

UNPACKING MOVING: A Quantitative Spatial Equilibrium Model with Wealth

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 - What policies allow for a better distribution of people across space and reduce individual/spatial inequalities?

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 - Are large migration costs the only cause of limited migration?
 - What policies allow for a better distribution of people across space and reduce individual/spatial inequalities?
- **This paper: Wealth and Income Risk matter for moving decisions**
 - Precautionary Moving
 - Migration and wealth are substitute self-insurance mechanisms

This paper/ Results

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2. **Migration as Insurance Mechanism** - **Low-wealth** households are more likely to **move to low-housing-cost** locations

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- Modest participation rates
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 2. **Migration as Insurance Mechanism** - **Low-wealth** households are more likely to **move to low-housing-cost** locations
- **Target Policy: Moving Voucher** for low income households
 - Modest participation rates
 - Younger, Renters and Low-wealth benefit the most
- **Untarget Policy:** Decrease of **Zoning** Restrictions in Vancouver

MIGRATION PATTERNS IN CANADA

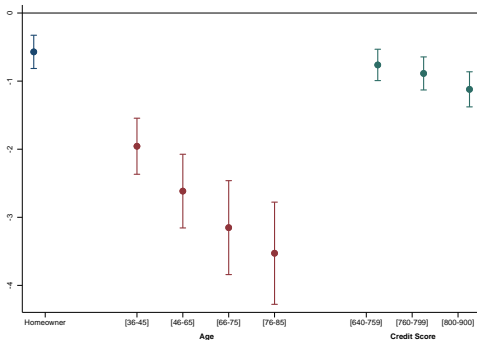
TRANSUNION

Migration Patterns in Canada by Demographics - Regression Framework

» Table

- **Data:** TransUnion Canada - Credit Registry Data [» Patterns](#)

$$1[Move_{i,z,t}] = \beta_0 + \beta_1 X_{i,t-1} + \delta_{z,t} + \epsilon_{i,z,t}$$



- Renters, younger and **less able to borrow** agents **move more**

**DYNAMIC MODEL OF
WEALTH AND MIGRATION**

Environment - I

- **Space**
 - N locations
 - Differ by productivity, labor market risk, amenities and housing supply

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- **Liquid Asset**

- Agents can borrow or save through an one-period financial asset b
- Incomplete Markets: Borrowing constraint

Environment - II

- **Housing**

- Households decide to be homeowners (H) or renters (R)
- Renters can freely adjust their housing consumption
- Illiquid asset: transaction cost
- House can be used as collateral: $b_t \geq \underline{b} - \xi p_t^l h_t$

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- **Location Choice**

- Decide which location l to live
- T1EV location preference shocks
- Monetary and Utility Moving Costs: $\tau^{l,l'} = \tau_0 + \tau_1 d_{l,l'}$

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- **Equilibrium**

- **Endogenous city-specific wage and house prices** that clear local markets

Timeline & Household's Problem

1. Idiosyncratic Location Preference Shock is realized
 - Location choice is made - Migration costs are paid if moving
 2. Idiosyncratic Income shock is realized
 3. Choice between Homeowner and Renter
 4. Decides non-durable consumption/liquid savings subject to borrowing constraint
- **Homeowners** solve the following problem:

$$V_t^{H,l}(a_t, \epsilon_t, q, l_{t-1}, \bar{h}_t) = \max_{c_t, h_t, b_t, \{a_{t+1}^k\}_{k=1}^L} u_q(c_t, \omega h_t, A^l) + (1 - \lambda_q) \varphi(a_{t+1}^l)$$

$$+ \lambda_q \beta \mathbb{E}_t \left\{ \max_{\{k\}_{k=1}^L} V_{t+1}^k(a_{t+1}^k, \epsilon_{t+1}, q+1, l_t, \bar{h}_{t+1}^k) - \tau^{l,k} + v \tilde{\epsilon}_t^{i,k} \right\}$$

$$\text{s.t. } c_t + b_t + p_t^l h_t (1 + F \mathbb{1}[h_t \neq \bar{h}_t]) = y^{\epsilon, l} + a_t - \mathcal{T}(y^{\epsilon, l})$$

$$a_{t+1}^k = (1 + r^b) b_t + p_{t+1}^l h_t (1 - \delta_h - \tau_h) - F_m \mathbb{1}[l \neq k]$$

$$b_t \geq \underline{b} - \zeta p_t^l h_t$$

**APPLICATION TO THE
CANADIAN ECONOMY**

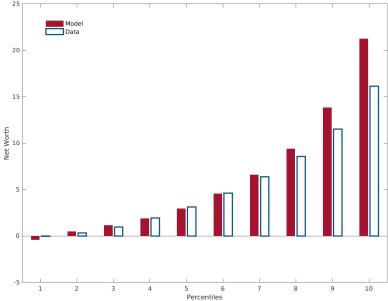
Calibration - Matched Moments

- **Space** 27 largest Canadian cities (CMAs)
- City **Productivity** and **Housing Supply elasticities** - externally calibrated
- Endogenous **Amenities** to match population distribution [▶▶ Details](#)

