SGA Newcomer Award 2022

1st rank

The role of risk preferences in the participation in agri-environmental schemes: A case study in the Flaachtal region

Eileen Ziehmann

Agriculture, forestry, and other land use produce around a quarter of current global greenhouse gas emissions (Smith et al., 2014), thus carrying an internationally recognized potential for climate change mitigation (FAO, 2019). Agri-Environmental Schemes (AES) have emerged as the prominent mechanism in European agricultural policy for promotion of sustainable farming practices (Hodge et al., 2015). Schemes can be action-, result- or multi-actor-oriented, and aim to financially incentivize ecosystem service (ES) provision through per-hectare direct payments (Was et al., 2021). With AES being both costly (Batáry et al., 2015; Uthes et al. 2012) and exhibiting only moderate success across Europe (e.g., Früh-Müller et al., 2019; Princé et al., 2012; Uthes et al., 2012), understanding drivers of farmer participation and engagement is crucial. In this thesis, I aim to provide an overview of important motivators and deterrents in scheme enrolment decisions, with an especial focus on the role of farmer risk preferences.

Previous literature has identified several structural, demographic, social, and financial determinants of AES participation (e.g., Lastra-Bravo et al. 2015; Mozzato et al., 2018; Siebert et al., 2006). Farmer attitudes towards risk and uncertainty have so far been included in only a small number of studies (e.g., Lefebvre et al., 2020; Was et al., 2021). However, their significant influence on other aspects of agricultural decision-making (e.g., Babcock et al., 2003; Chèze et al., 2020; Gardebroek et al., 2006; Läpple et al., 2011) suggests a potentially non-negligible effect of farmer risk preferences on AES enrolment decisions, especially in a Prospect Theory framework. Prospect Theory (PT) extends the Expected Utility Theory (EUT) framework by modeling a person's decision-making according to three parameters: their degree of risk aversion σ, their degree of loss aversion λ, and their subjective probability weighting α (Kahneman et al., 1979; Tanaka et al., 2010). PT has been shown to best explain farmer behavior in a number of cases (e.g., Bocquého et al., 2014; Carpentier et al., 2018; Finger et al., 2013; Gonzalez-Ramirez et al., 2018; Huang et al., 2013). Reports on a direct influence of risk preferences on AES participation however are rare (Lefebvre et al., 2020; Was, A. et al. 2021). Yet, risk preferences have been found to directly impact farming intensity (e.g., Chèze et al., 2020; Gardebroek, 2006; Läpple et al., 2011), a factor that itself plays an immediate role in program enrolment (e.g., Lastra-Bravo et al., 2015; Was, A. et al. 2021). Farming intensity thus may have a mediating effect on the relationship between risk preferences and AES participation.

The data analyzed in this thesis pertained to the Flaachtal region in the Canton of Zürich, Switzerland between the year 2014 and 2020. It consisted of survey data previously collected by Kreft et al. (2020), as well as census data (BLW, 2019). Since the data did not contain a direct measurement of farming intensity to be used as a mediator, a pair of mediating variables was computed instead. Firstly, average growth of total agricultural land and on-farm workforce between 2014 and 2020. And secondly, stocking density in total animal units per hectare of total agricultural land. Three variables were used to illustrate AES participation: 1) a binary measurement of participation (1 = yes, 0 = no), 2) the number of years participated in the respective scheme, and 3) changes in scheme payments between 2014 and 2020. All Swiss programs for which sufficient data was available were included in the analysis. This comprised action-oriented schemes aiming for a change in farming practices (Payments for Production Systems), or a change in resource use (Resource Efficiency Payments), schemes aimed mainly at biodiversity promotion (Biodiversity Payments), as well as multi-actor-oriented schemes focusing on regional conservation goals (Landscape Quality Payments).

Initial exploration of the potential relationship between scheme participation and farmer risk preferences was conducted using correlation matrices. The consecutive in-depth analysis consisted of seven econometric OLS regression models with varying specifications, based on those originally employed by Kreft et al. (2020). The models contained differing sets of explanatory variables, such as risk parameters only, risk parameters and controls, risk parameters and a mediating variable, controls only, controls and a mediating variable, or all three. One model used a sequential gestimation based on the approach of Acharya, Blackwell, and Sen (2016) capture the direct effect the risk parameter while ruling out omitted variable bias and other potential explanatory variables. Results of the models were illustrated using coefficient plots (Figure 1), thus making changes in significance resulting from inclusion or removal of certain explanatory variables more visible.

The econometric analysis yielded no significant association of Prospect Theory risk parameters for Resource Efficiency Payments, Landscape Quality Payments, as well as most schemes contained within Biodiversity Payments. We do however find significant relationships for three out of four programs in the category of Payments for Production Systems, i.e., for programs that require a more large-scale change in farming practices.

