a given production unit to achieve either technical or allocative efficiency without achieving economic efficiency. Gains in the overall economic efficiency of chili farms in Ghana offers the best option for productivity enhancement since improved chili cultivation technologies and productive resources are scarce.

Material and Methods

This study is based on farm level cross-sectional data collected from chili pepper producers in the Volta Region of Ghana. A multi-stage sampling technique was used to select 200 chili farmers for the study. The first and second stages involved the purposive selection of the four districts and the purposive selection of the communities noted for chili pepper production, respectively. The third stage involved the random selection of the chili farmers. The selected districts were South Tongu district, Ketu-South district, North Dayi district and Keta municipality. A total of 50 chili farmers were sampled from each district/municipality leading to a sample size of 200 respondents. This study adopts the stochastic frontier approach (SFA) to determine the productivity of selected agricultural inputs. It also measures technical, allocative and economic efficiency levels and their determinants of chili pepper production. The SFA is adopted because it specifies that rather than ascribing all deviations from the efficient frontier to the random error term, output variability can also be as a result of the symmetric error term. The random error term captures the effects of the conditions beyond the control of the decision maker and the asymmetric error term measures technical inefficiency. The study further identified the key constraints militating against the realization of the full frontier output using the Garret ranking technique. The modified translog stochastic frontier production and cost function models were analyzed on the sampled chili farms using the maximum likelihood estimation procedure.

Results and Discussion

The maximum likelihood estimates of the stochastic frontier production function evince that except for family labour, all the explanatory variables positively and significantly influence chili output. This therefore implies that a 1% increase in farm size, hired labour, price of fertilizer, quantity of seed and othercost may increase chili output by 0.19%, 0.13%, 0.27%, 0.18% and 0.45% respectively. However, the estimate for family labour is significant and negative, indicating that a 1% increase in family labour may decrease chili output by 0.23%. This may be ascribed to the excessive use of family labour for chili production in the study area. Since majority of the farmers are resource poor and may find it onerous to afford the services of hired labour, they tend to depend heavily on the services of their family members for farm operations, resulting in the excessive use of family labour. The sum of all the output elasticities, which measure the returns to scale of chili farms in the study area is estimated to be 0.987, implying that on the average, chili farms in the study area are characterized by decreasing returns to scale. This means that a 1% increase in all inputs will result in a 0.987% increase in output. The gamma value is 0.558 and it is also statistically significant at 1%, indicating that 56% of the total variation in chili output is due to technical inefficiency.

The maximum likelihood estimates of the stochastic frontier cost function show that all the input price variables are significant and positively influence the total cost of chili production. This therefore implies that a 1% increase in farm rent, price of hired labour, price of family labour, price of fertilizer, price of seed and othercosts will increase the total cost of chili production by 0.043%, 0.419%, 0.380%, 0.074%, 0.036% and 0.071%, respectively. The price of hired labour is found to have contributed more to total production cost than the rest of the input price variables. This finding is a confirmation of the assertion that chili pepper cultivation is a labour intensive activity and as a result, chili farmers spend more on hiring labour for their production activities. The estimated gamma value of the allocative efficiency model is 0.98 and it is significant at 1%, implying that the inefficiency error dominates the random error in explaining the allocative inefficiency of the farmers.

There are wide variations in the levels of technical, allocative and economic efficiency estimates among the sampled chili farms. The predicted technical, allocative and economic efficiencies ranged from 13.42%-92.76%, 62.71%-100% and 12.80%-92.13%, respectively with their means being 68.14%, 92.29% and 62.88%, respectively. This mean technical efficiency (TE) estimate shows that on average, chili farms are operating at 31.86% below the efficient frontier output. This therefore implies that with the current level of technology and resource endowment, chili farmers in the Volta region can increase chili output by 31.86% through the adoption of the best farm practices. The mean allocative efficiency (AE) estimate of 92.29% points out that on average chili farms in the study area are operating at 7.71% above the minimum attainable cost frontier. Consequently, there is the possibility for the chili farmers to minimize cost by an average of 7.71% through the adoption of the practices of the most cost efficient

farm. These high AE estimates of the sampled chili farms confirm the hypothesis formulated by Schultz (1964) that resource-poor farmers in developing countries are highly efficient in allocating the scarce financial resources at their disposal. The mean economic efficiency (EE) of 62.88% shows that on average, the ability of the chili farmers to produce a predetermined level of output at the lowest attainable cost is relatively low. The findings further show that substantial gains in EE can be achieved by improving both technical and allocative efficiencies of the chili farmers.

