City of Dreams

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Motivation

- Higher nominal earnings in big cities
  - static premium attained while working there
  - dynamic premium due to more valuable experience
- Larger big-city benefits for high ability workers
- Urban costs are higher in big cities for everyone
- Yet, little sorting on ability between big and small cities (within education or occupation categories)

▸ Earnings

Urban sorting and flawed self-assessment

- Why do we observe little sorting on ability despite big-city benefits for more able workers?
- New explanation: flawed self-assessment of ability
  - when young, individuals may have an imperfect assessment of ability
  - they choose a small/big city based on this (imperfect) assessment or self-confidence
  - later in life, they learn their ability and may relocate accordingly
  - but early decisions may have a lasting impact and reduce their incentives to move

Flawed self-assessment

- Psychology literature: people's assessment of their own abilities often has little resemblance to their actual ability
  - Correlation between people's views of their intelligence and performance on intelligence tests is between 0.2 and 0.3 (Hansford and Hattie, 1982)
  - In the workplace, the correlation between how people expect to perform and how they actually perform complex tasks is 0.2 (Stajkovic and Luthans, 1998)
- Complementary explanations for flawed self-assessment (Dunning, Heath, and Suls, 2004)
  - Assessing ability is inherently complex, often requiring the same skills one is trying to assess
  - Comparative assessments are very self-centered
  - Valuable information is often negleced

Dynamic model of urban sorting

- Two periods, two city sizes, workers with heterogeneous ability and self-confidence
  - self-confidence defined as (imperfect) assessment of own ability
- Trade-off: big cities provide more valuable experience when young and more opportunities when old, but involve higher urban costs
- For young workers, self-confidence helps explain location decision
- For older workers, ability plays a stronger role in location decision
- Initial location choice may have a lasting impact
- Yet, some relocations across cities take place by corrections to flawed self-assessment or by luck
- Model predictions tested using panel data from NLSY 79, with measures of ability and self-confidence

Preview of results

- Location of young workers is driven by self-confidence
  - one S.D. in self-confidence percentile ↑ probability by 13%
- Location of older workers is instead driven by ability
  - one S.D. in cognitive ability percentile ↑ probability by 20% (from S to B)
- Lasting impact of choices when young limit relocations
  - some overconfident young workers start in a big city and remain there
  - some underconfident young workers spend all their life in a small city
- Workers who seriously underestimate their own ability relocate from a small to a big city when senior
- Relocations from big to small cities appear to be driven by lack of success in the big city, instead of corrections to flawed self-assessment

Related literature

- Glaeser (1999): learning model, big city increases productivity of young workers, no benefits for older workers, homogeneous agents
- Behrens, Duranton, and Robert-Nicoud (2014): sorting, agglomeration and selection; irreversible location choice, perfect sorting by heterogeneous ability, luck opens up productivity distribution
- Eeckhout, Pinheiro, and Schmidheiny (2014): static sorting based on complementarities between workers with different skills
- Davis and Dingel (2012): perfect sorting of high ability workers driven by supermodularity in own ability and learning opportunities
- Bacolod, Blum, and Strange (2009): empirical analysis of sorting by a variety of skills

Overview

1. Model
2. Equilibrium location choices
3. Data
4. Empirical evidence
5. Conclusions

Setup of the model

- Workers live 2 periods (junior, senior)
- In each period, each worker chooses a location: big (B) or small (S) city
- Workers have heterogeneous ability
  - junior workers engage in a simple task
  - ability (α) is the actual probability of successfully completing this task
- Junior workers may have an inaccurate assessment of their ability
  - self-confidence (σ) is a junior worker's assessment of her own ability (i.e. her belief about α)
  - while completing their simple task workers learn about their true ability
    (senior workers know their α)

Model: junior workers

- Junior workers get a
  - low return (normalized to 0) if they fail at their simple task
  - high return $\pi_1 > 0$ if they succeed
- Successful workers also gain experience that will be valuable when senior
- Experience is more valuable when accumulated in big cities
  - experience acquired is 0 if unsuccessful when junior
  - e_S if successful in a small city
  - e_B if successful in a big city, where $0 < e_S < e_B < 1$

Model: senior workers

- Senior workers, at the very least, engage in a simple task
  - if they succeeded when junior, they succeed for sure
  - if they failed when junior, they try again and succeed with probability α
- Some senior workers are presented with an opportunity to engage in a more complex task
  - they must be faced with a relevant opportunity
  - they must have completed a simple task as a junior worker
  - if successful, they get an extra return π_2 on top of π_1
- Big cities offer senior workers greater opportunities to exploit their previously acquired experience
  - they arise with probability Ω_S in small cities
  - and with probability Ω_B in big cities, where $0 < \Omega_S < \Omega_B < 1$
- Senior worker's probability of success is $\alpha e > 0$

Model: city size trade-off

- Advantage for junior workers of locating in a big city
  - accumulate more valuable experience if successful ($e_B > e_S$)
- Advantage for senior workers of locating in a big city
  - more opportunities to use previously-acquired experience ($\Omega_B > \Omega_S$)
- Disadvantage for all workers of locating in a big city
  - higher urban costs ($\gamma_B > \gamma_S$)

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Ability and self-confidence

- Two scenarios:
  - self-confidence while junior accurately reflects ability ($\sigma = \alpha$)
  - self-confidence while junior may not reflect ability ($\sigma \neq \alpha$)

