



Is Inverse Relationship a Phenomenon?

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ABSTRACT

Inverse productivity principally disproves the land productivity which is presumably based on the size of the farm. The main aim of this paper is to analyse profoundly the empirical studies which have been conducted on this issue and to develop some policy implications. The empirical results show that an inverse relationship in developing countries could become more of an issue because of the predominant role of agriculture in economy. Some suggestions can be put forward in order to handle the problems that small farms encounter. First and foremost is the high value added product. The government thus should encourage small farmers to grow high value added products by actively controlling market supply and demand. Second, public policies should be sufficient to attract private investors in transportation, retail chain stores, processing and storage. The technology level of larger farms should be costless and easily transferred to smaller farms. Last but not least, small farms are one of the most fragile issues concerning family farms and food security. Hence, the policies should carefully be tailor-made.

1. Introduction

Inverse productivity (IP) basically disproves the land productivity which is presumably based on the size of the farm. One of the first empirical studies on IP was carried out by Sen (1962). His research covering farms in India clearly referred to this IR. Subsequently, this idea has increasingly attracted many researchers. This theory has been extended by many researchers. Barthan (1993) pointed out two main reasons for it; firstly, small farms have a larger productivity than big farms and second why small farms use more current inputs per acre. A similar view was held by Ellis (1998) that larger farms underutilize the total land area at their disposal contrary to smaller farms. In general, this adverse relationship has been mostly analysed in the developing countries where the agriculture is leading in the economy. Not only is this idea completely accepted but also challenged by researchers. While Mazumder (1965); Barthan (1973); Banarjee (1985); Feder (1985); Byiringo (1995); Heltberg (1998); Chen et al. (2005); Thapa (2007) demonstrated impressive empirical studies showing IR between productivity of land and size of farm, Deolalikar (1981); Barbier (1984); Barrett (1996); and Tadesse and Krishnamoorthy (1997); Muyanga & Jayne (2014) rejected this hypothesis in their researches. Moreover,

Barbier (1984) heavily criticized of this phenomenon by underlying that most researches on the issue have been based on wrong assumptions and methodologies. Similarly, Barrett (1996) indicated technology which seems an improbable source for this under most conditions.

The main aim of this paper is to analyse the empirical studies which have carried out on IR in detail and develop some policy implications. The paper is outlined in five sections including introduction and conclusion. After giving the Introduction section, the second part focuses on the empirical studies supporting inverse productivity, the second parts takes the researches rejecting the IR and the third section develops possible policy implications on the basis of the empirical studies. This study ends with a short conclusion.

2. Inverse Relationship

Sen (1962) found that increasing size of land does not remarkably show increasing productivity with his aggregated data. Afterwards, this fact was explained in three ways; technique-based, labour-based and fertility-based. Bharadwaj (1974) concurred with this theory with an investigation in India covering the years between 1954 and 1957. But his hypothesis was not found

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statistically significant though there was an inverse relationship in the majority cases. A similar stance comes from Mahesh (2000) and Bharadwaj (1974). Both studies also found no statistically important relationship between land size and productivity. Bharadwaj (1974) found that farms employing family labour are more efficient than farms employing only hired-in labour. Three essential arguments behind this hypothesis were argued by Feder (1985). First are the hired labourers. They could be more efficient when subjected to more supervision. Secondly, family members, apart from being motivated than hired labourers, perform a supervisory role regarding as hired labour and thirdly, the supply of working capital to each farming household is positively related to the amount of land it owns. In line with Sen (1962), Banarjee (1985) observed that larger farmers in the distinct of Nadia in West Bengal use their land and fertilizer inputs less intensely than smaller farms. He also showed that the inverse relationship between farm size and productivity are stronger in the agriculturally developed regions than less developed regions. A similar stance was taken by Heltberg (1998) and Byiringo (1995). In the first case, it was found that small farms are significantly more productive than big farms, particularly in irrigated and relatively developed areas of Pakistan. The latter case proved IR in Rwanda with decreasing of the marginal value of land while size of the farm increases. Likewise, Chen et al. (2005) found an inverse relationship between farm size and land productivity in China. However, they find that the inverse relationship is partially diminished on time.

