Moderating Effects of Support Policy on Agricultural Productivity

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Abstract

Economic indicators have long been recognized as an important indicator for agriculture productivity. Yet, measurements of this relationship are still scarce and not always reliable. The power of agriculture comes not only from physical capital and human capital effect but also from its potentially strong support policy effects on the rest of agriculture productivity. This paper presents a conceptual framework of the effects of economic indicators on agricultural productivity. As productivity is the main concern of this paper, the moderating role of support policy is emphasized in this conceptual model. The propose model is important to reveal the trend of output and input in agriculture as well as the determinants of agricultural growth in Malaysia and ASEAN countries. From the graphical trends, it is not possible to assess the contribution of inputs (capital, labour, fertilizer etc.) to the overall output. Proposition stated and model proposed in the paper can be tested in empirical study in various economic sectors.

Keywords: Economic Indicators, Agriculture, Productivity, Support Policy.

Introduction

Agriculture is the most important sector and the foundation of a country's economy. Agriculture development has recently returned to the forefront of development issues, given its contribution to employment, foreign exchange, food and its linkages with other sectors of the economy. Moreover, it influences industry through three types of linkages namely; production, demand and saving and investment. Despite this, attention to the impact of agriculture productivity change on economic growth and poverty reduction in both urban and rural areas has been arisen. Furthermore, the impact of agricultural growth on environment is also another concern, with technologies capable of depleting and renewing scarce resources.

Agricultural productivity is measured as the ratio of agricultural outputs to agricultural inputs. This output value may be compared to many different types of inputs such as labor and land (yield). These are called partial measures of productivity. Furthermore, agricultural growth depends on innovation and is a major source of improved productivity, competitiveness and economic growth throughout advanced and emerging economies. Innovation plays an important role in creating jobs, generating income, alleviating poverty and driving social development. If farmers, agribusinesses and even nations are to cope, compete, and thrive in the midst of changes in agriculture and economy, they must innovate continuously.

The contribution of agriculture to the Gross Domestic Product GDP of developed countries such as the United States of America, Germany, United Kingdom, Japan, South Korea and Taiwan is only between one and three per cent. For developing countries, this sector still continues to be the main contributor to GDP such as Cambodia and Lao PDR which contribute about one third of the GDP of the country. For Malaysia, this sector is still important despite the decreasing contribution to the economy.

According to Department of Statistics, on Selected Indicators for Agriculture, Crops and Livestock, Malaysia, 2006-2010, the contribution of agriculture to the GDP declined from 28.8 per cent in 1970 to 7.5 per cent in 2007. Contributions were maintained in 2008 before rising to 7.7 per cent in 2009 although the total GDP dropped to RM522.0 billion from RM530.7 billion in 2008. The figures decreased in 2010 to 7.3 per cent. Although the contribution of agriculture to GDP showed a declining trend, the actual value of output and productivity has increased.

In the past few decades, we have seen an explosion in agricultural study. There were hundreds of empirical studies on agricultural productivity have been done around the world and indicated the relationship between agricultural productivity and many variables. It is therefore, natural to study and test which of the factors suggested in the literature that give significant impact of agricultural productivity. Analysis of agricultural production functions began in 1944 which discovered by Tintner (1944), Tintner and Brownlee (1944) followed by Heady (1944). These studies were based on farm data.

In other study, which conducted by Hayami (1969,1970) and Hayami and Ruttan (1970) as cited by Mundlak et al. (1997) used a cross-country data to estimate a global production function. The results reveals that physical capital serves as a constraint to agricultural growth, the growth calculation are sensitive to the weight of land and the technology, prices and physical environment produced a production function that displays constant returns to scale.

Many studies have shown that, economic indicators give a positive impact on agricultural productivity (R. E. Evenson, 1990; L. Zepeda, 2001; Blaise, 2007; C. Rangarajan, 1982; Heady et al., 2010; Nair, 2010; Sepien, 1979), but how these support impact on support policy and productivity of agricultural since the study about productivity of agriculture is too limited in previous research. For the beginning, this paper provides a conceptual model for the relationship between economic indicators and productivity of agriculture. More specifically, this study proposed how support policy enhances the relationship between economic indicators (physical capital and human capital) and agricultural productivity.

