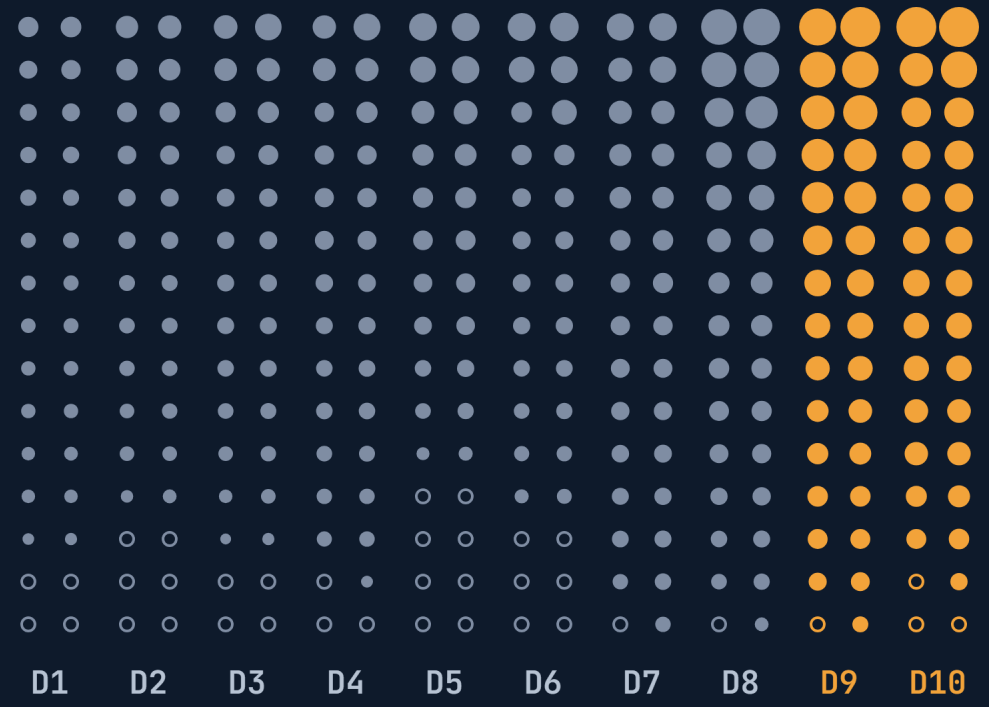
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Nonlinear Pricing of Subsidised Fuel

A microsimulation of family-card (Kartu Keluarga) quotas in Indonesia

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300 synthetic families, 30 per decile. Dot size = litres of Pertalite per month; hollow = no gasoline use; amber = deciles 9–10.

01 · THE PROBLEM

Pertalite subsidies flow mostly to better-off households

IDR 137 T
compensation per year for household Pertalite: economic price IDR 16,088 vs retail IDR 10,000

42%
of subsidised fuel consumed by deciles 9–10 (CNBC Indonesia, 2026)

6.8×
consumption of decile 10 vs decile 1: 62.4 vs 9.2 litres per family per month

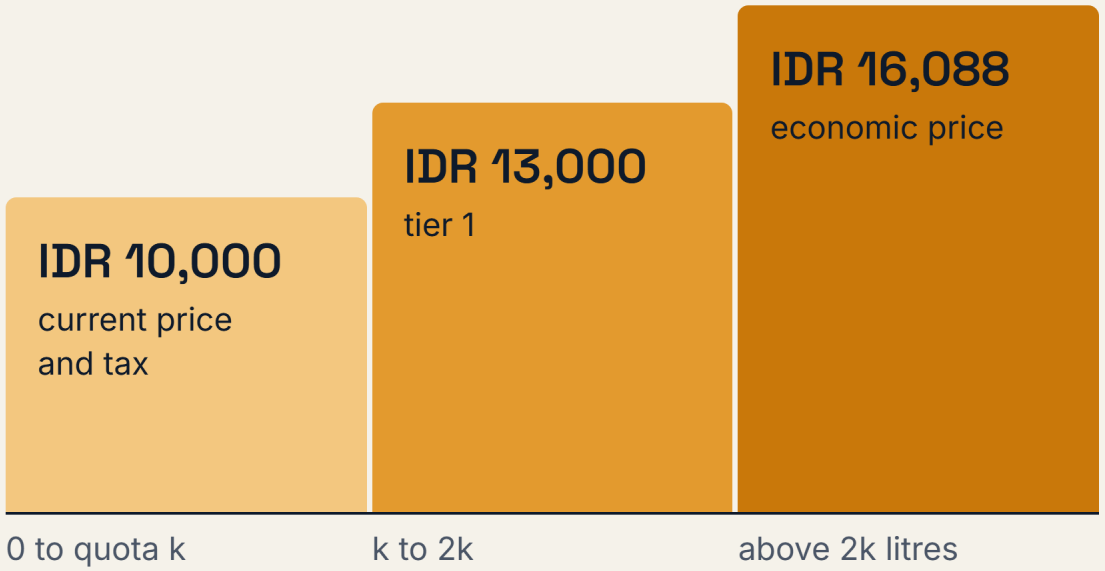
Share of household Pertalite consumption by expenditure group



