Economic Analysis and Policy 56 (2017) 114–125

Contents lists available at ScienceDirect

Economic Analysis and Policy

journal homepage: www.elsevier.com/locate/eap

Full length article

Which farming systems are efficient for Vietnamese coffee farmers?

Thong Quoc Ho [a,b,*], Viet-Ngu Hoang [a], Clevo Wilson [a], Trung-Thanh Nguyen [c]

[a] School of Economics and Finance, Queensland University of Technology, Australia
[b] Department of Economics, Tay Nguyen University, Viet Nam
[c] Institute for Environmental Economics and World Trade, Leibniz University Hannover, Germany

ARTICLE INFO

Article history:
Received 4 August 2017
Received in revised form 5 September 2017
Accepted 5 September 2017
Available online 8 September 2017

JEL classification:
Q1
O13

Keywords:
Vietnam's coffee production
Farming synchronization, segregation, diversification
Efficiency
Input distance function

ABSTRACT

This paper provides a comparative assessment of the productive efficiency of three common coffee growing systems in Vietnam: mono-cropping, synchronization and segregation. Results from an input distance function approach deliver several important findings. First, the average inefficiency level is estimated to be around 18% although inefficiency varies significantly between the three farming systems. Second, the synchronized system of growing coffee and the other industry crops is found to be the most efficient farming system. Third, coffee mono-cropping is less efficient than synchronized systems due to the presence of economies of scope between coffee and industrial crops. Fourth, the least efficient system is segregated cultivation of coffee and rice. Food insecurity is seen as a primary reason for coffee farmers diversifying into rice. These findings provide empirical evidence of agronomic benefits being derived from synchronized systems, and which are translated into higher productive efficiency. Policy options promoting synchronized farming systems may therefore enhance both economic and agronomic benefits.

1. Introduction

Coffee production is one of the primary economic sectors in the Central Highlands region of Vietnam with nearly 96% of Vietnam's export of coffee coming from this region. Due to significant price increases in the early 1990s, the area used for coffee cultivation increased by approximately 400% from 1999 to 2000. This expansion appears to be a natural adaptation of farmers in response to past increases in prices. However in subsequent periods the resulting increases in market supply caused prices to drop to a level which, by 2001, was lower than the production cost (Marsh, 2007). This forced many coffee farmers into bankruptcy (Wollni and Zeller, 2007) and is seen as one of the reasons motivating coffee farmers to diversify their business and for the presence of several distinct farming systems in Vietnam.

In this study, we consider three typical coffee growing systems in Vietnam: mono-cropping, synchronization and segregation. The nature of specialization and diversification vary significantly across these three distinct systems. Mono-cropping farms have only one land plot and grows only coffee. Segregated farming systems have more than one plot of land with each plot growing one primary type of crop. For example, where farms have two plots, one plot grows coffee and another plot grows rice. Synchronized farming systems grow coffee together with other industrial crops in one plot and rice in a separate plot(s). There is an obvious need to know which farming system are most efficient for coffee farmers in

* Correspondence to: Queensland University of Technology, Business School, School of Economics and Finance, W/S14, Z755, 02 George Street, QLD 4000, Brisbane, Australia.
E-mail address: quoc.ho@qut.edu.au (T.Q. Ho).

http://dx.doi.org/10.1016/j.eap.2017.09.002
0313-5926/

Vietnam — an issue which the existing literature provides no empirical evidence. This literature gap is, therefore, the primary motivation of the present paper.

It is noted that diversified systems, particularly through crops diversification, may obtain higher yields and/or cause less environmental damage (Letourneau et al., 2011). This is known as complementary or synergy effects among crops sharing the same environment. However, there may be diseconomies of scope or negative effects of synergy as empirically observed in, for example, Coelli and Fleming (2004). Since appropriate crop diversification strategies can deliver positive effects of synthesis, it could be expected that coffee farmers would be motivated to diversify by growing industrial crops such as pepper or durian which may also mitigate market risk. However, it becomes less clear why coffee farmers have chosen the segregated system in which rice and coffee are grown in separate land plots given it does not deliver positive synthesis effects and could produce diseconomies of scope (Villano et al., 2010). More particularly, some studies have hypothesized that Vietnamese coffee farmers diversify to rice because of the insecurity created by low incomes and volatile market conditions (i.e., Dang, 2003). If this is true, segregated farms face a trade-off between productive efficiency and income or poverty risks. In this paper, we aim to provide empirical evidence on this trade-off hypothesis. Our empirical results are therefore designed to indicate the rationale for Vietnamese farmers' decisions over which crops to grow rather than accepting that they may be made on *ad hoc* or irrational basis (Dang and Shively, 2008). As such, this study can provide a useful guide for policy makers in raising the productivity of Vietnamese coffee farmers.