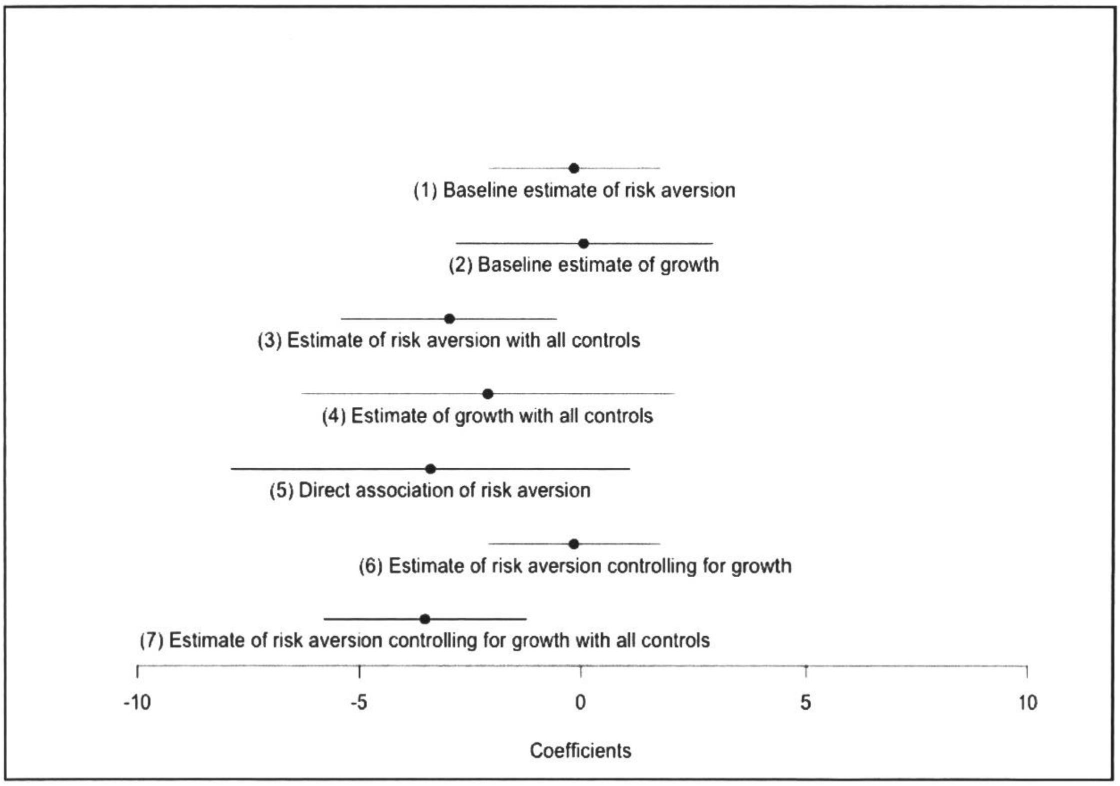

Figure 1: Example of a coefficient plot created through econometric analysis. Here, the effect of risk aversion on scheme participation is significant in model (3) as well as in model (7), upon inclusion of the mediator (growth in workforce and agricultural land). The lack of changes in significance between these models does not suggest a mediating effect of growth for this program.

For such schemes, we observe a negative association with risk aversion and a positive relationship with probability weighting. For loss aversion, correlations are heterogenous in direction. The associations with loss aversion and probability weighting are not mediated by farming intensity, but we find mediating effects in some of the models containing risk aversion.

We attempt to formulate mechanisms of participation arising from the interaction of scheme-related financial risks with farmer risk preferences, and the resulting effect on perceived volatility. We assume programs to be viewed by farmers as volatility-increasing, volatility-decreasing, or volatility-non-affecting. In our analysis, Resource Efficiency Payments, Landscape Quality Payments, and Biodiversity Payments seem to be regarded as volatility-non-affecting, with physical feasibility – such as land availability and suitability with current farming practices – being more important for enrolment decisions. An increase in biodiversity enhancement areas for example thus seems to not be affected by risk considerations, but rather by availability of suitable land, such as marginal or hard-to-manage areas, which are usually used for conservational purposes (e.g., Finger et al., 2012; Jahrl et al., 2012). Schemes seem to have a volatility-increasing character when a shift in farming practices is required, when program enrolment demands a conversion of productive cropland, or when commodity market prices are stable. In such cases, reducing inputs such as fungicides, insecticides, or growth regulators in certain crops – which is the case for a program offered within Payments for Production Systems – is likely to be perceived as increasing yield volatility, thus representing a potentially large income foregone. A particularly risk and loss averse farmer would prefer to avoid both additional volatility, as well as a potential income loss. If market prices fluctuate frequently, however, and farmers do not operate under a land or labor constraint, scheme payments might represent a more secure means of income, thus promoting adoption in farmers who are averse to market-based financial risks. Enrolling in a program for grassland-based milk production for example enables farmers to sell their milk at a higher price, thus counteracting potentially volatile or low milk market prices. This however is only possible without a land constraint, i.e., if sufficient land is available to produce the fodder needed.

From a policy perspective, this work indicates that increasing participation and engagement in AES should happen holistically, by considering a program's (perceived) effect on volatility as well as psychological consequences of enrolment decisions, and physical constraints. Decreasing scheme-related risk or uncertainty and making conservational farming psychologically rewarding should be among central aims of European agricultural policy. Technical support within a farmer's own context, farmer-to-farmer workshops, or informational campaigns could prove especially useful in this endeavor and could help increase cost-effectiveness and overall scheme success. Future research should focus on quantifying mechanisms behind program adoption and further exploring the role of risk considerations in related decision-making.

