Split Incentives and Energy Efficiency: Empirical Analysis and Policy Options

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Context

- Residential sector offers considerable potential to reduce energy uses
- Share of Tenants in Europe: 56.1% in Switzerland, 46.7% in Germany, 36.3% in France (Source: Eurostat 2013)
- Renters are often poorer than homeowners and spend an important share of their income on energy cost ➔ “fuel poverty”.
- Homeowners spend 6860 euros in energy efficiency works against 2,348 euros for tenants.
- 62% of homeowners who report cold problems in their housing units replace their equipment against only 32% of tenants

Tenants

Have to pay a large amount of energy + do not invest in energy efficiency systems

➔ **What factor is responsible for underinvestment: income, occupancy status or both?**

Objectives

- Studies on the split incentives problem are in limited number despite the magnitude of the problem (Levinson and Niemann ,2004; IEA, 2007; Gillingham et al. , 2012)
- Underinvestment in energy efficiency system
- The split incentives issue is not aimed at by policies. But the existence of split incentives (market failure) justifies government intervention.

What solutions?

2 main objectives:

1/ Analyze conceptually and empirically expenditures in different type of investments (energy efficiency and reparation) according to occupancy status (owner-occupied vs rented-occupied dwelling)
2/ Provide policy recommendations

Conceptual Framework

- 2 Agents (landlord and tenant) and 2 periods ➔ rented-occupied dwelling
- Tenant consumes 2 goods (NE and E) and the energy cost depends on energy efficiency of the dwelling.
- 2 types of investment: reparation and energy efficiency
- Test of public policies (rent function of investments)
- Reaction functions➔ Cournot Nash Equilibrium

Results:

- A equilibrium, neither agent invests
- But results are different in the case where the dwelling is owner-occupied
  ➔ **Split incentives (mandatory measure + repercussion on rent)**

- Investments depends on: housing attributes, income return and potential energy savings
- Tenants are very sensitive to potential energy savings and initial energy cost ➔ energy prices and housing attributes are clearly key variables

Data

« *Enquête Logement 2006* » (INSEE) and OPEN data:

- Dwelling ;Household ; Geographical situation; Renovation works; Distinction between renovation works and energy efficiency works

According to the conceptual part: take into account **potential energy savings** ?

ESTIMATION OF ENERGY EXPENDITURES USING PROMODUL Theoretical expenditures
1/ The dwelling stock is divided into several categories according to the climate area, the period of contruction, the main fuel used for heating and hot water… 2/ Simulation of energy expenditures before renovation works 3/ Simulation of energy expenditures after renovation works (8 types) ➔ 2160 categories

Variables

Socio-economic characteristics of households
- Income (quintile)
- Tenure
- Mutliplicative Income*Tenure

Dwelling characteristics
- Period of construction
- Climate area
- Type of dwelling
- Type of heating
- Surface

Potential Energy savings

Public policy and professional
Self production
Tax credit

Renovation works expenditures

Energy efficiency works

Repair works

Descriptive statics

The final sample still contains 16509 households.

•In 2006, only 4.10% of households undertake energy-saving renovations. They spent 6143 euros on average.

•75% of households who decide to make energy-savings investments are homeowners (i.e owner-occupied dwellings).

	Energy efficiency works		Repair works	
	Expenditures	Number of observations	Expenditures	Number of observations
Owner-occupied	6237	*517*	5886	*1281*
Rented-occupied	5185	*168*	6658	*1020*
Total	6143	*685*	6228	*2301*

Model

The decision to invest in energy efficiency system

Main objective: to identify the determinants of energy-saving investments

- **Censoring ?**

Significant proportion of households with zero expenditures

- **Interdependance ?**

Possible interdependence across two expenditures types: repair works and energy-saving works

Censoring + interdependence → Multivariate Tobit (Amemiya, 1974 ; Maddala, 1983)

Results: decision to invest

Energy efficiency expenditures	Repair works expenditures
Socio-economic characteristics of households	
Homeowner (+)	•Income (quintile 3) (-) •Income*homeowners (quint1*homeowners, quint2*homeowners, quint3*homeowners) (-)
Dwelling characteristics	
Period of construction (bef 74) (+) Cold climate area (+) Individual housing units (+) Surface (+) (non linear effect ↘)	•Period of construction (bef 74) (-) •Individual housing units (+) •Surface (+) (non linear effect -)
Potential Energy Savings	
(+)	
Public policy and professional	
Self production (+) Tax credit (+)	Self production (+)
Likelihood ratio test of rho12 = 0: chi2(1) = 309.126 Prob > chi2 = 0.0000 rho (0 .417)*** (0.0222)	

