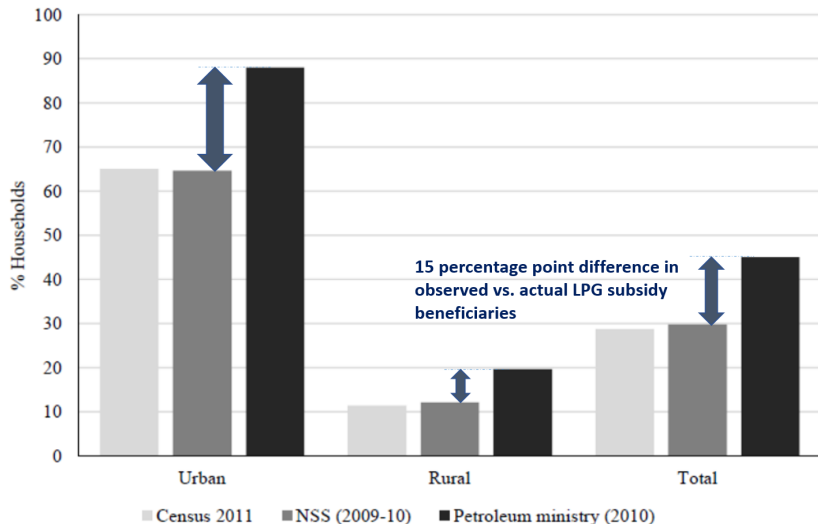


Curbing Leakage in Public Programs with
Direct Benefit Transfers
Evidence from India's Fuel Subsidies and Black Markets

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SJE Symposium - June 2016
Seoul, South Korea

Missing 40 million Households: India's Cooking Gas Subsidy



Leakage in Welfare Delivery

- High govt. expenditure in welfare programs in developing countries
 - ▶ E.g., Fossil Fuel subsidies:
 - ★ Indonesia: \$18 billion in 2013-14 (17% of Govt. expenditure)
 - ★ India: \$20 billion in 2013-14 (5% of Govt. expenditure, 20% of Personal Income Tax collection)
- High level of leakage in public programs:
 - ▶ **Leakage:** Transfers to non-beneficiaries through illegal means
 - ▶ more than 70% in some cases (Reinikka-Svensson 2001; Niehaus-Sukhtankar 2013)

“Losing sleep over subsidy leakage, not subsidy itself”

- Pranab Mukherjee, Finance Minister of India (2012)

Subsidies and Taxes: Enforcement under Dual Pricing

- Price subsidies for commodities lead to dual pricing: E.g. Public Distribution Systems, Heating oil subsidy, Farm input subsidies
 - ▶ Targeted sector received subsidies to ensure access and welfare
 - ▶ Non-targeted sectors may even have to pay taxes
- Dual pricing incentivizes diversion through black markets
- Enforcement is difficult, specifically in developing countries: Ghost/duplicate beneficiaries and Tax evasion
 - ▶ Weak Fiscal capacity i.e. the power to tax and transfer
 - ▶ Developing countries (Besley-Persson 2010, 2013): Revenues needed for economic development. Yet inefficient tax-transfer systems prevail.
 - ▶ Ex-ante uncertainty: “To date technological solutions remain more hopes than realities” (Bird 2008)
- **This paper:** Increasing enforcement by direct transfer of subsidies
 - ▶ **Impact of enforcement on leakage in a fuel subsidy program**
 - ▶ **How formal and black markets respond to a reduction in leakage?**

Overview: Setting and Methodology

- **Setting:** an in-kind transfer program leading to dual pricing
 - ▶ Domestic (i.e. for households' domestic cooking) and Commercial fuel
- **Policy change:** Increased enforcement with “Direct Benefit Transfers” i.e. **transferring subsidies directly** to the bank accounts of verified beneficiaries
 - ▶ Recognized recently as the **world's largest cash transfer program**
- **Empirical approach:**
 - ▶ **Identification:** Difference-in-differences using two quasi-experiments
 - ★ Phasing-in of the policy across districts
 - ★ Unexpected termination of the policy
 - ▶ **Data:** Administrative data and audit survey in black markets

Overview: Results

- **Increasing enforcement**

- ▶ **Subsidized sector (household fuel):** Up to 14% reduction in fuel purchase

- **Removal of enforcement:**

- ▶ **Subsidized sector (household fuel):** Fuel purchase reverts to the pre-enforcement level
- ▶ **Black market:** Price decreases by ~20%, confirming a positive supply shock
- ▶ **Non-subsidized sector (commercial fuel):** commercial firms reduce their purchase through formal market, in response to lower prices in the black market

- Little evidence on displacement in fraud in short term

Related Literature

- Targeting in welfare programs, Identity fraud, Corruption in developing countries: Reinikka-Svensson 2001, Olken 2006, Yang 2008, Olken-Pande 2012, Niehaus-Sukhtankar 2013
- Role of information in tax-transfer systems and shifting the monitoring task away from the intermediating agents: Kopczuk-Slemrod 2006; Gordon-Li, 2009; Kleven et al. 2009
- Role of technology in governance, State capacity building: Banerjee et al. 2008, Gine et al. 2012, Muralidharan et al. 2014
- Empirical evidence on black markets with direct measurement: Pissarides-Weber (1989), Fisman-Wei (2004, 2009), Slemrod-Weber (2011), Buehn-Schneider (2013)
- Fuel tax evasion in developing countries: Marion-Muehlegger (2008), Kopczuk et al. (2013)

Institutional Background: LPG Delivery System in India



Source: <http://in.reuters.com>

Institutional Background: LPG supply

- Govt. regulates price of Liquefied Petroleum Gas (LPG)
 - ▶ Domestic fuel (for household's domestic cooking): "regulated price" - subsidy
 - ▶ Commercial fuel (Industrial, transport and business): "regulated price" + taxes
 - ▶ price is regulated monthly based on the international market prices
- Traditional enforcement of market segmentation:
 - ▶ Visual difference in size and color of subsidized cylinders
 - ★ Similar to red dye in diesel in USA and UK
 - ▶ **Penalty and prison term:** for re-selling or using subsidized fuel for commercial purpose

