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Risk-Management to Reduce Multidimensional Poverty? Comparative Evidence on the Effects of Crop Diversification on Poverty in Southeast Asia

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Introduction

Vietnam and Thailand rank 6th and 9th in the Global Climate Risk index according to the losses resulting from extreme weather events (Eckstein et al. 2019). These extreme weather events heavily affect agriculture by a combination of higher temperatures, greater variability in rainfall patterns, and altered growing seasons (Gass et al., 2011). When shocks destroy or reduce the harvest, escaping poverty becomes harder for households.

Escaping poverty while facing shock-induced harvest loss can be achieved by crop diversification (Feliciano 2019). However, the contribution of crop diversification to SDG 1 “no poverty” needs further research. This also includes its contribution to several other goals, such as Goal 2 (zero hunger), 3 (good health and wellbeing), 4 (quality education), 5 (gender equality), 6 (clean water and sanitation), 7 (affordable and clean energy), 8 (decent work and economic growth), 12 (sustainable production and consumption), 10 (reduced inequalities), 13 (climate action), or 15 (life on land) (Feliciano 2019). Several of these SDGs can be addressed by studying multidimensional poverty indices (MPIs) as they comprise aspects touching several of the afore-mentioned SDGs. Furthermore, MPIs provide a more detailed picture about patterns of poverty than income-based measures (Alkire and Santos 2014).

This analysis uses a uniquely large and long-term data set of 4,400 rural Vietnamese and Thai households from a socio-economic panel (TVSEP) ranging from 2007 to 2017. This data is used to calculate household specific indices for multidimensional poverty and crop diversification. To measure the shock mitigating effect of crop diversification we use self-reported environmental shocks from the TVSEP project as well as the deviation from historic precipitation patterns. Precipitation data from Matsuura and Willmott (2018) was used to calculate the deviation in precipitation. A fixed-effects logistic panel regression shows that crop diversification reduces multidimensional poverty. Crop diversification can help to mitigate shocks however, only under certain circumstances. Those circumstances are subject to further investigation.

Material and Methods

To answer the research question, socio-economic data from the Thailand Vietnam Socio-Economic Panel (TVSEP) project is used to calculate the MPI, the Simpson Index of Diversification (SID) to measure crop diversification and the number of annual self-reported environmental shocks per household as well as further control variables such as socio-demographic household information. The TVSEP data set is part of the research project "Poverty Dynamics and Sustainable Development: A long-term Panel Project in Thailand and Vietnam, 2015 - 2024". This project, building on previous work by the research unit FOR 756 of the Deutsche Forschungsgemeinschaft (DFG), aims to provide a long-term panel that "enables and carries out research on long-term welfare dynamics, rural-urban migration, agricultural transformation and intergenerational aspects of households as well as on the long-term impacts of development interventions" (TVSEP 2020). The panel data covers 4,400 households within three Vietnamese and three Thai provinces in seven waves from 2007 to 2017. The sampling of the provinces ensures that those are representative of mainly rural provinces in central Vietnam.

In order to construct this "TVSEP-MPI", we have to select the appropriate dimensions and indicators. The multidimensional poverty index can be adapted in its dimensions, indicators, and weights to account for local conditions and research foci (Ayuya et al. 2015; Ogutu and Qaim 2019; Oshio and Kan 2014). Those are health, education, standard of living/basic infrastructure, and monetary poverty. With the available TVSEP data, we could easily replicate the World Bank index (World Bank 2018). The composition of the "TVSEP-MPI" is illustrated in Figure 1.

