AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

The Structural Estimation of Princip al-Agent Models by Least Squares:

Evidence from Land Rental Markets in Madagascar

Zachary S. Brown
PhD Student in Environmental Economics
Nicholas School of the Environment

Marc F. Bellemare
Assistant Professor of Public Policy and Economics
Sanford School of Public Policy

Duke University

Durham, NC

Presentation for SCC-76 Meetings

March 19-21, 2009

Galveston, TX

Research questions:

1.) How do exogenous sources of utility figure into the formulation of a 2nd best optimal risk sharing contract?

2.) How can this structure be used in reduced form empirical work?

Motivation

- Are contracts optimal (Chiappori and Salanié 2002)?
- What are some restrictions on the optimal contract in terms of the primitives?
- No one has systematically analyzed how principal *and* agent "wealth" affect an optimal contract.

Wealth effects and contracts, precedents

- Guo and Yang (2004, JET)
- Vera-Hernandez (2003, RAND)
- Laffont, Matoussi (1995, RES)
- Others…

Ackerberg and Botticini (2002, JPE)

$$\text{contract} = \beta_p(\text{principal traits}) + \beta_a(\text{agent traits}) + \varepsilon$$

Instrument:

$$\text{principal and agent traits} = \gamma(\text{regional heterogeneity}) + \omega$$

Theoretical Model

Principal's objective

$$\max_{w(\cdot),e} \int_{\underline{q}}^{\overline{q}} V\big(z_p + q - w(q)\big) f(q,e)\,dq$$

Agent rationality

$$\int_{\underline{q}}^{\overline{q}} U(z_a + w(q)) f(q,e)\,dq - \Psi(e) \geq U(z_a + c)$$

Agent incentive compatibility

$$e = \arg\max_{\tilde{e}} \int_{\underline{q}}^{\overline{q}} U(z_a + w(q)) f(q, \tilde{e}) dq - \Psi(\tilde{e})$$

Using first-order approach (Rogerson 1985),

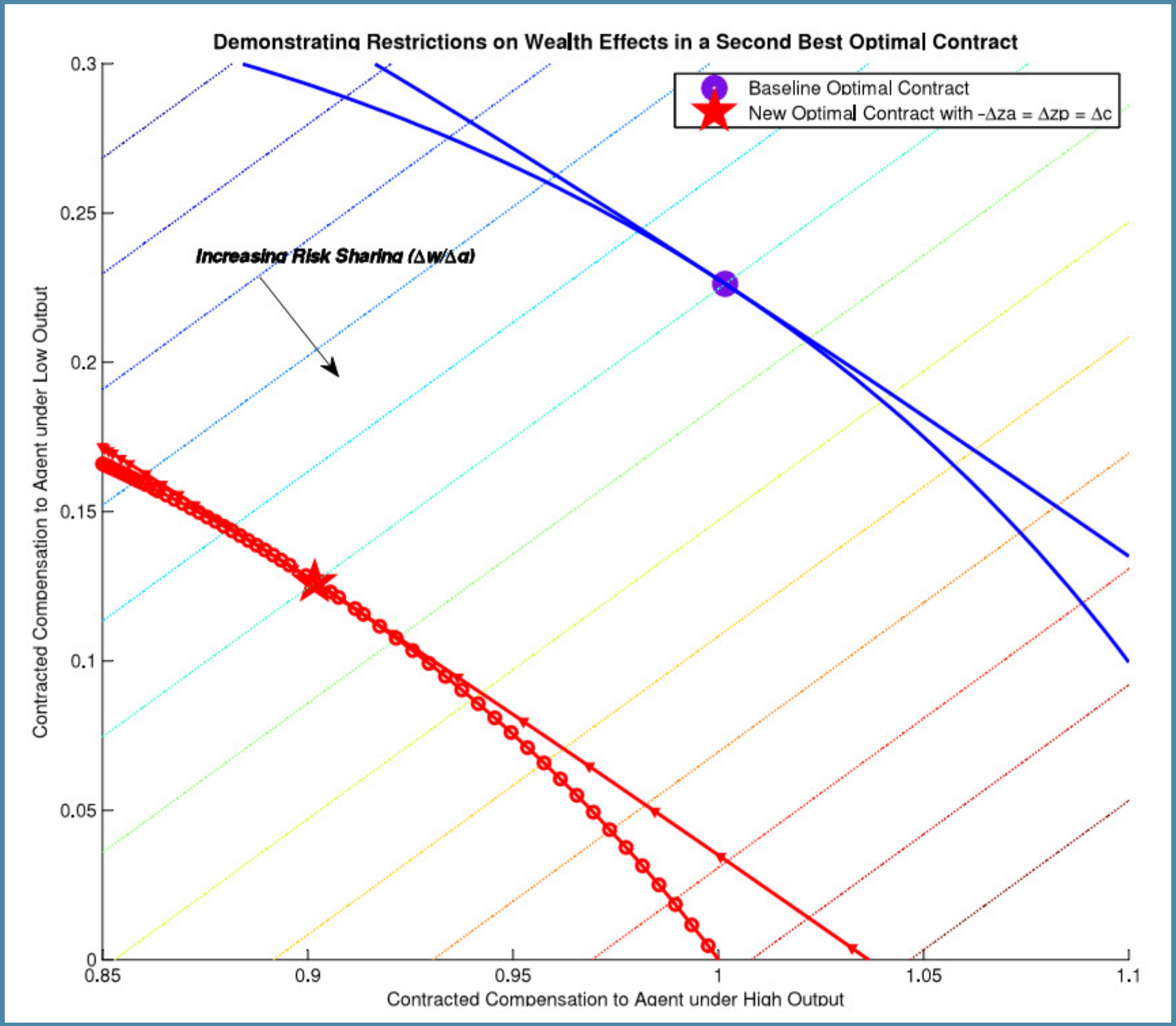
$$\int_{\underline{q}}^{\overline{q}} U(z_a + w(q)) f(q, e) dq - \Psi'(e) = 0$$