Senior period location of unsuccessful junior workers

- A worker who fails to complete a simple task when junior always locates in S when senior:
  - No advantage from greater opportunities in big cities ($\Omega_B > \Omega_S$)
  - No advantage from greater experience in big cities ($e_B > e_S$)
  - Disadvantage from higher urban costs in big cities ($\gamma_B > \gamma_S$)
- Successfully completing simple task depends on
  - ability and luck
  - so, some high ability workers also fail (but with lower probability)

Utility

- Expected utility of locating in city i when junior and (conditional on earlier success) locating in city j when senior is:

$$U_{ij}(\alpha) = -\gamma_i + (1-\alpha)(-\gamma_S + \alpha\pi_1) + \alpha(2\pi_1 - \gamma_j + \Omega_j \alpha e_i \pi_2),$$

$$i, j \in \{B, S\}$$

Senior period location of successful junior workers

- If a worker locates in B when junior, then she prefers to also locate in B when senior (conditional on earlier success) iff

$$U_{BB}(\alpha) - U_{BS}(\alpha) = \alpha\left[\alpha(\Omega_B - \Omega_S)e_B\,\pi_2 - (\gamma_B - \gamma_S)\right] > 0$$

or, iff

$$\alpha > \alpha_{BB\succ BS} \equiv \frac{\Delta\gamma}{e_B\,\pi_2\,\Delta\Omega}$$

where

$$\Delta\gamma \equiv \gamma_B - \gamma_S\,, \qquad \Delta\Omega \equiv \Omega_B - \Omega_S$$

- Successful junior workers sort by ability when senior
  - those with high α ($> \alpha_{B,B\succ B,S}$) stay in B
  - those with low α relocate to S
- This ability threshold is lower (more senior workers locate in B) when
  - $\downarrow \Delta\gamma, \uparrow \Delta\Omega, \uparrow e_B, \uparrow \pi_2$

Senior period location of successful junior workers

- If a worker locates in S when junior, then she prefers to relocate to B when senior (conditional on earlier success) iff

$$U_{SB}(\alpha) - U_{SS}(\alpha) = \alpha\left[\alpha(\Omega_B - \Omega_S)e_S\,\pi_2 - (\gamma_B - \gamma_S)\right] > 0$$

  or, iff

$$\alpha > \alpha_{SB \succ SS} \equiv \frac{\Delta\gamma}{e_S\,\pi_2\,\Delta\Omega}$$

- Note

$$\alpha_{BB \succ BS} \equiv \frac{\Delta\gamma}{e_B\,\pi_2\,\Delta\Omega} < \frac{\Delta\gamma}{e_S\,\pi_2\,\Delta\Omega} \equiv \alpha_{SB \succ SS}$$

  (Junior workers who locate in B acquire more valuable experience, so they require a lower ability threshold to locate in B when senior)

Senior period location

- Senior period location depends on the value of ability relative to two thresholds, $\alpha_{BB \succ BS}$ and $\alpha_{SB \succ SS}$, where $\alpha_{BB \succ BS} < \alpha_{SB \succ SS}$
  - A worker with $\alpha \leqslant \alpha_{BB \succ BS}$ locates in S when senior
  - A worker with $\alpha_{BB \succ BS} < \alpha \leqslant \alpha_{SB \succ SS}$ locates in B when senior iff she locates in B when junior and succeeds at the simple task
  - A worker with $\alpha_{SB \succ SS} < \alpha$ locates in B when senior (if successful)
  - A worker who fails at the simple task when junior, locates in S when senior

Junior period location (when $\sigma = \alpha$)

- When choosing junior period location, workers anticipate their senior period location choice
- Senior-period location depends on the value of ability relative to two thresholds, $\alpha_{BB \succ BS}$ and $\alpha_{SB \succ SS}$, where $\alpha_{BB \succ BS} < \alpha_{SB \succ SS}$
- Thus, three ranges of ability matter to study junior period location
  - $\alpha \leqslant \alpha_{BB \succ BS}$
  - $\alpha_{BB \succ BS} < \alpha \leqslant \alpha_{SB \succ SS}$
  - $\alpha_{SB \succ SS} < \alpha$

▸ $\alpha \leqslant \alpha_{BB \succ BS}$ ▸ $\alpha_{BB \succ BS} < \alpha \leqslant \alpha_{SB \succ SS}$ ▸ $\alpha_{SB \succ SS} < \alpha$ ▸ Lemma

Equilibrium location (when $\sigma = \alpha$)

Proposition 1. When workers' self-confidence while junior accurately reflects their ability, location and relocation patterns fall in one of three cases:

Case 1. If $\frac{\Delta e}{\Delta \Omega^2} < \frac{\pi_2 \, {e_S}^2}{\Omega_B \, \Delta \gamma}$, workers with

- $\alpha \leqslant \alpha_{SB \succ SS}$ locate in S in both periods,
- $\alpha_{SB \succ SS} < \alpha \leqslant \alpha_{BB \succ SB}$ locate in S when junior and, iff successful, relocate to B at senior
- $\alpha_{BB \succ SB} < \alpha$ locate in B in both periods unless they fail when junior, in which case they relocate to S when senior

Case 2. If $\frac{\pi_2 \, {e_S}^2}{\Omega_B \, \Delta \gamma} \leqslant \frac{\Delta e}{\Delta \Omega^2} \leqslant \frac{\pi_2 \, {e_B}^2}{\Omega_S \, \Delta \gamma}$, workers with