However, besides the two economic indicators, there are two control variables namely; climate and land size or farm size that might give significance impact to the productivity of agriculture. Agriculture is primarily and heavily dependent on climate. Climate change is proven to have had impacted the agricultural productivity, crop choice and food security everywhere in the world and agriculture is primarily and heavily dependent on climate. The nature, scale, frequency and outcome of such impact differ significantly among countries, regions and areas within a country. Due to the climate change, several agricultural factors, such as yield, cultivated area and value of crops, are changing that influences the sustainability of agriculture (Mahmudul et al., 2011). In other study, conducted by Cornia (1985) for 15 developing countries, there are three countries (Bangladesh, Thailand and Peru) with a strong negative correlation between farm size on the one side and factor inputs and yields per hectare on the other. Besides that, there are few findings towards the climate change and farm area from Kamara, 2004; O. E.Ayinde et al., 2011 and Austin et al., 2012.

The propose model is important to reveal the trend of output and input in agriculture as well as the determinants of agricultural growth in Malaysia and ASEAN countries. From the graphical trends, it is not possible to assess the contribution of inputs (capital, labour, fertilizer, technology etc.) to the overall output. To obtain these contributions, it is necessary to model the inputs in order to establish the relationship between the inputs and output.

The Three Constructs

Economic Indicators

Agricultural productivity is measured as the ratio of agricultural outputs to agricultural inputs. In order to improve productivity of agriculture, there are some indicators that might be significant. The indicators include human capital and physical capital.

Quality of human capital plays an important role to stimulate the growth. Mankiw et al., (1992) believed that high value of human capital such as increase number of schooling citizens will bring significant impact to the nation. Lacking of this matter could promote disparities among countries resulting from unequal dissemination of technology according to Coe et al., (1995). A country with higher number of experts such as engineers, scientist, patents and active in research and development will boost the economic growth with the talent and ideas belonging to their citizens. However, this argument is not consistent with Jones (1996). He argued based on the fact that in 1950 until 2000, even though United States greatly increased in producing scientists and engineers, the growth rate declined over that period.

Solow (1956) suggested the accumulation of physical capital acted as a critical engine to move economic growth higher. In 1957, he found over the half of the twentieth century in United States, a huge portion which is 90% of the economic growth contributed by the increase of total factor productivity. It indicates that, a country with high level of TFP correlates with high growth or high performance country. According to Mundlak et al. (1997), input to agricultural capital is directly an important determinant of agricultural production. This is especially significant since land another important determinant of production. He also stated that, prices have little immediate and direct impact on agricultural growth.

By Sidiq (2004), supporting elements ranging from provision of agricultural inputs for rice production such as increasing fertilizer supply, provision of good quality seed, credit with low interest rate, played significant role in providing basic support to increase productivity to improve quality and minimise losses in Indonesia. In addition, the production technique chosen and the combination of factors it required to have depended on factor prices, given the range of determinant, such as water supply, soil conditions, climate and rice varieties preferred by producers and consumers (Eng, 2004).

Agriculture Productivity

The existing model conducted by Tolo (2011) uses a panel of 23 emerging markets for the period of 1965-2008 to study the determinants of per capita GDP growth in the Philippines. The Philippines is an outlier in terms of agricultural exports, investment, research and development and population growth. According to Alston (2010), agricultural economists have used supply and demand models of commodity markets to represent agricultural research impacts, beginning with Schultz (1953) and Griliches (1958), with important subsequent contributions by Petersen (1967), Duncan and Tisdell (1971).

Blaise (2007) investigated the factor accumulation, total factor productivity (TFP) and technology absorption of agricultural growth in Africa. He found that one main contribution and new findings is the quantification of the contribution of the productivity growth and the contribution of different inputs such as land, labour, tractor and fertilizer in the agricultural growth.

