

論文の内容の要旨

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論文題目 A Study on Production and Distribution Efficiency of the
Peruvian Agri-Food System

(ペルーにおけるアグリフードシステムの生産・流通効率性に関する研究)

Peru is currently in a critical point in its development process. Currently included in the *urbanized countries* of Latin America (World Development Report 2008), Peru has seen the gradual decrease in importance of agriculture in GDP (agriculture production accounts for 9% of total GDP for 2008). Yet, Peru still faces many of the characteristics found in *transforming countries* characterized by rising rural-urban income disparities and extreme rural poverty. Development resides on wherever Peru can overcome its challenges both as an *urbanized* and as a *transforming country*. A vast number of economists have emphasized the importance of the agricultural sector not only as a means to provide food resources but also as a necessity for development. The link between economic growth and an efficient agricultural sector has been proven explicitly or implicitly by many literatures as a backbone for the direct and indirect achievement of development (Hayami, 2001).

According to previous studies, Peruvian agriculture development faces two major challenges. The first challenge is the problem of low agricultural productivity which is vital for stimulating economic growth and reducing rural-urban income disparities. For the last two decades all efforts by the public sector had focused on increasing agricultural productivity, yet this has been done without paying much

attention to the relationship between product and market.

The second challenge is the accessibility to a competitive commercialization system. In the current setting of the Peruvian agriculture, market competition is a crucial factor in assuring that the system of prices assigns resources in an efficient way. Productivity must be accompanied by an adequate infrastructure system, with information and institutions that provide a fair value to the producers as well as to consumers.

Both of these challenges are associated with efficiency, at the production level and at the commercialization level. To analyze one without considering the other could lead to ineffective implications, since both sectors are highly integrated.

The problematic in the Peruvian agriculture development that this study focuses on is twofold. The first deals with the problem of low productivity at the Peruvian agriculture based on the viewpoint of the disproportionate regional resource endowment. The second problem deals with market inefficiency of the Peruvian agri-food system.

The purpose of this study, after examining both arguments, is to reach an integrated understanding of the efficiency problems in the Peruvian agriculture in order to determine opportunities to alleviate the challenge faced.

This paper is divided into two main parts. The first tackles the productivity problem of the Peruvian agriculture based on the viewpoint of the disproportionate regional resource endowment and its relationship to efficiency and technological change. The second part tries to grasp the market efficiency of the Peruvian agri-food sector by applying vertical and spatial price transmission analysis.

Chapter 2 tries to quantitatively examine the evolving regional agricultural process in Peru for the period 1970-2003 applying a labor productivity decomposition analysis (Kuroda, 1995) to the three main regions. This study provides a segregated regional analysis with results that might differ from those of traditional aggregated national examinations.

According to the regional Peruvian agriculture dual cost estimates, labor productivity levels were greatly dependant upon technical change only in the Costa region. The Sierra and Selva regions share very similar characteristics (increasing returns to scale and low TFP levels). This might be explained by the differences in natural resources, crop production technology, and geography in the Costa region as compared to the other two regions. Low growth rates of labor productivity have been

the trend for both the aggregated view as well as the disaggregated regional views, with differences between the Costa region and the Sierra and Selva regions. Factor price change effects have contributed positively to increase labor productivity in all the regions except for the Selva region, implying that farm units were partly sensitive to factor price changes. In the Selva region the contribution by factor price changes to increase labor productivity has not been substantial, possibly due to the lower availability of agricultural labor and the higher prices of fertilizer and machinery inputs. In addition, the biased technical change effects were labor-saving for the Costa and Selva regions. For the Sierra region the labor-consuming trend might be due to the high agricultural labor pressure on arable land and relatively low wages. Machinery use has been significantly biased toward saving in both the Sierra and Selva regions. This might be related to their small farm size which precludes the necessity of machinery; the ample availability of labor in the Sierra region as a cheaper alternative; and the fact that the imported technology was probably not suited for the specific geographical requirements of the mountainous Sierra region and the rainforest environment of the Selva region.

Chapter 3 focuses on productivity at the provincial level and tries to examine the unobserved characteristic of the Total Factor Productivity (TFP). Although it can be decomposed into its many measurable effects (Antle and Capalbo 1988), there still remains an unobserved characteristic that cannot be molded into quantitiveness. This unobserved trait which stems from different sources, e.g. management attributes, propensity to try new technology, and entrepreneurship, could be obtained through panel data estimates (Gardebreek and Oude Lansink, 2003). By applying this methodology to the case of Peruvian agricultural output we can determine which factors could explain the recent trend of productivity divergence between traditional and non-traditional crops. Traditional crops, which have been the main output of Peruvian agriculture, have started to decrease in importance, while non-traditional crops such as asparagus have seen an exponential increase in their share of agricultural GDP in the last decades. The objective of this chapter is to try to econometrically examine the unobserved factor components in agricultural TFP for the different provinces of Peru, and its relationship with traditional and non-traditional agricultural outputs.

