Negotiation of joint discrete decisions in dual-earner couples

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The gap we address

Collective models in **discrete-choice** settings remain rare, and the **level** of bargaining power is typically not identified.

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- **Point identification of the baseline level** of intra-household bargaining power λ_{ref}, **conditional on a monetary-scale normalization**.

- Identification **relies on** three ingredients :
  1. Egotistic preferences (Chiappori, 1988)
  2. Private assignable-good structure of individual attributes (here, **travel times**)
  3. **Monetary-scale normalization** : assigning the **same VoT to the reference individual**, (male and female). The level of λ_{ref} is identified conditional on this neutral normalization.
- **No data on prices, income, or budget shares required**.

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Empirical application

- 158,812 dual-earner couples, 2021 French census, Paris Region (Île-de-France)
- Joint commuting modes × vehicle ownership
- Mixed logit with shared error components, estimated by Bayesian HMC

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- **Differential approach** (Chiappori, 1988 ; Chiappori et Ekeland, 2009) : sharing rule identified up to an additive constant.
- **Revealed preference** (Browning et Chiappori, 1998 ; Cherchye, De Rock et F. Vermeulen, 2011) : set identification.
- **Preference similarity** (Browning, Chiappori et Lewbel, 2013 ; Dunbar, Lewbel et Pendakur, 2013) : recovers level under the assumption that individual preferences are invariant between single and couple states.
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Our angle

Symmetric monetary-scale anchor on values of time instead of an arbitrary Pareto weight, allowing the level of bargaining power to be estimated (.i.e, interpreted).

Joint choice set

Each couple jointly chooses commuting modes and vehicle ownership.

Commuting modes : $\mathcal{J} = \{ca, cd, cp, pt\}$

- ca : car alone cd : car driver (with detour to drop off partner)
- cp : car passenger pt : public transport

Vehicle ownership : $d_1 \in \{0, 1\}$, $d_2 \in \{0, 1\}$ with $d_2 \leq d_1$.

Joint alternative : $y = (j, j', d_1, d_2)$, where $j, j' \in \mathcal{J}$ are the modes chosen by the woman and the man respectevely, and d_1, d_2 index vehicle ownership.

$$\mathcal{C} \subseteq \{(j, j', d_1, d_2) : j, j' \in \mathcal{J},\ d_1, d_2 \in \{0, 1\}\}$$

- Vehicle ownership is **endogenous** : not only conditioning the mode choice, but jointly determined with it.
- Short-term mode choice constrained by medium-term ownership.

Joint utility under Pareto efficiency

Household decisions are Pareto efficient (Chiappori, 1988 ; Chiappori, 1992) :

$$U_{i,y} = \lambda_i V^w_{i,j} + (1-\lambda_i) V^m_{i,j'} + V_{i,d_1} + V_{i,d_2} + \xi_{i,y}$$

Pareto weight (logistic specification) :

$$\lambda_i = \left[1 + \exp\left(-(\kappa_\lambda + X_i\gamma)\right)\right]^{-1}$$

- κ_λ : **baseline bargaining power**
- X_i : includes distribution factors (Chiappori, Fortin et Lacroix, 2002)

With $\xi_{i,y} \sim$ EV1 (scale μ), choice probabilities take the logit form :

$$P_{i,y} = \frac{e^{\mu V_{i,y}}}{\sum_{k \in \mathcal{C}} e^{\mu V_{i,k}}}$$

Mode choice and value of time

Individual value of time for car alone :

$$\nu_i^g = \exp\big((X_i^g)^\top \beta^g\big) \times 10 \quad (€/\text{hour}), \quad g \in \{w, m\}$$

Mode-specific scaling : $\text{VOT}_j^g = \exp(\delta_j^g) \cdot \nu_i^g$.

Individual systematic utilities :

$$\begin{cases} V_{i,ca}^g = -\nu_i^g \, \tau_{i,ca}^g \\ V_{i,cp}^g = \alpha_{cp}^g - \nu_i^g \, e^{\delta_{cp}^g} \, \tau_{i,ca}^g \\ V_{i,cd}^g = \alpha_{cd}^g - \nu_i^g \, e^{\delta_{cd}^g} \, \tau_{i,ca}^{g'} \boxed{-\nu_i^g \, \tau_{i,ca}^{g'g}} \\ V_{i,pt}^g = \alpha_{pt}^g - \nu_i^g \, e^{\delta_{pt}^g} \, \tau_{i,pt}^g + \beta_{\tau^2}^g (\tau_{i,pt}^g)^2 \end{cases}$$

Key identifying variation

The **extra travel time** $\tau_{i,ca}^{g'g}$ in $V_{i,cd}^g$ is a **private assignable bad** : it enters only the driver's utility, not the partner's. This assignability is what allows the collective utility to be decomposed into spouse-specific components.