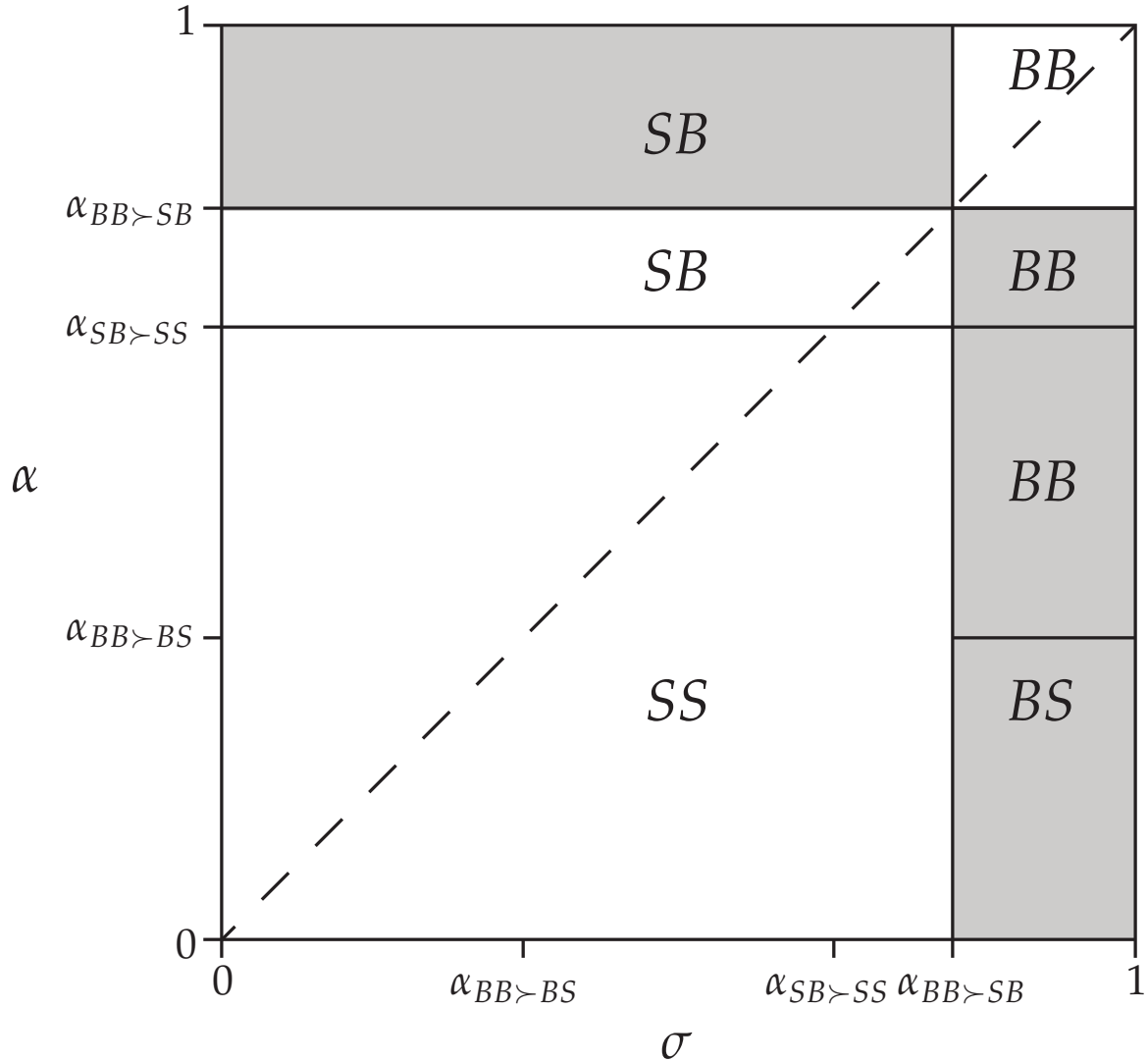
- $\alpha \leqslant \max(\alpha_{BB \succ BS}, \min(\alpha_{SB \succ SS}, \alpha_{BB \succ SS}))$ locate in S in both periods
- $\max(\alpha_{BB \succ BS}, \min(\alpha_{SB \succ SS}, \alpha_{BB \succ SS})) < \alpha$ locate in B in both periods unless they fail when junior, in which case they relocate to S when senior

Case 3. If $\frac{\pi_2 \, {e_B}^2}{\Omega_S \, \Delta \gamma} < \frac{\Delta e}{\Delta \Omega^2}$, workers with

- $\alpha \leqslant \alpha_{BS \succ SS}$ locate in S in both periods.
- $\alpha_{BS \succ SS} < \alpha \leqslant \alpha_{BB \succ BS}$ locate in B when junior and relocate to S when senior
- $\alpha_{BB \succ BS} < \alpha$ locate in B in both periods unless they fail when junior, in which case they relocate to S when senior

