Development Economics (PhD) Consequences of Risk and Shocks

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Consequences of Risk and Shocks

References

- References:
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  - *Maccini, Sharon and Dean Yang. 2009 Under the Weather: Health, Schooling, and Economic Consequences of Early-Life Rainfall, American Economic Review, 99(3): 1006-1026.
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Dercon (2008)
Motivation

- Risk and shocks;
  - Covariate: e.g., drought, natural disasters, conflict, political instability,
  - Idiosyncratic: e.g., high levels of adult and child mortality and morbidity, loss of job
- Are common in developing countries (more proportionally common in Africa and South Asia)
- Main objective:
  - To review key existing work and identify avenues for further research

Dercon (2008)

A simple model in the face of risk

- Consider the standard utility maximization framework under uncertainty at any period t

$$u_t = E_t[\sum_{\tau=t}^{T}(1+\delta)^{t-\tau}v(c_\tau)] \tag{1}$$

- δ is the rate of time preference; $v' > 0$ $v'' < 0$
- Assume income y_t, a function of technology x_t at $t-1$
- Higher x represents higher returns with higher risk
- Assets evolve with an interest rate r:

$$A_{t+1} = (1+r)(A_t + y_t)(x_t, A_t) - c_t) \tag{2}$$

- Assume insurance markets are missing
- See table 1 for the decisions that need to be made by the farmer

Dercon 2008)

Key results cont.

Table 1: *Risk and Outcomes*

Uninsured risk 'sources of risk'	→	Risk management decisions	→	Implications for outcomes in the short run and in the long run	→	Shock 'realisation of the state of the world'	→	Risk-coping decisions	→	Implications for outcomes in the short run and in the long run

Dercon (2008)

A simple model in the face of risk cont.

- In each period, the hh faces A_t, realized income y_t, and chooses c_t, A_{t+1}, and x_{t+1}, which combined with with A_{t+1} will generate a particular risk distribution
- Decisions on x_{t+1} and A_{t+1} should be made *ex-ante*, and are called *risk management strategies*
- Once income outcome is realized, the hh could be facing a negative, or positive, or no income shock.
- If a shock happens, the hh will smooth consumption using *coping strategies*
- With missing or imperfect credit market, these decisions may have both short-run and long-run costs
- Variants of this framework have been used to model decisions of hhs in developing countries

Dercon (2008)

A simple model in the face of risk cont.

- Much attention to informal *risk sharing arrangements*
- Much attention to other forms of risk coping
- Less evidence on risk management strategies due to higher data demands on how activity and asset portfolios are affected by risk
  - I.e., realized shocks are not relevant to identify these effects. One rather needs variation in risk exposure to identify the impact of risk
- Dercon (1996): those with less protection against shocks specialized relatively more in drought-resistant crops in Tanzania
- Dercon and Christiaensen (2011): fertilizer use was significantly lower for those with higher consumption risk
- Alem et al., (2010): fertilizer use was significantly lower for those with higher variability in rainfall

Dercon (2008)

A simple model in the face of risk cont.

- A major fallacy: risk is problem for some economic agents because of risk aversion!
  - Those taking risks are less risk averse and "entrepreneurial", and their decisions results in lower earnings!
  - If people were less risk averse, risk would not be a problem; it is just a matter of choice and outcomes are driven by preference
- But the poor lack the opportunities to choose a particular degree of protection, consistent with their preferences
- Still much to learn about the risk management and coping strategies in developing countries
- Expansion of panel data gives opportunities to expand existing knowledge

Dercon (2008)
The Failure of Coping Mechanisms

- Consumption smoothing and risk-sharing are incomplete
- How important is the remaining impact of shocks on outcomes?
  - Dercon et al., (2005), using panel data from rural Ethiopia spanning (1994-2004) show that 50% of hhs were affected by drought
  - But a large number of other idiosyncratic shocks were also observed (43% death, 28% illness, 10-20% other shocks)
- The impact of these shocks is measured by their coefficients in a consumption function
  - Idiosyncratic shocks had little impact but covariate ones has significant impact on consumption
  - Inability to smooth consumption (uninsured shocks) result in poverty in and out (higher average poverty)

Dercon (2008)

The Failure of Coping Mechanisms cont.