Institutional Background: Ghost Beneficiaries in PDS

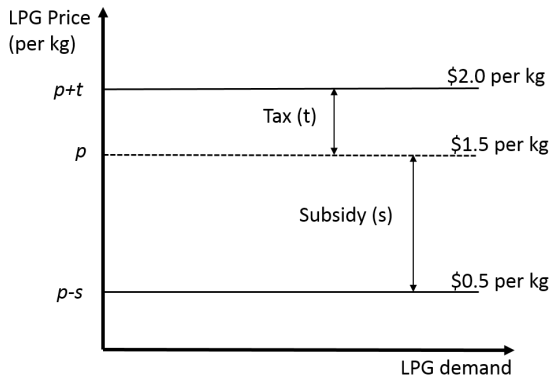
- Audits reveal millions of ghost beneficiaries
- Over-reporting through fictitious “ghost” and duplicate accounts
- Agency problems:
 - ▶ State has imperfect information on beneficiaries and transfers
 - ▶ Collusion: Perverse incentives to mis-report, political connections
 - ▶ No credible threat of monitoring and enforcement: costly and ineffective
- Identity fraud: Creating Ghost beneficiary accounts
 - ▶ Low cost to counterfeit documents and collusion

Policy Intervention: Direct Benefit Transfer

- **Policy Intervention:** Direct Benefit Transfer for LPG (DBTL) policy
 - ▶ Subsidy transferred directly to household's bank a/c through a secure payments infrastructure
 - ▶ Conditional Transfer: within days after each LPG refill purchase
 - ▶ No subsidy to non-compliant beneficiaries - they can buy fuel as usual but they don't get subsidy
 - ▶ DBTL minimizes the role of intermediating agents
- The impact of enforcement would be undermined if
 - ▶ Agents find new ways to manipulate the system
 - ▶ Technology fails to deliver
 - ▶ Displacement in fraud and changes in social norms

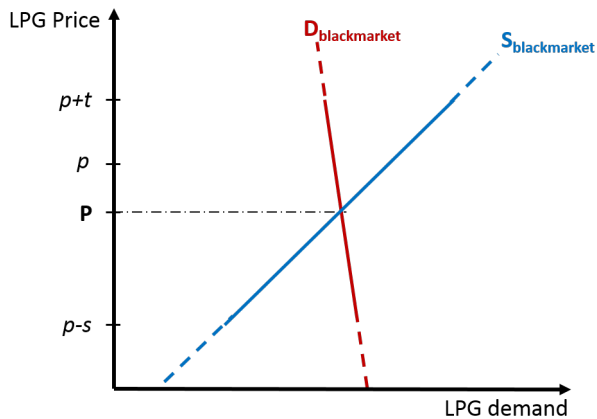
Ex-ante, the outcome is not clear

LPG Pricing

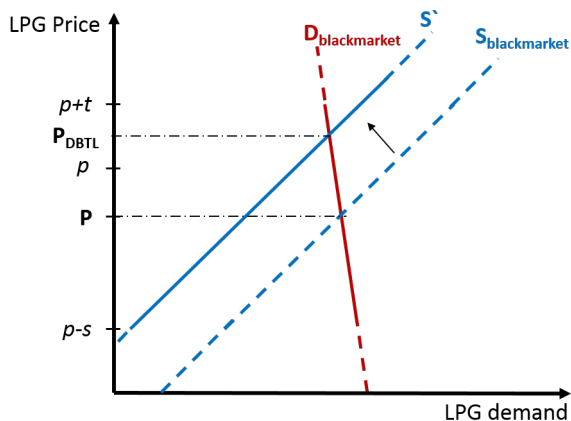


- January 2014 price: Regulated price ' p ' is determined monthly as per international market prices

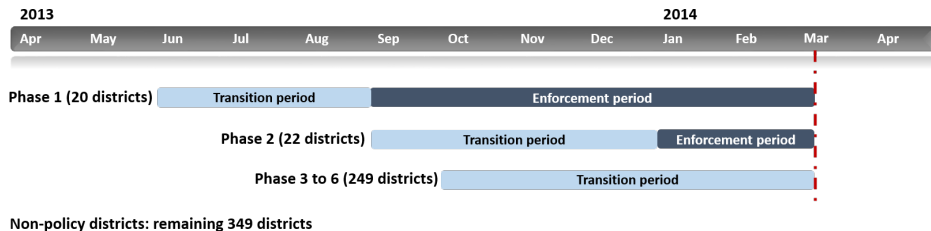
Equilibrium Price in Fuel Black Market



Increasing Enforcement on Diversion: Negative Supply Shock



Policy Change Timeline and Data Coverage



Policy Termination: Direct Benefit Transfer

- Policy introduced to 291 districts by January 2014 in six phases
- **Unexpected termination:** In the run to the federal elections in 2014
- Policy manipulation during re-elections (Nordhaus 1975, Alesina 1997) and Lobbying by special interest groups, whose rents are threatened (Kapur-Vaishnav 2014)
- *“The scheme [...] could have a negative fallout in the forthcoming general elections.”* - The Economic Times 2014
- *“As a politician, I am telling you that 90% of the LPG dealers and black-marketeers in the state are either politicians, bureaucrats, or their kin.”* - a former minister (2012)
- Policy termination restored the old subsidy transfer system
- Other explanations: Imperfect Implementation and Legal issues

... and the new government re-introduced the policy

Predicted Impact of Enforcement

- **If this enforcement is effective in reducing leakage:**

- ▶ Domestic fuel purchase [\downarrow]
- ▶ Equilibrium black market price [\uparrow]
- ▶ Commercial fuel purchase [\uparrow]

- **Symmetrically, policy termination would bring:**

- ▶ Domestic fuel purchase [\uparrow]
- ▶ Equilibrium black market price [\downarrow]
- ▶ Commercial fuel purchase [\downarrow]

Outline

- Motivation, Background and Policy Change
- **Data and Estimation**
- Summary and Policy Discussion

Administrative Data: Descriptive Statistics

A. Household level LPG transactions data			
	Mean	Median	SD
Subsidized Refills	6.523	7	2.853
Total Refills	6.575	7	2.935
Monthly Refills	0.553	1	0.586
Households	3.79 million		
Distributors	3165		
Districts	509		
States	25		
Time period	12 months (Apr 2013 - Mar 2014)		
Transactions	23.17 million		
B. Distributor level LPG sales data			
	Mean	Median	SD
14kg refills (Domestic)	6,670	5,656	5,530
19kg refills (Commercial)	459.8	150	1,007
Distributors	3341		
Districts	504		
States	25		
Time period	13 months (Apr 2013 - Apr 2014)		
Monthly observations	43433		