Results indicated that province-specific effects are correlated with investment and technological progress. Since the province-specific effects account for the

unobserved components of TFP, we can conclude that differences in TFP between provinces are related to differences of these quasi-fixed inputs. By looking at the correlation between these fixed inputs and outputs, we can see that the technological trend reduces output for traditional crops and increases output for non-traditional crops. This result may be explained from two possible viewpoints. It seems that the technological trend is clustered only in some provinces and in some crops. Provinces that produce traditional crops seem to lack the ability to positively absorb the technological trend, showing a negative effect. This may be due to the lack of technical assistance and managerial efficiency as well as production and environmental restrictions of traditional crops. Another possibility is that there seems to be a large divergence between traditional and non-traditional output due to technological trend for some provinces and some crops. Infrastructure investment increases output for both traditional and non-traditional crops, although land and infrastructure investment seem to have a much greater effect on output for traditional crops than for non-traditional crops. This might be explained by the differences in existing resource requirements, crop production technology and investment scale between the two types of crops and the provinces in which they are produced. It can be inferred that effective managerial abilities are a determinant of infrastructure investment or that infrastructure investment help increase TFP levels.

Chapter 4 delves into the market efficiency of the Peruvian agriculture system by analyzing vertical price transmission. Price transmission analysis has been used in countless studies to try to determine the efficiency of vertical or spatial markets. Yet there is one trait common to market players that is of importance, adjustment resistance. This behavior can be interpreted by way of thresholds. For the case of the agri-food supply system of Peru, saturation and a highly competitive distributor sector may provide an understanding for the interpretation of price adjustment resistance. The objective of this chapter is to try to econometrically analyze and assess the presence of nonlinear price transmission behavior between farm-gate, distributor and wholesale agri-food prices in Peru using a Threshold Vector Error Correction Model (TVECM).

Granger-causality results indicated the presence of significant feedback between farm-gate and wholesale prices, yet no significant feedback between farm-gate and distributor prices. Price transmission results indicated that, in general, wholesale prices were significantly more responsive than distributor prices to price variations

due to exogenous shocks in the long-run. Results indicated non-linear performance in this system, with distribution prices strongly adjusting to farm-gate price variations only after a certain threshold was surpassed. This behavior might be explained by the high fixed costs, excess capacity, and competition in the distribution market level of the Peruvian agri-food supply system which prohibit perfect price adjustment if the price variation is within a threshold value.

Chapter 5 provides a spatial market integration analysis using a threshold model. Recently the addition of thresholds in VECM has opened the possibility to include an important issue in market arbitrage, transaction costs. For the case of the Peruvian agri-food supply structure, different distribution networks may provide an understanding for the interpretation of arbitrage and transaction costs. The objective of this chapter is to try to econometrically analyze and assess the presence of threshold behavior between separated markets for different Peruvian agri-food commodity crops using a TVECM (Hansen and Seo, 2002), in order to determine possible factors influencing transaction costs and arbitrage.

Results indicated that *Lima* potato and rice wholesalers are more flexible towards price variation of potato and rice in comparison to other provinces. Observing long-run speed of adjustment estimates between provinces other than *Lima* we saw that trade flowed in both directions which was expected since most provinces, with the exception of *Lima*, alter between being net-suppliers and net-consumers of potato and rice during different periods. For the case of brown sugar the results show that trade flows mostly in one direction and could be explained by the sugar agri-food industry which is composed of few companies with high market share, therefore making these provinces net-suppliers at all times. Results also indicated non-linear performance in this system, with market prices strongly adjusting to differential price variations only after a certain threshold was surpassed.

In conclusion, productivity levels were found to differ according to the region and the type of crops produced. Land and infrastructure investment were found to have a much greater effect on output for traditional crops at the Sierra and Selva regions than for non-traditional crops at the Costa region.

Wholesalers were significantly more responsive to price variations due to exogenous shocks than distributors and farmers.

Trade of potato and rice between pair provinces, with the exception of Lima,

flow in a bi-directional manner which suggest that most provinces alter between being net-suppliers and net-consumers of potato and rice during different periods.

Based on the results obtained the following general implications can be formulated. Land and infrastructure investment should be mainly directed toward traditional crop producing provinces. The focus should not only be on introduction of new technologies, but also in the appropriate use of such technologies given the managerial abilities and resources of the farmers. Adequate technical assistance and adaptation of technologies according to the productive environment of traditional crop production should be of special concern.

Adjustment costs at the distribution sector of the agricultural system seem to impede efficient price adjustment; further studies should be made to pinpoint the contributing factors and reduce such asymmetries in price transmission.

Different climate conditions within Peru make certain provinces net-suppliers and net-consumers of potato during different periods. Therefore the government should monitor climate and price changes to create an adequate and efficient harvesting production schedule.