Endogenous Persistent Shocks and Household's Welfare

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Motivation

- Adverse shocks to households (HHs) are common in developing countries:
  - 45% of urban households in Colombia (ELCA, 2013)
- Since markets are incomplete, household's must importantly distort their decisions to smooth consumption
- Besides affecting current utility, strategies may affect future vulnerability of household, e.g.:
  - Reducing consumption may result in malnutrition
  - Increasing hours of work may result in health problems
- Which in turn could trap households in a low-income equilibrium

- Objective of paper is to characterize such distortions and quantify their effect on HHs' welfare
- We first use Colombian panel data (ELCA 2010, 2013) to:
  - Characterize how persistent and endogenous (how dependent are on strategies) are the shocks
  - We also characterize the strategies followed by households after a shock
- We then construct a dynamic model to understand the reactions of such households
- Finally the model is calibrated according to data and we show how a poverty trap may arise

Data

- Colombian Longitudinal Survey of Wealth, Income, Labor and Land (ELCA) follows 6000 urban and 4000 rural HHs in 2010 and 2013
- Representative of low and middle income HHs and 5 geographical regions
- Lots of socioeconomic variables, information on adverse shocks and its intensity, expenditures and assets

- Information on adverse shocks:
  - Health: Accident, illnesses, death of a family member
  - Labor: family member lost job
  - Family: new member, abandonment
  - Assets: had to leave home, bankruptcy, loosing home or remittances, destruction, theft
  - Natural disaster
  - Violence
- For HHs strategies we focus on expenditure on food consumption and net assets

Table: Summary statistics for urban area

	Full sample			Below median assets		Above median assets	
Variable	**Mean**	**Std. Dev.**	**N**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
General characteristics							
Income USD	175.10	185.72	4635	107.14	103.90	243.15	221.29
Number of Household members	4.37	1.99	4635	4.47	2.21	4.27	1.73
Owners of the house	0.41	0.49	4635	0.37	0.48	0.45	0.80
Head of household's education							
No education	0.05	0.22	4431	0.08	0.27	0.02	0.14
Primary shcool	0.33	0.47	4431	0.40	0.49	0.24	0.43
High school	0.44	0.50	4431	0.43	0.47	0.44	0.50
Higher education	0.19	0.39	4431	0.08	0.28	0.30	0.50
Shocks in							
2011	0.12	0.37	4635	0.14	0.35	0.11	0.31
2012	0.24	0.43	4635	0.22	0.42	0.16	0.37
12 months before 2010	0.33	0.47	4635	0.29	0.45	0.23	0.42
Between 2010 & 2013	0.50	0.50	4635	0.45	0.50	0.33	0.47
Type of shocks in 2013							
Health	0.282	0.45	4635	0.309	0.462	0.255	0.436
Familiar	0.125	0.331	4635	0.138	0.345	0.112	0.315
Labor	0.254	0.435	4635	0.268	0.443	0.24	0.427
Other	0.107	0.309	4635	0.125	0.331	0.088	0.283
Asset	0.219	0.413	4635	0.255	0.436	0.183	0.386
Type of shocks in 2010							
Health	0.154	0.361	4635	0.167	0.373	0.14	0.347
Familiar	0.03	0.169	4635	0.029	0.168	0.03	0.171
Labor	0.084	0.277	4635	0.09	0.286	0.078	0.268
Other	0.01	0.098	4635	0.014	0.117	0.006	0.075
Asset	0.023	0.15	4635	0.022	0.147	0.024	0.154

Table: Summary statistics for rural area

	Full sample			Below median assets		Above median assets	
Variable	**Mean**	**Std. Dev.**	**N**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
General characteristics							
Number of Household members	4.71	2.07	4239	4.69	2.09	4.73	2.05
Owners of the house	0.52	0.50	4239	0.49	0.50	0.55	0.50
Income (USD)	191.56	889.82	4239	140.96	869.30	242.24	907.27
Head of household's education							
No education	0.13	0.33	4183	0.16	0.37	0.09	0.29
Primary shcool	0.67	0.47	4183	0.69	0.46	0.65	0.47
High school	0.18	0.39	4183	0.15	0.35	0.22	0.47
Higher education	0.02	0.14	4183	0.00	0.07	0.03	0.18
Shocks in							
2011	0.22	0.41	4239	0.21	0.41	0.22	0.47
2012	0.36	0.48	4239	0.38	0.49	0.34	0.47
12 months before 2010	0.37	0.48	4239	0.36	0.48	0.35	0.48
Between 2010 & 2013	0.58	0.49	4239	0.59	0.49	0.56	0.50
Type of shocks in 2013							
Health	0.277	0.448	4239	0.29	0.454	0.265	0.442
Familiar	0.102	0.302	4239	0.103	0.304	0.1	0.3
Labor	0.095	0.293	4239	0.088	0.283	0.101	0.302
Other	0.096	0.294	4239	0.092	0.289	0.1	0.3
Asset	0.523	0.5	4239	0.52	0.5	0.525	0.499
Type of shocks in 2010							
Health	0.16	0.367	4239	0.167	0.373	0.153	0.36
Familiar	0.023	0.149	4239	0.023	0.149	0.023	0.149
Labor	0.017	0.127	4239	0.014	0.116	0.019	0.138
Other	0.004	0.067	4239	0.004	0.061	0.005	0.072
Asset	0.162	0.369	4239	0.162	0.369	0.162	0.369