Theoretical Implications

$$\frac{dw^*}{dz_p} = \frac{dw^*}{dz_a} - \frac{dw^*}{dc} + 1$$

$$w^* = \Phi\left(q, z_p + z_a, c + z_a\right) - z_a = \Omega\left(q, z_p + z_a, c + z_a\right) - z_p$$

$$\mathrm{E}_q\left\{V\left(z_p + q - w^*(q)\right) | e^*\right\} = \nu\left(q, z_p + z_a, c + z_a\right)$$


Demonstrating Restrictions on Wealth Effects in a Second Best Optimal Contract
Baseline Optimal Contract
New Optimal Contract with -Δza = Δzp = Δc
Increasing Risk Sharing (Δw/Δa)
Contracted Compensation to Agent under Low Output
Contracted Compensation to Agent under High Output
0.3
0.25
0.2
0.15
0.1
0.05
0
0.85
0.9
0.95
1
1.05
1.1

Empirical framework

$$w = \beta_0 + \beta_z z_p + (\beta_z + \beta_c - 1) z_a + \beta_c c + \beta_q q + \eta$$

$$\eta = \beta_{qq} q^2 + \beta_{zz} z_p^2 + \beta_{cc} c^2 + (\beta_{zz} + 2\beta_{zc} + \beta_{cc}) z_a^2 + \beta_{zc} z_p c + \beta_{qc} q c + \beta_{qz} q z_p$$
$$+ \left(\beta_{qz} + \beta_{qc}\right) q z_a + (\beta_{zz} + \beta_{zc}) z_p z_a + (\beta_{zc} + \beta_{cc}) c z_a + r$$

An Nth order Taylor approximation gives us

N(3N-1)/2 restrictions on the coefficients.

And all of this buys us … ?

Estimation

- Survey data from Lac Alaotra, Madagascar. Collected to analyze reverse share tenancy; see Bellemare (2008, working paper)
- Around 387 observations.

Table 1: Descriptive Statistics

Variable	Mean	Std. Dev.	*N*
Sharecropping Dummy	0.687	(0.464)	387
z_p (1,000,000 Ariary)	0.273	(0.652)	380
z_a (1,000,000 Ariary)	0.171	(0.275)	384
c (1,000 Ariary)	0.294	(0.178)	383
q (1,000,000 Ariary)	1.361	(0.890)	387
Family-Owned Plot Dummy	0.199	(0.400)	387
Plot Size (Ares)	109.809	(84.164)	387
Titled Plot Dummy	0.384	(0.488)	125
Tanety Dummy	0.070	(0.255)	387
Bas-Fonds Dummy	0.075	(0.264)	387
Irrigated Plot Dummy	0.755	(0.431)	387
Distance from House (Walking Minutes)	33.013	(36.266)	387
P Household Size (Individuals)	5.475	(2.807)	387
P Household Dependency Ratio	0.450	(0.252)	387
P Household Head Age (Years)	53.359	(16.391)	387
P Household Head Female Dummy	0.196	(0.398)	387
P Household Head Education (Years)	5.413	(3.882)	387
P Household Income Per Capita (100,000 Ariary)	1.162	(2.349)	386
Relationship Length (Years)	5.373	(7.433)	386
Kin Contract Dummy	0.638	(0.481)	387
A Household Size (Individuals)	5.753	(2.566)	384
A Household Dependency Ratio	0.412	(0.216)	384
A Household Head Age (Years)	39.036	(11.098)	384
A Household Head Income (100,000 Ariary)	0.931	(1.484)	384
A Household Head Education (Years)	5.927	(3.427)	384
Slope of Asset Risk Function (r_a)	-0.258	(3.960)	387