Summary of main results

Conceptual part:

Investment in energy saving in owner-occupied case and no investment in the case with split incentives ➔ mandatory measures

Potential energy savings key determinant ➔ information on the savings (or losses)

Empirical part:

Occupancy status (homeowner) positively affects expenditures in energy efficiency (not in repair works) ➔ importance of occupancy status and mandatory measure

Potential energy savings key determinant ➔ information on the savings (or losses)

Positive effect of housing attributes

Conclusion and policy recommandations

	Landlord	Tenant
Benefits to energy efficiency investment	• Bonus on the housing market value • Bonus on the housing rental value	• Energy savings • Productivity savings (stress, health risks…) • Less dependence on rising energy prices
Costs to energy efficiency investment	• Significant investment expenditures and maintenance costs • Negotiation with the tenant • Deterioration of housing • Direct or indirect rebound effect (rising of energy consumption)	• Significant investment expenditures • Indirect costs or disturbance costs
Public policy recommendations	• Repercussion on rent (lump-sum or Share of investment expenditures) • Mandatory measures to retrofit buildings • Mandatory measures to limit rebound effect • Largest deposit	• Tax credit • Mandatory measures to improve energy efficiency • Repercussion on rent (lump-sum or share of investment expenditures) • Information

Conclusion

- Importance of energy saving variable in the decision to invest
- Importance of occupancy status: homeowner are more likely to improve their home
- Tenants are poorer than landlords and live in the most poorly insulated dwelling ➔ government intervention
- Work in progress: test public policies such as tax credit in the conceptual part…

Thank you for your attention

Data

	Energy in Kwh/m²/year	GHG emissions in kg.$_{CO2}$	Expenditures by m² and by year in euros
Without renovation	747	48	33.8
EE renovation works			
Isolation			
Double glazing	703*	45	32.3
Wall insulation	661	42	30.7
Roof insulation	622	38	29.1
Floor insulation	667	42	30.9
Replacement			
Mechanical ventilation	645	41	30.9
New heating system	713	46	32.6
New hot water system,	740	47	33.6
Chimney	686	37	31.2