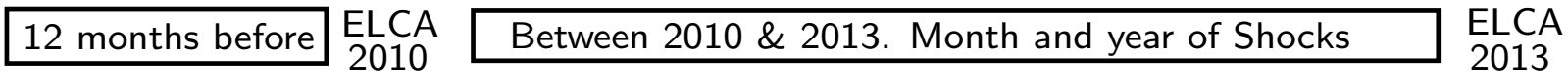
Empirical Strategy

- Want to find how persistent are shocks and how they depend on the followed strategies

$$Shock_{t+1} = f\left(Shock_t, Strategy_t, X_t\right)$$

- Where X_t includes previously determined HH controls
- However there are unobservables that we cannot control for
- We follow Altonji et al. (2005) to measure the selection bias.

Shocks information

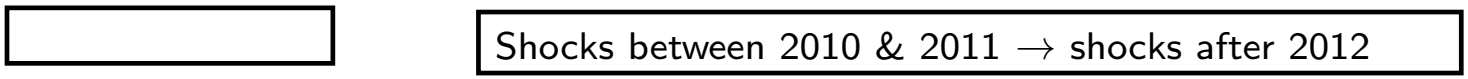


Shock persistence analysis

Strategy 1

+) Useful to study mechanisms
-) Weak identification

Strategy 2*



+) Strong identification
-) Can't study mechanisms

*Removed all families with shocks prior to 2010

- We divide samples for urban and rural areas since information on shocks is different
- We also restrict sample to HHs with at least two years in same dwelling (for a better match)
- We use PSM to compare similar HHs (according to observables previously determined)
- We also follow a parametric matching controlling by propensity score to study mechanisms
- Estimations are obtained for wealth quartiles to find nonlinearities

Table: Shock persistence: Urban areas

	(1)	(2)	(3)	(4)
Estimation method:	OLS	OLS + Controls	Matching	"Parametric" matching (OLS)
Panel A. Dependent variable: Shock in 2012				
Shock in 2011	0.09***	0.10***	0.10***	0.10***
	(0.02)	(0.02)	(0.03)	(0.02)
Pscore				0.42**
				(0.19)
Observations	3,111	2,902	2,895	2,854
R-squared	0.01	0.02		0.01
Proportional selection		0.17		
Panel B. Dependent variable: Shock in 2010-2013				
Shock before 2010	0.113***	0.125***	0.116***	0.119***
	(0.0155)	(0.0173)	(0.00828)	(0.0178)
Observations	4,635	3,982	3,951	3,825
R-squared	0.011	0.039		0.012
Proportional selection		-0.28		
Panel C. Dependent variable: Shock in 2010-2013, restricting to households with $\geq$ 2 years in same dwelling				
Shock before 2010	0.110***	0.115***	0.116***	0.114***
	(0.0189)	(0.0214)	(0.0203)	(0.0219)
Observations	3,242	2,756	2,723	2,643
R-squared	0.010	0.059		0.013
Proportional selection		0.21		

*** p<0.01, ** p<0.05, * p<0.1. Proportional selection is a constant such that if unobservable variables were as important as the constant, the magnitude of the estimation would be zero.