References:

- Abadi Ghadim, A. K., Pannell, D. J., and Burton, M. P. (2005) 'Risk, uncertainty, and learning in adoption of crop innovation', Agricultural Economics, 33, pp. 1-9.
- Acharya, A., Blackwell, M., and Sen, M. (2016) 'Explaining causal findings without bias: Detecting and assessing direct effects', American political science review, 110, pp. 512-529.
- Babcock, B. A., Fraser, R. W., and Lekakis, J. N. (eds.) (2003). Risk Management and the Environment: Agriculture in Perspective. Dordrecht: Springer Science+Business Media.
- Batáry, P. et al. (2015) 'The role of agri-environmental schemes in conservation and environmental management', Conservation Biology, 29(4), pp. 1006-1016.
- Bocquého G., Jacquet F. and Reynaud A. (2014) 'Expected utility or prospect theory maximizers? Assessing behavior from field-experiment data', European Review of Agricultural Economics, 41; pp. 135-172
- BLW (2019). Agrarpolitisches Informationssystem AGIS
- Cao Y., Weersink A. and Ferner E. (2019) 'A Risk Management Tool or an Investment Strategy? Understanding the Unstable Farm Insurance Demand via Gain-Loss Framework', Agricultural and Resource economics Review, 2; pp. 1-27
- Carpentier A. and Reboud X. (2018) 'Why farmers consider pesticides the ultimate crop protection: economic and behavioral insights', 30th

International Conference of Agricultural Economists.
- Chèze, B., David, M., and Martinet, V. (2020) 'Understanding farmers' reluctance to reduce pesticide use: A choice experiment', Ecological Economics, 167.
- FAO. (2019) 'Agriculture and climate change – Challenges and opportunities at the global and local level – Collaboration on Climate-Smart Agriculture'. Rome.
- Finger, R. (2013) 'Expanding risk consideration in integrated models – The role of downside risk aversion in irrigation decisions', Environmental Modelling & Software, 43, pp. 169-172.
- Finger, R. and Lehmann, B. (2012) 'Adoption of Agri- environmental Programs in Swiss Crop Production', EuroChoices, 11(1), pp. 28-33.
- Früh-Müller, A. et al. (2019) 'The use of agri- environmental measures to address environmental pressures in Germany: Spatial mismatches and options for improvement', Land Use Policy, 84, pp. 347-362.
- Gardebroek, C. (2006) 'Comparing risk attitudes of organic and non-organic farmers with a Bayesian random coefficient model', European Review of Agricultural Economics, 33(4), pp. 485-510.
- Gonzalez-Ramirez J., Arora P. and Podesta G. (2018) 'Using Insights from Prospect Theory to Enhance Sustainable Decision Making by Agribusiness in Argentina', Sustainability, 10; pp. 2693.
- Hodge, I., Hauck, J. and Bonn, A. (2015) 'The alignment of agricultural and nature conservation policies in the European Union', Conservation Biology, 29(4), pp. 996-1005.
- Huang J. and Liu E. M. (2013) 'Risk preferences and pesticide use by cotton farmers in China', Journal of Development Economics, 103; pp. 202-215.
- Jahrl, I. et al. (2012) 'Motivationen für die Umsetzung von Ökoausgleichsmassnahmen', Agrarforschung Schweiz, 541(3), pp. 208-218.
- Kahneman, D. and Tversky, A. (1979) 'Prospect Theory: An Analysis of Decision Under Risk.' Econometrica, 47(2), pp. 263-291.
- Kreft, C. S. et al. (2020) 'Data on farmers' adoption of climate change mitigation measures, individual characteristics, risk attitudes and social

influences in a region of Switzerland', Data in Brief, 30.

- Läpple, D. and Kelley, H. (2015) 'Spatial dependence in the adoption of organic dry stock farming in Ireland', European Review of Agricultural Economics, 42 (2), pp. 315-337.
- Lastra-Bravo, X.B. et al. (2015) 'What drives farmers' participation in EU agri-environmental schemes?: Results from a qualitative meta-analysis', Environmental Science & Policy, 54, pp. 1-9.
- Lefebvre, M., Midler, E. and Bontems, P. (2020) 'Adoption of Environment-Friendly Agricultural Practices with Background Risk: Experimental Evidence', Environmental and Resource Economics, 76, pp. 405-428.
- Mozzato, D. et al. (2018) 'The Role of Factors Affecting the Adoption of Environmentally Friendly Farming Practices: Can Geographical Context and Time Explain the Differences Emerging from Literature?', Sustainability, 10(3101).
- Princé, K., Moussus, J. P., and Jiguet, F. (2012) 'Mixed effectiveness of French agri-environment schemes for nationwide farmland bird conservation', Agriculture, Ecosystems & Environment, 149, pp. 74-79.
- Siebert, R., Toogood, M. and Knierim, A. (2006) 'Factors Affecting European Farmer's Participation in Biodiversity Policies', Sociologia Ruralis, 46(4), pp. 318-340.
- Smith, P. et al. (2014) 'Agriculture, Forestry and Other Land Use (AFOLU)' in Edenhofer O.R. et al. (eds.) Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press.
- Tanaka, T., Camerer, C., F., and Ngyuen, Q. (2010) 'Risk and Time Preferences: Linking Experimental and Household Survey Data from Vietnam', American Economic Review, 100(1), pp. 557-571.
- Uthes, S. and Matzdorf, B. (2012) 'Studies on Agri- environmental Measures: A Survey of the Literature', Environmental Management, 51, pp. 251-266.
- Was, A. et al. (2021) 'In search of factors determining the participation of farmers in agri-environmental schemes – Does only money matter in Poland?', Land Use Policy, 101.