Audit Survey with Unsuspecting Agents in Black Markets

- Total 89 districts in 11 states: 15 small businesses and 7 delivery-men per district
- **Supply side: Delivery man survey**
 - ▶ Surveyor poses as a potential customer to solicit price using a script
 - ▶ Re-visits same distributor areas (~zip code)
- **Demand side: Small business survey**
 - ▶ Ongoing black market price and fuel refill history
 - ▶ Re-visits same firms (~20% attrition)
 - ▶ Similar production function: restaurants and snacks sellers
- Two waves covering enforcement “ON” and enforcement “OFF” periods

▶ Descriptive Stats: BlackMarket

▶ Descriptive Stats Box Plot

Identification Strategy: DBTL Policy Phasing-in across Districts and its Termination

Basic Specification:

$$y_{idt} = \beta_0 + \beta_1(treatment_d * post_t) + \beta_2 treatment_d + \beta_3 post_t + \alpha_i + \lambda_t + \varepsilon_{idt}$$

i : household, d : district, t : month

y_{idt} : Fuel refills purchased by the household i in district d in month t

Includes all domestic refills – irrespective of subsidy

$treatment_d$: 1 for districts under DBT policy, 0 otherwise

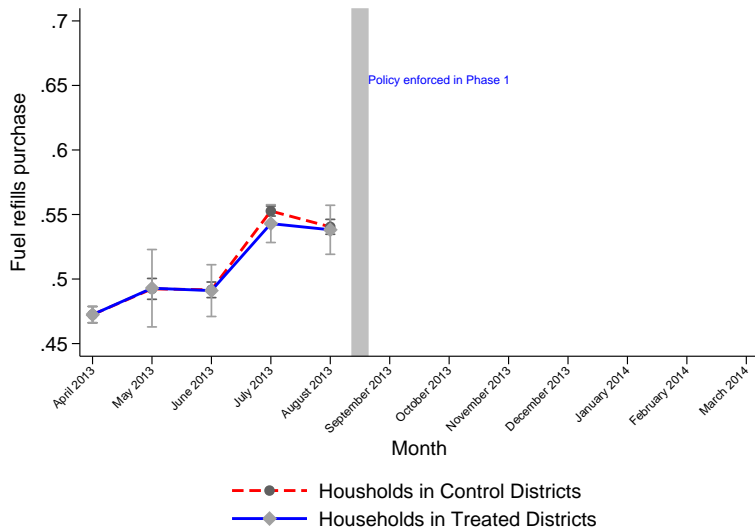
$post_t$: 1 for the post-treatment months, 0 otherwise

α_i - household fixed effect; λ_t - month fixed effect

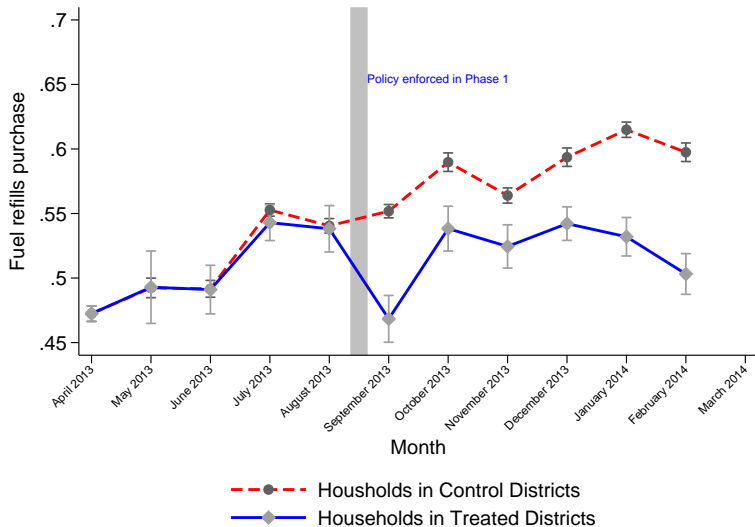
Standard errors clustered at the district level

Similar model estimated with distributor-month data

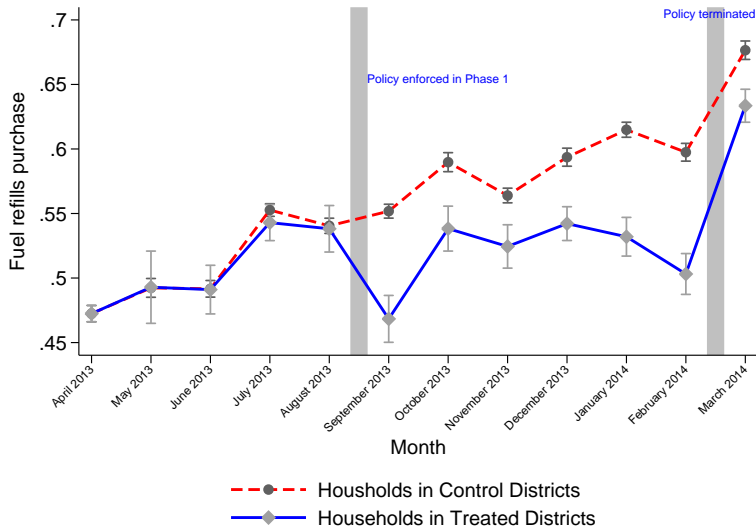
Policy Phasing-in: Domestic Fuel Purchase (Beneficiary-level Panel)



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Policy Phasing-in: Domestic Fuel Purchase (Beneficiary-level Panel)

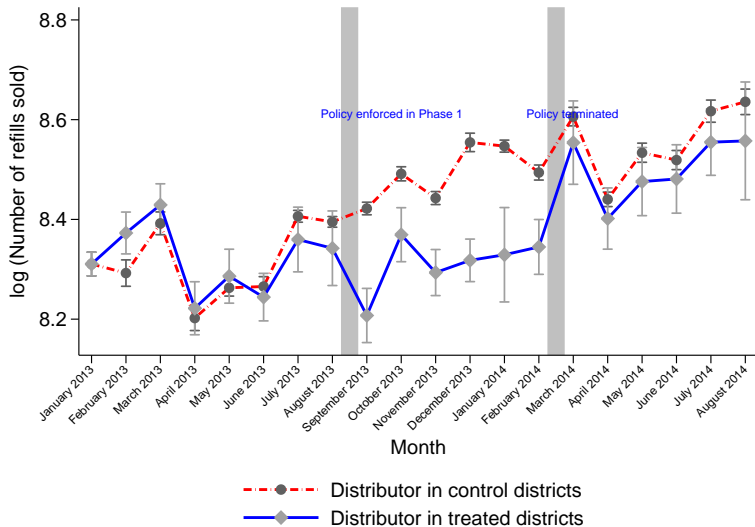
Table 3: Impact of DBTL policy on domestic fuel sales (Beneficiary level data)

