

**Three essays on the economics of cocoa – The technical
and environmental efficiency of Indonesian cocoa
production**

Dissertation

to obtain the Ph. D. degree

in the International Ph. D. Program for Agricultural Sciences in Goettingen (IPAG)

at the Faculty of Agricultural Sciences,

Georg-August-University Göttingen, Germany

presented by

Andras Tothmihaly

born in Veszprem, Hungary

Göttingen, April 2017

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1. Name of supervisor: Prof. Dr. Stephan von Cramon-Taubadel

2. Name of co-supervisors: Prof. Dr. Bernhard Brümmer, Dr. Vijesh Krishna

Date of dissertation: 12 July 2017

Summary

In the new millennium, the soaring economic growth in Asia and Africa, the increase of world trade, and globalization have boosted the global demand for cocoa. However, world cocoa supply could barely keep up with demand. These processes triggered a high volatility in global cocoa prices. Volatility induces uncertainty among market participants, hence preventing the market from working properly. It also makes the millions of cocoa farmers in the developing world highly vulnerable to poverty.

Our first essay helps to inform development policies of the elements involved in the global cocoa bean market to understand the roots of the recent price volatility. A large volatility in the value of an agricultural commodity is linked to the inelasticity of its supply or demand. Therefore, we test the hypothesis that the price elasticities of the global cocoa supply and demand are low. We find that the global cocoa supply is extremely price-inelastic: the corresponding short- and long-run estimates are 0.07 and 0.57. The price elasticity of the world cocoa demand also falls into the extremely inelastic range: the short- and long-run estimates are -0.06 and -0.34 . Based on these empirical results, we consider the prospects for cocoa price stabilization. The cocoa price volatility was treated with various unsuccessful methods in the past. A possible solution for reducing the price volatility would be the encouragement of crop diversification. This increases the price elasticity of cocoa supply by adjusting the effort and money allocation between the crops, thus decreasing price volatility.

Our second essay investigates how the cocoa sector can be made more productive to increase supply and farmer incomes. We concentrate on Indonesia, which gives 10 percent of the world cocoa production. According to our results, technical efficiency growth and the increased chemicals use supported by government subsidies were responsible for the majority of average productivity gains (75 percent) between 2001 and 2013. Furthermore, we find large distortions in the input allocations. Hence, policies that encourage the adjustment of the cocoa farms' input use would be highly beneficial. Moreover, because of the weather-induced volatility in cocoa production, policy makers should also promote investment in agricultural research and transfer of drought-resistant cocoa varieties to farmers. Additionally, the average efficiency of cocoa farmers is estimated to be around 50 percent. We find that farmers' educational attainment and their experience in cocoa farming are significant factors that can increase the efficiency levels. Our research also shows the insignificant effect of existing agricultural extension services, farmer associations, and rural credit programs on the technical

efficiency of cocoa farming. Hence, public policy should focus on adjusting the public extension programs, fostering the mutual benefits in the farmer groups, and developing viable credit institutions.

In our third essay in Chapter 4, we look at the trade-off between smallholder cocoa intensification and the ecosystem in Indonesia and investigate the determinants of environmental efficiency in cocoa production. In our analysis, we apply a distance output function that includes cocoa production and the abundance of native rainforest plants as outputs. Our data set, based on a household and environment survey conducted in 2015, allows us to analyze 208 cocoa producers with both measured and self-reported data. We find that the intensification of cocoa farms results in higher ecosystem degradation. Additionally, the estimations show substantial average inefficiencies (50 percent). Increasing efficiency could lead to a win-win-win situation: more production coming from less hectares, with more native plants co-existing with cocoa on the remaining hectares. On average, the efficiency scores point to a possible production expansion of 367 kg of cocoa per farm and year, to a possible increase of 43680 rainforest plants per farm, or to a possible acreage reduction of 0.52 hectares per farm. Furthermore, we find that agricultural extension services have a substantial role in increasing efficiency. Finally, our results show that credit access does not have a significant effect on efficiency. Feasible agricultural credit services are viewed by numerous economists as a crucial prerequisite for improving efficiency, a critical part of encouraging development. We recommend linking credit to extension services as part of this effort.