IR was shown by Bharadwaj (1974) as a result of the sensitivity of cropping patterns to farm size. According to his research, small holdings with higher productivity have larger percentage of area under coconut and banana of which value added is explicitly more than other products and higher productivity is related with certain types of crop mix. Another point to be carefully considered is the technical level of small farms. For instance, a study covering Indian state of Tamil Nadu showed that 90% of the variation in output among paddy farms in the state is due to differences in technical efficiency. This means that paddy farms achieved it with the technical efficiency that they possess. A similar view was expressed by A.K. Ghose (1979) that an essential pre-condition for the existence of the inverse relationship phenomenon is nothing more than technical backwardness. Apart from this perspective, Thapa (2007) believed that reaching credit and having perfect market information would be likely enough to ignore this relationship. Last but not least is the type of the data used in the model. Rather than using aggregated data in Sen's (1962) model, Barthan (1973) used deliberately disaggregated farm-level input and output data to fit production functions in Indian agriculture. Though he found an evidence showing decreasing returns to scale in paddy agriculture he was to a certain extent unsuccessful to get the same results from wheat agriculture displaying constant returns to

scale. It might be concluded from this result that IR cannot be proved for each agricultural products.

3. Adverse Studies For Inverse Relationship

There are three main criticism raised in the literature (Heltbergh, 1998). These are omitted variable bias, green revolution and a missing consistent explanation for the inverse relationship. Also the crucial effect of land reforms made in India could be included among these criticisms. IR hypothesis developed by Sen (1962) was vigorously attacked by Barbier (1984). From his point of view, this model was based on the wrong assumptions made by most researchers. He even went on the claim that the inverse relationship thesis was spurious and without any theoretical meaning. This view was supported by Professor Khusro with his survey, stating "the minimum size of holding to achieve a minimum income goal for tenant-cultivators is 10-15 acres". Nonetheless, productivity per acre in this size-group is about 25 per cent below the maximum obtained on smaller holdings (Mazumder, 1965). Similarly, Carter (1984) provided that smaller farmers in India would produce 15% less output than larger farmers given the same inputs (Carter, 1984). In line with anti-thesis, Carletto et al. (2011) found that IR emanates from land measurement error in their empirical results belonging Uganda since small farms would underreport land area and productivity if compared with large farms.

It is widely believed that the data used in the model proposed by Sen (1962) and the other supporting models belonged to the 1950's and the beginning of the 1960's. So, they do not reflect the reality of productivity at all as it leads to any size of farms to increase their output with the use of fertilizers in their production. As a matter of fact, Deolalikar (1981) stated that IR has changed after the Green Revolution in one district of the Punjab but remained unchanged in another district. However, it was found by Heltberg (1998) that there is no indication showing that Green Revolution changed IR. Another argument used in inverse relationship is the labour force. There is a common belief that farms employing family labour due to the supervision achieve higher productivity than those employing only hired labour. Yet, this again provided no conclusive evidence in a study carried out by Mahesh (2000). However, the co-efficients of family size both in output and in labour hours per hectare reveal the importance of family labour on farm productivity in most part of rural areas (Thapa, 2007). Helbert (1998) based the adverse relationship with lack of labour, reaching to land and credit and insurance market failures on his model. The last case comes from the data extracted from 47 counties of Kenya. Muyange and Jayne (2014) observed the positive relationship between farm productivity and landholding size. But it is considered by the authors that this is not the only driving force. There are also other factors that might affect this rela-

tionship. These are; scale of farming providing employment effects per unit land cultivated and scale of farming providing upstream and downstream multiplier effects.