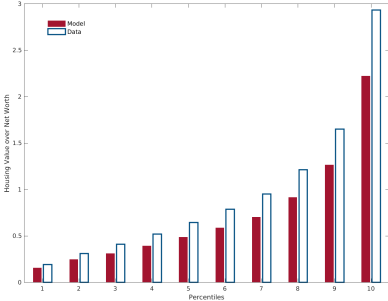
Moment	Data Value	Model Value
av.out-migration (%)	1.54	1.54
corr.(distance,out-migration)	-0.225	-0.23
corr.(prod,in-migration)	0.894	0.86
migration rate of the youth	3.2	2.85
share pop. negative assets (%)	5.7	5.5
20th perc. networth/income distribution	0.59	0.82
50th perc. networth/income distribution	3.83	3.66
50th perc. home equity/networth distribution	0.7	0.52
networth age 85/networth age 65	0.88	1.17
homeownership share	0.61	0.61
Population Distribution		

Model vs Data: Networth and House Value Distributions

Wealth to Income Ratio

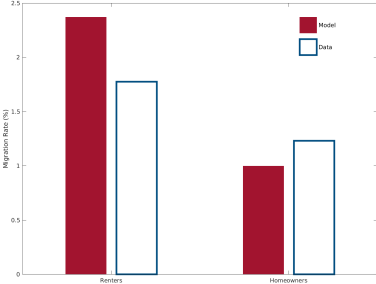


House Value to wealth ratio

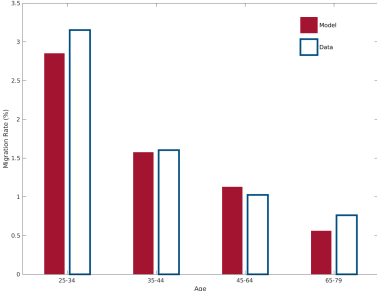


Model vs Data: Migration Rates by Demographics

By Homeownership

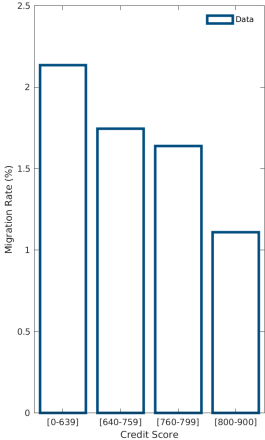
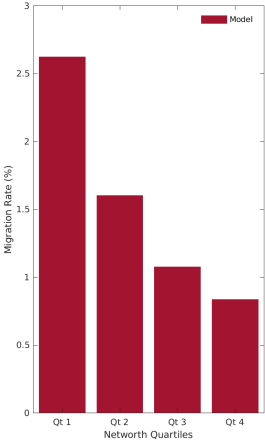


By Age



Model vs Data: Migration Rates by Demographics

By Network



UNDERSTANDING THE MODEL

Why do people move?

1. Location Preference shocks
2. Moving Costs

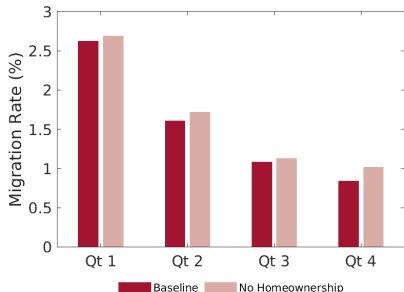
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4. **Uninsurable Income risk**
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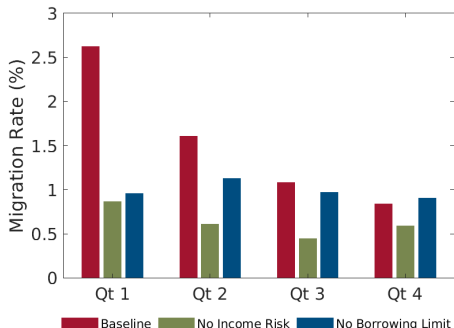
Decomposition of Migration Rates By Network



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Decomposition of Migration Rates By Network



- **Migration is an Insurance Mechanism for negative income shocks**

Why do low-wealth individuals move more?