- Dercon (2002) shows that on average poverty is higher by 50% in 2004 due to shocks
  - Main implication: policies dealing with shocks (e.g., safety nets) would be welfare enhancing
- The chronically poor on the other hand should be supported by growth enhancing interventions

- Short-term shocks (e.g., nutritional) may have long-term persistent health effect
  - There is for e.g., clear evidence linking child height at age 3 and adult height
  - Far-reaching effects: children with slow height growth are found to perform less-well in school, score poorly in cognitive functions and develop slower
  - Adult height is correlated with earnings and productivity
  - Taller women experience lower risks of child and maternal mortality
  - Higher body mass index (BMI) is linked to agr. productivity and wages
  - Low BMI $\Longrightarrow$ large number of many health-related indicators (e.g., early onset of chronic conditions, increased risk of premature mortality)

Dercon (2008)

The Long-run Consequences of shocks and Risk cont.

- More evidence on the long-term impact of transitory shocks on income and well-being
  - Alderman et al (2004): 1982/-84 drought in Zimbabwe had on average a 2.3 cm loss of stature and delay in starting school of 3.7 months 13-16 years later
    - Translated into aa 14% loss of lifetime earnings
  - Beegle et al., (2008): used panel data from Kagera, Tanzania and show that losing one's mother during childhood reduces height at adulthood by about 2cm; and orphans have about 1 less year of education than others
  - Krutikov (2003): Used same data set and show that children engage in more child labor in response to agricultural crop shocks experienced by the family
    - This results in permanent loss in terms of educational achievement
  - Das et al., (2007): both child and teacher absenteeism in school due to the HIV(AIDS pandemic reduced cognitive achievement by children in Zambia

Dercon (2008)

The Long-run Consequences of shocks and Risk cont.

- Such transitory shocks are often the cause for a **poverty trap**
  - Equilibrium levels of poverty in which one may slide relatively easily, but from which there is no possible recovery without "outside" intervention
- An ideal way of testing the persistence of the impact of shocks is to use the lags of the shocks as regressors
  - If shocks only have transitory effects, then lagged shocks should have no effect
  - Dercon (2004): shows that lagged rainfall shock had negative welfare impact long after the shocks

Main Message from the Literature

- Uninsured risk is a cause of poverty
  - But more evidence is needed to generalize the importance of these effects
  - If shocks have such large impact, avoiding these impacts is crucial for policy fighting poverty
  - Human and physical capital deterioration due to shocks affects overall growth of a country
  - Provision of social protection would have high social benefits in terms of growth and poverty

Weaknesses of the Literature

- It mixes up "risk" with "shocks"; on disasters ("fate") rather than fear and threat of disaster and its implications
- Focused on the imperfections in "coping" mechanisms
- When there is risk with no insurance market, hhs engage in *risk management* activities to limit their exposure to risk
- Quantifying the implications of these risk management strategies is important
- If hhs deal with risk by for e.g., applying drought resistant but low-return seed variety, risk variables would not be related to outcomes
- But stating that risk did not have an impact would be misleading!

Weaknesses of the Literature cont.

- Very few papers exist on African data trying to quantify the *ex ante* or *risk management effect on incomes or assets*
  - Dercon (1996): hhs with limited liquid assets in rural Tanzania grow proportionately more sweet potatoes, a low-return, low-risk crop
  - Elbers and Gunning (2003): risk management strategies (building-up livestock to reduce consumption risk) reduced steady state level of capital by about 40%
  - Alem et al., (2010): risk of rainfall variability discourages farm households from adopting productivity-enhancing modern agricultural inputs (fertilizer) in rural Ethiopia
  - Dercon and Christiaensen (2011): fertilizer use would increase significantly if downside consumption risk due to rainfall shock had been insured

Weaknesses of the Literature cont.

- This is an area that requires more research but the challenge is to identify risk, rather than shocks and then trace the implications
- This would provide more knowledge about poverty persistence
- Would have clear policy implications: policies reducing risk and its consequences should be at the core of growth and poverty reduction strategies

Limitations of the Current Literature

- Relying on risks and shocks (idiosyncratic and covariate) that are relatively easy to measure
- Most of the related panel data was done in agrarian areas: findings on urban context are thin
- Lack of systematically linking the literature on key institutional issues with risk
  - Risk of conflict at the micro-level are very few (most are macro-level)
    - Has both *ex post* (e.g., loss of asset due to war) and *ex ante* (e.g., changing asset portfolio: saving in jewelery instead of productive assets) impacts
  - Institutional risks such as governance, corruption, and property right (e.g., land tenure) problems
    - Increase the cost of running business, and change asset portfolios
    - Risk of tenure insecurity reduces incentive to invest on land