Table 2: Estimation Results

	(1)		(2)		(3)		(4)		(5)	
	Coefficient	(Std. Err.)	Coefficient	(Robust Std. Err.)	Coefficient	(Robust Std. Err.)	Coefficient	(Robust Std. Err.)	Coefficient	(Robust Std. Err.)
z_p	-0.02	(0.09)	0.33	(0.34)	0.25	(0.34)	0.35	(0.36)	0.38	(0.36)
z_a	0.04	(0.12)	-0.03	(0.65)	0.00	(0.70)	0.35	(0.71)	0.30	(0.69)
c	0.00	(0.19)	0.19	(0.80)	0.43	(0.81)	0.21	(0.83)	0.10	(0.82)
q	0.03	(0.04)	0.01	(0.14)	-0.01	(0.20)	-0.16	(0.21)	-0.11	(0.20)
z_p^2			-0.03	(0.06)	-0.02	(0.06)	-0.02	(0.07)	-0.02	(0.07)
z_a^2			-0.14	(0.27)	-0.13	(0.28)	-0.25	(0.28)	-0.20	(0.26)
c^2			-0.21	(0.76)	-0.29	(0.72)	-0.17	(0.76)	-0.11	(0.78)
q^2			-0.01	(0.04)	-0.04	(0.05)	-0.01	(0.05)	-0.01	(0.05)
z_p*q			-0.06	(0.11)	-0.04	(0.10)	-0.05	(0.11)	-0.08	(0.11)
z_a*q			0.13	(0.19)	0.08	(0.20)	0.05	(0.21)	0.02	(0.20)
$c*q$			0.13	(0.26)	0.06	(0.27)	0.19	(0.28)	0.18	(0.28)
z_p*c			-0.85	(0.70)	-0.86	(0.68)	-1.03	(0.71)	-1.03	(0.72)
z_a*c			0.29	(1.86)	0.27	(2.01)	0.29	(2.01)	0.30	(1.93)
z_p*z_a			0.20	(0.55)	0.19	(0.54)	-0.03	(0.55)	0.02	(0.52)
Family-Owned Plot					-0.11	(0.08)	0.18	(0.16)	-0.12*	(0.07)
Plot Size					0.00*	(0.00)	0.21**	(0.13)	0.00*	(0.00)
Titled Plot					0.15	(0.27)	-0.34	(0.16)	0.24	(0.27)
Tanety					0.01	(0.17)	0.04	(0.17)	-0.01	(0.17)
Bas-Fonds					-0.04	(0.17)	0.06	(0.17)	-0.04	(0.16)
Irrigated Plot					-0.09	(0.10)	-0.24	(0.15)	-0.11	(0.10)
Distance from House					0.00	(0.00)	-0.12	(0.29)	0.00	(0.00)
P Household Size							0.05	(0.15)	0.01	(0.01)
P Household Dependency Ratio							0.05	(0.14)	0.00	(0.13)
P Household Head Age							-0.39*	(0.17)	0.00*	(0.00)
P Household Head Female							-0.48	(0.19)	-0.02	(0.07)
P Household Head Education							-0.12	(0.08)	-0.01	(0.01)
P Household Income Per Capita							0.00	(0.00)	0.01	(0.01)
Relationship Length							0.29	(0.28)	0.02	(0.01)
Kin Contract							0.00	(0.18)	0.01	(0.07)
A Household Size							-0.06	(0.17)	-0.02	(0.02)
A Household Dependency Ratio							-0.10*	(0.10)	0.26*	(0.15)
A Household Head Age							0.00	(0.00)	0.00	(0.00)
A Household Head Income							0.01*	(0.01)	-0.05*	(0.02)
A Household Head Education							0.00	(0.13)	-0.01	(0.01)
Slope of Asset Risk Function (r_a)									0.03***	(0.01)
Intercept	0.77***	(0.12)	0.73***	(0.23)	0.69**	(0.31)	1.06***	(0.39)	1.20***	(0.38)
N	376		376		376		376		376	
Village Dummies	Yes		Yes		Yes		Yes		Yes	
Bootstrap Replications	1000		1000		1000		1000		1000	
R^2	0.19		0.21		0.23		0.30		0.33	
p-value (All Coefficients)	0.00		0.00		0.00		0.00		0.00	
p-value (Structural Coefficients)	0.94		0.99		0.99		0.94		0.97	

- Caveats:
  a. Data
  b. Standard econometric issues

- Future work
  a. More general theoretical model (e.g. incorporation of disutility of effort).
  b. Dynamic stochastic control framework (Schattler 1993, JET)