Negative Income Shock

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- Moves: high utility costs **but**
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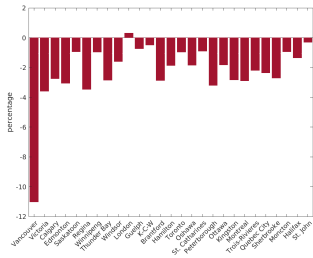
**LOWER ZONING RESTRICTIONS IN
VANCOUVER**

Zoning Regulations in Vancouver

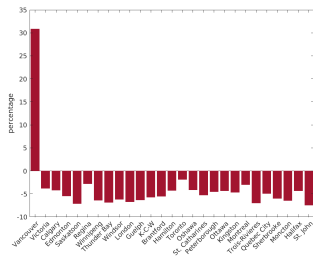
- Vancouver is the most **expensive** housing market in North America
- **Regulations** partly explain the high prices:
 - 52% of the land can only have single-family housing
- **Local Based Policy:** Decrease of zoning regulations in Vancouver
 - Vancouver building permits $\bar{L}^{Vancouver}$ ↑ by 30% over 10 years
 - Increase of housing supply

Vancouver Policy - Long-Run Impact

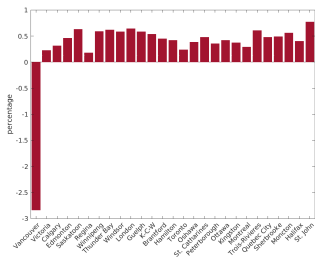
House Prices



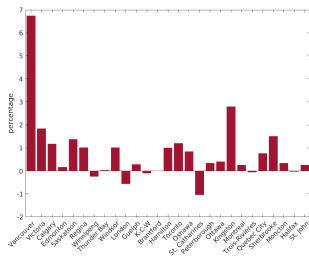
Population



Wages



Homeownership



Vancouver - Welfare

Welfare Change (%)				
Demographics	Short-run			Long-Run
	Vancouver	All cities but Vancouver	Canada	Canada
All	0.25	-0.03	0	1.06

- Vancouver Policy Impact spills over across the country
- Vancouver wins in the SR but negative impact in the rest of the country
- Long-Run: Overall Gains

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All	0.25	-0.03	0	1.06
Homeowners	-1.25	-0.24	-0.28	1.28
Renters	0.57	0.27	0.33	0.74
Age 25-65	0.32	-0.01	0.03	1.15
Age 65-85	-0.53	-0.28	-0.31	0.74

- **Short-run**

- Vancouver: Renters wins but homeowners loose as drop in house prices reduce their wealth
- Rest of the country: Negative impact on homeowners dominates

- **Long-run**

- Homeowners gains are higher than Renters due to higher homeownership

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Networth - Qt1	0.85	0.2	0.27	0.88
Networth - Qt2	0.12	-0.14	-0.12	0.9
Networth - Qt4	-0.46	-0.28	-0.31	0.52

- **Short-run**

- Low wealth households benefit everywhere
- High wealth households lose everywhere

- **Long-run**

- Everyone wins, but larger gains for low wealth households

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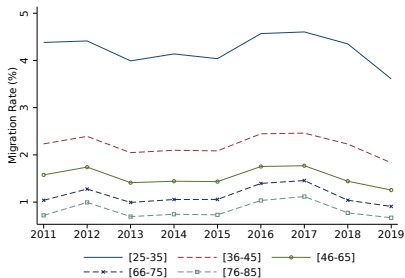
Conclusion

- **Empirically** Migration choices vary by demographics
 - Age, ability to borrow and home-ownership matter
- **New Model of Location Choice + Income Risk + Wealth**
 - Migration as a mechanism to ensure/smooth income shocks for low-wealth households
 - Moving Costs 37% lower than estimated by previous literature
 - **Moving Voucher**
 - Benefits **Low Income** Young, Renters, Low Wealth
 - Participation and Welfare Gains are limited specially for the conditional policy - low wealth are very sensitive to housing costs
 - **Decreasing Housing Regulations**
 - Benefit Young, Renters and Low-wealth at the cost of homeowners
 - Sizeable LR welfare gains across the entire country