- Two sources of data on risk
  - Objective data: e.g., rainfall distributions
    - But worth noting that under some cases, climatic variables may be endogenous
  - Subjective data: self-reported based on for e.g., recording shocks or based on hypothetical data to elicit perceived distributions
    - Limitations: reporting bias (e.g., self-reported health)
    - Possible remedy: instrument them using exogenous instruments

Dercon (2008)
Conclusions

The Current Literature on Risk and Shocks:

1. Focus more proportionately on risk management and coping strategies, but not enough on its implications and the scope for interventions
2. Focus on short-run implications ignoring the long-run
3. Being driven by a narrow social protection agenda rather than growth and fighting poverty
4. Lack of differentiating between risk and shocks
5. Focusing on risks that are "easy" to analyze (e.g., weather shocks) ignoring the key factor - lack of African and foreign investment in the continent
6. Lack of embracing more seriously the experimental and behavioral literature

Maccini & Yang (2009)

Introduction

- Life in rural areas of developing countries is prone to many kinds of risk and shocks
  - Certain kinds of shocks may have long-lasting effects
  - Identifying shocks that have large long-term effects is important from public policy point of view
  - Shocks (e.g., health shocks) may have both direct and indirect long-term impacts on people's well-being
- M&Y analyze the impact of shocks that occur at the beginning of life:
  - Do environmental conditions around the time of birth affect individual long-run well-being?
- Answer this by investigating the effect of weather shocks around the birth of Indonesian women and men born between 1953 & 1974

Maccini & Yang (2009)

Introduction cont.

Key contributions

- Focus on the impact of exogenous shocks in early life (before and after birth) on adult outcomes
  - Carefully investigate which periods are most sensitive to be affected by shocks?
- Focus on outcomes in individuals' adult prime-age years
- Using a large and representative data (allows generalization)

Maccini & Yang (2009)

Introduction cont.

Key contributions cont.

- Spelling out gender bias in allocation of nutrition and other resources particularly during shock periods (significant impact on women than men)
  - Only in the first year of life are the rainfall shocks associated with long-run outcomes, as opposed to shocks experienced in utreo (before the gender of the child is known)
  - Gender bias has long-term impacts!
  - Existing studies on gender bias in Indonesia and other countries focus on short-term negative impacts
    - Monica Das Gupta (1987): girls in rural India have twice the mortality rate as boys mainly due to differences in medical care, nutrition, and clothing
    - Behrman (1988); Behrman and Deolalikar (1990): document biases favoring boys in nutrient allocation

A Health Production Function

- Grossman (1972): Individual health at time t, H_t is a function of initial health endowment H_0, and the history of health inputs $N_1, ..., N_t$, and other health determinants X e.g (demographic variables), the time histories of community infrastructure $C_0, C_1, ..., C_t$, and disease environment $D_0, D_1, ..., D_t \Longrightarrow$

$$H_t = h(H_0, N_1, ..., N_t, X, C_0, C_1, ..., C_t, D_0, D_1, ..., D_t) \quad (3)$$

- H_0 is determined by genetic characteristics G, environmental conditions experienced in early life R_0, as well as early life community infrastructure and disease environment which may have persistent effects on health $\Longrightarrow$

$$H_0 = k(G, R_0, C_0, D_0) \quad (4)$$

A Health Production Function cont.

- M&Y focus on the component of individuals' initial health endowment that is determined by environmental conditions in early life
  - The reduced-form relationship between early-life rainfall shocks and later-life health and socioeconomic outcomes
- Do you see the potential for selection bias? The authors test for it by checking if birth year rainfall affects the likelihood of inclusion in the sample. They find no effect!

Maccini & Yang (2009)
Data

- IFLS3 (collected in 2000), 4615 women and 4277 men born outside urban areas between 1953-1974
- The IFLS includes information on district (kabupaten) of birth to which the authors link historical ranifall data
- Sample individuals were born in 166 districts
- The survey data also includes a variety of health variables, ranging from clinical measures to self-reported (subjective) measures

Maccini & Yang (2009)

Data cont.