Table: Shock persistence: Rural areas

	(1)	(2)	(3)	(4)
Estimation method:	OLS	OLS + Controls	Matching	"Parametric" matching (OLS)
Panel A. Dependent variable: Shock in 2012				
Shock in 2011	0.15***	0.14***	0.14***	0.14***
	(0.02)	(0.02)	(0.03)	(0.02)
Pscore				0.45***
				(0.16)
Observations	2,687	2,654	2,650	2,598
R-squared	0.02	0.04		0.02
Proportional selection		0.21		
Panel B. Dependent variable: Shock in 2010-2013				
Shock before 2010	0.11***	0.08***	0.07***	0.08***
	(0.02)	(0.02)	(0.01)	(0.02)
Pscore				0.36***
				(0.07)
Observations	4,635	3,982	3,951	3,825
R-squared	0.011	0.039		0.012
Proportional selection		0.11		
Panel C. Dependent variable: Shock in 2010-2013, restricting to households with $\geq$ 2 years in same dwelling				
Shock before	0.11***	0.08***	0.08***	0.08***
	(0.02)	(0.02)	(0.02)	(0.02)
Pscore				0.31***
				(0.08)
Observations	3,306	2,914	2,914	2,809
R-squared	0.01	0.06		0.01
Proportional selection		0.12		

*** p<0.01, ** p<0.05, * p<0.1. Proportional selection is a constant δ such that if

Table: Effect of current shocks on net assets: Urban areas

	(1)	(2)	(3)	(4)	(5)
Estimation method:	Matching	Matching	Matching	Matching	Matching
Panel A. Dependent variable: Net assets in 2013					
Shock between 2010 & 2013	-1.44**	-0.77	-1.50	-0.34	-0.67
	(0.63)	(0.85)	(1.28)	(1.38)	(0.41)
Observations	732	735	706	703	2,883
R-squared					
Percentile	0-25	25-50	50-75	75-100	full sample
Panel B. Dependent variable: Net assets in 2010					
Shocks before 2010	-2.80***	-2.02***	-1.15	-0.66	-1.67***
	(0.79)	(0.65)	(1.29)	(1.02)	(0.44)
Observations	997	968	943	928	3,948
R-squared					
Percentile	0-25	25-50	50-75	75-100	full sample
Panel C. Dependent variable: Net assets in 2010 restricting to households with $\geq$ 2 years in same dwelling					
Shock before 2010	-0.02	-0.09	-0.13	-0.21**	-0.09**
	(0.07)	(0.08)	(0.10)	(0.11)	(0.05)
Observations	715	713	732	742	2,914
R-squared					
Percentile	0-25	25-50	50-75	75-100	full sample
Proportional selection					

*** p<0.01, ** p<0.05, * p<0.1

Table: Effect of current shocks on food consumption: Urban areas

	(1)	(2)	(3)	(4)	(5)
Estimation method:	Matching	Matching	Matching	Matching	Matching
Panel A. Dependent variable: Food consumption in 2013					
Shocks between 2010 & 2013	-0.05	-0.09	-0.01	-0.05	-0.04
	(0.08)	(0.08)	(0.06)	(0.06)	(0.03)
Observations	732	735	711	717	2,902
R-squared					
Percentile	0-25	25-50	50-75	75-100	full sample
Panel B. Dependent variable: Food consumption in 2010					
Shock before 2010	0.03	-0.02	-0.04	-0.04	-0.04
	(0.03)	(0.04)	(0.07)	(0.08)	(0.03)
Observations	997	968	946	928	3,951
R-squared					
Percentile	0-25	25-50	50-75	75-100	full sample
Panel C. Dependent variable: Food consumption in 2010 restricting to households with $\geq$ 2 years in same dwelling					
Shock before 2010	-0.05	-0.11	-0.12***	-0.10	-0.07
	(0.05)	(0.10)	(0.04)	(0.10)	(0.05)
Observations	650	654	653	603	2,723
R-squared					
Percentile	0-25	25-50	50-75	75-100	full sample