Kontakt:
Eileen Ziehmann
Hohlstrasse 212
8004 Zürich

aziehmann@ethz.ch

2nd rank

The Effects of National Climate Change Policies on Greenhouse Gas Emissions From Global Croplands

Melanie Eggimann

In 2019 agriculture emitted 7.2 Gigatons (Gt) CO2 equivalent (CO2eq) which roughly converts to 20% of the total global greenhouse gas (GHG) emissions (FAO, 2020, 2021a). Thus, over the last decades policy attention has been shifted towards the agricultural sector (Grantham Research Institute on Climate Change and the Environment & Sabin Center for Climate Change Law, 2021). Policymakers worldwide recognize climate change as an urgent threat to the planet and agree that significant reductions in global emissions have to be achieved (UNFCCC, 2015). This political will has led to the emergence of international, national, and subnational policies (Garnache et al., 2017). Croplands in particular face several challenges in meeting the growing food demand and reducing emissions. The question arises whether the many climate policies are effective.

It was first analysed, how much countries do affect their GHG emissions from croplands and second, if climate change mitigation policies show effects. To answer the causal research question and explore potential mechanisms a spatial regression discontinuity design (RDD) was applied (Cattaneo et al., 2016; Imbens & Lemieux, 2008; Keele & Titiunik, 2015; Lee & Lemieux, 2010). The RDD is one of the most credible non-experimental research strategies to study causal treatment effects (Cattaneo et al., 2016). The spatial RDD exclusively compares areas close to political borders. A political border is "manmade" and not natural. Thus, it is assumed the areas very close to a political border are comparable. To ensure that all natural borders, which are for example formed through a mountain range or by waters, are excluded some robustness test were applied. The RDD then compares the cropland emissions on the left and right side of the political border. If there is a difference in the emissions a country effect is present. Country effects are for example national policies, cultivation methods or similar. The thesis analysed the effect of national climate change policies. No data was collected but pre-existing datasets were used. The data can be divided in four categories. First, data on GHG emissions from global croplands from Carlson et al. (2016) and FAO (2021b), second, data on global mitigation policies from Eskander and Fankhauser (2020), third, data on the quality of governance from the University of Gothenburg (Teorell et al., 2021), and fourth, additional data for robustness tests from Bastin et al. (2019).

The first step of an RDD is to visualize the data. The plots help to identify potential discontinuities. If a jump (called a discontinuity) right at the border (located at zero) is visible most likely the regression will confirm the presumption.

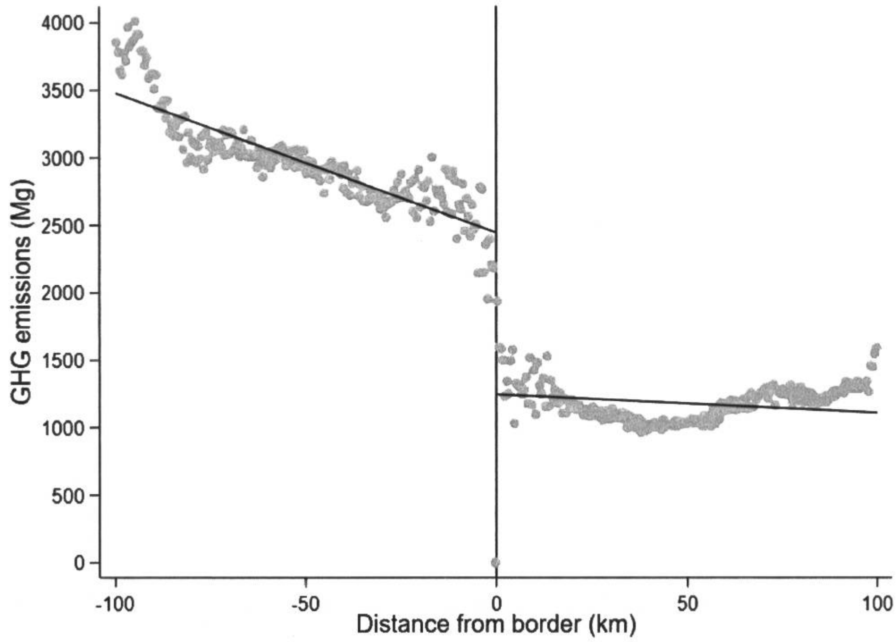

Figure 1: Spatial Distribution of GHG Emissions 2000.

Note. Border discontinuities were examined in cropland emissions a GHG emissions for the year 2000 sorted according to the GHG emissions from 2000.

Figure 1a shows the cropland emissions from 2000 on the y-axis and the distance from border on the x-axis and a jump right at the border is visible. The emissions were sorted according to the emissions from 2000. This means that countries with higher emissions than their neighbour were sorted to the left and those with lower emissions than their neighbour were sorted to the right. The border can be imagined as if all countries were lined up on their borders forming one very long "global" border. If countries do have more than one neighbour they are lined up more than once because only two countries per border at a time are compared. It is important to sort the countries in reference to their neighbour and not to the average emissions because that could cause a bias.