- Rainfall data for one's year of birth is defined as the sum of rainfall in one's birth season and in the following season
- In analysing the impact of rainfall on adult outcomes, the authors focus on the *deviation* of birth year rainfall from the norm for one's birth district
  - The log of birth year rainfall minus the log of mean annual rainfall in the given district.
  - Mean district rainfall for a particular individual is calculated over the 1953-1999 period

Maccini & Yang (2009)
Empirical Strategy

- Rainfall is measured with error
  - Measured at the closest rainfall station to the birth district in the birth year, but this measurement is only imperfectly correlated with actual rainfall in the individual's narrowly defined locality
  - Classical measurement error in the early-life rainfall variable will lead to attenuated coefficient estimates
- Solution: Instrumental variable (IV) regression
- Early life rainfall measured at the closest rainfall station to one's birth district in one's birth year is instrumented with four analogous rainfall variables measured in the same birth year but in the second-through fifth-closest rainfall stations

Maccini & Yang (2009)

Empirical Strategy cont.

- A reduced-form linear relationship between adult outcome Y_{ijst} of adult i born in district j, in season s and in year t:

$$Y_{ijst} = \beta R_{jt} + \mu_{js} + \gamma_{js} TREND + \delta_{st} + \varepsilon_{ijst} \quad (5)$$

- The parameter of interest is β, the impact of (instrumented) birth year rainfall R_{jt} on the adult outcome
- Parents may time children to be born in particular seasons (e.g., Artadi, 2005)
  - Separate fixed effects for individuals born in the wet and dry season of each district, μ_{js} (district j and season s)
- Allow the cohort effect do differ across wet and dry seasons: using a fixed effect for the birth year-season combination δ_{st}
- $\gamma_{js} TREND$: a linear time trend specific to the district-season, and ε_{ijst} a mean-zero error term. Standard errors are clustered by birth province

Maccini & Yang (2009)

TABLE 2—EFFECT OF BIRTH YEAR RAINFALL ON ADULT OUTCOMES: WOMEN AND MEN BORN 1953–1974
(Instrumental variables estimates. Coefficients (standard errors) in regression of outcome on rainfall in individual's birth year and birth district. Instrumental variables for birth year/birth district rainfall are rainfall measured at second- through fifth-closest rainfall stations to respondent's birth district.)

	Women	Men
Self-reported health status very good (indicator)	0.101	−0.029
	(0.058)*	(0.072)
	[4,613]	[4,270]
Self-reported health status poor/very poor (indicator)	−0.192	−0.100
	(0.082)**	(0.098)
	[4,613]	[4,270]
Ln (lung capacity)	−0.044	−0.073
	(0.049)	(0.062)
	[4,454]	[3,907]
Height (centimeters)	2.832	0.998
	(0.821)***	(1.795)
	[4,495]	[3,924]
Days absent due to illness (last four weeks)	−1.175	0.515
	(0.831)	(0.779)
	[4,611]	[4,267]
Completed grades of schooling	1.086	−0.474
	(0.453)**	(1.490)
	[4,598]	[4,259]
Ln (expenditures per capita in household)	0.095	−0.274
	(0.204)	(0.301)
	[4,615]	[4,277]
Asset index	0.876	−0.279
	(0.324)**	(0.507)
	[4,613]	[4,276]
Ln (annual earnings)	0.065	−0.202
	(0.988)	(0.350)
	[2,332]	[3,963]

Maccini & Yang (2009)

Results cont.

- If rainfall is serially correlated over time, then it could be that rainfall in some year before or after the birth year has the actual impact on adult outcomes.
- If so, the coefficients on birth year rainfall in Table 2 might simply reflect the fact that other years' rainfall were not controlled for (omission variable bias)
  - Run regressions controlling for annual rainfall variables from three years prior to the birth year to three years after the birth year, including the birth year rainfall
- Results from Table 2 remained robust (see table 3) i.e., birth year rainfall matters in and of itself!
- The authors also used the estimated coefficients to estimate the forgone GDP due to the shocks through the earnings of females

Maccini & Yang (2009)

TABLE 3—EFFECT OF RAINFALL IN YEARS BEFORE AND AFTER BIRTH: WOMEN BORN 1953–1974
(Instrumental variables estimates. Rainfall in individual's birth year and birth district instrumented with rainfall measured at second- through fifth-closest rainfall stations to respondent's birth district.)

