

Diverse Crops, Local Markets and Diet Quality of Farming Families in Mali

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Question

Which investment pathway most influences diet quality among smallholder farming families in Mali?

Motivation

Globally we face a triple burden of malnutrition

Urbanization and growth are driving dietary changes in Africa

Urbanization rates are highest in West Africa

Large literature on agriculture-nutrition pathways

Two main channels supply diet quality to farming households



Malian Context



- **Stunting affects more than 1 in 4 children**
- **Obesity rates are lower than in other African regions**
- **Consumption of highly processed and convenience foods remains low**
- **Less than half of farm women consume the minimum number of food groups needed to ensure adequate diets**



Our analysis

On household farms in Mali, we

- **identify determinants of**
 - **crop diversity**
 - **food market diversity**
- **test which channel is most strongly associated with diet quality**



Crops



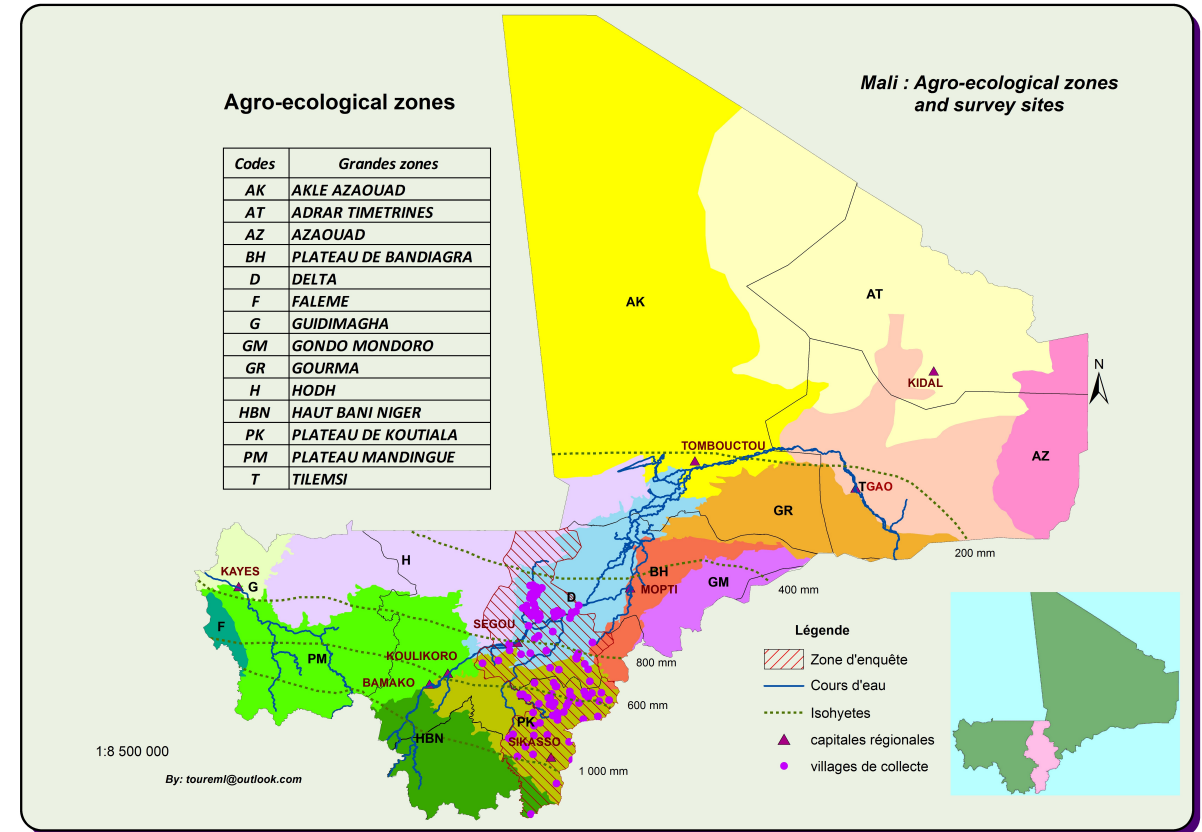
Markets

Related literature

- **Dietary diversity is a broad measure of nutrition adequacy**
- **Women's diets also represent those of their children**
- **Reviews and meta-analyses conclude that the effect of crop diversity on diet diversity is positive but small**
- **Bellon et al. (2016) depict crop diversity, market diversity and dietary diversity as an interactive triangle**