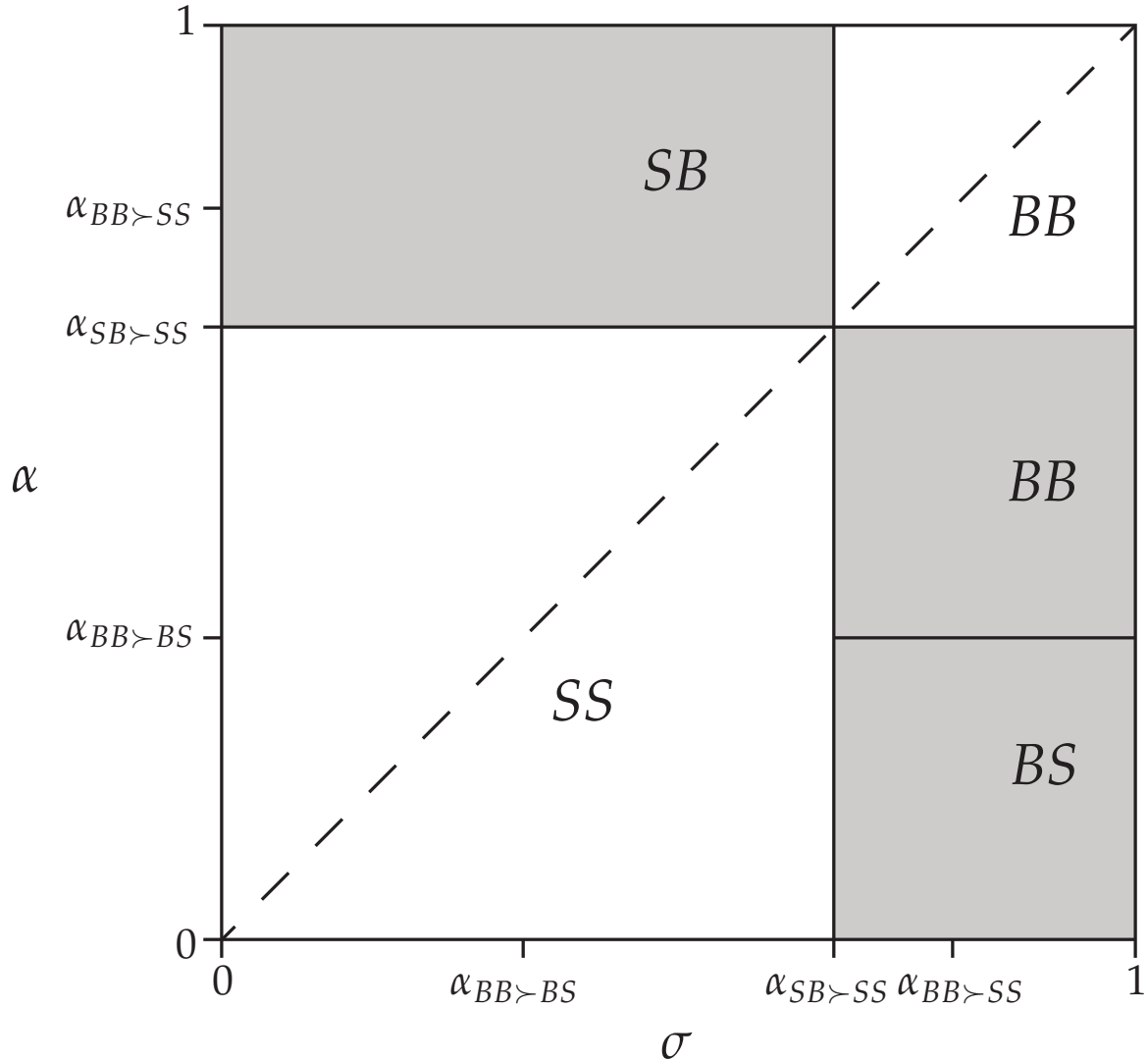
Equilibrium ($\sigma = \alpha$): $\Delta\Omega$ drive relocations

- Case 1. $\frac{\Delta e}{\Delta\Omega^2} < \frac{\pi_2 \, e_S{}^2}{\Omega_B \, \Delta\gamma}$