	(1)	(2)	(3)
Outcome variable: Household monthly LPG refill purchase			
Post	0.126*** (0.00532)	0.108*** (0.00568)	0.158*** (0.00753)
DBTL X Post	-0.0664*** (0.00375)	-0.0621*** (0.00401)	-0.0769*** (0.00466)
Constant	0.484*** (0.00319)	0.485*** (0.00378)	0.475*** (0.00396)
Observations	37,408,250	27,389,714	13,064,788
Household	3,400,750	2,489,974	1,187,708
Mean of outcome var	0.561	0.556	0.556
Control group	Ph 3-6 & Non-policy	Ph 3-6	Non-policy
Household FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes

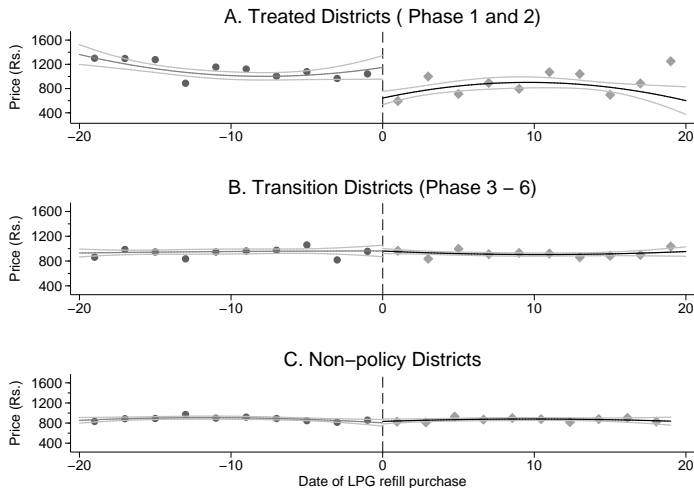
DBTL policy enforcement reduces household fuel purchase by 11 to 14%

► Additional results

Policy Phasing-in and Termination: Domestic Fuel Purchase (Distributor Panel)



Policy Termination: Impact on Black Market Prices

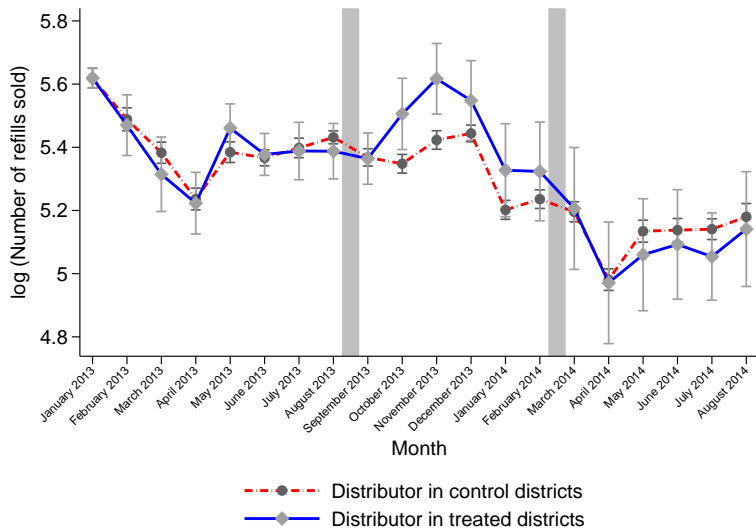


Policy Termination: Impact on Black Market Prices

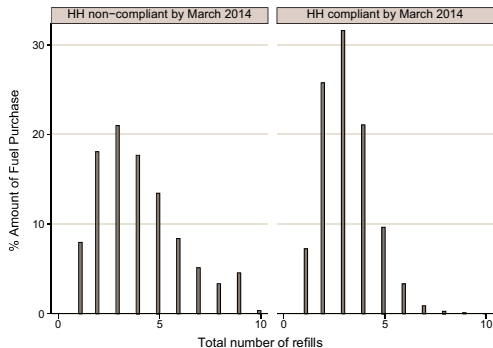
Table 9: Impact of DBTL policy termination on black-market price

	(1)	(2)	(3)	(4)
	A. Supply Side		B. Demand Side	
Outcome variable: log (price)				
DBTL			0.188*** (0.0371)	0.196*** (0.0582)
Post termination	-0.205*** (0.0369)	-0.203*** (0.0606)	-0.203*** (0.0360)	-0.444*** (0.0715)
DBTL X Post termination	-0.127*** (0.0417)	-0.159*** (0.0406)	-0.175*** (0.0610)	-0.192*** (0.0736)
Constant	7.058*** (0.0137)	7.023*** (0.0234)	6.973*** (0.0363)	7.134*** (0.00787)
Observations	504	504	1,000	1,000
Treatment	Ph1&2	Ph1&2	Ph1&2	Ph1&2
Control	Non-policy	Non-policy	Non-policy	Non-policy
Firm			602	602
District	38	38	38	38
District FE	Yes	Yes		
Firm FE			Yes	Yes
Date FE		Yes		Yes

Policy Phasing-in and Termination: Commercial Fuel Purchase (Distributor Panel)



Non-Compliance and Pre-Enforcement Fuel Purchase

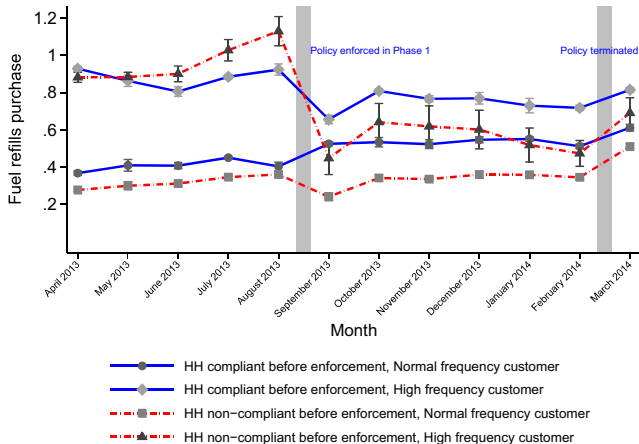


Beneficiaries who failed to comply later, bought higher amount of LPG refills in the pre-enforcement period