*** p<0.01, ** p<0.05, * p<0.1

Table: Effect of food consumption on shocks: Urban areas

Estimation method:	(1) "Parametric" matching (OLS)	(2) "Parametric" matching (OLS)	(3) "Parametric" matching (OLS)	(4) "Parametric" matching (OLS)	(5) "Parametric" matching (OLS)
Panel A. Dependent variable: Shocks between 2010 & 2013					
Food consumption	0.00	0.02	-0.04**	-0.05**	-0.04***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
Shocks before 2010	0.11***	0.13***	0.09**	0.13***	0.12***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)
Pscore	-0.19	0.07	0.03	-0.19	-0.06
	(0.13)	(0.16)	(0.16)	(0.17)	(0.08)
Constant	0.54**	0.18	0.94***	1.08***	0.91***
	(0.25)	(0.27)	(0.26)	(0.27)	(0.12)
Observations	1,032	1,007	997	1,012	4,050
R-squared	0.01	0.02	0.01	0.02	0.02
Percentile	0-25	25-50	50-75	75-100	full sample
Panel B. Dependent variable: Shocks between 2010 & 2013 restricting to households with $\geq$ 2 years in same dwelling					
Food consumption	0.04	-0.00	-0.04	-0.09***	-0.04***
	(0.03)	(0.02)	(0.03)	(0.03)	(0.01)
Shocks before 2010	0.14***	0.13***	0.06	0.13***	0.11***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.02)
Pscore	-0.14	0.09	0.15	-0.15	0.01
	(0.19)	(0.18)	(0.18)	(0.20)	(0.09)
Constant	0.15	0.43	0.93***	1.60***	0.97***
	(0.35)	(0.27)	(0.36)	(0.38)	(0.15)
Observations	708	676	708	707	2,799
R-squared	0.02	0.02	0.01	0.03	0.02
Percentile	0-25	25-50	50-75	75-100	full sample

*** p<0.01, ** p<0.05, * p<0.1

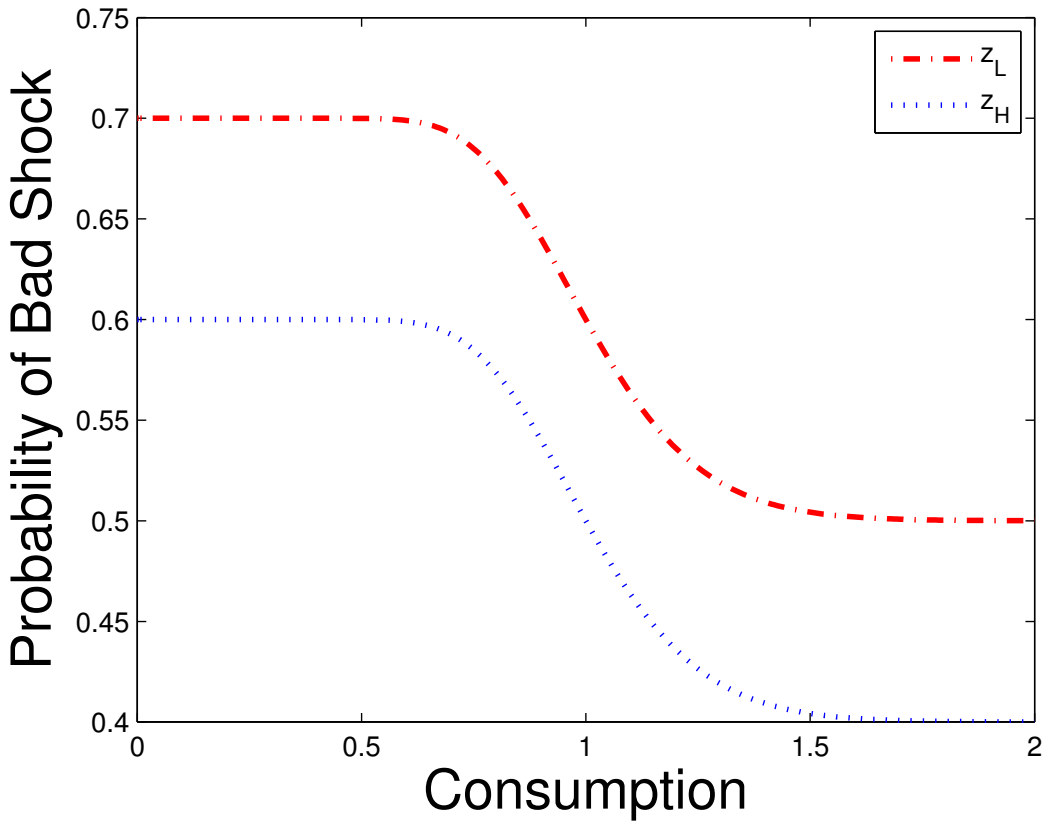
Findings

- Adverse shocks hit mostly poor HHs and are quite persistent:
  - Increase likelihood in 11pp in urban areas
  - Increase likelihood in 14pp in rural areas and dissipates over time
- HHs in quartiles 1, 2 and 4 use assets when hit by shock
- Whereas HHs in third quartile decreased food consumption
- Decreasing consumption in quartiles 3 and 4 are associated to an increase in vulnerability