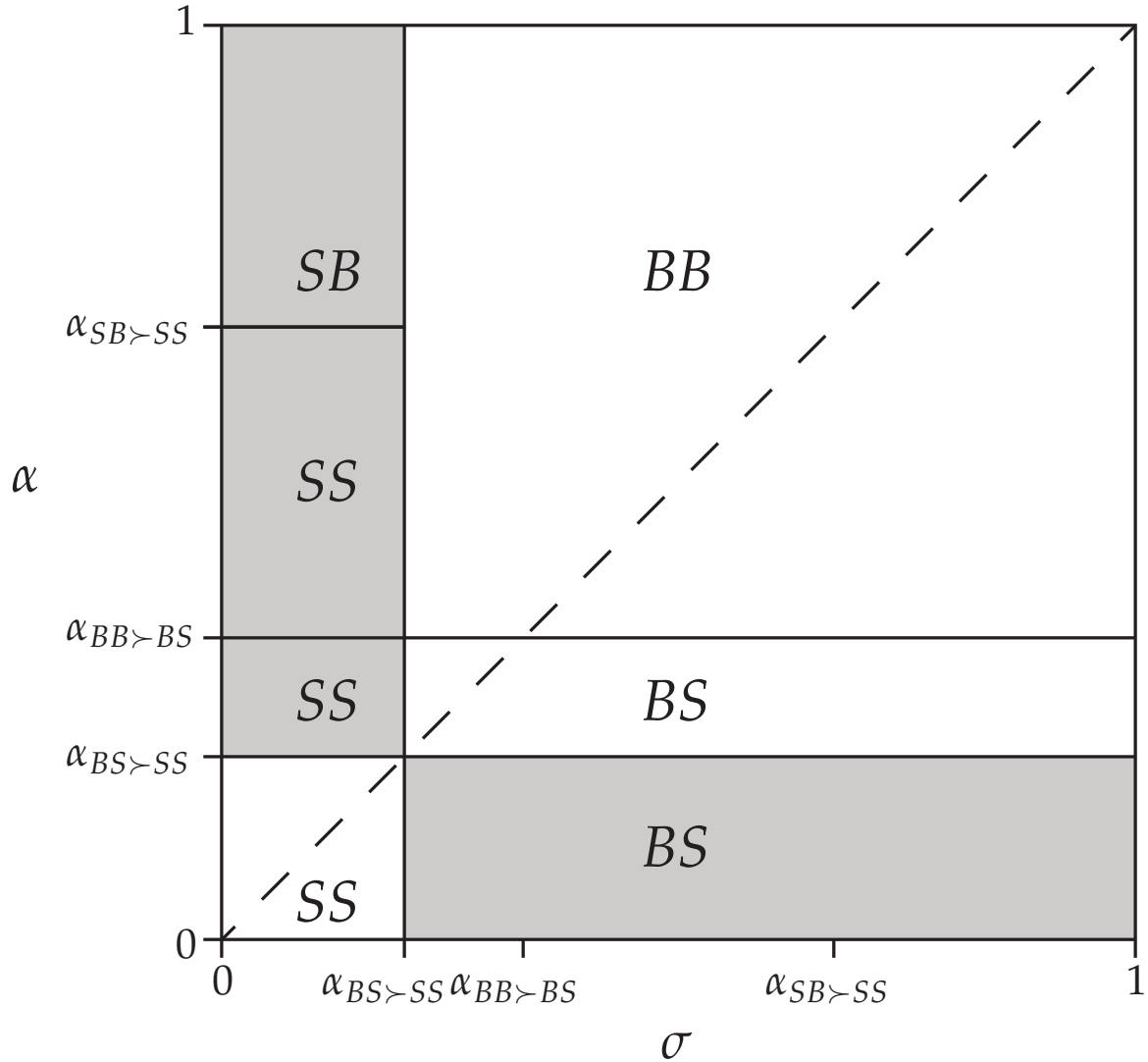
Equilibrium ($\sigma = \alpha$): Δe and $\Delta\Omega$ balance out

- Case 2. $\frac{\pi_2 \, {e_S}^2}{\Omega_B \, \Delta\gamma} \leqslant \frac{\Delta e}{\Delta\Omega^2} \leqslant \frac{\pi_2 \, {e_B}^2}{\Omega_S \, \Delta\gamma}$



Equilibrium ($\sigma = \alpha$): Δe drive relocations

- Case 3. $\frac{\pi_2 \, {e_B}^2}{\Omega_S \, \Delta\gamma} < \frac{\Delta e}{\Delta\Omega^2}$