Data

- 2400 farm households in the Niger Delta and Koutiala Plateau, 2017/18
- including 5000+ women
- Michigan State University and Institut d'Economie Rurale
- <https://power.larc.nasa.gov/data-access-viewer/>



Measuring on farm crop diversity



Bioversity International

<u>Variable</u>	<u>Definition</u>	<u>Mean</u>	<u>Std.</u> <u>Dev.</u>	<u>Min</u>	<u>Max</u>
Menhinick Richness Index	$(n-1)/\sqrt{A}$	1.21	.612	.104	4.939
Simpson Evenness Index	$1-\sum_i \alpha_i^2$.42	.309	0	.881
Starchy staple dominance	α_S	.78	.222	0	1

n=crop count, A = land area, α =crop area share, S=starchy staples

Measuring market diversity



Mamadou Sissoko

<u>Variable</u>	<u>Definition</u>	<u>Mean</u>	<u>Std.</u> <u>Dev.</u>	<u>Min</u>	<u>Max</u>
Food market diversity	Count of food groups consumed in 7 days from market purchases	3.363	1.94	0	9

Measuring diet quality



Food and Agriculture Organization
of the United Nations

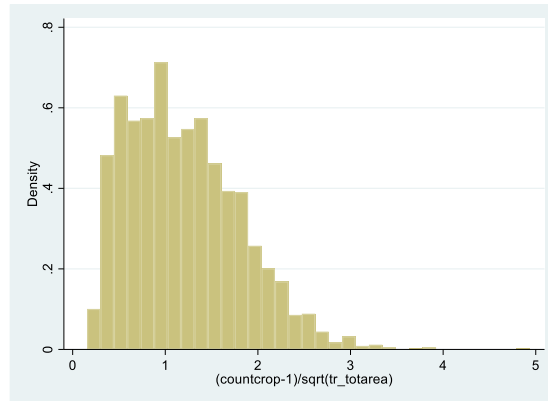


<u>Variable</u>	<u>Definition</u>	<u>Mean</u>	<u>Std. Dev.</u>	<u>Min</u>	<u>Max</u>
Women's Dietary Diversity Score	Count of food groups consumed in previous 24 hours averaged over women 15-60 yrs in household	5.16	1.27	1	9

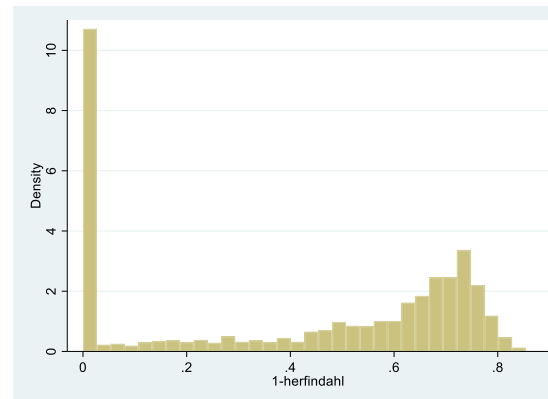
Groups: 1) starchy staples; 2) dark green leafy vegetables; 3) other vitamin A-rich fruits and vegetables; 4) meat, poultry, and fish; 5) other fruits and vegetables; 6) dairy; 7) eggs; 8) organ and 9) pulses, nuts and seeds.