According to Mundlak et al. (2002) in determinants of agricultural growth in Indonesia, The Philippines and Thailand concluded that the new technology changed the returns to fertilizers, irrigated land and capital, all of which proved scarce to varying degrees. Despite the geographical region, similar climate and other characteristics, gains in productivity differed significantly among countries. Yet, the factor accumulation played an important role in output growth and that accumulations from policy-driven investments in human capital and public infrastructure were important sources of productivity gains. Furthermore, the efficient and effective policies imposed on factor markets will provide best opportunities for agricultural growth in both people and infrastructure.

Apart from that, another significant study about the determinants of agricultural growth and productivity in Kenya is consistent with the other findings which the main indicators are land and labour. The study utilized secondary information and econometric technique used to assess the determinant. The study has also established that Kenya’s trade policy, climate and government

expenditure on agriculture are important of agricultural total factor productivity (Odhiambo et al., 2004).

Support Policy

How do we measure good and poor support policy? Do we measure in terms of man hour's work? If we measure in terms of man hours work itself, this may not necessarily evaluate the achievement of productivity. Policy measures are uniformly different, including instruments such as import tariffs, subsidies and a host of different government spending to farmers. Many of these policies share the common feature that they transfer money to farmers, and thereby impact on production decisions, incomes, international trade and the environment.

According to Sepien, (1979), there is a positive association between the farmer's technical knowledge and management index. Support policy also been included by employment policy, decision-making and instrument which contains scheduling and systems.

Huffman and Evenson (2002) concluded in a recent empirical contribution to the literature that is highly relevant to this study. They used a longitudinal data from 1950 to 1982 to consider the relationship between farm structure (farm size, specialization, and off-farm work), government policies, and productivity changes over the period. The study showed that farm structural change does impact productivity. They also found that public R&D give positive impacts on farm structure, whilst agricultural policies had less impact on structure. Besides that, they assumed that farm productivity did not affect farm structure. Ahearn et.al (2002) studied the impact of government policies on agricultural productivity and structure using the simulation equation econometric model. The purpose of this study is to seek the causal relationship between productivity, farm structure, government farm payments and public investment.

Modelling Agricultural Productivity

Economic Indicators and Agricultural Productivity

There are numerous study have been conducted on the relationship between economic indicators and agricultural productivity. This study has been proven by the previous researcher such as Tolo, 2011; Preibisch, 2011; Nair et al, 2010; McNamara et al., 2010; Ciccone & Papaioannou, 2009; Headey et al, 2009; Levine, 2009; Blaise, 2007; Odhiambo et al, 2004; Mundlak et al, 2002; Zepeda, 2001; Mundlak et al, 1997; Narman, 1991; Sepien, 1979.

Agricultural productivity is likely to be affected by the overall technological level of the country. As economies develop generally, the physical, legal, regulatory infrastructure and institutions which support agriculture develop as well (Mundlak, 1997). However, another factor input such as land is also important determinant of agricultural productivity. Apart from that, trade policy, climate and government expenditure were contribute significant impact on agricultural productivity (Odhiambo et al, 2004). Wadud & White (2002) listed the factors like credit availability, farm size, weather, topography and poor soil as the principle production constraints.

Most of the studies use the number of years of schooling as a proxy of education (either of the head of the household or an average for the household). It is possible, however, that the positive impact of this variable on agricultural productivity results because education screens more able from less able persons (Knight & Sabot 1990); the significant coefficient, then, could be a reflection of the higher ability of more educated persons, even though those persons did not gain that ability through education. If education only serves to screen persons by ability, it would not be expected an increase in agricultural productivity to result from increases in rural education.

Based on the literature review the first and second proposition can be drawn as:

P1: There is positive impact between physical capital and agricultural productivity.
P2: There is positive impact between human capital and agricultural productivity.