APPENDIX

Migration Patterns in Canada by Demographics

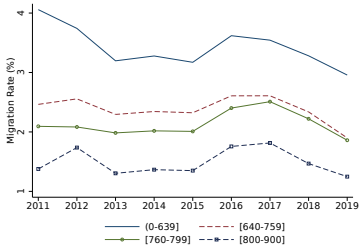
Panel A: By Age



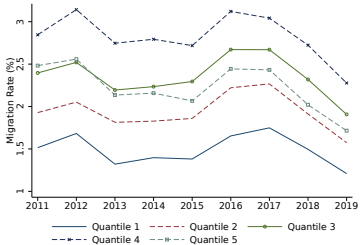
Panel B: By Homeownership



Panel C: By Credit Score



Panel D: By Credit Usage



Heterogeneous Migration Responses

	(4)	(5)	(6)	(7)	(8)
			Move=100		
Homeowner	-0.571*** (0.124)	-0.900*** (0.119)			-0.571*** (0.124)
Age [36-45]	-1.958*** (0.208)		-2.116*** (0.229)		-1.956*** (0.208)
Age [46-65]	-2.615*** (0.274)		-2.859*** (0.304)		-2.615*** (0.274)
Age [66-75]	-3.153*** (0.350)		-3.373*** (0.370)		-3.152*** (0.349)
Age [76-85]	-3.529*** (0.380)		-3.658*** (0.386)		-3.528*** (0.380)
Credit Score [640-759]	-0.760*** (0.117)			-1.055*** (0.167)	-0.762*** (0.117)
Credit Score [760-799]	-0.884*** (0.123)			-1.344*** (0.196)	-0.887*** (0.123)
Credit Score [800-900]	-1.119*** (0.130)			-1.977*** (0.241)	-1.121*** (0.130)
Observations	146602877	146602877	146602877	146602877	146602877
Adjusted R^2	0.107	0.101	0.106	0.102	0.107
City Fixed-Effects	Yes	No	No	No	No
Year Fixed-Effects	Yes	No	No	No	No
City \times Year Fixed-Effects	No	Yes	Yes	Yes	Yes

Renters Problem

- **Renters** solve the following problem:

$$V_t^{R,l}(a_t, \epsilon_t, q, \bar{h}_t) = \max_{c_t, h_t, b_t, \{a_{t+1}^k\}_{k=1}^L} u_q(c_t, s_t, A^l) + (1 - \lambda_q)\varphi(a_{t+1}^l) \\ + \lambda_q \beta \mathbb{E}_t \left\{ \max_{\{k\}_{k=1}^L} V_{t+1}^k(a_{t+1}^k, \epsilon_{t+1}, q+1, \bar{h}_{t+1}^k) - \tau^{l,k} + v \tilde{\epsilon}_t^{i,k} \right\}$$

s.t. $c_t + R_t^l h_t + b_t = y^{\epsilon,l} + a_t - \mathcal{T}(y^{\epsilon,l})$
 $b_t \geq \underline{b}$
 $a_{t+1}^k = (1 + r^b) b_t - F_m \mathbb{1}[l \neq k]$
 $s_t = h_t \in \mathcal{H}^R, \quad \bar{h}_{t+1} = 0$

Moving probabilities

- Assuming **Type I Extreme Value** for the preference shock:
 - The moving probability is given by:

$$\mu_t^{l,t}(a_{t+1}^k, \epsilon_t, q, \bar{h}_{t+1}^k, d_t) = \frac{\exp(\beta \mathbb{E}_t V_{t+1}^k(a_{t+1}^k, \epsilon_{t+1}, q+1, \bar{h}_{t+1}^k) - \beta \tau^{l,k})^{\frac{1}{\nu}}}{\sum_{k=1}^L \exp(\beta \mathbb{E}_t V_{t+1}^k(a_{t+1}^k, \epsilon_{t+1}, q+1, \bar{h}_{t+1}^k) - \beta \tau^{l,k})^{\frac{1}{\nu}}}$$

$$V_{t+1}^k(a_{t+1}^k, \epsilon_{t+1}, q+1, \bar{h}_{t+1}^k) = \max \left[V^H, k_{t+1}(a_{t+1}^k, \epsilon_{t+1}, q+1, \bar{h}_{t+1}^k), V^R, k_{t+1}(a_{t+1}^k, \epsilon_{t+1}, q+1, \bar{h}_{t+1}^k) \right]$$

Production & Equilibrium

- **Production of Final Good**

- Competitive final good Y produced with labor

$$w^l = \eta z^l (N_c^l)^{\eta-1} (\bar{N}^l)^{\zeta}$$

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$$w^l = \eta z^l \left(N_c^l\right)^{\eta-1} \left(\bar{N}^l\right)^{\zeta}$$

- **Housing Sector** (Kaplan, Mitman and Violante, 2017)