4. Policy Implications

The empirical results show that an inverse relationship in developing countries might become more of an issue due to the predominant role of agriculture in economy. Carletto et al. (2011) underlined land measurement errors coming from small farms in Uganda. The statistics received from these small farmers could be artefact rather than real fact. So, true statistics strengthened with Geographical Information Systems would play an essential role for explaining the IR. Also, significant number of researchers shows that many developing countries from India to Pakistan, from Turkey to Brazil try to implement an efficient land reform. The empirical studies conducted in India proved that if the higher productivity land is divided in small farms, these could even be more productive. Fan and Chan-Kang (2005) pointed out average size of large farms dropped from 32.7 acres to 25.5 acres over the period of 1953-1954. This decline suggested that much growth in the number of smaller farms may have resulted from the subdivision of large farms. Aside from land reform, what small farmers challenge is to reach credit easily and to use new technology in their farms. Therefore, developing credit mechanism and easily transferring of technology from bigger farms to smaller farms are in essence very important.

As stated by Heltberg (1998), removal of subsidies, improved access to credit for small farmers, improved access to extension for small farmers and having secure tenure contracts are most important issues for small farmers. The more these conditions are provided to small farmers, the more the productivity of these farms might be higher. Otherwise, the advantage of large farms will continue over small farms unless credit markets are perfect and factor price distortions against small-sized farms is removed (Ellis, 1998). Also, this is not only important for the economy but also for the food security in spite of the fact that there exists some opposite ideas like Bellemare (2012). It has been argued that considering smallholders are in a better position than larger holders is a serious misconception.

Mellor (2014), on the other hand, suggests that supporting small commercial farmers can provide large scale expenditure on the employment intensive and providing large declines in poverty. This is in line with United Nation policies. For instance, small-scale farming is strongly linked with food security according to the FAO. Concerning food security, small farms specialize in less profitable products rather than high-value added products (Lipton, 2006). It is suggested that policies in developing countries should focus on productivity of small farms rather than leaving them to their fate. Accordingly, the United Nations, Food and Agricultural Organization declared the 2014 year as “International

Year of Family Farming”. In contrast to green revolution focusing on industrial farming by leaving conventional agriculture in 1960's, there is nowadays a growing aspiration by consumers to turn back to conventional agricultural methods in order to live in a healthy way. In this sense, the importance of good agricultural practices or organic agriculture continuously increases. What consumers mostly demand from markets nowadays is generally provided by small holders. But it cannot be said that the demand is sufficiently met by the local producers as the number of local producers decreases though the population increase. Last but not least are the high value-added products which are based on technical efficiency like paddy farming. If small sized-farms produce high-value added products, their productivity would be higher.

5. Conclusion

The objective of this study is deeply analyse the relationship between land size and land productivity. The main argument in literature is still disputable. In spite of the fact that there are a significant number of studies refusing IR, there are a large number of field studies mainly coming from Asian and African countries find negative relationship between land size and land productivity. The lack of perfect market conditions in developing and underdeveloped countries is sufficient enough to explain low shadow price of family labour. Labour intensively production system of the small-sized farms distinguishes them from medium and large farms.

IR has immensely attracted many researchers. This relationship in general can mostly be seen in the countries of which economy is mostly based on agriculture. In particular, the countries having small farm sizes like India, Nepal and Pakistan are the best suited countries. However, there is no unanimity in literature. Different opinions usually stem from the data used in the surveys. The critiques that are made generally focus on the year of survey just before the green revolution that causes higher productivity with the technology level of farms. But there is a considerable amount of studies finding negative relationship on IR after green revolution. Several reasons can be brought forward for explaining the IR. The condition of soil, the level of technology, experience of farmers, the status of land tenure, the products having more value-added and reliable data that are used in the models are some of them.

Some suggestions can be made in order to handle problems that small farms encounter. First and foremost is the high value added product. Small farmers should be encouraged by the Governments/Agents to grow high value added products by controlling market supply and demand. Good agricultural practices and organic farming can also be subsidized by the Government as there is a growing demand from consumers. Second, public policies should be sufficient to attract private investors in transportation, retail chain stores, processing and storage. The technology level of bigger farms should be

costless and easily transferred to smaller farms. Last but not least, small farms are one of the most fragile issues concerning family farms and food security. Therefore, tailored-made policies on IR might have a major influence on IR concerning employment patterns, and the level of technology, being supported with an efficient data system covering all farms from subsistence farms to medium or large farms.

6. References

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