► Monthly Compliance

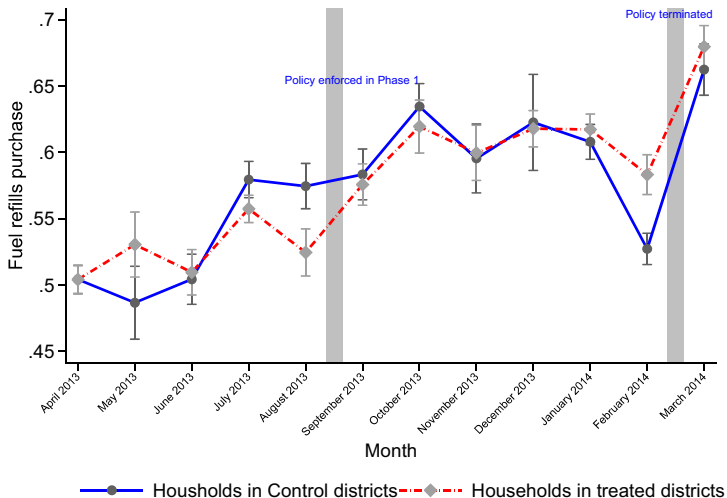
Heterogeneous Response: Non-Compliance and Pre-Enforcement Fuel Purchase Behavior

Figure 8: Heterogeneous effect in treated districts



Higher impact on high frequency non-compliant beneficiaries~ about 30%

Displacement in Leakage: Does Enforcement increase Diversion of Subsidized Fuel by Genuine Households?



Genuine Exclusion

Genuine exclusion due to increased complexity?

- Compliance requires Bank account number and UID
- Bank account penetration dominates LPG adoption, because LPG is primarily an urban fuel used by middle and richer class ▶ LPG vs Banking
- Type-I error due to any administrative hassle for UID?
 - ▶ 98.5% UID penetration ▶ UID Penetration

Late Compliance

Late Complier households

- ~20% beneficiaries complied after the first month of enforcement
 - Compliance
- Timing to comply: depends on the need for next LPG refill
- Late complier households contribute little to the estimated effect
 - Comparison with compliers in upcoming phase ▸ Fig. A21
 - Comparison with compliers in treated districts ▸ Fig. A20

Non-Compliant Beneficiaries

- Non-compliant beneficiaries (~20%) drive main effect on reduction in domestic fuel purchase ▶ Non-compliant
- “Potential” ghost beneficiaries:
 - ▶ Exit of beneficiaries: 11% increase in beneficiaries who did not purchase a single refill ▶ No Refills
- Voluntary “opt-out” :
 - ▶ Time cost of compliance: middle to high income households
 - ▶ Stigma factor?
- Is non-compliance driving the black market prices?
 - ▶ Black market price is generally higher than the non-subsidized domestic refill

Outline

- Motivation, Background and Policy Change
- Data and Estimation
- **Summary and Policy Discussion**

Summary of Main Results

- Enforcement by DBTL
 - ▶ Up to 14% reduction in the purchase of subsidized household fuel
 - ★ This causes supply shock in the black market causing prices to change by ~20%
 - ★ Higher prices in the black market lead to increase in commercial fuel sales through formal channel
- Once enforcement is removed, purchase of subsidized household fuel reverts to the same level
- For comparison, Karnataka state found 22% illegal beneficiary a/c
- Little evidence on displacement in fraud in short term

Fiscal Savings and Welfare

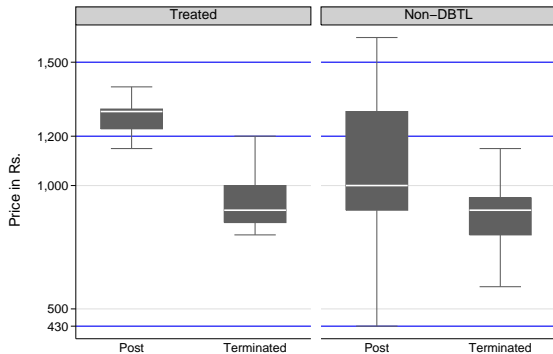
- **Expected govt. savings** : \$ 0.8 billion per year (i.e. 11% savings minus 1% subsidy transfer cost incurred under new regime)
 - ▶ 2% of total social welfare spending in 2013-14
- Elimination of transfer from the state to officials, middle-men, firms
 - ▶ More effective redistribution and lower taxes
 - ▶ Resources employed in the black market
- Possibility of net social welfare loss if
 - ▶ Leakage and Black market helps in meeting equity and efficiency
 - ▶ Type I exclusions are significant
- Other potential second order effects:
 - ▶ Fuel black markets and energy efficiency
 - ▶ Reduces informality and cash in the underground economy
 - ▶ Rise in general price levels

Policy Discussion

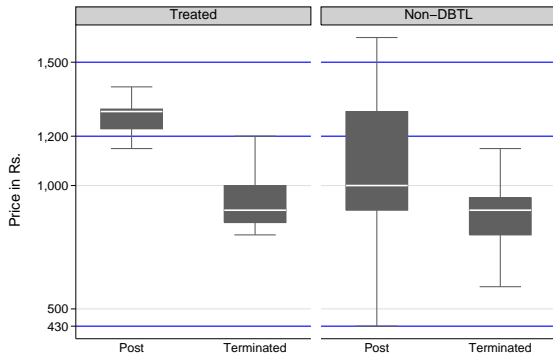
- Investing in state's fiscal capacity with a Direct Benefit Transfer system
 - ▶ Secured payments infrastructure and investment to increase financial inclusion
 - ▶ Expected investment in the UID program ~ \$ 4 billion
 - ▶ Supports market forces through enhancement in legal capacity? (Besley and Persson, 2010)
- Tax-transfer administration: Improving the design of welfare programs
 - ▶ Effective targeting of subsidies and potential to increase tax base
 - ▶ Fewer resources engaged in traditional enforcement
- Political impediments may obstruct adoption of governance improving technology!

Thank You!