- Risk neutral foreign investors can arbitrage between the owned-housing market and the rental market

$$p_{r,t}^l = p_t^l - (1 - \delta - s) \frac{p_{t+1}^l}{1 + r}$$

- Foreign-owned competitive construction sector operates a city specific production technology

$$H_t^l = (1 - \delta)H_{t-1}^l + I_t^l, \quad I_t^l = \left(\frac{1}{1 + \kappa^l} p_t^l\right)^{1/\kappa^l} \bar{L}^l$$

- where \bar{L}^l are city-government issued land permits for construction

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- **Production of Final Good**

- Competitive final good Y produced with labor

$$w^l = \eta z^l (N_c^l)^{\eta-1} (\bar{N}^l)^{\zeta}$$

- **Housing Sector** (Kaplan, Mitman and Violante, 2017)

- Risk neutral foreign investors can arbitrage between the owned-housing market and the rental market

$$p_{r,t}^l = p_t^l - (1 - \delta - s) \frac{p_{t+1}^l}{1 + r}$$

- Foreign-owned competitive construction sector operates a city specific production technology

$$H_t^l = (1 - \delta)H_{t-1}^l + I_t^l, \quad I_t^l = \left(\frac{1}{1 + \kappa^l} p_t^l \right)^{1/\kappa^l} \bar{L}^l$$

- where \bar{L}^l are city-government issued land permits for construction

- **Equilibrium**

- **Endogenous city-specific wage and house prices** that clear local markets

General Equilibrium

The stationary equilibrium of the economy consists of: price vectors w, p, p_r ; policy functions $\tilde{c}, \tilde{b}, \tilde{h}, \tilde{a}, \tilde{I}_h, \mu$; a law of motion Γ^* , a housing stock H and a stationary distribution over individual states m such that:

1. Given w, p, p_r , the policy functions, $\tilde{c}, \tilde{b}, \tilde{h}, \tilde{a}, \tilde{I}_h, \mu$, solve the agent's problems;
2. Labor markets clear according to $N_y^l + N_k^l = (1 - \pi_u^l)\bar{N}^l$, where π_u^l denotes the unemployment rate in location l ;
3. Housing markets clear¹
4. The law of motion of individual states Γ^* is consistent with policy functions $\mu, \tilde{a}, \tilde{I}_h, \tilde{h}$ and exogenous processes for q and ϵ ;
5. The distribution over individual states m is invariant with respect to Γ^* , i.e.,

$$m = \Gamma^* m.$$

Calibration Strategy

- **Space** 27 largest Canadian cities (CMAs)
- Mix of methods:
 - Parameters from the literature
 - IV estimation to get **labor elasticity** η and city-specific **productivities** ▶▶ TFP
 - Estimation of city-specific **housing supply elasticities** ▶▶ Housing Supply
 - Using approach in Guren et al. (2018)

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 - **Internal Calibration** [▶▶ Table](#)
 - Moving Parameters
 - Amenities [▶▶ Amenities](#)
 - Bequest, borrowing constraint, housing grid

Calibration

Parameter Values

Parameter	Interpretation	Internal	Value
Space			
L	Number of Locations	N	27
Demographics			
\bar{Q}	Length of Life (years)	N	60
Q	Working Life (years)	N	35
λ_q	Survival probability	N	StatCan
Preferences			
α	Housing consumption share	N	0.15
β	Discount factor	Y	0.988
σ	Risk aversion	N	2
ω	Additional utility from owning	Y	1.72
e_q	Equivalence scale	N	
$\bar{\varphi}, \underline{a}$	Bequest	N	900, 19
A	Amenities	E	Figure ??
Endowments			
Π_l	Transition Matrix	N	
χ_q	Life-cycle profile	N	SFS
Migration			
ν	Income Dependence	Y	0.4
ν	Scale of Type 1 E.V. shocks	Y	0.9
τ_0, τ_1	Utility moving costs	Y	6.27; 0.008
F_m	Monetary moving cost	Y	0.26