The regression confirmed the discontinuity in Figure 1a for the year 2000. A country effect is also present in 2019. The country effect was also present when analysing every continent separately. Thus, as expected countries have an influence on their GHG emissions from croplands. Further the thesis tried to explore what mechanisms could explain these country effects. The main intention was to analyse if climate mitigation policies show an effect on the GHG emissions from croplands. For that countries were sorted that on the left side of the "global" border all countries with more policies or more effective policies than their neighbour are and on the right therefore, those with less or not as effective as their neighbour are. If a jump at the border is then present it means that the policies show an effect. The thesis did not identify such an effect. But only general climate change mitigation policies and not agricultural specific or even cropland specific policies were analysed. Further, the number of mitigation policies is not necessarily related to a country's' level of ambition and the effectiveness of the policies (European Environment Agency, 2019). The results suggest that countries influence their emissions considerably, but general climate mitigation policies have not yet strongly affected the agricultural sector.

To explore if gross domestic product (GDP) shows an effect on GHG emissions from croplands, various test have been done. GDP growth has been observed to be a mechanism influencing the GHG changes from 2000 to 2019. Economic growth has led to less emissions globally, which is driven by emission trends in Asia and North America. In other words: the wealthier countries were the less they emitted. In Africa the effect was the other way around, economic growth has been observed to increase GHG emissions from croplands. An economic theory, the environmental Kuznets curve (EKC) tries to explain this phenomenon (Prastiyo et al., 2020; Ridzuan et al., 2020). It states that economic growth is bad for the environment at first, but after a certain level of economic growth a society will begin to improve the relationship with the environment and the degradation reduces. There is also critique to this hypothesis which says that there is no guarantee that economic growth will lead to an improvement of the environment and that in reality the opposite is often the case. In the thesis no evidence for an EKC has been observed.

Reference:

- Bastin, J.-F., Finegold, Y., Garcia, C., Mollicone, D., Rezende, M., Routh, D., Zohner, C. M., & Crowther, T. W. (2019). The global tree restoration potential. Science, 365(6448), 76-79. https://doi.org/10.1126/science.aax0848
- Carlson, K. M., Gerber, J. S., Mueller, N. D., Herrero, M., MacDonald, G. K., Brauman, K. A., Havlik, P., O'Connell, C. S., Johnson, J. A., Saatchi, S., & West, P. C. (2016). Greenhouse gas emissions intensity of global croplands. Nature Climate Change, 7(1), 63-68. https://doi.org/10.1038/nclimate3158
- Cattaneo, M. D., Titiunik, R., & Vasquez-Bare, G. (2016). The Regression Discontinuity Design. In The SAGE Handbook of Research Methods in Political Science and International Relations (Vol. 2, pp. 835-857). SAGE Publications Ltd. https://doi.org/http://dx.doi.org/10.4135/9781526486387.n47

- Eskander, S. M. S. U., & Fankhauser, S. (2020). Reduction in greenhouse gas emissions from national climate legislation. Nature Climate Change, 10(8), 750-756. https://doi.org/10.1038/s41558-020-0831-z
- European Environment Agency. (2019). More national climate policies expected, but how effective are the existing ones? (2467-3196). https://www.eea.europa.eu/publications/more-national-climate-policies-expected
- FAO. (2020). The share of agriculture in total greenhouse gas emissions. www.fao.org/3/ca8389en/CA8389EN.pdf
- FAO. (2021a). Emissions from agriculture and forest land. In Global, regional and country trends 1990–2019 (pp. 17). Rome, Italy.
- FAO. (2021b). FAOSTAT, Crops and livestock products. Retrieved 19.10.2021 from https://www.fao.org/faostat/en/#data/QCL
- Garnache, C., Mérel, P. R., Lee, J., & Six, J. (2017). The social costs of second-best policies: Evidence from agricultural GHG mitigation. Journal of Environmental Economics and Management, 82, 39-73. https://doi.org/https://doi.org/10.1016/j.jeem.2016.10.004
- Grantham Research Institute on Climate Change and the Environment, & Sabin Center for Climate Change Law. (2021). Climate Change Laws of the World database. Retrieved 10.06.2021 from https://climate-laws.org/
- Imbens, G. W., & Lemieux, T. (2008). Regression discontinuity designs: A guide to practice. Journal of Econometrics, 142(2), 615-635. https://doi.org/https://doi.org/10.1016/j.jeconom.2007.05.001
- Keele, L. J., & Titiunik, R. (2015). Geographic Boundaries as Regression Discontinuities. Political Analysis, 23(1), 127-155. https://doi.org/10.1093/pan/mpu014
- Lee, D. S., & Lemieux, T. (2010). Regression Discontinuity Designs in Economics. Journal of Economic Literature, 48(2), 281-355. https://doi.org/10.1257/jel.48.2.281
- Prastiyo, S. E., Irham, Hardyastuti, S., & Jamhari. (2020). How agriculture, manufacture, and urbanization induced carbon emission? The case of Indonesia. Environmental science and pollution research international, 27(33), 42092-42103. https://doi.org/10.1007/s11356-020-10148-w

- Ridzuan, N. H. A. M., Marwan, N. F., Khalid, N., Ali, M. H., & Tseng, M.-L. (2020). Effects of agriculture, renewable energy, and economic growth on carbon dioxide emissions: Evidence of the environmental Kuznets curve. Resources, Conservation and Recycling, 160, 104879. https://doi.org/https://doi.org/10.1016/j.resconrec.2020.104879
- Teorell, J., Sundström, A., Holmberg, S., Rothstein, B., Alvarado Pachon, N., & Dalli, C. M. (2021). The Quality of Government Standard Dataset, Version Jan21. https://doi.org/doi:10.18157/qogstdjan21
- UNFCCC. (2015). Adoption of the Paris Agreement. Proposal by the President. https://unfccc.int/documents/9064