Dependent variable	Self-reported health status very good (indicator)	Self-reported health status poor/very poor (indicator)	Height (centimeters)	Completed grades of schooling	Asset index
Coefficient on rainfall in:					
Year −3	0.025	−0.114	1.505	−0.065	0.003
	(0.084)	(0.120)	(1.572)	(0.992)	(0.424)
Year −2	−0.037	−0.013	0.854	−0.852	−0.426
	(0.103)	(0.075)	(1.813)	(1.670)	(0.721)
Year −1	−0.080	−0.045	3.338	0.104	−0.380
	(0.123)	(0.088)	(2.155)	(1.332)	(0.530)
Year 0	0.090	−0.179	3.833	1.598	0.750
	(0.067)	(0.093)*	(1.420)**	(0.675)**	(0.399)*
Year 1	−0.008	−0.096	0.676	1.083	0.203
	(0.053)	(0.067)	(1.592)	(0.769)	(0.272)
Year 2	−0.041	−0.015	1.666	0.117	−0.229
	(0.043)	(0.068)	(0.984)	(0.840)	(0.452)
Year 3	−0.020	−0.104	1.996	−0.135	0.088
	(0.116)	(0.067)	(1.774)	(0.802)	(0.232)
Observations	4,613	4,613	4,495	4,598	4,613

Maccini & Yang (2009)
Conclusions

- Early life rainfall had a significant persistent impact on Indonesian women but not on men
  - This $\Longrightarrow$ significant gender bias
- Rainfall has a positive impact on agricultural output, and leads to higher hh income and therefore better health for infant girls
- There may have been partial consumption smoothing in rural Indonesia
  - However they were not able to protect female infants from the impacts of weather shocks on average

Maccini & Yang (2009)

Conclusions cont.

- key policy implications:
  - Infant girls are more vulnerable (and should be targeted by policy makers)
  - Cost benefit analysis of programs is worth considering given the long-term (persistent) impact of shocks
  - Weather insurance, social insurance schemes, public health investments, or policies ensuring food security

Alem and Colmer (2013)
Research Questions

- We are interested in measuring the impact of climate variability (a proxy for future income uncertainty) on Subjective Well-being (SWB) of small-holder farmers who depend on rain-fed agriculture for their livelihood.
  - Does climate variability reduce SWB?
- To answer this, we use two rounds of household-level data from rural Ethiopia combined with a new set of data containing daily atmospheric parameters
  - We exploit exogenous variation in future income uncertainty (proxied by climate variability)
- We find climate variability to have one of the largest negative impact on reported SWB of farmers!
- Our analysis adds onto existing knowledge on the welfare cost of climate variability!

Alem and Colmer (2013)

Motivation: two-fold

- 1. Understand how uncertainty affects welfare - difficult to measure and identify
  - Our results can be better explained by a model of utility and behavior (beliefs about future states of the world impact utility directly)
  - Brunnermeier & Parker, (2005)'s optimal expectation framework is used to interpret results and set-up the identification strategy
- 2. Better understand climatic influence on economic outcomes
  - Climate change is likely to increase the incidence of environmental disasters and variability of rainfall, temperature, and other atmospheric parameters $=>$ future income uncertainty, especially in developing countries

Alem and Colmer (2013)

Motivation cont.

- While some costs related to this (e.g impacts on agr. yield, and health) are easy to measure, the impact of increased risk on experienced utility is a difficult one
- It is this aspect of climatic influence, currently absent from the literature that we aim to capture here
- I.e., how the $ex-ante$ beliefs about the likelihood of future climatic events affects current well-being
- Climate Variability (CV) is likely to affect welfare mainly through the psychological impact of risk and uncertainty (Van den Bos et al., 2009; Hare 2009; Delgado & Porcellie, 2009)
- The literature so far focuses on the $ex-post$ impacts of CV (e.g., Deschenes & Greenstone, 2007; 2012; Guiteras, 2009; Schlenker & Roberts, 2009; Barreca et al., 2013)
- $Ex-ante$ impacts of climate is missing from the literature!

Data

- We use two rounds of panel data from ERHS (2004, & 2009), representative of main agro-ecological zones
- Conducted by Addis Ababa University in collabotation with CSAE-Oxford and IFPRI
- Data was also collected since 1994 but did not contain SWB module. SWB was asked in a 7 likert scare
- Stratified random sampling was used within each village based on gender of household heads
- Attrition has been close to 1-2%
- The data also contains detailed individual and household-level variables

Data Cont.

