

Final Progress Report

Sustainability Science Program

September 1, 2008 – August 31, 2009

Name: Lorenzo Casaburi
Ph.D. Candidate Economics, Harvard University (expected 2012)
Doctoral Fellow in Sustainability Science

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Field: Development Economics

Faculty Host: Prof. Michael Kremer (Economics Department and CID)

SSP-related research activity: 1) Learning In Networks and Technology Diffusion: Theory and Evidence from a Randomized Experiment in Kenya (*first semester*); 2) The Kenya Small Scale Cash Crop Longitudinal Study: Understanding the Impact of Environmental Stress on Agricultural Dynamics in Sub-Saharan Africa (with M. Kremer, S. Mullainathan, O. Ozier and I Tomb) (*second semester*).

Abstract:

1) The research focuses on the process of diffusion of new technologies in social networks. I focus on the way agents in a social network process information that comes from their neighbors. In particular, I look at the patterns of social learning when agents have multiple sources of information but some of these sources can in fact convey similar (redundant) information.

I develop a simple model that shows that, under the stated assumptions, the learning process is slower in highly clustered networks. I also propose a framework to investigate how the presence of redundant information affects the dynamics of link creation. I test the predictions of my model on data from a randomized evaluation in Kenya. The intervention focused on the adoption of chlorine in rural areas. (*paper available upon request*)

2) The Kenya Small Scale Cash Crop Longitudinal Study. The research aims to shed light on the impact of environmental stress climate shocks and demographic pressure on small scale farmers production decisions and output. We use data from the registry of a large sugar producer in Western Kenya that include information on productivity, inputs, plot characteristics and rainfall regimes for approximately 60,000 farmers that produce sugar cane the company through an outgrowing contracting scheme

Problems / Research Questions

1) My goal is to investigate two main research questions: a) How do agents weigh information coming from their neighbors? Do they filter pieces of information that are potentially redundant?
b) Does the search for independent, non-redundant information affect the dynamics of links creation?

2) First, we are interested in studying the impact of rainfall shocks on the interaction between the farmers and the company. We frame the sugar cane production process as a repeated interaction between the two players. A cooperative equilibrium is one where the company provides inputs and farmers efficiently use inputs and complete sugar cane production. We hypothesize that rainfall shocks and increase in uncertainty over rainfall regime can induce sub-optimal farmers'

behavior, inducing negligence of the plot, diversion of inputs and other forms of “deviation”. Future work will aim to test this hypothesis. Second, we plan to investigate the impact of demographic pressure, and resulting land fragmentation, on productivity.

Methodology

1) I address the first of the above questions developing a simple model of learning. Agents assign lower precision (and thus lower weight) to the average signal they receive from their neighbor when those are highly clustered (i.e. neighbor to each other). As a result, the main testable result of the model is that, for a given number of neighbors, the learning process is slower the denser is the network of neighbors. My empirical work provides some support to this hypothesis.

In order to address the second question, I look at the creation of new links in terms of costs benefits comparison. I present some evidence, though not strongly robust, that the search for independent neighbors (i.e. new neighbors that are not related to previously existing neighbors) affects the evolution of the network structure.

2) First, we will frame our analysis in a repeated game framework where the two parts, farmers and company, can decide whether to cooperate or to deviate. Second, we aim to combine several data sources (different forms in the registry, rainfall data) in one dataset. We will use panel data techniques to perform the econometrics analysis

Relevant Literature

1) The research builds on different strands of literature. First, I rely on the theoretical literature on technology diffusion and learning in social networks. Second, I rely on the growing literature on program evaluation, focusing in particular on the analysis of data from randomized evaluations

2) The research is primarily based on the growing literature on the effects of environmental stress and climate change on agricultural productivity and farmers’ decision making. In addition, game theory is used to derive the simple framework that captures the interaction between the farmers and the company.

Empirical Data Acquisition Description

1) I use data collected for the Rural Water Project, a large intervention aimed to improve access to clean drinking water in Western Kenya. I concentrate on an intervention that promoted the diffusion of a chlorine-based product among rural households. In particular, I focus on the social network data that have been collected before and after the intervention.

2) We use data from the registry of a large sugar factory in Western Kenya. The records include information about cane harvest, soil fertility, farming inputs, upkeep of farmers’ plots, contracts between MSC and their farmers. For a substantial portion of the farmers, information dates back to mid 1980s and in some cases goes back to early 1980s.

Geographical region studied

The data were collected in Busia and Butere-Mumias District, Western Kenya.

1) The sugar factory we are partnering with is located in Mumias District, Western Kenya.

Recommendations

2) The nature of the research seems to be extremely well fit to a multi-disciplinary approach. We plan to explore opportunities of cooperation with SSP fellows from other disciplines in the upcoming work.

Final products description

The primary targets for both research projects are journals in the field of Development Economics and, more generally, Applied Economics.

Other intellectual and professional achievements

- Second year sequence of Ph.D. Economics. I successfully passed my oral exam and qualified for ph.d. candidacy.
- I completed the year pro-seminar for the Inequality and Social-Policy Multi-Disciplinary Fellowship. I completed the first draft of the paper “The effects of Gender Preferences by Class and Income Level” (with E. Greenwood)
- Participation to the Water and Development discussion group at the Sustainability Science Program.
- Ongoing research on trade and organizational forms in Italy (with Valeria Gattai and G. Alfredo Minerva)

Updated CV attached

Other awards:

- 2007-2009: Harvard Graduate School of Arts and Sciences Fellowship
(~\$23,500 per academic year, awarded in April 2007)
- 2008- : Doctoral Fellow at the Harvard Interdisciplinary Program in Inequality and Social Policy (\$15,000 expected in 2011)
- 2012 (exp.): Harvard Graduate School of Arts and Sciences Dissertation Fellowship

Comments on SSP activity

The presence of “senior” researchers has been extremely helpful throughout the year and has provided significant extra value-added to my experience as a fellow. I believe other doctoral fellows have had similar benefits, too. I benefited from detailed comments after each of my presentations both from fellows who are in the field of economics and from fellows with different backgrounds (specially for the research project on agriculture).