Kontakt
Melanie Eggimann

melanie-eggimann@gmx.ch

3rd rank

A Gendered Analysis of Small-Scale Cocoa Production in Uganda

Michaela Kuhn

"When Africa's female farmers thrive, everyone benefits: the women themselves, the children in whom they invest, the communities that they feed, and the economies to which they contribute." (Meinzen-Dick, 2019)

Introduction

Women in developing countries, women in agriculture, and women in general, face numerous obstacles and limitations that their male counterparts do not. For female farmers and female household members in smallholder production systems, these include limited access to education (UN Women, 2020), agricultural training (Fischer & Qaim, 2012; Pan et al., 2018), productive resources such as land, inputs, and labour (Barrientos, 2016; Kumase et al., 2010; Pan et al., 2018), and formal financial services (World Bank, 2017). However, achieving gender equality can result in better food and nutrition security and more resilient and just food systems (Njuki et al., 2021), which is crucial for sustainable development and therefore included in the Sustainable Development Goals as Goal 5 "Achieve gender equality and empower all women and girls" (United Nations, 2021).

The unjust distribution of resources also applies to cocoa production. Cocoa is mainly produced in low-income tropical countries for high-value markets in the global North by smallholders, who heavily depend on cocoa for their livelihoods (Voora et al., 2019). Due to the high physical workload and its cash crop nature, it is still considered a "male crop", even though women are heavily involved in its cultivation (Fountain & Hütz-Adams, 2020).

Consumer awareness of poor living conditions and unsustainable agricultural practices has increased in recent years, partly due to increased media coverage, leading to greater demand for higher levels of social and environmental sustainability (Thorlakson, 2018). As a result, members of cocoa-chocolate supply chains, such as processors or traders, are increasingly sourcing sustainably produced cocoa (Voora et al., 2019), but there is insufficient information available to assess whether the cocoa they source is produced under conditions of gender equality.

The thesis addresses a research gap in revenue generation and decision-making on small-scale cocoa farms. It sheds light on gender dynamics in a geographical area that is underrepresented in the current literature, as most research focusses on larger cocoa-producing regions in West Africa. The findings can be used to design interventions for more gender-equitable rural development that take into account the complexities of disadvantages in the local context, and provide crucial information on suppliers and implications for gender-sensitive research.

Based on the insights from the literature and the local study context, the thesis proposes three concrete research hypotheses. First, female cocoa farmers do not have the same prerequisites as male farmers to participate in the agricultural sector and manage their farms. Second, differences exist in roles and approaches to cocoa-growing and related activities between male and female managed farms. Third, female managed farms achieve lower cocoa revenue than male managed farms.

The research is part of the SusChain research project of FiBL, funded by SNSF (NFP73), which aims to enhance supply chain stability, resilience and sustainability through improved sub-supplier management in chocolate.

Methodology

The evidence builds on primary cross-sectional data from the Mukono district, where the farmers surveyed represent a random sample from the supplier base of a large cocoa export company operating in the district and supplying to the Swiss market (Figure 1).