- In addition, daily, seasonal and annual rainfall data has been constructed from the ERA-Interim data archive (European Center for Medium-Term Weather Forecasting (ECMWF)
- Metrological data from Africa is not reliable
- The number of weather stations in Africa declined from 3500 in 1990 to around 500 in the present time (Lorenz & Kuntsman, 2012)
- The number of weather stations in Eth. does not exceed 18 (most of them with a lot of missing observations)
- Even the ones functioning are located in high potential agr. areas (serious selection issues)

Data Cont.

- The ERA-Interim renalysis data archive provides 6-hourly measurements of precipitation, temp, wind speed and wind direction, relative humidity, cloud cover and many other atmospheric parameters from July 1 1979- present day
- Resolution 0.75×0.75 degrees $\equiv 83km \times 83km$
- Constructed through a process whereby climate scientists use available observations as inputs into climate models to produce a physically consistent record of atmospheric parameters over time
- Provides a consistent measure of atmospheric parameters over time and space
- Increasingly being used by economists

Empirical Strategy

- We use a fixed effects "within" transformation to deal with unobserved heterogeneity

$$W_{it} = \alpha_i + \beta_1 CV_{vt} + \beta_2 SHOCK_{vt} + \beta_3 X_{it} + \beta_4 X_{ht} + \alpha_m + \alpha_t + \epsilon_{it} \quad (6)$$

- With cluster-robust Huber-White standard errors at the village level to account for serial correlation within villages

Main

Table 4: Climate Variability and SWB: Results from Alternative Models.

Dependent Variable: Life Satisfaction	OPROBIT- RE	RE	FE
Climate Variability	-0.047***	-0.077**	-0.070**
	(0.013)	(0.031)	(0.030)
Negative Rainfall Shock (past 5 years)	-0.115	-0.140	-0.272
	(0.081)	(0.295)	(0.307)
Average Temperature (Day of Survey)	0.030	0.091	0.313
	(0.070)	(0.165)	(0.208)
Rainfall (mm) (Day of Survey)	-0.001	-0.003	-0.014
	(0.002)	(0.006)	(0.009)
Log Real Consumption per capita	0.220***	0.300***	0.373***
	(0.031)	(0.059)	(0.109)
Month dummies	Y	Y	Y
Year dummies	Y	Y	Y
Village dummies	Y	Y	-
Individual fixed effects	N	N	Y
N	3517	3517	3517
Log-likelihood	-5710.6275	-	-

Alem and Colmer (2013)

Results cont.

- Several robustness tests have been performed
  - Regression for different seasons
  - Other measures of subjective well-being
  - Alternative measures of rainfall variability
  - Exploring the impact of CV on urban households (who are not rain dependent for livelihood)

Alem and Colmer (2013)

Conclusions

- We investigated the impact of future income uncertainty (proxied by CV) on SWB of rain-dependent farmers in Eth.
- We used individual, hh-level, climate variables, and a robust panel data model (fixed effects) to deal with unob. indiv. heterogeneity
- Performed extensive robustness exercise
- We show that CV has no impact on experienced utility other than through uncertainty about future states of the world
- Of particular importance is our ability to control for the level of rainfall and temperature on the day that each respondent was surveyed and disentangle the effects of CV from that of weather
- We computed the welfare cost of CV in terms of equivalent economic loss

Alem and Colmer (2013)
Conclusions Cont.

- FE regression results suggest that CV has a significant adverse impact on the SWB of farmers in Eth.
- A 1 SD increase in CV $=>$ about 2% decrease in real consumption per capita
- This is shown to be one of the largest determinants of SWB
- Anticipatory utility is important determinant of well-being
- We rule out indirect channels related to effects on cons and show that CV outside the belg (the short rainy season) season is not important for SWB
- Belg season is important: lack of rain in this season means a complete crop loss as there needs to be sufficient rainfall for seeds to germinate

Alem and Colmer (2013)
Conclusions Cont.

- CV does not have any impact on urban hhs who don't depend on rainfed agr. for their livelihood
- Investigating the impact of CV on SWB offers useful insights into the welfare costs of climatic influence
- Welfare enhancing mechanisms:
  - Increased access to *expost* coping mechanisms such as insurance,
  - *exante* risk management strategies, as well as increased information to help farmers to form better subjective probabilities about the likelihood of future shocks
  - These would reduce the impact of anticipatory utility, increasing welfare!