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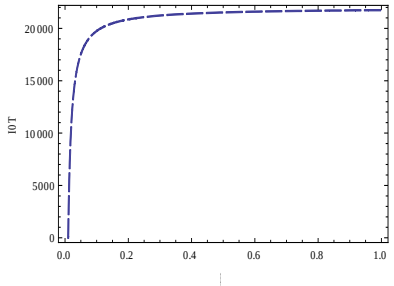
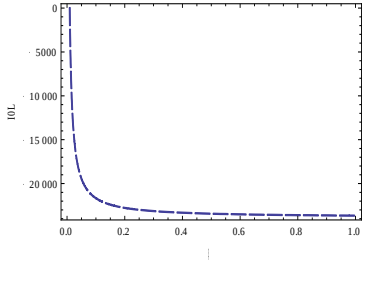
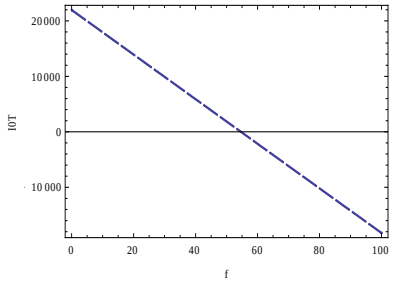
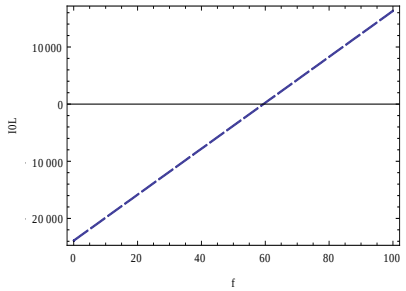
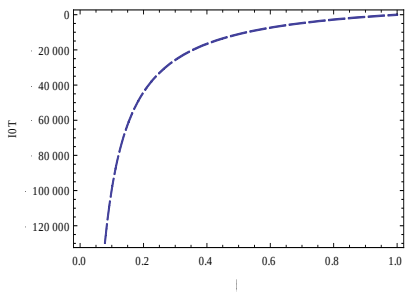
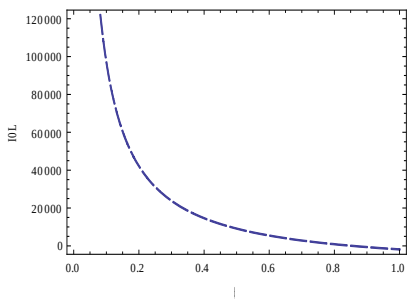
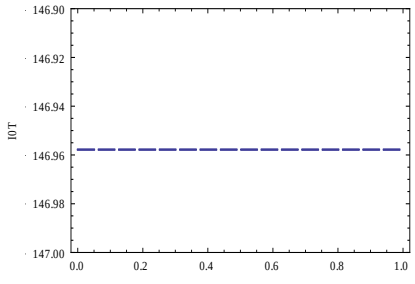
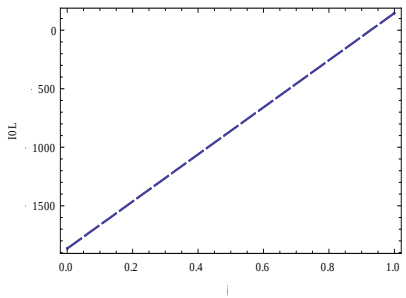
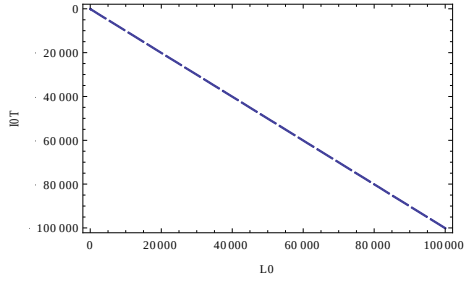
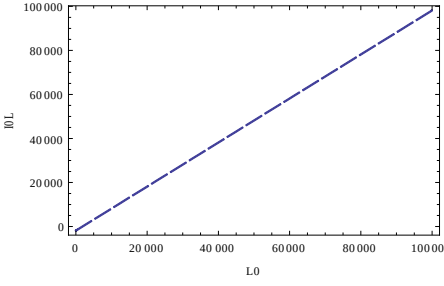
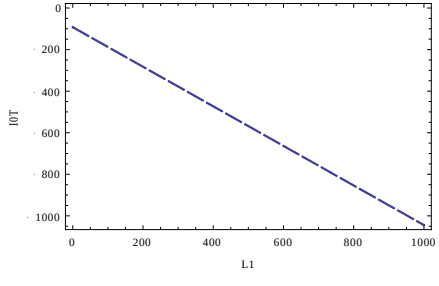
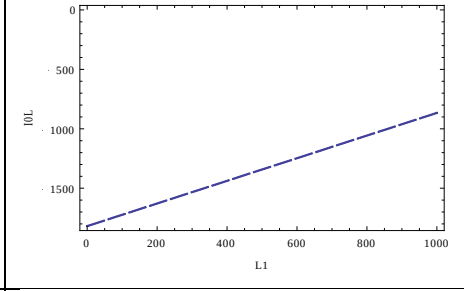
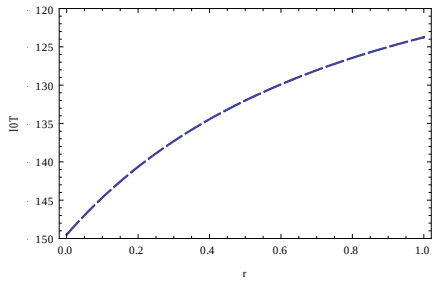
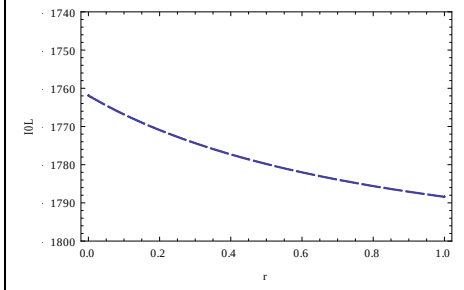
ξ		
f		
β		
δ		

L_0		
L_1		
r		
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