Descriptive Statistics: Black-market Price (Supply Side)



Descriptive Statistics: Black-market Price (Supply Side)



Black Market Survey: Descriptive Statistics

Black market survey data

Variable	N	Mean	SD	Min	Max
Demand side price	2369	1039.13	241.26	430	1600
Supply side price	1202	1062.49	233.41	550	1950
Firms			1452		
Delivery men			1202		
District			89		
State			11		

Policy Phasing-in: Commercial Fuel Purchase (Distributor Panel)

Table 5: Impact of DBTL policy on commercial fuel sales (Distributor level data)

	(1)	(2)	(3)
Outcome variable: log(Commercial LPG refills sales)			
Post	-0.0121 (0.0173)	0.00294 (0.0206)	-0.0468 (0.0285)
DBTL X Post	0.0113 (0.0212)	-0.000159 (0.0217)	0.0326 (0.0234)
Constant	5.119*** (0.0110)	5.447*** (0.0132)	4.672*** (0.0182)
Observations	24,288	16,303	9,475
District	482	235	262
Distributor	2678	1745	1082
Control	Ph3-6 & Non-policy	Ph3-6	Non-policy
Distributor FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes

Policy Termination: Commercial fuel purchase (Distributor Panel)

Table 8: Impact of DBTL policy termination on commercial fuel sales

	(1)	(2)	(3)
Outcome variable: log(Commercial LPG refill sales)			
Post termination	-0.0291* (0.0167)	-0.0429** (0.0206)	0.00494 (0.0272)
DBTL X Post termination	-0.0727** (0.0348)	-0.0637* (0.0353)	-0.0895** (0.0377)
Constant	5.124*** (0.0106)	5.467*** (0.0126)	4.636*** (0.0186)
Observations	17,661	11,862	6,883
District	480	234	261
Distributor	2637	1727	1060
Control	Ph3-6 & Non-policy	Ph3-6	Non-policy
Distributor FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes

Policy Phasing-in: Domestic Fuel Purchase (Distributor Panel)

Table 4: Impact of DBTL policy on domestic fuel sales (Distributor level data)

	(1)	(2)	(3)
Outcome variable: $\log(\text{Domestic LPG refills sales})$			
Post	0.285*** (0.0126)	0.243*** (0.0152)	0.341*** (0.0171)
DBTL X Post	-0.149*** (0.0110)	-0.134*** (0.0118)	-0.174*** (0.0128)
Constant	8.178*** (0.00716)	8.357*** (0.00927)	7.975*** (0.00953)
Observations	31,322	19,944	13,135
District	485	236	264
Distributor	3013	1909	1269
Control	Ph3-6 & Non-policy	Ph3-6	Non-policy
Distributor FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes

Policy Termination: Impact on Domestic Fuel Purchase (Beneficiary-level Panel)

Table 6: Impact of DBTL policy termination on domestic fuel sales (Beneficiary level data)

	(1)	(2)	(3)
Outcome variable: Household monthly LPG refill purchase			
Post termination	0.101*** (0.00513)	0.0849*** (0.00557)	0.141*** (0.00620)
DBTL X Post termination	0.0343*** (0.00509)	0.0444*** (0.00519)	0.00963 (0.00676)
Constant	0.560*** (0.00314)	0.558*** (0.00382)	0.538*** (0.00279)
Observations	23,885,798	17,481,131	8,347,633
Mean of outcome var	0.605	0.597	0.603
Control group	Ph 3-6 & Non-policy	Ph 3-6	Non-policy
Month FE	Yes	Yes	Yes
Household FE	Yes	Yes	Yes

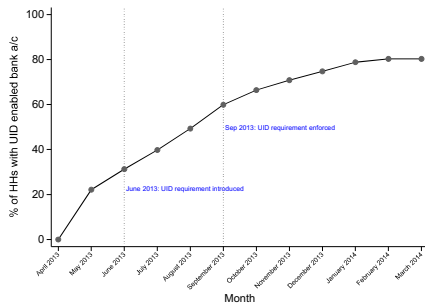
Policy Termination: Domestic Fuel Purchase (Distributor Panel)

Table 7: Impact of DBTL policy termination on domestic fuel sales

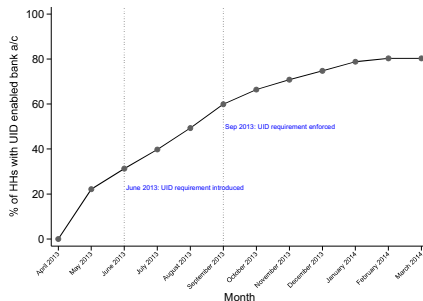
	(1)	(2)	(3)
Outcome variable: log(Domestic LPG refill sales)			
Post termination	0.0396*** (0.0112)	-0.0108 (0.0122)	0.115*** (0.0161)
DBTL X Post termination	0.101*** (0.0234)	0.127*** (0.0235)	0.0593** (0.0247)
Constant	8.303*** (0.00678)	8.492*** (0.00808)	8.069*** (0.00812)
Observations	23,396	14,826	9,854
District	485	236	264
Distributor	3060	1932	1294
Control	Ph3-6 & Non-policy	Ph3-6	Non-policy
Distributor FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes

Compliance with Enforcement Policy

Figure A18: Fuel subsidy beneficiary household compliance



Compliance with Enforcement Policy



Note: This table shows household compliance in treated districts (Phase 1). Compliance requires households to submit their bank account and UID number. Right after the introduction of the DBTL policy, compliance increased steeply and gradually the take up rate decreases. Households are not necessarily required to comply if they do not want subsidy transfer. When DBTL policy was enforced, a non-compliant beneficiary could continue to avail domestic fuel, but not the subsidy. It is likely that the timing of next refill would affect household's decision to comply. Overall more than 80% compliance was achieved during the six month enforcement period.

Figure A19: Compliance and pre-enforcement fuel purchase

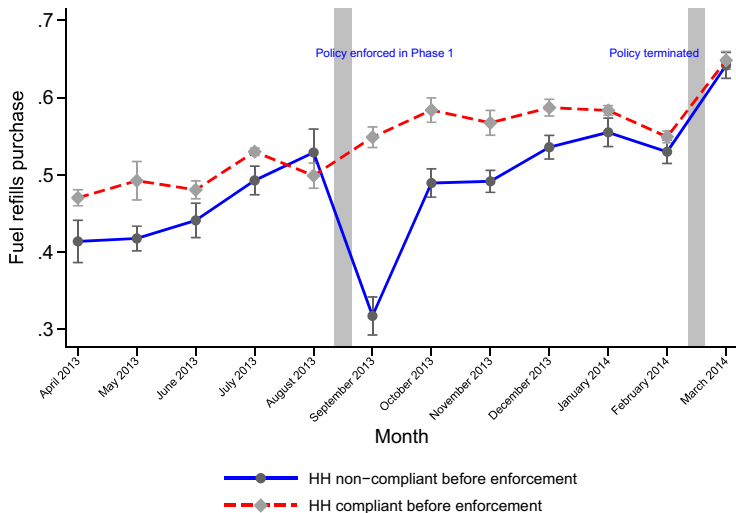


Heterogeneous Response : Non-Compliance and Pre-Enforcement Fuel Purchase Behavior