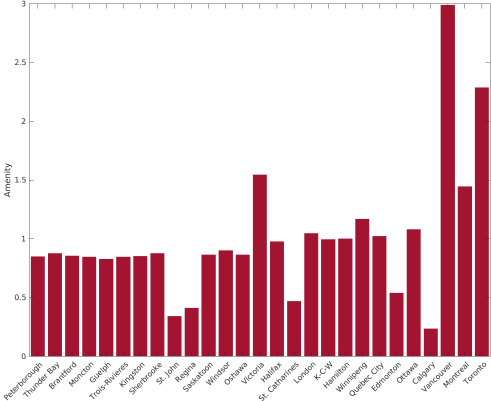
Calibration

Parameter Values

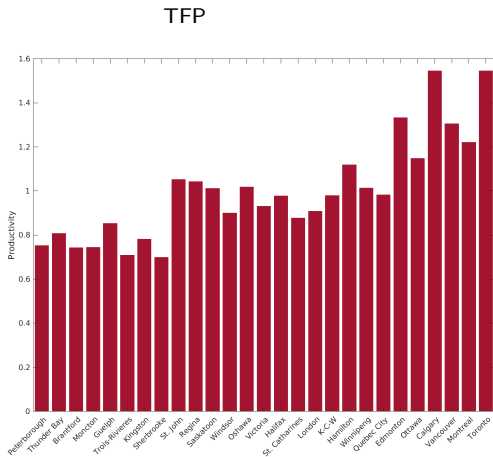
Parameter	Interpretation	Internal	Value
Technology			
η	Labor Elasticity	N	0.75
ζ	Agglomeration Elasticity	Y	0.13
z^l	Local productivity	E	
Housing			
δ	depreciation+property tax	Y	
κ^l	Local housing supply elasticities	E	Figure
F	Housing transaction Costs	N	0.07
H^R, H^H	Housing grid	Y	
\bar{L}^l	Local land permits	Y	
Financial Instruments			
r	Interest rate	N	0.015
l	Borrowing wedge	N	0.01
\underline{b}	Unsecured borrowing limit	Y	-1.2
$\bar{\zeta}$	Collateral constraint	N	0.8
τ_0, τ_1	Income tax	N	0.92, 0.87

Estimated Amenities Distribution

Amenities

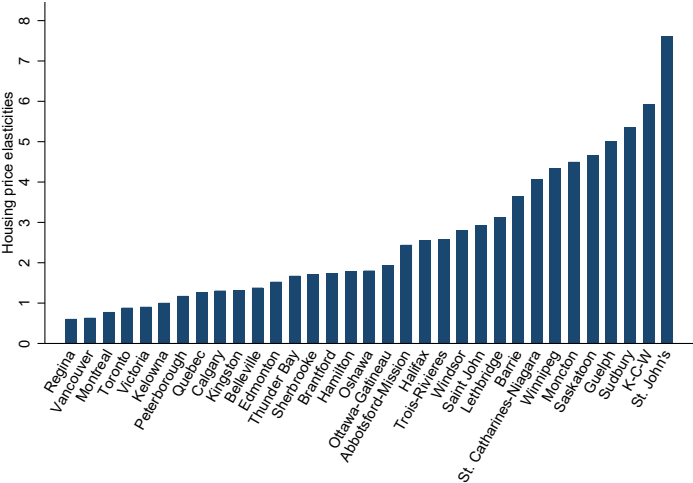


Estimated TFP Distribution



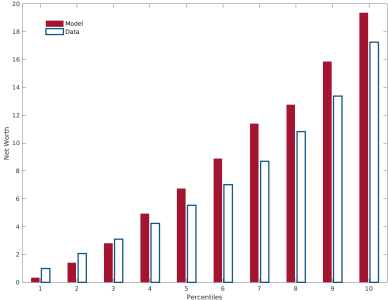
Estimated Housing Elasticities Distribution