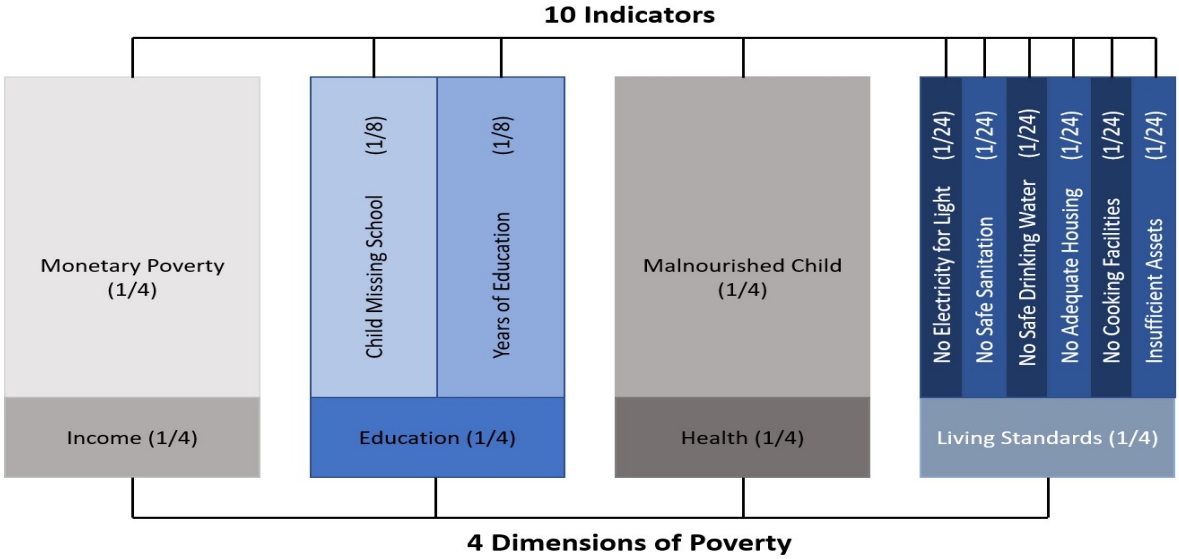

Figure 1 Dimensions and Indicators of the Multidimensional Poverty Index (Source: Adapted from UNDP, O. (2019), Own Presentation).

The TVSEP data set was combined with precipitation data from Matsuura and Willmott (2018) from the University of Delaware to measure exogenous weather shocks and use them instead of self-reported environmental shocks. Precipitation data was used from 1900 until 2017 to construct monthly historic precipitation averages. After merging the precipitation data to the TVSEP villages we created an indicator showing whether precipitation in a month exceeded one

or minus one standard deviation from the historic mean. In order to get annual shock indicators the previous monthly indicator was aggregated for each year.

For the econometric model we use the "TVSEP-MPI" as dependent variable. In accordance with the literature three poverty cutoffs (0.25, 0.33 and 0.5) were also used to define whether a household can be considered multidimensional poor. To ensure that our results are not sensitive to the definition of the poverty cutoff, we estimate all regressions for three poverty cutoffs. For the MPI as dependent variable a panel fixed-effects regression was used whereas for the MPI cutoff values a fixed-effects logistic panel regression was conducted. The regression equation reads as follows:

$$MPI_{it} = \beta_0 + \beta_1 Diversification_{it} + \beta_2 Shock_{it} + \beta_3 (Diversification * Shock)_{it} + \epsilon_{it}$$

Shock represents either self-reported environmental shocks or precipitation shocks. Included control variables are the household size, the dependency ratio, mean household education, indicator variables whether the household head is female or belongs to a minority group, the age and squared age of the household head, household income from off-farm activities, remittances to the household, an indicator whether the household owns a phone, agricultural assets, the condition of the main road, and the distance to the district capital. In addition, year and province fixed-effects were included.

Results and Discussion

The results for using the annual number of droughts derived from the precipitation data are presented in Table 1. The results using self-reported environmental shocks from the TVSEP projects are reported in Table 2.