Support Policy, Economic Indicators and Agricultural Productivity

Government intervention in the agricultural sector is persistent and significant. Some government policies are purposely designed to impact agriculture, and other government policies actually are not designed to give the impact on agriculture e.g., macroeconomic policies. In that case, this impact is called a secondary impact. Of course, it is tremendously difficult and perhaps, foolish to identify the future impacts of many government policies on agriculture, given the nature of our system of government. According to Rausser (1992) government set up agricultural policies that correct for market failures, lower transaction costs or enhance productivity.

In contrast, there are government policies clearly designed to impact the productivity growth of agriculture in recognition of the value of enhancing the social benefits of a more productive sector. Regardless of the primary intent of government intervention, there are significant impacts from government actions on both structure and productivity.

The role of agricultural extension is to extend useful information to farmers and other constituents at a level that can be useful in application and problem-solving. Extension agents disseminate information on crops, livestock, and management practices to farmers and demonstrate new techniques as well as consult directly with farmers on specific production and management problems. In particular, giving farmers good information on new technologies can speed the adoption process, which generally increases the rate of return on research expenditures. Unlike research, agricultural extension input can be expected to have an almost immediate impact on agricultural productivity. The bulk of public extension funding now comes from state and county governments rather than the federal government (Ahearn, Yee, and Bottum, 2002).

According to Aschauer (1989), the empirical evidence is that public infrastructure has a positive and statistically significant impact on output and productivity. This finding is even more impressive given that much public infrastructure spending goes for improving the environment and other objectives that are not captured in output or productivity measures.

Policies to improve the quality of secondary schools are often put forward, and debates over such policies are intense. They argued that such policies are unlikely to have any substantial effect on the quality of the U.S. workforce unless more fundamental reforms in incentives in schools are made (Carneiro & Heckman, 2003). Besides that, tax and subsidy policies are also advocated to address early disadvantage. They found that such policies are likely to have only modest effects on skill formation. Policies to limit the immigration of the unskilled are also proposed to alleviate downward pressure on wages and to reduce inequality (Borjas, 1999).

Growth accounting computation highlights the fact that factor rather than TFP account for a large share of agricultural output growth and fertilizer has been the most significantly important physical input contributor to agricultural growth (Blaise, 2007). According to Ramli et al. (2012), the growth in population will further put a pressure to the government to increase important and to find alternative policies to sustain production and to increase yield such as subsidy, incentive, tax exemption and many more.

Based on the literature review the third and fourth proposition can be drawn as:

P3a: The positive relationship between physical capital and agricultural productivity is moderated by support policy, such that this positive relationship is stronger at higher levels of support policy of agriculture.

P3b: The positive relationship between human capital and agricultural productivity is moderated by support policy, such that this positive relationship is stronger at higher levels of support policy of agriculture.

The four propositions give rise to the agricultural productivity model as shown in Figure 1.