Housing Elasticities

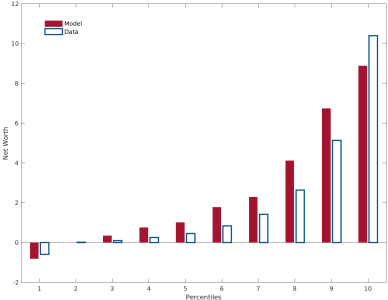


Model vs Data: Networth-to-Income Ratio Distribution

Homeowners

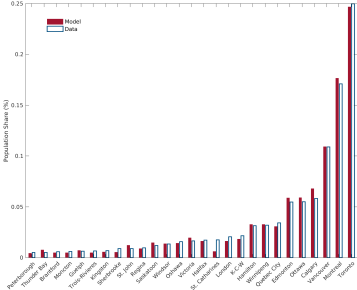


Renters

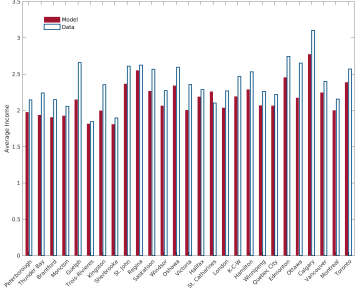


Model vs Data: Population and Income

Population



Income

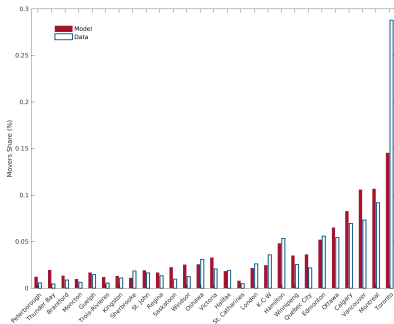


Model vs Data: Migration Destination

Share of Migrants and Cities' Characteristics

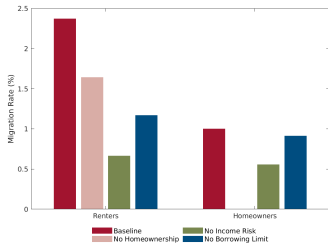
Characteristics	Correlations	
	Data	Model
Average Labor Income	0.42	0.5
Average Income	0.31	0.39
TFP	0.74	0.86
House Prices Index	0.64	0.53
Population	0.93	0.96
Amenities	0.57	0.66

In-migration rates

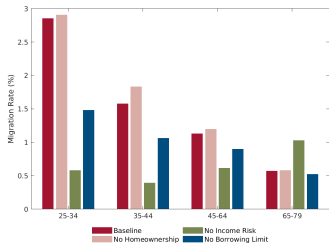


Model Decomposition

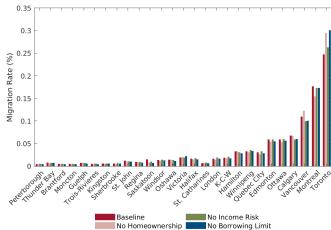
Panel A: Homeownership



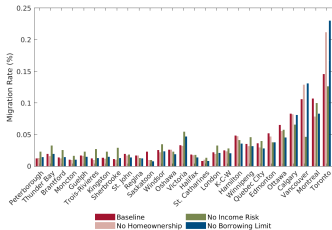
Panel B: By Age



Panel C: Population Distribution

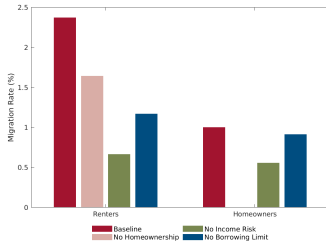


Panel D: In-migration

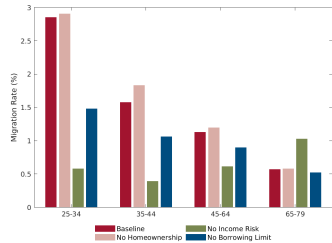


Model Decomposition - Matched Migration Moments

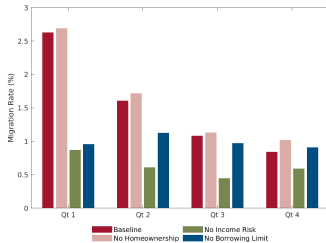
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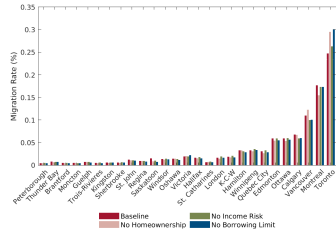
Panel B: By Age



Panel C: By Network



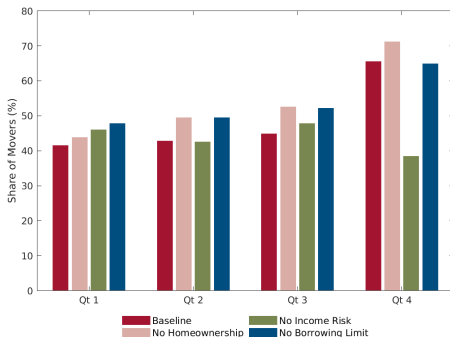
Panel D: Population Distribution



Moving for Lower Housing Costs Areas

- Housing costs are an important component of moving choices - Lower bound consumption/cost
- Low Network individuals are more likely to move to low housing costs locations

Share of Movers to higher House Prices Locations by Network

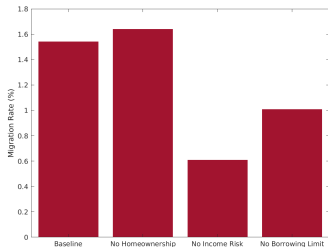


MOVING COSTS

Moving Costs

- Estimated Migration costs depend on Model specification

Migration Shares rates across models



- No Income Risk: Less incentive to move
- Model with no wealth ("financial constrained"): Higher Incentive to move

Moving Costs

- Recalibrate Moving Costs for each model specification to match average moving rate of 1.53% [▶ Migration moments](#)