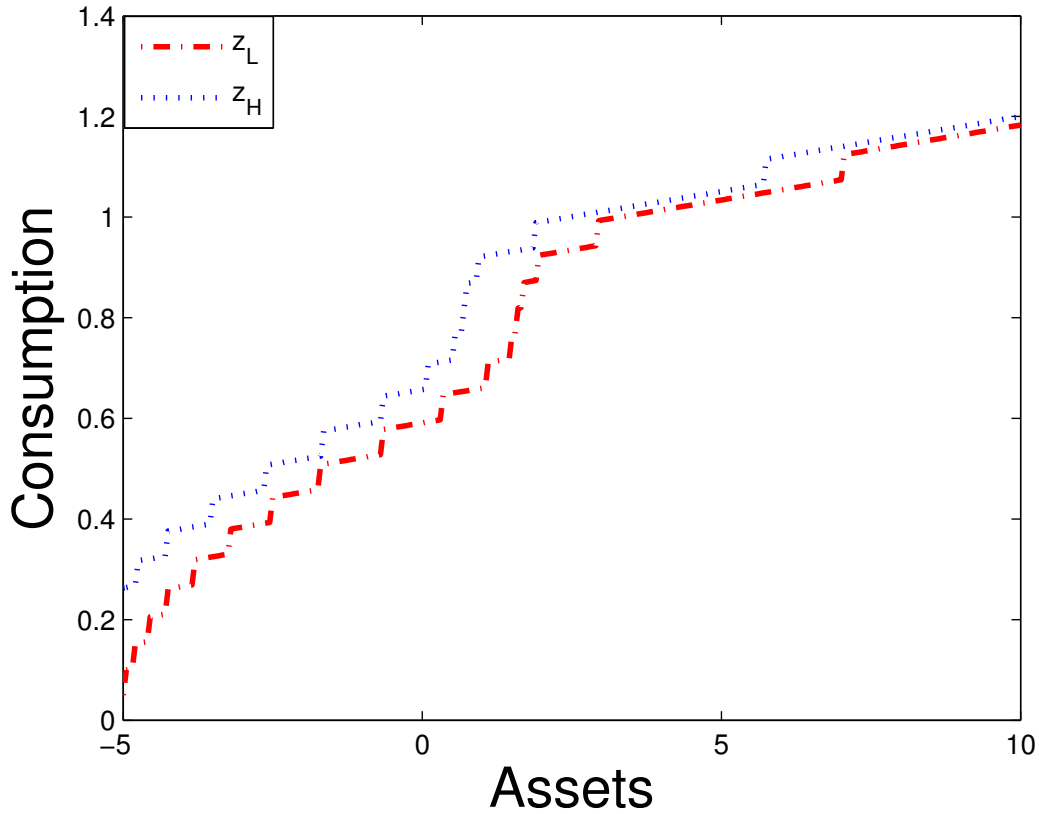
Model Preview

- Infinitely lived HH that maximizes intertemporal discounted expected utility
- HH chooses consumption c and a risk free bond $a \geq a_{min}$
- Each period HH can be hit by a shock $z_L < z_H$ that decreases income
- Prob of facing a future shock is decreasing in c and z, and not concave in c