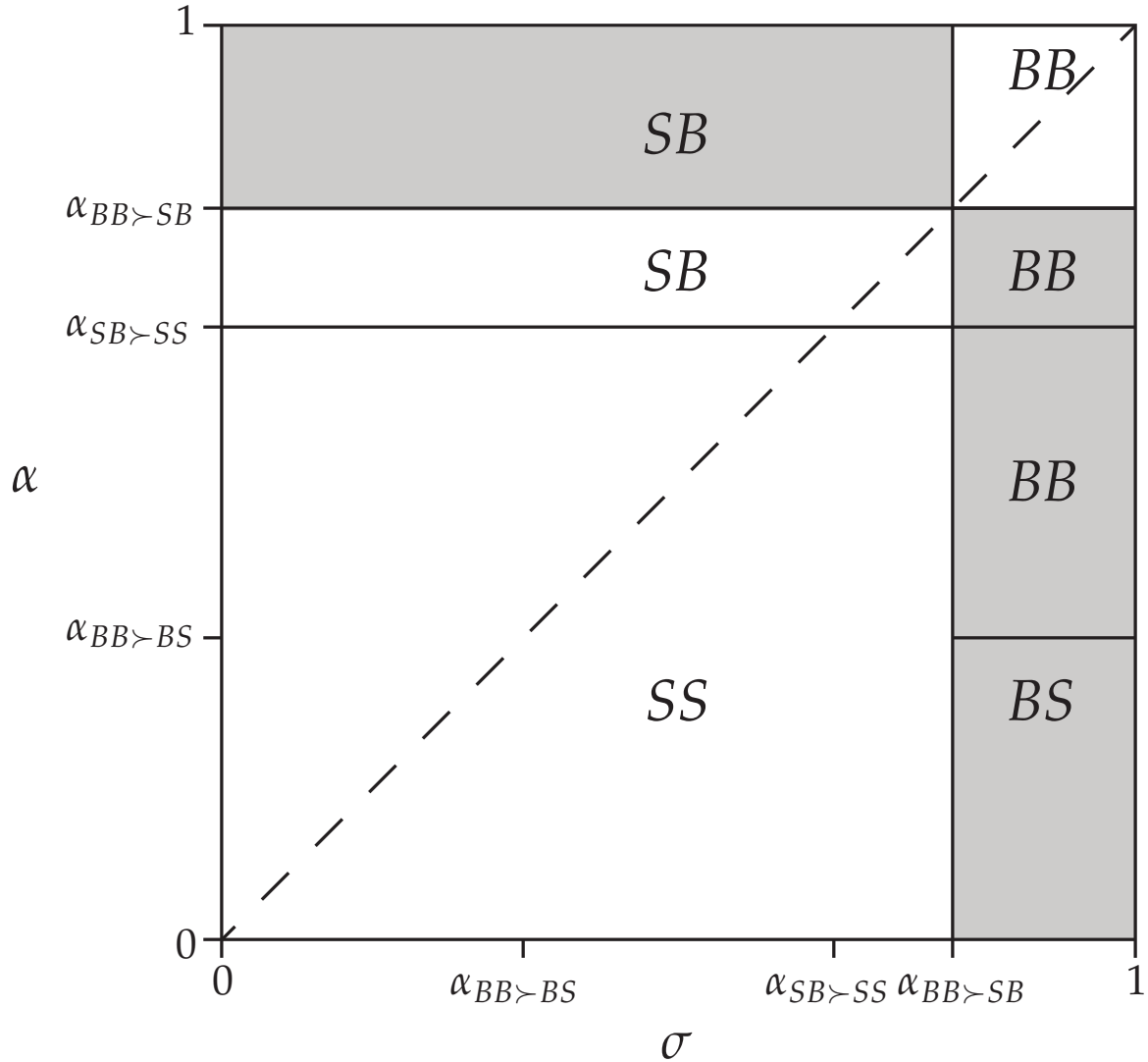
Introducing self-confidence

- Self-confidence while junior may not reflect actual ability ($\sigma \neq \alpha$)
  - only after working in a task workers learn their actual ability
- No specific assumption on the correlation between σ and α
- Junior period location decision as before, but based on σ instead of α
- Senior period location decision is affected, even if α is then known
  - junior period decision affects experience
  - experience affects the relative incentives to locate in B or S when senior
- Workers for whom $\sigma \neq \alpha$ may end up making decisions they would not have made if they had known their actual ability to start with

▸ Proposition

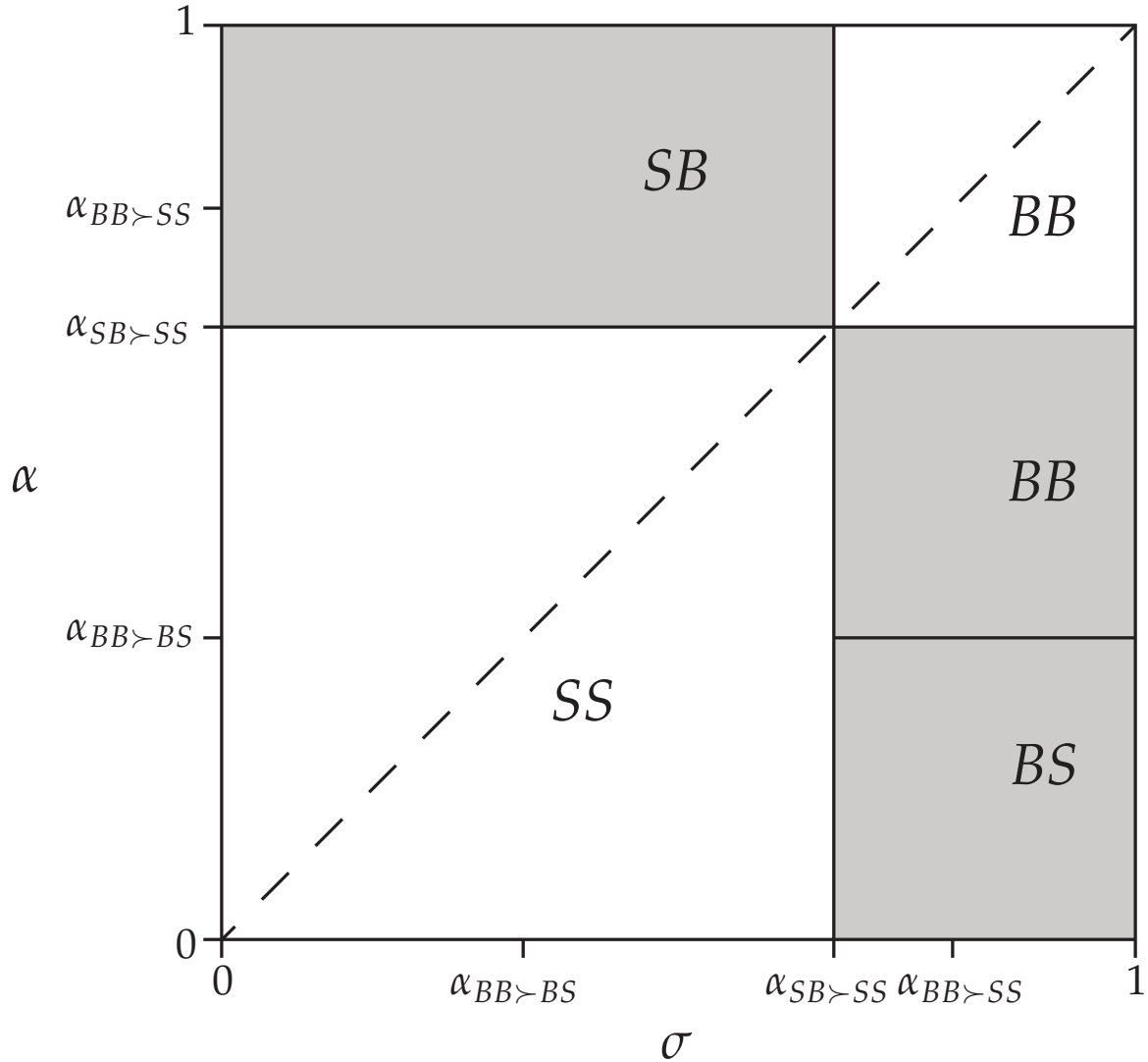
Equilibrium ($\sigma \neq \alpha$): $\Delta\Omega$ drive relocations