	(1)	(2)	(3)
Outcome variable: Household monthly LPG refill purchase			
Post	0.100*** (0.00771)	0.0971*** (0.00796)	0.140*** (0.00926)
High frequency HH	0.548*** (0.00607)		0.464*** (0.00348)
Post X High frequency HH	-0.345*** (0.0273)		-0.249*** (0.0155)
HH not complied		-0.0233 (0.0147)	-0.0789*** (0.00735)
Post X HH not complied		-0.131*** (0.0134)	-0.0816*** (0.00792)
High frequency HH X HH not complied			0.154*** (0.0119)
Post X High frequency HH X HH not complied			-0.154*** (0.0345)
Constant	0.338*** (0.00444)	0.461*** (0.00694)	0.378*** (0.00548)
Observations	3,095,114	3,095,114	3,095,114
Households	281,374	281,374	281,374
Month FE	Yes	Yes	Yes
District FE	Yes	Yes	Yes

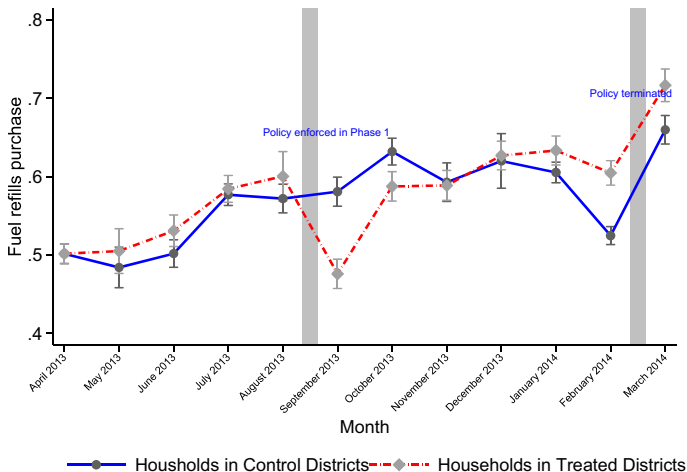
Fuel Purchase by Late Compliers in Treated Districts

Figure A20: Comparison of the early and late complier households in treated districts



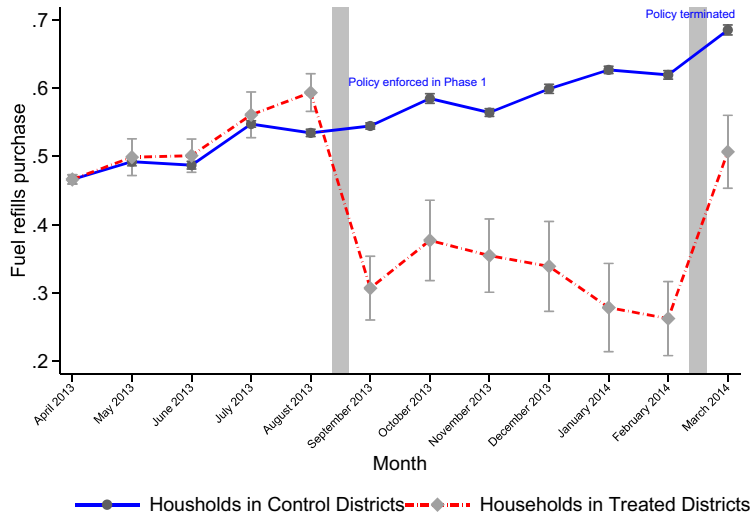
Fuel Purchase by Late Compliers in Treated Districts Vs. Compliers in Control Districts

Figure A21: Comparison of the late complier households in treated districts with complier households in control districts



Fuel Purchase by Non-Compliers

Figure 11: Non-compliant beneficiaries



Phasewise roll out: Impact on domestic LPG purchase in Phase 2

Household	3,416,283	2,505,507	1,203,241
Mean of outcome var	0.559	0.554	0.550
Control group	Ph 3-6 & Non-policy	Ph 3-6	Non-policy
Household FE	Yes	Yes	Yes
Month FE	Yes	Yes	Yes

This table reports estimates of the impact of DBTL program in Phase 2 districts. A household-month level panel is used. Outcome variable is – *number of LPG refills purchased in a month*. Estimates suggest about 22% to 29% reduction in domestic-use LPG purchase (i.e. coefficient on the interaction term as a percentage of mean value). Phase 2 districts ad the DBTL policy enforced for a relatively short period, so these estimates include households’ timing behavior. Phase 1 districts are not included. Note that control groups are different in three columns and provide a robustness check. Household and month fixed effects are included. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses. Standard errors are clustered at the district level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses.

Table A14: Fuel purchase in domestic sector: Comparison of OLS and Poisson estimates

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	Poisson	OLS	Poisson	OLS	Poisson
Outcome variable: Household monthly LPG refill purchase						
Ph2t	0.195***	0.230***	0.110***	0.206***	0.159***	0.271***

Policy Termination: Phase 2 Results

Table 7: Impact of Biometrics based transfer termination on HH LPG purchase in Phase 2

	(1)	(2)	(3)
Outcome variable: Household monthly LPG refill purchase			
Post termination	0.0377*** (0.00481)	0.0323*** (0.00572)	0.0577*** (0.00687)
Post termination X Treated districts	0.155*** (0.0228)	0.157*** (0.0229)	0.148*** (0.0234)
Constant	0.616*** (0.00316)	0.601*** (0.00387)	0.594*** (0.00405)
Observations	10,330,190	7,568,627	3,644,193
Households	3.498e+06	2.558e+06	1.238e+06
Mean of outcome var	0.629	0.613	0.631
Control group	Ph 3-6 & non-DBTL	Ph 3-6	non-DBTL
Month FE	Yes	Yes	Yes
Household FE	Yes	Yes	Yes

Black Market Data: Robustness Check

	89	89	61	61	38	38
District	Ph3-6 & Non-policy	Ph3-6 & Non-policy	Ph3-6	Ph3-6	Non-policy	Non-policy
Control	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE						
Day FE						

Note: This table shows the impact of policy termination on the ongoing black market prices as collected from the small businesses. Outcome variable is Log(black-market price). Even numbered columns include interview date fixed effect. Robustness is checked with different combinations of control groups. Col (5) and Col(6) present the preferred specification (already provided in the paper) and are provided here for a comparison. Firm FE are included. Standard errors are clustered at the district level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses.