Frequency distributions

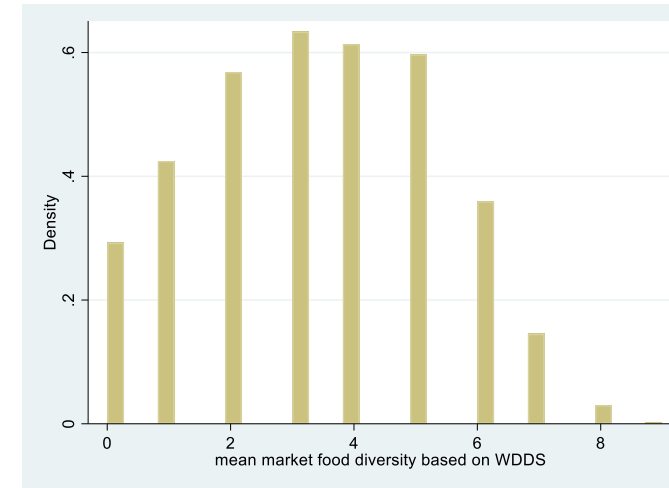
Menhinick



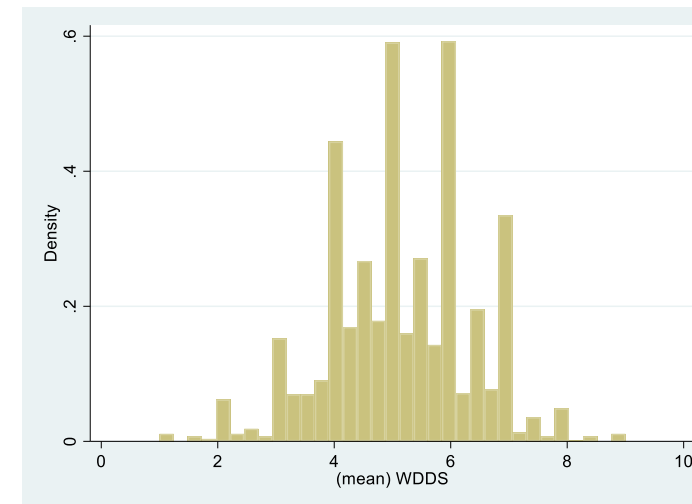
Simpson



Food market diversity



WDDS



Estimation approach

$$(1) \mathbf{D}_c = \mathbf{D}_c (\mathbf{X}_1, \mathbf{X}_2, \mathbf{X}_3, \mathbf{W}) + \varepsilon$$

$$(2) \mathbf{D}_m = \mathbf{D}_m (\mathbf{X}_1, \mathbf{X}_2) + v$$

$$(3) \mathbf{D}_d = \mathbf{D}_d (\mathbf{D}_c, \mathbf{D}_m, \mathbf{X}_1, \mathbf{X}_2) + \psi$$

\mathbf{X}_1 = household characteristics

\mathbf{X}_2 = market characteristics

\mathbf{X}_3 = plot characteristics

\mathbf{W} = long-term weather at village scale

Explanatory variables

HH characteristics

Number of plots managed by females

Age of head of household

(No. children under 5+adults>65)/household size

Non-farm income (FCFA)

Equipment index (PCA)

Plot characteristics

Number of plots by household

Number of different types of soil

Number of different types of relief

Distance to from household to plot (km)

Mean plot age (years)

Number of intercropped plots

Market characteristics

Distance to paved road (km)

Weekly market (dummy) in village

Distance to nearest market (km)

Distance to Bamako city (km)

Median distance to food market (km)

Weather

Mean temperature (1981 to 2017)

Coefficient of variation of rainfall (1981 to 2017)

Results: Menhinick Index

	Crop Richness	Food Markets	Women's Dietary Diversity
Crop Richness			0.233***
Food Markets			0.238***
number of female plot managers	***	***	**
other household characteristics	*	***	**
market characteristics	***	***	**
plot characteristics	***		
long-term weather	***		



Results: Simpson Index

	Crop Evenness	Food Markets	Women's Dietary Diversity
Crop Evenness			0.478***
Food Markets			0.264***
number of female plot managers	***	***	***
household characteristics	**	***	**
market characteristics	***	***	**
plot characteristics	***		
long-term weather	***		



Results: Area Share in Starchy Staples

	Area in Starchy Staples	Food Markets	Women's Dietary Diversity
Area in Starchy Staples			-0.432**
Food Markets			0.219***
number of female plot managers		***	***
household characteristics	**	***	**
market characteristics	***	***	**
plot characteristics	***		
long-term weather	***		



Endogeneity tests

	Wu-Hausman F(1,2136)
Menhinick	= 32.6227 (p = 0.0000)
Simpson	= 9.43714 (p = 0.0022)
Areashare	= 30.9305 (p = 0.0702)
Food market	= 16.7504 (p = 0.0000)



Conclusions

- **Both production and market channels affect diet quality of smallholder farming families**
- **Production effect size is surprisingly large**
- **Revisit agricultural policies that support diversification for a win-win strategy?**
- **Local market development also involves farm women**



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