Correlated unobserved heterogeneity

Mixed logit with shared error components (McFadden et Train, 2000 ; Walker et Ben-Akiva, 2002) :

$$\begin{aligned} U_{i,y} = & \lambda_i (V^w_{i,j} + \sigma^w_j \eta^w_{i,j}) \\ & + (1-\lambda_i)(V^m_{i,j'} + \sigma^m_{j'} \eta^m_{i,j'}) \\ & + V_{i,d_1} + \sigma_{d_1} \eta_{i,d_1} + V_{i,d_2} + \sigma_{d_2} \eta_{i,d_2} + \xi_{i,y} \end{aligned}$$

where $\eta^w_{i,j}, \eta^m_{i,j'}, \eta_{i,d_1}, \eta_{i,d_2} \overset{\text{iid}}{\sim} \mathcal{N}(0,1)$ are drawn independently per individual or per couple.

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Two correlation channels :

- **Vehicle ownership** : parking, garage, maintenance $\rightarrow \sigma_{d_1}$, σ_{d_2}
- **Individual mode tastes** : latent preferences for driving / aversion to PT $\rightarrow \sigma^g_j$

$\rightarrow$ Generates individual-specific correlation patterns across alternatives, more flexible than nested logit.

Identification : $\sigma^w_{cp} = \sigma^m_{cp} = 0$ to break a perfect collinearity.

Data : dual-earner couples in Île-de-France

2021 French census + *METROPOLIS2* travel times (Javaudin et de Palma, 2024).

$N = 158{,}812$ dual-earner couples (522,475 representative).

Joint mode / Ownership	2+ cars	1 car	No car	Total
Both car	25.21%	6.32%	—	31.53%
Woman car / Man PT	5.22%	**6.12%**	—	11.34%
Woman PT / Man car	8.69%	**14.32%**	—	23.01%
Both PT	4.69%	17.65%	11.78%	34.12%

The descriptive smoking gun

Among 1-car couples, the man drives **2.3**× more often than the woman.
Among singles in the same region, the Man/Woman gap in car use is only **1.13**× (33.4% vs. 29.7%).
⇒ The within-couple asymmetry far exceeds what individual preferences alone would predict.

The unitary model is decisively rejected

	Collective	**Unitary**
Posterior mean log-likelihood	−125,948	−126,214
Number of parameters	57	52

Likelihood ratio test

$$LR = 2 \times 266 = \mathbf{532} \quad \gg \quad \chi^2_{0.01}(5) = 15.09$$

→ Intra-household bargaining is a **first-order determinant** of joint commuting decisions.

→ Treating the household as a single decision-maker produces **significant misspecification**.

Estimated bargaining power

	Mean	**[5%, 95%]**
Intercept (κ_λ)	0.353	[0.287, 0.414]
Woman more educated	−0.221	[−0.248, −0.191]
Man more educated	−0.013	[−0.044, 0.021]
Age diff. (w − m) when w. before 40	−0.186	[−0.226, −0.142]
Age diff. (w − m) when w. after 40	−0.044	[−0.085, −0.012]
Married couple	−0.129	[−0.156, −0.102]
λ_{ref} (reference couple)	**0.587**	[0.571, 0.602]
λ_{mean} (sample average)	**0.555**	

- Women hold **structurally more than half** of the decision-making weight on commuting in the vast majority of couples.

What determines the woman's Pareto weight ?

Marriage (-0.129)

- Higher exit costs in France than PACS / cohabitation (Chiappori, Fortin et Lacroix, 2002).
- Less attractive non-cooperative threat point for women (S. Lundberg et Pollak, 1993).