Table A16: Robustness check: Impact of DBTL Policy Termination on Black market Price (Refill History Data)

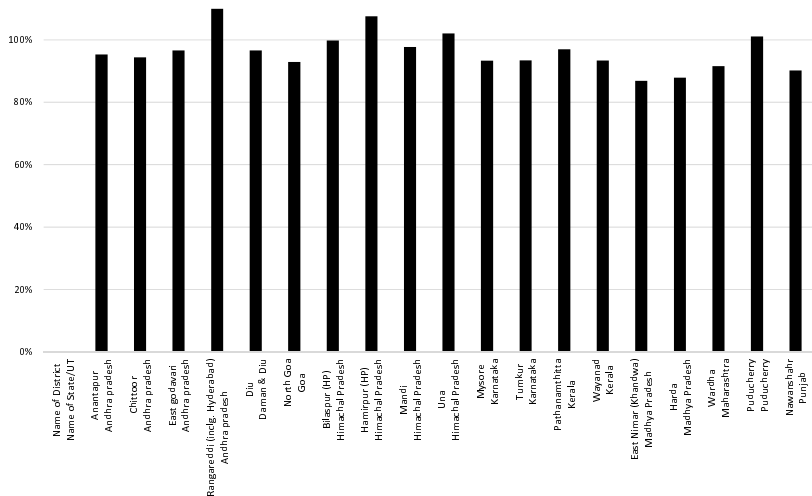
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Outcome variable: log(price)							

Black Market Data: Robustness Check

Table A16: Robustness check: Impact of UID-based Transfer Policy Termination on Black market Price (Refill History Data)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Outcome variable: log(price)							
Policy termination	-0.131** (0.0642)	-0.127** (0.0620)	-0.127** (0.0621)	-0.191** (0.0765)	-0.00692 (0.0263)	0.0627** (0.0264)	0.0658** (0.0257)
UID-based transfer X Policy termination	-0.0902** (0.0374)	-0.0916** (0.0383)	-0.0915** (0.0349)	-0.0711** (0.0345)	-0.163** (0.0717)	-0.112** (0.0451)	-0.117*** (0.0407)
Constant	6.861*** (0.0201)	6.865*** (0.0200)	6.866*** (0.0200)	6.932*** (0.0397)	6.799*** (0.0223)	6.816*** (0.0235)	6.820*** (0.0236)
Observations	1,895	2,021	2,037	1,271	782	908	924
Firm	624	671	677	424	259	306	312
District	74	79	81	53	30	35	37
Treatment group	Ph 1	Ph 2	Ph 1 & 2	Ph 1 & 2	Ph 1	Ph 2	Ph 1 & 2
Control group	Ph 3-6 & Non-policy			Ph 3-6	Non-policy		
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

UID Penetration in January 2014



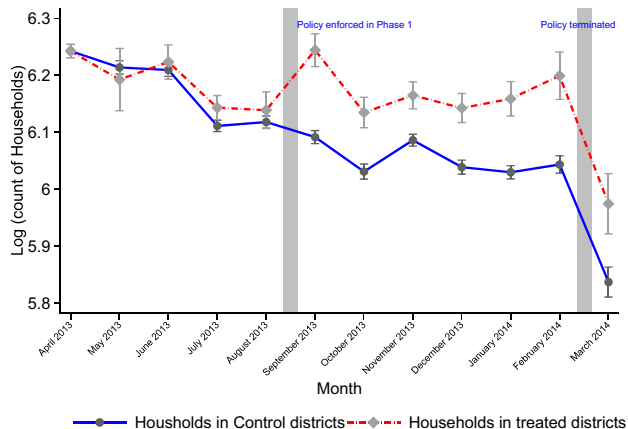
Impact of UID requirement: Increase in household level diversion

Table 12: Domestic fuel purchase by compliant households

	(1)	(2)
Outcome variable: Household monthly LPG refill purchase		
Post	0.0525*** (0.00953)	0.0659*** (0.0118)
DBTL X Post	0.0215*** (0.00476)	-0.00195 (0.00590)
Constant	0.479*** (0.00330)	0.488*** (0.00564)
Observations	11,803,583	3,899,918
Control group	Ph 3-6	Ph 6
Mean of outcome var	0.537	0.551
Month FE	Yes	Yes
Household FE	Yes	Yes

Household purchasing no refills

Figure 9: Number of beneficiaries who purchased no fuel



Descriptive stat: blackmarket price (Supply side)

भारत सरकार
Unique Identification Authority of India
Government of India

संलग्नक अर्थ (Enrollment No.): 12345678/901234

To
Nitesh Singh
पिता (Ft)
House No. 2,
Sant Nagar, East of Kalkaji,
Delhi-110065
Delhi-110015

UC123456789 012
Ref. No.: 14B2E3X91

आपका आधार क्रमांक / Your Aadhaar No. :
4444 1111 4444

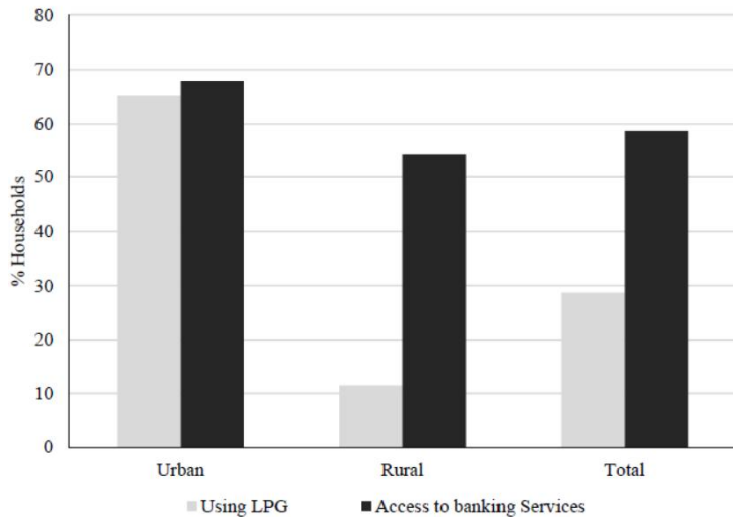
आधार — आम आदमी का अधिकार

भारत सरकार
GOVERNMENT OF INDIA

पिता (Ft)
Nitesh Singh
पिता : कर्नल सिंह
Father : Karmar Singh
जन्म वर्ष / Year of Birth : 1980
पुरुष / Male
4444 1111 4444

आधार — आम आदमी का अधिकार

Bank Accounts Vs. LPG Penetration



Source: Census of India (2011).

Policy Termination: Impact on Domestic Fuel Purchase (Beneficiary-level Panel)