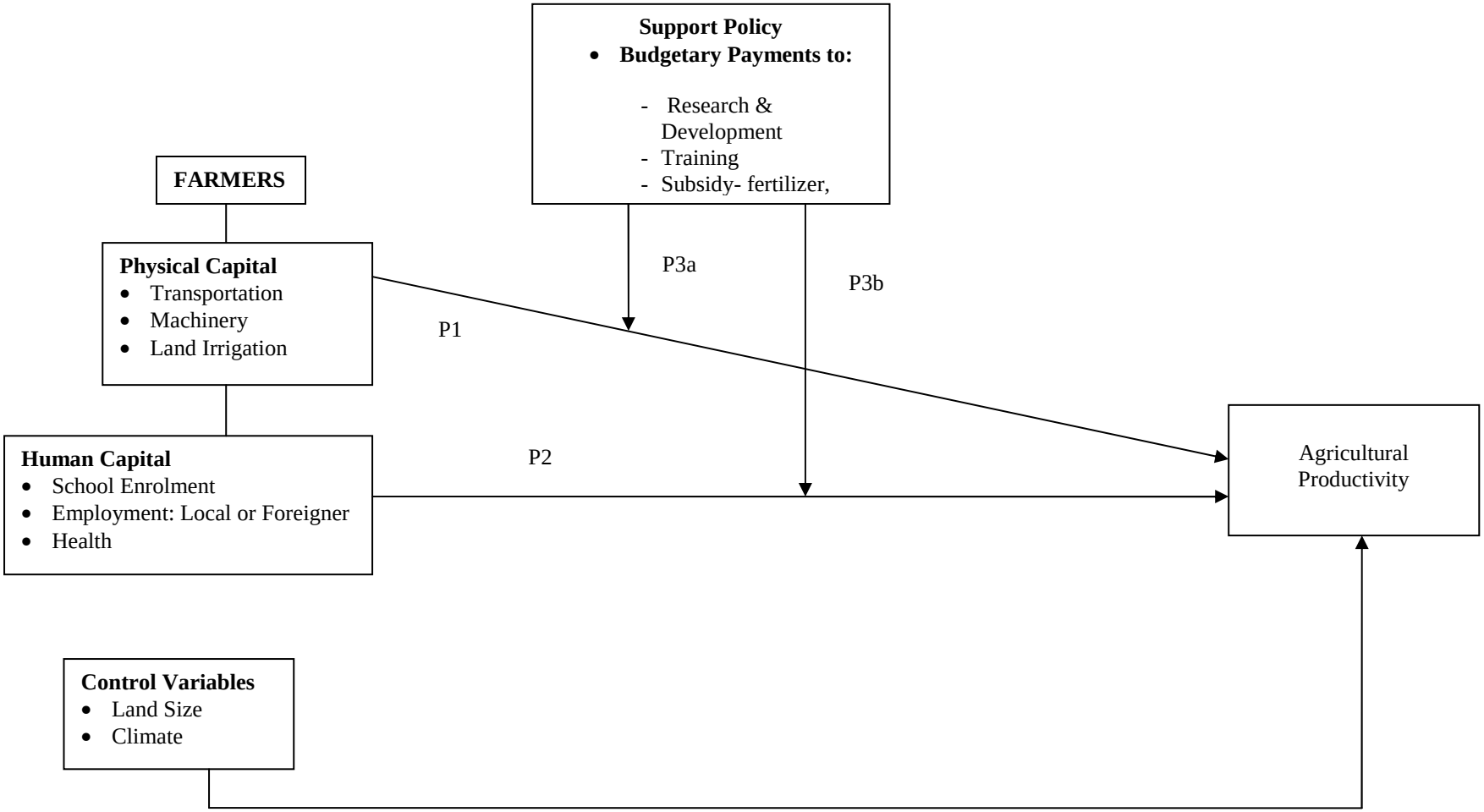

Figure 1: A proposed agricultural productivity model

Conclusion

Agriculture is the most important sector in developing countries given its contribution to employment, trade, food security and it linkages with other sectors of the economy. Improving the production capacity of agriculture in developing countries through productivity increases is an important policy goal where agriculture represents an important sector in the economy. Economic indicators have long been recognized as an important instrument for agriculture productivity. There are many reasons for the remarkable improvements in agricultural inputs such as physical capital and human capital. The provision of physical capital such as land, labour, fertilizer, climate, water sources and irrigation are expected to help the productivity of agriculture. In spite of physical capital, another factor to be concerned is human capital. High value of human capital such as increase number of schooling citizens will bring significant impact to the nation. Lacking of this matter could promote disparities among countries resulting from unequal dissemination of technology. This paper provides a framework for analyzing the relationship between the effects of economic indicators on agriculture productivity. In addition, it highlights the relevance and effectiveness of economic indicators as external resources which stimulate the productivity of agriculture. So, support policy is set as a moderator which it is expected to improve both physical capital and human capital and thus enhance the productivity of agriculture.

Future Research

As a final remark, since this is a conceptual paper, future research is recommended to use this framework. This can be done by using primary data collected from the farmers and government bodies. Future research could consider Malaysia and some ASEAN countries to determine outcome similarities or differences. In addition, future research also should consider other variables that may influence the agriculture productivity such as technology and innovations. Future research should also incorporate a longitudinal study since agriculture is one of the main contributors to the GDP and it is extremely difficult to measure the productivity in a short-term period.

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