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Age difference when woman is less than 40 (-0.186)

- Age difference have an impact on woman's bargaining power only before 40.
- When the woman is younger before 40 compared to her husband, her decision power increases $\rightarrow$ **better marriage market for her before 40**
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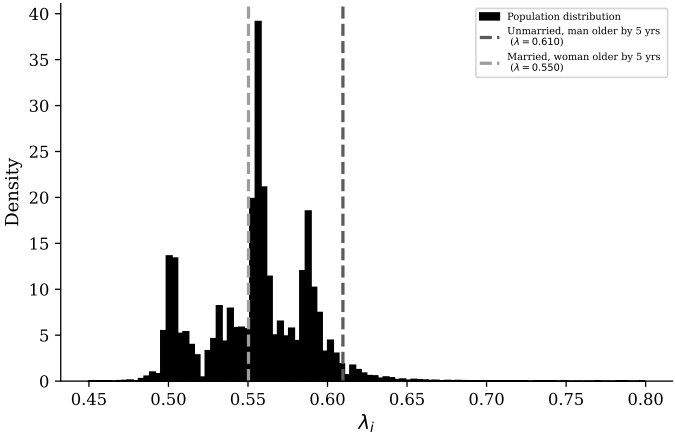
Educational hypogamy (-0.221, asymmetric !)

- Apparently counterintuitive — higher education $\rightarrow$ lower bargaining weight for women — but consistent with the gender-identity framework (Akerlof et Kranton, 2000 ; Bertrand, Kamenica et Pan, 2015) : norm against wives out-earning husbands.
- No symmetric effect for hypergamy (-0.013, n.s.).
- Compensatory dynamics extend from housework to mobility.

Distribution of λ_i across the sample



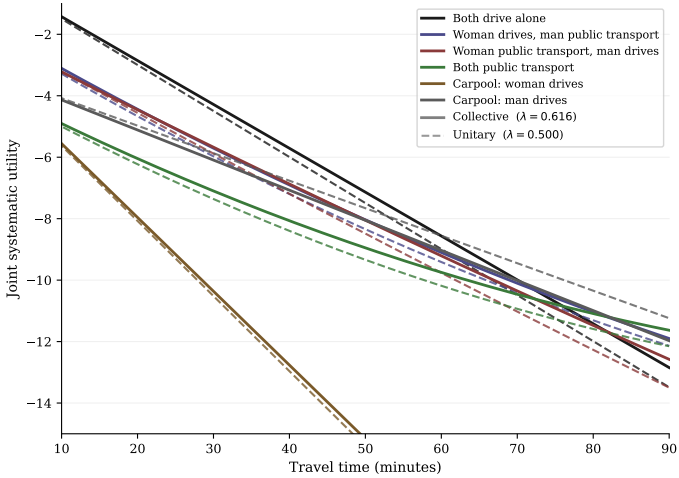
- Concentrated between 0.45 and 0.80, with a mode around 0.57.
- **Almost entirely above** 0.5.
- Unmarried, man 5 years older :

$$\lambda = 0.610$$

- Married, woman 5 years older :

$$\lambda = 0.555$$

Policy-relevant implications



Joint utility ranking as travel time grows :

- Unitary ($\lambda = 0.5$) : switches to **carpool** at $\approx$ **55 min** ; never predicts both-PT.
- Collective ($\lambda = 0.616$) : sustains both-drive-alone until $\approx$ **74 min** ; switches to **both-PT**, never carpool.

$\rightarrow$ Carpool subsidies / congestion pricing calibrated on a unitary model would target the **wrong threshold** and the **wrong mode**.

Conclusion

Methodological takeaways

- Egotistic preferences + assignable detour times + money-metric normalization → **point identification of baseline bargaining power**.
- No data on prices, income, or budget shares required.
- Framework portable to other joint discrete choices : residential location, school choice, extensive-margin labor supply.

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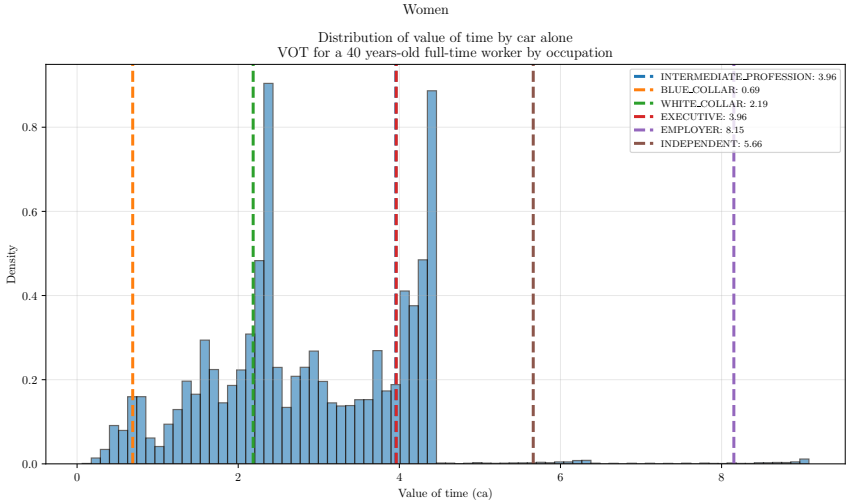
Empirical takeaways

- Unitary model decisively rejected ($LR = 532$).
- Average $\lambda_w = 0.57$, woman holds majority decision power.
- Marriage, age gap, hypogamy all reduce women's bargaining weight → gender-identity logic extends to mobility.
- Ignoring bargaining biases counterfactual policy responses.