- Calibrate distribution of future shocks as a function of c and z

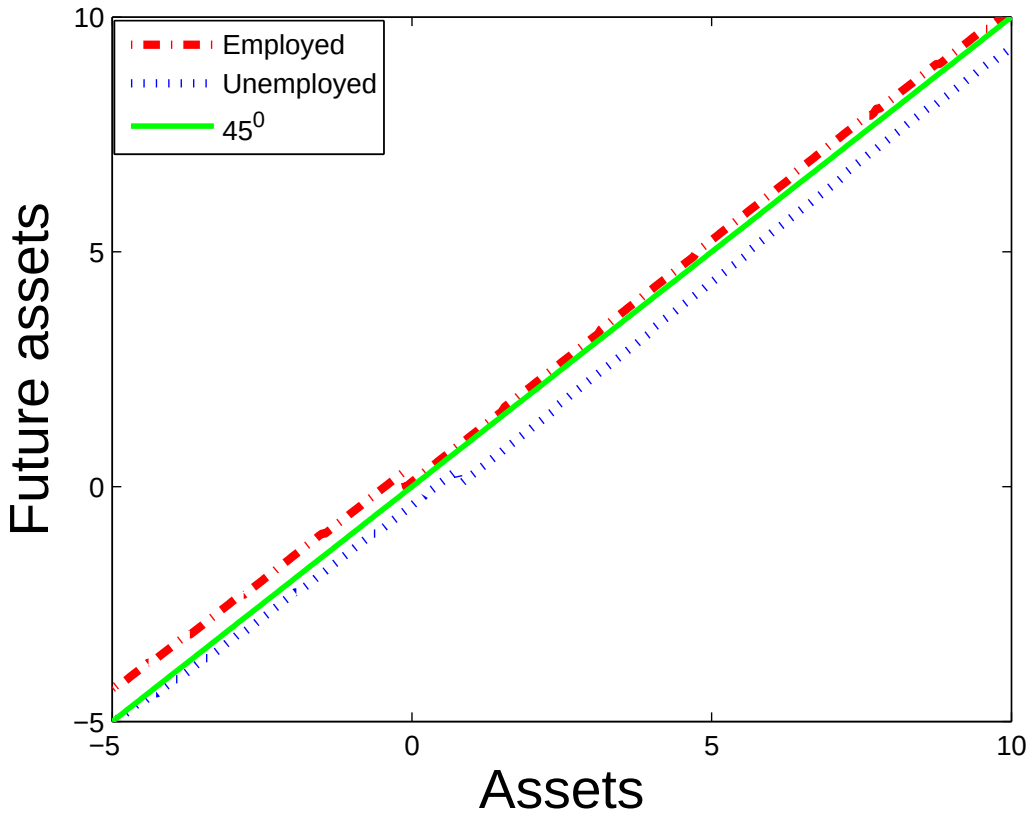


- Optimal consumption



- Given nonconcavity of optimal consumption, optimal assets are not monotone

- This in turn may generate poverty traps



Concluding remarks

- Shocks are quite persistent and affect mostly poor HHs
- Decreases in consumption for middle income HHs are associated to an increase in future vulnerability
- HHs in highest and lowest quartiles smooth consumption using assets
- HHs in middle of distribution prefer to reduce consumption rather than assets
- Such empirical reactions to adverse shocks are consistent with a model that generate poverty traps

- Next step is to quantify such distortions using the model and empirical results
- Explore role of labor supply as another mechanism to cope with shocks
- Propose policy recommendations that prevent such poverty trap

Table: Mean difference: T statistic

Variable	Shocks 2011 vs Shocks 2012			
	RURAL Matched	RURAL Unmatched	URBAN Matched	URBAN Unmatched
Dust floor	0.61	-1.602	-0.63	0.924
Walls made of brick	1.14	-0.894	-0.56	0.592
Walls of "bahereque"	-1.33	1.212	-1.58	2.088
Electricity	-0.03	-0.506	1.11	-0.803
Natural gas	-0.44	0.774	-0.71	-0.412
Aqueduct	0.69	-0.178	0.76	-0.427
Sewer	0.89	-0.689	-1.59	2.092
Phone service	0.58	-1.574	0.32	1.023
Waste recollection	0.06	0.206	-0.69	1.949
Burn waste	-0.72	0.229	-0.17	1.056
Number of rooms	0.26	-0.417	-0.82	1.813
Number of bedrooms	0.24	-1.108	-0.24	1.999
Septic tank	-0.93	1.076	-0.53	-0.273
No sanitary system	1.13	-1.617	-0.79	0.511
Water from river	-0.67	0.563	0.33	0.834
Comunal aqueduct	0.33	0.517	0.24	-2.185
Kitchen	-0.09	0.646	-0.56	0.397
Cook with fire	-0.06	-0.0177	0.29	0.529
Owners of the dewling	0.6	-0.898	0.29	0.0595
Usufruct	-0.06	-0.0177	0.38	-3.428
Number of fridge	0.43	-1.908	-0.26	-0.226
Number of washing machines	0.47	-2.567	-0.52	1.568
Number of blender	0.65	-1.532	0.56	0.334
Number of oven	0.41	-2.063	-1.45	0.0566
Number of microwaves	0.5	-2.147	0.89	1.297
Number of heaters	0.51	-2.544	0.48	0.308
Number of showers	0.56	-2.25	0.39	0.0702
Number of air conditioner	0.17	-1.405	-0.46	0.791
Number of television	0.82	-2.572	-0.01	-1.452
Number of radios	-1.33	0.408	-0.37	0.0617
Number of stereos	0.49	-1.933	-0.26	1.787
Number of video systems	-0.31	-0.386	-0.42	0.502
Number of cable TV	0.38	-2.214	-0.27	1.051
Number of routers	0.47	-2.377	-0.46	0.0531
Number of computers	0.47	-2.53	-0.51	1.31