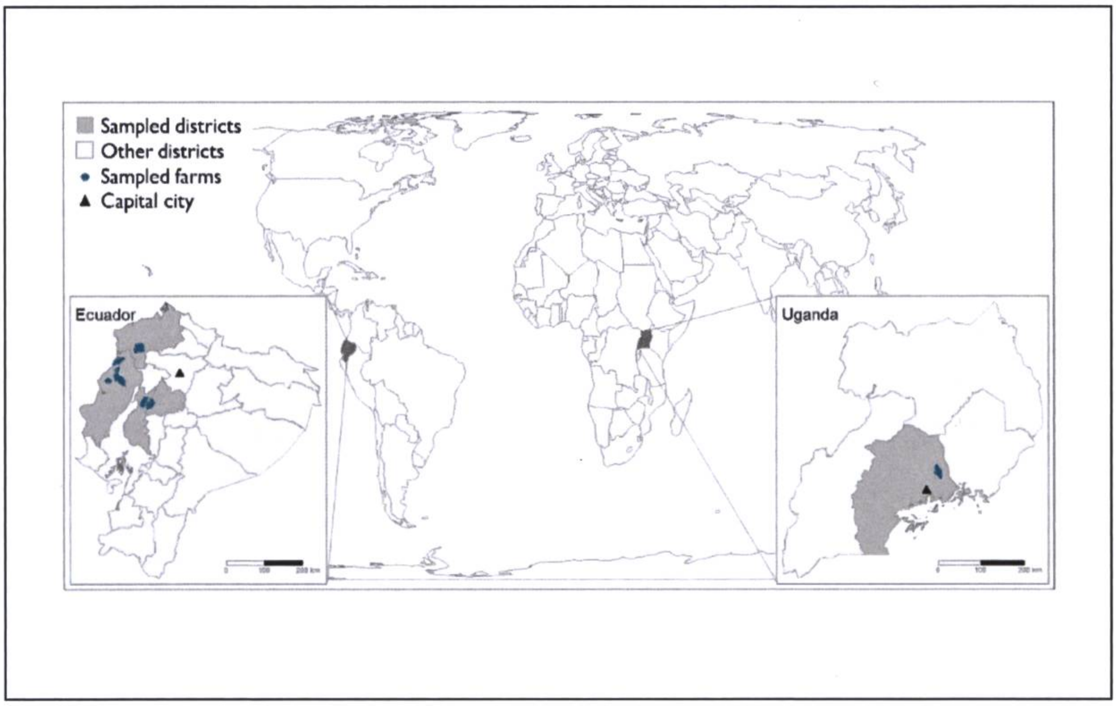

Figure 1: Map of study sites in Uganda

First, descriptive statistics and independent samples t-tests are used to compare various variables between male and female farmers. Furthermore, to account for differences on the farm-level, the responsibilities, affiliations and roles in cocoa cultivation and related activities are examined for the surveyed cocoa farmers. The analyses are carried out for the entire sample and separately for the farms managed by men and women. In addition, ordinary least squares (OLS) regression models are developed to estimate whether female farmers have lower cocoa revenues than male farmers, with and without controlling for other sociodemographic, farm and contextual characteristics, such as farm size, education, and access to financial services.

Results

The analysis confirms the three hypotheses that were tested as part of the research. The women in the sample are significantly less educated, manage smaller farms, receive less training in good agricultural practices and are considered disadvantaged in official land titles and formal savings accounts (Table 1).

Table 1: Descriptive statistics of individual characteristics by gender

		Mean (sd)			
	Observations	All	Female	Male	t-stat
Female (dummy)	205	0.31 (0.46)			
Age (years)	205	52.73 (12.85)	56.36 (11.75)	51.05 (13.03)	-2.80
Education (years of schooling)	187	7.37 (3.49)	5.66 (2.63)	8.13 (3.57)	4.68*
Farm Size (hectares)	205	7.26 (7.52)	4.70 (4.06)	8.45 (8.42)	3.40*
Cocoa Area (hectares)	205	0.64 (0.72)	0.41 (0.39)	0.73 (0.81)	2.97*
Dried Cocoa (dummy)	192	0.24 (0.43)	0.24 (0.43)	0.24 (0.43)	-0.05
Production Diversity (number)	205	6.85 (1.90)	6.75 (1.88)	6.90 (1.92)	0.51
Workforce (number)	205	3.33 (1.25)	3.09 (1.10)	3.45 (1.30)	1.92
Weed Management (number per year)	198	4.26 (3.30)	3.57 (1.61)	4.57 (3.78)	1.99*
Formal Savings Account (dummy)	196	0.19 (0.40)	0.06 (0.25)	0.26 (0.44)	3.35*
Informal Savings Account (dummy)	196	0.46 (0.50)	0.65 (0.48)	0.37 (0.48)	-3.82*
Group Membership (dummy)	205	0.69 (0.46)	0.70 (0.45)	0.69 (0.46)	-0.21
Training (days)	200	2.72 (4.05)	1.52 (1.60)	3.27 (4.68)	2.88*

** significant at $p < 0.05$; sd = standard deviation*
Source: Survey

As indicated in Figure 2, women are involved in all processing steps and most farming decisions, but several gender-based differences remain in the sample group. The female managed farms are characterized by a prominent female workforce and most of the decisions and activities are carried out by women. Only decisions regarding inputs are male-dominated and fall under the responsibility of men on all farms. Male managed farms, on the other hand, include women more often in decisions and activities concerning the farm.

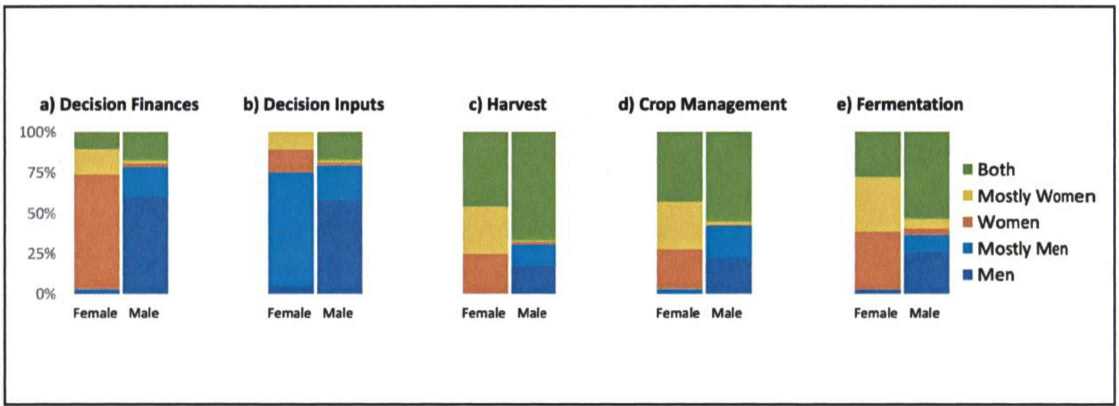

Figure 2: Differences in roles and responsibilities concerning various decisions and activities on farm between male and female managed farms

According to the results from the regression analysis, female managed farms generate substantially lower cocoa revenue, totaling approximately 212 USD in revenue gap. A formal savings account, a greater workforce, and a larger cocoa area are identified as the key determinants that significantly influence the revenue. These most certainly represent areas where the female farmers of the sample are disadvantaged, as they generally have smaller farms and are prevented by institutional norms from owning formal savings accounts.