We utilize several techniques to examine differences in the level of productive efficiency among the three farming systems using a dataset of 167 farms surveyed in five Central Highlands communes in 2012. The input distance function is used to estimate efficiency scores for each farm. Parametric and non-parametric tests are then applied to assess if these differences are statistically different across the farming systems of the three districts. Additionally, the input distance function allows us to examine economies of diversification which is based on the concept of economies of scope in diversified farms (Baumol et al., 1982; Willig, 1979). While there are several approaches to measuring scope economies (Chavas and Di Falco, 2012; Chavas, 2008; Ofori-Bah and Asafu-Adjaye, 2011; Chavas and Kim, 2010; Hajargasht et al., 2006), we use Coelli and Fleming's (2004) model as it does not require price information and provides a more straightforward interpretation of both efficiency results and diversification economies of each pair of crops.

The remaining part of this paper is set out in eight sections. Section 2 provides a literature review. Section 3 provides a measure of economies of diversification using the distance function. Section 4 sets out the empirical models, data sources and the use of relevant variables. Survey and descriptive statistics are presented in Section 5. Section 6 provides the empirical results. Section 7 discusses the presence of agronomic benefits and the way in which they are translated into efficiency improvements and provides an explanation of why coffee farmers still choose rice. Section 8 sets out the conclusions, policy recommendations and avenues for further study.

2. Literature review

The various dimensions of farming management practices are well captured in the literature (Bell and Moore, 2012). In particular the farming system in which crops use the same resources, i.e., water and nutrients simultaneously, is known as an intercropping system or synchronization (van Asten et al., 2011). Another common farming integration system is crop rotation: however it is not applicable to perennials such as coffee and other industrial crops. In addition, segregated systems are known as integration of spatially separated crops. This farming practice is found to be attractive to smallholder farmers cultivating both subsistence crops and cash crops (Solís et al., 2009). For example, in the Central Highlands of Vietnam, coffee is a dominant crop and farming is mostly small scale (Luong and Tauer, 2006) mixed with some diversified subsistence crops, i.e., rice (Doutriaux et al., 2008). Therefore, by examining the economic benefits of different farming practices, i.e., crop specialization (not integrated organizationally), segregation (only integrated organizationally) and synchronization (integrated organizationally, spatially and temporally) (Bell and Moore, 2012), it is intended to make a useful contribution to the farming management literature.

Crop diversification in synchronized systems has, on the one hand, the potential to deliver agronomic and ecological benefits; however realizing these potential benefits depends on the characteristics of ecosystems and the choice of crops (Bacon, 2005; Dang and Shively, 2008; Kremen and Miles, 2012; Padrón and Burger, 2015). On the other hand, there are little or no agronomic benefits from crop segregation, although this type of farming system may have other desirable outcomes in terms of food security and allocation of inputs (Bell and Moore, 2012).

There is a rich literature on various synchronized systems of crop diversification (i.e., Rahman, 2009; Kim et al., 2012), but only a few studies examine coffee farming (i.e., van Asten et al., 2011) and no study compares the productive efficiency between synchronized and segregated systems. For synchronized systems, it can be expected there will be a direct transformation of agronomic and ecological benefits into economic benefits through reductions in consumption of inputs without sacrificing output levels or through increasing output levels without requiring more input consumption. For example, the agronomic literature has identified crops such as avocados and fruit trees as being suitable for cultivation with coffee (Borkhataria et al., 2012) joint-production of which can result in less fertilizer being required. It is noted that lower fertilizer consumption delivers both a cost reduction and a reduction in negative environmental impacts. But synchronized systems may require greater management attention (Bell and Moore, 2012). However, growing different crops in different land plots in segregated systems may not deliver benefits of synchronization and in many situations segregation exposes farms to a higher risk of productive inefficiency. This comes about through misallocation of resources as farmers maybe inefficient in allocating limited resources among different plots growing different types of crops (Bell and Moore, 2012).