Much of the agriculture efficiency studies in the literature focus on determining the key factors that influence the efficiency status of farmers. Knowledge of these factors according to Bravo-Ureta and Pinheiro (1993) is of great importance in formulating appropriate policies towards the attainment of the full frontier output given the technology level. The estimated determinants of technical and allocative inefficiencies show that male chili farmers are allocatively more efficient than their female counterparts. Male farmers who are mostly the heads of their respective households may want to minimize cost in order to save money for the upkeep of their families and by so doing may end up producing at the minimum attainable cost. Contrary to the findings of Khan and Saeed (2011) and Khairo and Battese (2005), but consistent with Onumah et al. (2010b) and Wang et al. (1996), chili farmers who have attained high level of formal education are less efficient in their production activities than their less educated or uneducated counterparts. This may be due to the fact that farmers with high level of formal education may tend to take up chili farming as a secondary economic activity and so do not devote much of their time to farming activities. Consistent with the findings of Onumah et al. (2010a), chili farmers who received regular advisory services from extension agents are technically more efficient in their production than their counterparts who did not receive such services. This is because, farmers who have regular contact with extension agents are better equipped with state-of-the-art technology and information which can help them to effectively utilize productivity enhancing inputs and hence are more efficient in their production activities than those who do not receive such services. Contrary to expectation, experienced chili farmers are found to be technically and allocatively less efficient relative to their inexperienced counterparts. This finding may be attributed to the fact that farmers who are more experienced may tend to rely on their know-how and so may not seek help from extension agents, leading to their inefficiency. New entrants to the chili industry are more likely to seek help from extension agents than their experienced counterparts. This finding lends support to Onumah and Acquah (2011) and Onumah et al. (2010a) who posit that new farmers are progressive and willing to implement new farming systems, which makes them more efficient relative to their experienced counterparts. Aged farmers are also found to be technically and allocatively less efficient compared to their younger counterparts. This may be ascribed to the difficulty aged farmers are likely to face in using modern productivity enhancing inputs available in the chili industry and hence are more likely to maintain their outmoded inputs. Similar findings were reported by Bravo-Ureta and Pinheiro (1997) and Khan and Saeed (2011) in their respective studies. Although the individual effects of age and experience are found to influence TE and AE negatively, this study illustrates that the joint effect of these factors impact TE and AE positively. This implies that aged farmers with numerous years of experience in chili pepper cultivation are relatively more efficient as opposed to aged farmers who are less experienced or experienced young farmers. This finding reveals that people who go into chili farming at old age (e.g. after retirement) are less efficient as opposed to those who enter at a tender age since they tend to acquire more experience as they grow. An akin finding was reported by Onumah and Acquah (2011) in their study of the TE of fish farms in Ghana. Chili farmers who employ the services of hired labour for farm operations are found to be allocatively more efficient than their counterparts who depend on the services of family labour. This finding buttress our earlier finding that hired labour is more productive than family labour. The results also show that farmers who engage in off-farm income generating activities are more efficient than those who do not engage in such activities. This is because, farmers who engage in such activities earn cash with which they are able to purchase productivity enhancing inputs for chili cultivation. Contrary to the findings of Thibbotuwawa et al. (2012), famers using modern irrigation facilities are found to be less efficient compared to their counterparts who do not use such facilities. This may be due to the atomized landholdings of most farmers which may constrained them from fully exploiting the irrigation technology at their disposal since this may lead to higher production cost and low output and hence are less efficient. Consistent with the findings of Okike et al. (2001), but contrary to the findings of Khan and Saeed (2011) and Abdulai and Huffman (2000), chili farmers who have access to credit facilities operate with less TE and AE than those without access. For

agricultural credit to be productive, it needs to be invested into farming activities so that it can yield the desired results. Possibilities of credit diversion to meet other needs rather than chili cultivation may be the reason for this finding. Chili farmers who belong to farmer based organizations (FBOs) are found to operate with higher efficiency. Belonging to FBO has the potential to increase the bargaining power of the farmers and this may eventually lead to higher prices which may serve as incentive for the farmers to produce more output. Farmers who belong to FBOs are also more likely to receive support from financial institutions, government and non-governmental agencies as opposed to their single and scattered counterparts.