- Case 1. $\frac{\Delta e}{\Delta\Omega^2} < \frac{\pi_2 \, e_S{}^2}{\Omega_B \, \Delta\gamma}$



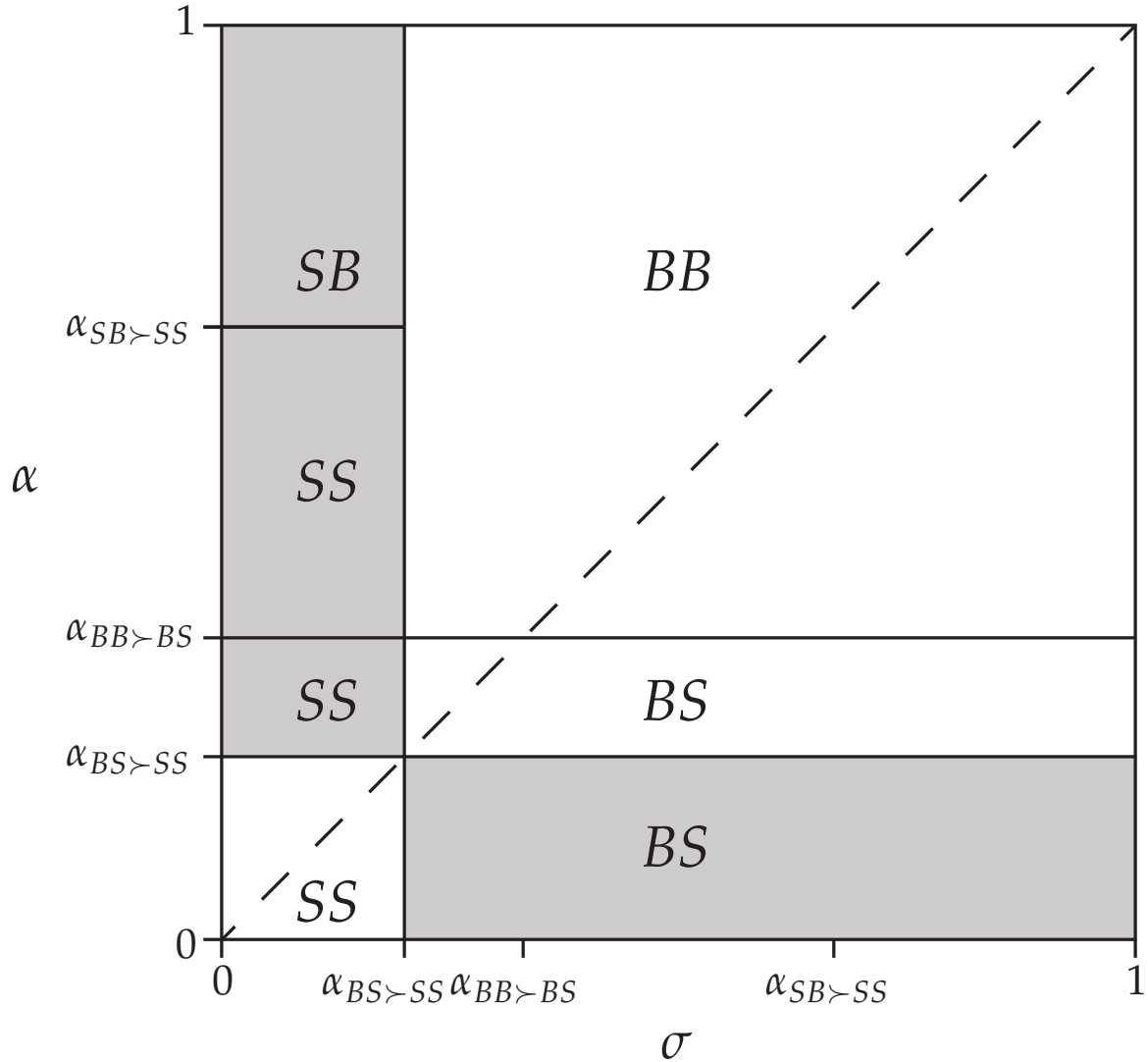
Equilibrium ($\sigma \neq \alpha$): Δe and $\Delta\Omega$ balance out

- Case 2. $\frac{\pi_2 \, e_S{}^2}{\Omega_B \, \Delta\gamma} \leqslant \frac{\Delta e}{\Delta\Omega^2} \leqslant \frac{\pi_2 \, e_B{}^2}{\Omega_S \, \Delta\gamma}$



Equilibrium ($\sigma \neq \alpha$): Δe drive relocations

- Case 3. $\frac{\pi_2 \, {e_B}^2}{\Omega_S \, \Delta\gamma} < \frac{\Delta e}{\Delta\Omega^2}$



Endogenizing city sizes

- Endogenize city sizes and Δy through simple monocentric city model

Proposition 2. *There exists a unique equilibrium allocation of population across cities. In equilibrium, both the big and small cities are populated. The difference n in population between the big and small cities decreases with the common commuting cost per unit of distance τ, and increases with the additional opportunities $\Delta\Omega$ and the additional experience Δe provided by the bigger city.*