Conclusions

The results of the thesis reveal a considerable gender gap for the sample caused by several interrelated systemic inequalities that hinder women from participating in the cocoa sector and aggravates their ability to manage a successful agricultural business. In order to strengthen a

woman's role in cocoa, several substantial disparities for female cocoa farmers need to be addressed, such as the access to official land titles and formal savings accounts, productive resources, and the requirement for more education and training opportunities.
As challenges such as undernourishment and rural poverty prevail, the transformation towards a gender-transformative cocoa sector offers an opportunity to combat these through removing the existing bottlenecks for female farmers. This, in turn, would allow them to lead their own successful agricultural businesses and could contribute to Uganda's food security and economic development.

For the organizations and actors involved in the cocoa value chain, the research findings are crucial to strengthen the role of female cocoa farmers and contribute to strategies that close the systemic gender gap. This guides effective interventions, which can expand the evidence base on what is successful in reaching, benefiting, and empowering female farmers and women in agriculture.

Pictures from the study side (© Brasio Kawere and Mubiru Derrick Triesman)

Recommendations

Based on the study results, various recommendations can be made for local exporters and private companies that have the potential to strengthen the role of female cocoa farmers and reduce the gender gap in the cocoa sector:

- Promotion of gender equality: All companies and organizations in the cocoa value chain need a clear strategy to promote gender equality, both within their organizations and along their supply chains.

- Recognition of women in cocoa: Women involved in cocoa production should be recognized as producers regardless of their land ownership status.
- Reduction of constraints in access to land, credit, productive resources, market information and technology: The differential needs of female cocoa farmers need guidance and support. Better access to the key aspects of farming is vital for the empowerment of female farmers.
- Provision of trainings: Female trainers are needed to encourage women to become specialists in cocoa growing. Group meetings should be held at the community level to ensure that women are reached and can participate, although being time-constraint.
- Support in fermentation and drying: It has been shown that female farmers are less likely to be involved in the fermentation and drying of beans. Support should be given to encourage female cocoa farmers to take this step, to dry beans collectively and to educate them about techniques and quality measurements.
- Gender sensitization trainings for husbands and wives: The distribution of the respective roles and activities follows the tendency that men are primarily involved in decisions about inputs and finances. Specially designed trainings that focus on the value and benefits of transparency and shared decision-making could lead to beneficial outcomes at the household level.

References

- Barrientos, S. (2016). Promoting Gender Equality in the Cocoa-Chocolate Value Chain Opportunities and Challenges in Ghana. GDI Working Paper. The University of Manchester, 2016(006), 1–36. http://hummedia.manchester.ac.uk/institutes/gdi/publications/workingpapers/GDI/GDI_WP2016006_Barrientos_Bobie.pdf.
- Fischer, E., & Qaim, M. (2012). Gender, Agricultural Commercialization, and Collective Action in Kenya. Food Security, 4(3), 441–453. https://doi.org/10.1007/s12571-012-0199-7.
- Fountain, A. C., & Hütz-Adams, F. (2020). 2020 Cocoa Barometer. VOICE Network.

- Kumase, W. N., Bisseleua, H., & Klasen, S. (2010). Opportunities and Constraints in Agriculture: A Gendered Analysis of Cocoa Production in Southern Cameroon. Discussion Papers, Georg-August-University Göttingen, 27, 1–24. http://hdl.handle.net/10419/90510.
- Meinzen-Dick, R. (2019). Empowering Africa's Women Farmers. Retrieved from https://www.ifpri.org/blog/empowering-africas-women-farmers. Accessed April 13, 2021.
- Njuki, J., Eissler, S., Malapit, H., Meinzen-Dick, R., Bryan, E., & Quisumbing, A. (2021). A Review of Evidence on Gender Equality, Women's Empowerment, and Food Systems. Food Systems Summit Brief Prepared by Research Partners of the Scientific Group for the Food Systems Summit. https://doi.org/10.48565/scfss2021-1q69.
- Pan, Y., Smith, S. C., & Sulaiman, M. (2018). Agricultural Extension and Technology Adoption for Food Security: Evidence from Uganda. American Journal of Agricultural Economics, 100(4), 1012–1031. https://doi.org/10.1093/ajae/aay012.
- Thorlakson, T. (2018). A Move Beyond Sustainability Certification: The Evolution of the Chocolate Industry's Sustainable Sourcing Practices. Business Strategy and the Environment, 27(8), 1653–1665. https://doi.org/10.1002/bse.2230.
- UN Women. (2020). SDG 4: Ensure Inclusive and Equitable Quality Education and Promote Lifelong Learning Opportunities for All. Retrieved from https://www.unwomen.org/en/news/in-focus/women-and-the-sdgs/sdg-4-quality-education. Accessed March 3, 2021.
- United Nations. (2021). SDG 5: Achieve Gender Equality and Empower All Women and Girls. Retrieved https://sdgs.un.org/goals/goal5. Accessed October 14, 2021.
- Voora, V., Bermúdez, S., & Larrea, C. (2019). Global Market Report: Cocoa. Sustainable Commodities Marketplace, 2019, 1–12. https://www.iisd.org/system/files/publications/ssi-global-market-report-cocoa.pdf.
- World Bank. (2017). Mobile Technologies and Digitized Data to Promote Access to Finance for Women in Agriculture. Working Paper 29104, 1–74. https://doi.org/10.1596/29104.

Contact:
Michaela Kuhn
8003 Zurich

info@michaela-kuhn.com
LinkedIn: www.linkedin.com/in/michaelakuhnde