	MPI	MPI 0.25	MPI 0.33	MPI 0.5
Panel A: Whole Sample				
SID	-0.0196**	-0.2885***	-0.3675**	-0.6466**
	(0.0078)	(0.1108)	(0.1429)	(0.3016)
Number Droughts	0.0015	0.0359*	0.0416	-0.0839
	(0.0015)	(0.0207)	(0.0277)	(0.0636)
SID * Droughts	0.0064*	0.0290	0.00559	0.1924
	(0.0036)	(0.0496)	(0.0630)	(0.1373)
Panel B: Thailand				
SID	-0.0163	0.1763	0.1644	-0.2355
	(0.0138)	(0.2142)	(0.2957)	(0.7672)
Number Droughts	-0.0010	-0.0010	-0.0042	-0.0265
	(0.0026)	(0.0396)	(0.0548)	(0.1427)
SID * Droughts	0.0146	-0.0715	-0.0851	0.2837
	(0.0092)	(0.1449)	(0.2009)	(0.5591)
Panel C: Vietnam				
SID	-0.0286***	-0.4764***	-0.5391***	-0.7667**
	(0.0101)	(0.1386)	(0.1733)	(0.3378)
Number Droughts	0.0002	0.0161	0.0101	-0.1553*
	(0.0019)	(0.0255)	(0.0336)	(0.0746)
SID * Droughts	0.0053	0.0121	0.0620	0.2740*
	(0.0042)	(0.0562)	(0.0706)	(0.1529)

Standard errors in parentheses

$^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table 1: Results for Number of Annual Droughts (source: own calculations).

	MPI	MPI 0.25	MPI 0.33	MPI 0.5
Panel A: Whole Sample				
SID	-0.0060	-0.1392	-0.1363	-0.3049
	(0.0073)	(0.1070)	(0.1408)	(0.3121)
Self-Reported	0.0136***	0.1497***	0.2416***	0.2359**
Shocks	(0.0029)	(0.0393)	(0.0524)	(0.1168)
SID * Self-	-0.0151*	-0.2715**	-0.3920**	-0.3278
Reported Shocks	(0.0086)	(0.1193)	(0.1532)	(0.3314)
Panel B: Thailand				
SID	0.0100	0.2768	0.2665	0.1794
	(0.0114)	(0.1789)	(0.2494)	(0.6874)
Self-Reported	0.0081**	0.0962*	0.1893***	0.0758
Shocks	(0.0036)	(0.0521)	(0.0715)	(0.1792)
SID * Self-	-0.0338**	-0.4556*	-0.49098	-0.4809
Reported Shocks	(0.0156)	(0.2387)	(0.3315)	(0.9799)
Panel C: Vietnam				
SID	-0.0197**	-0.4222***	-0.3997**	-0.3814
	(0.0098)	(0.1387)	(0.1780)	(0.3673)
Self-Reported	0.0134***	0.1432**	0.1837**	0.2317
Shocks	(0.0047)	(0.0642)	(0.0832)	(0.1647)
SID * Self-	-0.0066	-0.1251	-0.1714	-0.4021
Reported Shocks	(0.0117)	(0.1583)	(0.2012)	(0.4021)

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2: Results for Number of Self-Reported Annual Environmental Shocks (source: own calculations).

We find that crop diversification decreases multidimensional poverty. However, the results seem to be driven by Vietnam as crop diversification has no effect on any MPI variable in Thailand. Droughts derived from precipitation data do not affect multidimensional poverty whereas self-reported environmental shocks increase multidimensional poverty and also the likelihood to be multidimensional poor. Crop diversification as a shock mitigation strategy does not affect multidimensional poverty when looking at droughts from precipitation data. When we look at self-reported shocks crop diversification decreases multidimensional poverty especially in Thailand while the effects in Vietnam are not statistically significant.

Conclusion and Outlook

The results show that crop diversification can help to mitigate shocks under certain circumstances. Circumstances that affect crop diversification's function as a shock mitigation strategy can be the severity of shocks and whether farmers also experience shocks. Additionally, precipitation data covers a large area as the data we use is gridded on a 0.5°x0.5° scale which might not be able to take micro climate into account and therefore might not give an actual measure of precipitation shocks for each village in the TVSEP project. The work presented, however, is early stage work and we are currently trying to implement better shock measures from smaller scale precipitation data as well as better econometric methods. So far the results support the positive effect of crop diversification not only on monetary poverty measures but also on multidimensional poverty and therefore its contribution to SDG 1, 2, 3, 4, 6, and 9. This implies that policies supporting crop diversification are effective in reducing poverty and increasing live quality.

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