Thank you ! Questions ?

References

Choice of the reference woman for normalization



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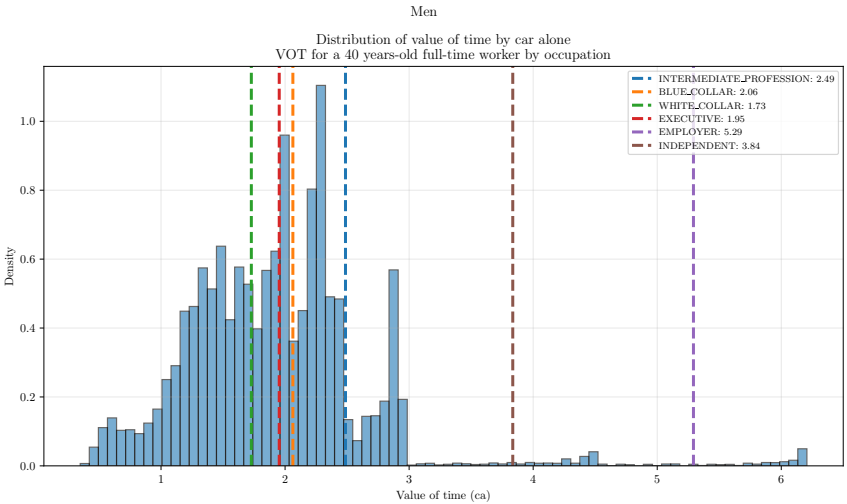
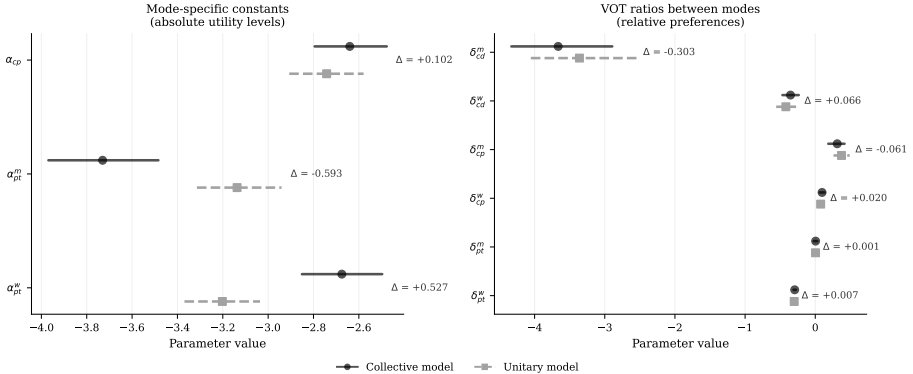


Identification visualized : what the unitary model misses



Left panel — Mode-specific constants α_j^g : **biased** in unitary model. The unitary model absorbs the bargaining asymmetry into the constants (+0.527 for women's PT, −0.593 for men's PT).

Right panel — Value-of-time ratios δ_j^g : **essentially identical**. They are identified from ratios of travel-time coefficients, in which $\lambda_i \nu_i^g$ cancels exactly.

Vehicle ownership : who owns how many cars ?

	Two cars Mean [5%, 95%]	**One car** Mean [5%, 95%]
Children		
Children 0–16	0.090 [0.074, 0.103]	**0.828** [0.782, 0.879]
Children 17+	0.616 [0.585, 0.646]	**1.052** [0.985, 1.126]
Nationality		
Foreign man	−0.566 [−0.621, −0.514]	−1.722 [−1.840, −1.594]
Foreign woman	−0.992 [−1.053, −0.929]	−1.508 [−1.619, −1.383]
Residential density (log scale)		
Population density	−1.059 [−1.103, −1.015]	**−2.301** [−2.398, −2.200]

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Three patterns

- **Children** : stronger effect on the 1st car than the 2nd. Older children weigh more, consistent with their logistical autonomy needs.
- **Foreign nationality** : associated with substantially lower car ownership, more pronounced for women than for men..
- **Density** : consistent with public transport substituting for car ownership in dense areas.