01 · THE IDEA

One family card, one quota: current price inside, tiered prices above

Price per litre by monthly purchases of a family



1. **Quota per family card**
   k = 16.8 × (1 + adults) litres per month: 34 L for one adult, 50 L for two, 67 L for three.
2. **Inside the quota**
   Current price and tax; 90% of families never exceed it.
3. **Above the quota**
   IDR 13,000 up to twice the quota, then the economic price: the subsidy becomes inframarginal.

Tool: MyPertamina QR code linked to the identity and KK numbers

Similar approach: tiered tariffs for electricity and water (Borenstein, 2012; Nauges & Whittington, 2017); a fuel ration in Iran (Salehi-Isfahani et al., 2015)

01 · GAP AND HYPOTHESES

Block tariffs are well studied for electricity and water, not for fuel

Fuel suits a block design: consumption rises steeply with vehicles and expenditure, and MyPertamina already records purchases. No study compares a household fuel quota with a uniform increase at equal fiscal savings.

H1

At equal savings, a KK quota yields higher weighted welfare and fewer net losers than a uniform price increase.

H2

A quota adjusted for adults protects large poor families better than a flat quota.

H3

Fiscal savings survive average-price responses; the fall in consumption does not.

02 · METHOD

300,000 synthetic families built from published BPS tables

01

Family size

Drawn from the BPS size distribution; adults separated from children.

Mean 4.76 members among the poorest 8.25%

02

Expenditure

Lognormal, correlated with size, then transformed to the five quintile means.

Susenas March 2026 within 0.02%; Gini 0.366

03

Consumption

Constant-elasticity demand: $\eta = 0.989$, $\theta = 0.5$, $\sigma\varepsilon = 0.70$, $\varepsilon = -0.25$.

Gasoline use 78% (poorest) to 97% (richest)

04

Decile scaling

Consumption scaled to published decile shares.

D1 3.7% · D10 25% · D9–10 42%

IDR 67,715

Pertalite per capita per month vs IDR 71,245 for all gasoline in Susenas

± IDR 0.10 T

range of lenient-quota savings across five random seeds

Similar approach: microsimulation on populations calibrated to published aggregates (Bourguignon & Spadaro, 2006)

02 · METHOD

Four scenarios, compared on one welfare scale

Code	Scenario	Design
S1	Flat quota	55.2 L per family
S2	Adjusted quota	16.8 × (1 + adults) L
S4	Adjusted quota, tight	4.89 × (1 + adults) L · saves IDR 57.4 T
S6	Uniform increase	IDR 12,365 per litre · saves IDR 57.4 T

WELFARE

$$\Delta W = \Sigma\ g \cdot (\tau - L)$$

L: exact consumer-surplus loss · τ: savings returned equally per family · g = (y / ȳ)^−e, Atkinson weights

UNCERTAINTY

200 Monte Carlo draws of five unobserved parameters; scenarios compared as paired differences

Similar approach: welfare weights (Atkinson, 1970); confidence intervals in microsimulation (Creedy et al., 2007); paired differences (Goedemé et al., 2013)

03 · RESULTS · H2

A lenient quota saves IDR 16 trillion and spares the poor

IDR 16.0 T
savings per year with S2, 12% of household compensation

10%
of families ever exceed the quota

84%
of the burden falls on deciles 9–10

Flat quota (S1) → quota adjusted for adults (S2), at almost equal savings

BOTTOM-40% AFFECTED

1.44% → 0.97%

fewer poor families pay more

KAKWANI INDEX

0.48 → 0.51

more progressive burden

GAIN FROM SPLITTING A KK

101,900 → 50,500

IDR per month, halved

03 · RESULTS · H1

At equal savings, the quota beats a uniform price increase

Quota (S4) Uniform increase (S6)

Net change by decile after equal transfers, % of expenditure

+56%

weighted welfare at e = 1: IDR 30.2 T vs 19.4 T (+51% at e = 2)