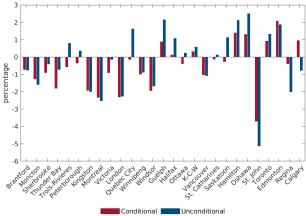
	Baseline	No House	No IncRisk	No Borrow
Moving Costs (CAD 2016)	196,303	217,513	124,187	182,796
Moving Costs - Males (CAD 2016)	234,086	259,378	148,089	217,979
Moving Costs - Males	196,460	217,686	124,286	182,942

- Revised Estimates of Moving Costs**
 - 37% lower moving costs than previously estimated**
 - Kennan and Walker (2011): 312,000 USD (2010)

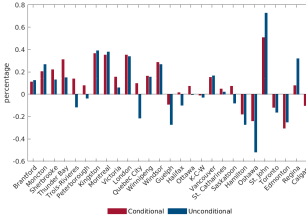
MOVING POLICIES

Moving Voucher - Long-Run Changes

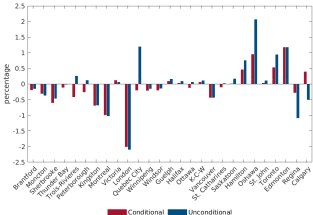
Population



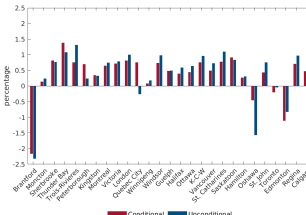
Wages



House Prices



Homeownership



Moving Voucher - Program Usage

Demographics	Policy	Eligible share	Particip. Rate	Migration Rates			Partici. Contribution
				Aggreg.	Non-elig.	Elig.	
All	Pre-Policy	7.81	3.79	1.54	1.04	7.14	91.83
	Cond	7.53	5.59	1.64	1.01	9.1	
	UnCond	7.42	10.1	1.7	0.99	10.1	

- 8% of population eligible for the subsidy
- Modest participation rate
- Higher participation rate for the unconditional policy
 - Positive correlation between city median income and housing costs
 - Conditional policy induces moving to more expensive cities
- General Eq. effects also impact moving rates of non-participants

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Moving Voucher - Program Usage by Wealth

Demographics	Policy	Eligible share	Particip. Rate	Migration Rates			Partici. Contribution
				Aggreg.	Non-elig.	Elig.	
Wealth - Qt1	Pre-Policy	7.7	0.12	3.42	1.79	12.63	2.47
	Cond	6.89	0.2	3.82	1.67	16.17	
	UnCond	6.97	0.47	4.03	1.66	17.69	
Wealth - Qt2	Pre-Policy	16.84	6.45	1.22	0.88	9.8	113.99
	Cond	18.12	9.6	1.26	0.88	12.57	
	UnCond	17.69	17.22	1.3	0.87	14.2	
Wealth - Qt4	Pre-Policy	2.43	0.04	0.8	0.79	0.83	35.78
	Cond	2.31	0.04	0.78	0.78	0.86	
	UnCond	2.27	0.82	0.78	0.76	0.98	

- **Quartile 2: highest eligibility and participation**
- **Quartile 1 - high income but high debt. Highest moving rates**
 - Small participation in the program but moving rates increase
 - General Eq. effects make eligible in this group to move more, but not to higher income/higher housing costs areas

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Moving Voucher - Welfare Change (%)

Demographics	Policy	Short-Run			Long-Run
		All	Eligible	Non-eligible	All
All	Conditional	0.03	0.38	-0.01	0.28
	Unconditional	0.05	0.71	-0.02	0.34

- Higher Aggregate Welfare Gains in the Long-Run than in the short-run
- Unconditional Policy delivers higher gains
- Change in House Prices and Wages impact even those than do not participate
 - In the short-run, high income Renters are the main losers while low income renters the main winners

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Homeowners	Conditional	0.03	0.22	0.02	0.17
	Unconditional	0.03	0.44	0.02	0.2
Renters	Conditional	0.03	0.41	-0.06	0.71
	Unconditional	0.08	0.75	-0.08	0.79

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Networth -Qt1	Conditional	0.11	0.58	0	0.45
	Unconditional	0.19	0.85	0.02	0.65
Networth -Qt2	Conditional	-0.06	0.46	-0.08	0.05
	Unconditional	-0.08	0.84	-0.14	0.09
Networth -Qt4	Conditional	0.09	0.17	0.09	-0.08
	Unconditional	0.12	0.51	0.11	-0.11

- **Long-Run:** Higher Aggregate Welfare Gains for low wealth households
 - All gain except those on top of the distribution
- Short-run
 - Quartile 2: Eligible benefit from the policy but Non-eligible loose
 - Quartile 2: Overall negative impact in the SR

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