The Garret ranking technique reveals the difficulty in accessing credit, lack of reliable produce market and lack of irrigation infrastructure as the three most predominant constraints militating against chili pepper production in the study area. Chili farmers are unable to access credit facilities for farm operations and this is due to the exorbitant interest rates charged by money lenders and other financial institutions which deter them from accessing credit from such institutions. This finding agrees with Adebayo and Adeola (2008) who revealed interest rate as the highest constraint faced by farmers in sourcing for agricultural credit. Without access to credit, farmers cannot invest in productivity enhancing inputs to produce more output. The inability of the farmers to access ready and reliable produce market and the low prices they receive for their produce have made most farmers to grow other crops rather than chilies. Most of the farmers who export their produce complained about how most middlemen adjust their weighing scales in order to cheat them. A reliable produce market is needed to attract new entrants into chili farming. Most of the farmers also lack access to modern irrigation facilities which leave them with no option than to use buckets to fetch water for irrigation and this has implication for the farm sizes they cultivate. Lack of irrigation facilities has forced most farmers to cultivate chili pepper only in the raining season. This finding lends support to Obeng-Ofori et al. (2007) who observed that chili cultivation in Ghana is mostly done under rain-fed conditions without irrigation systems, leading to significant drops in production volumes during the dry season.

Conclusions and Outlook

Based on the findings of the study, the following conclusions are drawn. Chili pepper output is greatly influenced by farm size, hired labour, family labour, price of fertilizer, quantity of seed and othercost of chili production. Chili farms in the study area exhibit decreasing returns to scale. The total cost of chili pepper production in the study area is significantly influenced by all the input price variables. However, output does not significantly influence total cost though they are positively related. Chili farms in the study area are operating below the economically efficient frontier and this is largely due to the presence of both technical and allocative inefficiencies in chili production. It is however evident from the results that technical inefficiency effects constitute a more serious problem to EE than allocative inefficiency effects. This therefore means that EE could be improved substantially by improving both TE and AE, however improvement in TE offers a higher potential for enhancing EE than in AE. This further suggests that chili farmers in the study area generally take good decisions with respect to resource allocation rather than good decisions regarding the efficient transformation of inputs into output.

The results also put to the fore the importance of examining not only TE as a measure of productivity but also allocative and economic efficiency components. The current level of EE of the farmers implies that the ability of the chili farmers to produce a predetermined level of output at a lower cost is relatively low on average and needs to be improved. There is the presence of technical and allocative inefficiencies among the chili pepper producers and these inefficiencies are greatly influenced by farmers' socio-economic characteristics as well as technical and institutional factors. The joint effects of technical and allocative inefficiencies are responsible for explaining the variations in the EE of chili farms although the individual effects of some variables are statistically non-significant. Difficulty in accessing credit, lack of market and lack of irrigation facilities are the key constraints to chili pepper production in the study area. From the findings of the study, it was realized that chili cultivation has the potential to improve welfare gains of chili farmers from technological interventions.

The study recommends policies that aim at attracting the teaming youth into chili pepper cultivation to be pursued by the government and other stakeholders of the chili industry. These policies should focus on

giving incentive packages such as enhancing the access of the youth to improved inputs at subsidized prices. It is also recommended that intensive extension service delivery which aims at raising the technical knowledge of the chili farmers should be pursued by recruiting and resourcing more extension agents. The study further recommends the formation of associations by the chili farmers so as to create the platform for the sharing of technical knowledge among the farmers. Policy makers should also focus on policies that will facilitate chili farmers' access to bank loans in the form of inputs. It is further recommended that experienced chili farmers should not solely depend on their know-how but should endeavour to complement their knowledge with advisory services from extension agents since this offers a great potential for efficiency gains.

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