19.1% vs 28.9%

families losing on net

6.5 vs 5.8

efficiency gain, IDR T: heavy users face a price near cost

Savings survive average-price responses; the ranking survives every draw

AVERAGE-PRICE RESPONSE (ITO, 2014)

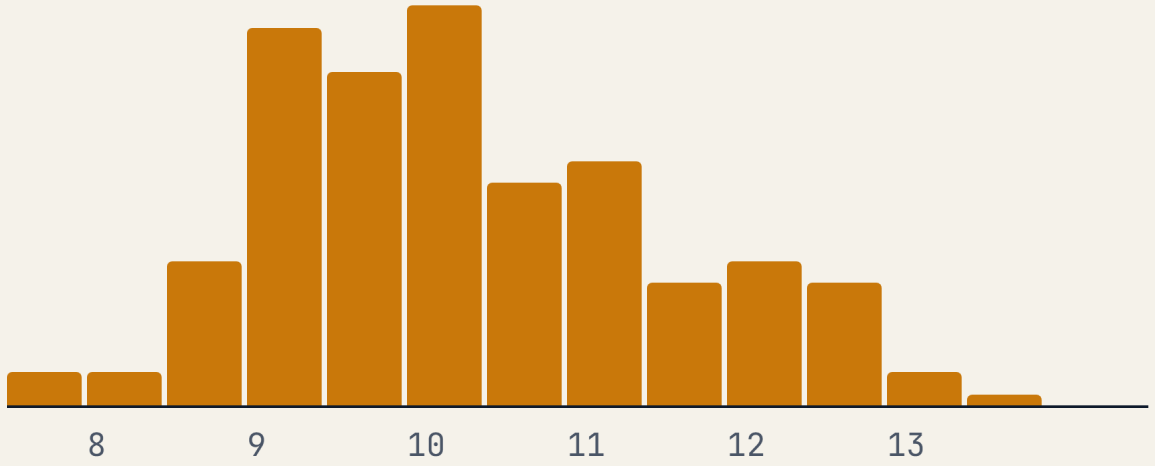
Savings: −4.2% (S2), −1.3% (S4)

Consumption cut halves: 2.98% → 1.37% (S2). Savings come from extra payments on litres still bought. H3 is supported.

BUNCHING AS A TEST

Only marginal-price responders bunch at the quota (1.1% of families under S2), so MyPertamina data can reveal the rule.

ΔW quota − uniform (IDR T, e = 1), 200 Monte Carlo draws



Median 10.3 · 5th–95th percentile 8.7 to 12.6 · positive in 200 of 200 draws

Similar approach: paired differences across shared draws (Goedemé et al., 2013); bunching at kinks (Kleven, 2016)

03 · ROBUSTNESS

The ranking holds across data, behaviour and model choices

Test	ΔW quota	ΔW uniform	Ratio
Main calibration	30.25	19.36	1.56
Average-price response	28.9	19.4	1.49
Compensation IDR 3,794 per litre (Ministry of Finance)	18.2	11.3	1.61
95.3 million family cards (welfare register)	30.3	19.4	1.56
Singh-Maddala base distribution	30.62	19.48	1.57

ΔW at e = 1, IDR trillion per year. With 95.3 million cards, a per-KK quota loses IDR 1.1 T of savings unless k is reset or set per adult (25.3 L). Consumption heterogeneity explains about 85% of the uncertainty in savings: the first parameter to estimate with Susenas microdata.

04 · POLICY IMPLICATIONS

A phased introduction through MyPertamina

1

Monitor

Link QR codes to identity and KK numbers; record consumption per family without changing prices.

2

Lenient quota

16.8 × (1 + adults) L, or about 25 L per adult; IDR 13,000 for the next tier; business quotas for ojek, farmers and fishers.

3

Tighten if needed

Lower the allowance step by step if larger savings are required.

4

Recycle

Return savings as transfers: without recycling every reform lowers weighted welfare.

Legal basis: revision of Presidential Regulation 191/2014 and the downstream regulator's quota rules.

CONCLUSION

Protect the first litre, charge for the extra litres.

Findings

- Lenient quota: IDR 16.0 T saved, 10% of families affected.
- At equal savings: +56% weighted welfare, 19.1% vs 28.9% net losers, in all 200 draws.
- Adjusting for adults protects large poor families.

Limitations and next steps

- Synthetic population from aggregates; estimate parameters with Susenas microdata.
- Static, partial model: no vehicle choice or general equilibrium.
- Estimate the price elasticity from bunching in MyPertamina data.

Thank you · Yusuf Hendriarto · hendriarto@gmail.com

Questions and discussion