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Data: NLSY 79

- Panel data from the "cross-sectional sample" of the National Longitudinal Survey of Youth 1979 (NLSY79)
- Representative US sample of 6,111 young men and women who were 14–21 years old on 31 December 1978

Data: ability

- Main ability measure
  - percentile score in the Armed Forces Qualification Test (AFQT)
  - cognitive ability test administered to NLSY 79 respondents in 1980 (median age 19)
- Alternative ability measure
  - price-theoretic measure of skills following Eeckhout, Pinheiro, and Schmidheiny (2014)
  - nominal wages adjusted for housing cost differences across cities

Data: self-confidence

- In the model, 'self-confidence' refers to individuals' perception of their own ability
- Psychologists often use 'general self-efficacy' to capture this aspect of self-evaluation (Judge, Erez, and Bono, 1998, p. 170)
- NLSY 79 respondents were subject in 1980 to a test using Rosenberg's (1965) self-esteem scale
- Chen, Gully, and Eden (2001, p. 67): both scales correlate highly ($r = .75$ to .91) and conclude that general self-efficacy "does not capture a construct distinct from self-esteem"
- Judge, Erez, and Bono (1998): both concepts are strongly related to individuals' assessment of their own ability to perform on the job

Data: periods and locations

- Junior period: year after the highest level of education is completed (excluding breaks over two years)
- Senior period: ten years after junior period location
- In each period, individuals are assigned to a location
  - metropolitan area or Core Based Statistical Area (CBSA)
  - big city: CBSA with population over 2 million in 2010
  - small city: CBSA with population between 55,000 and 2 million

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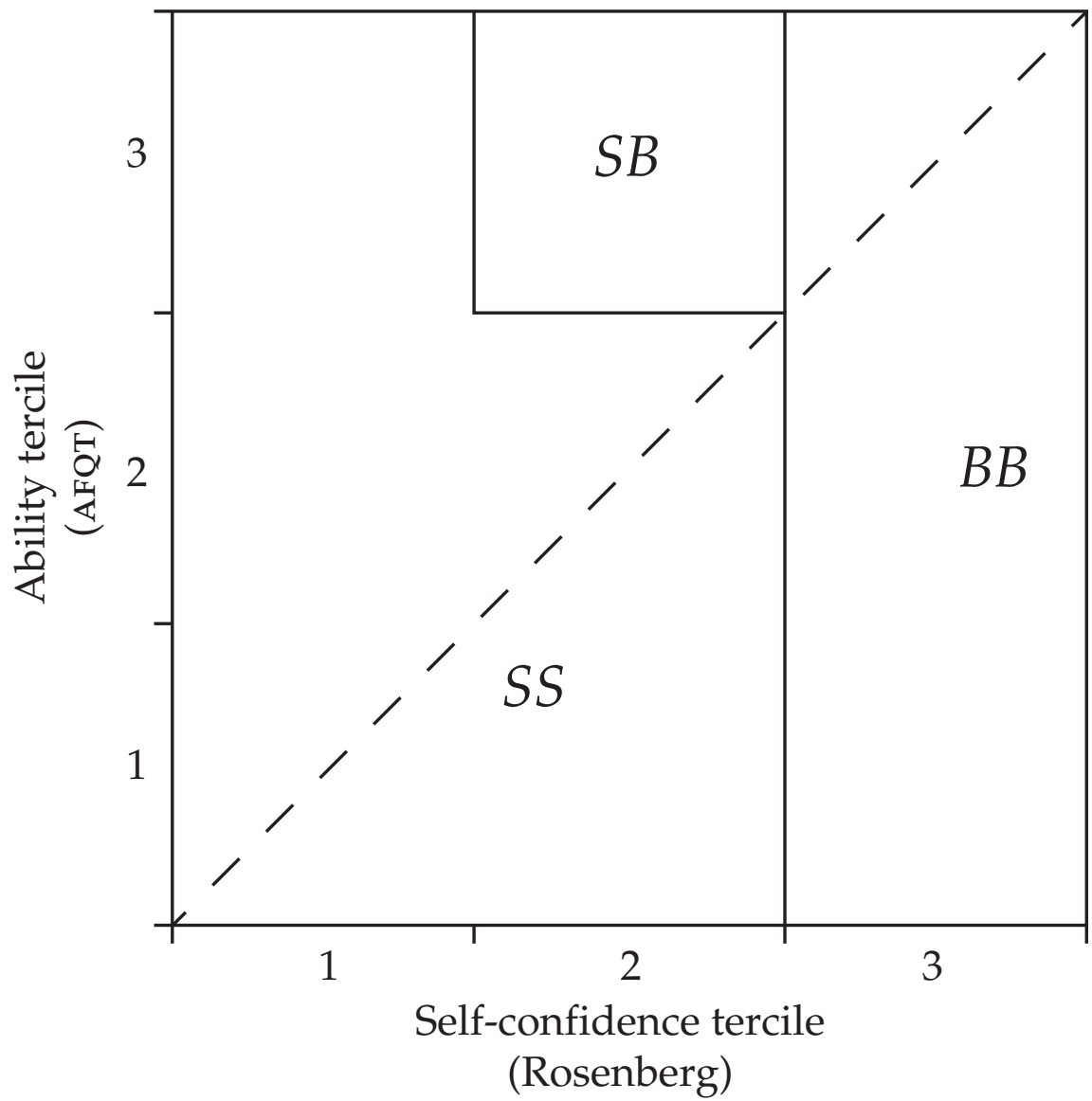
Review: predictions of the model

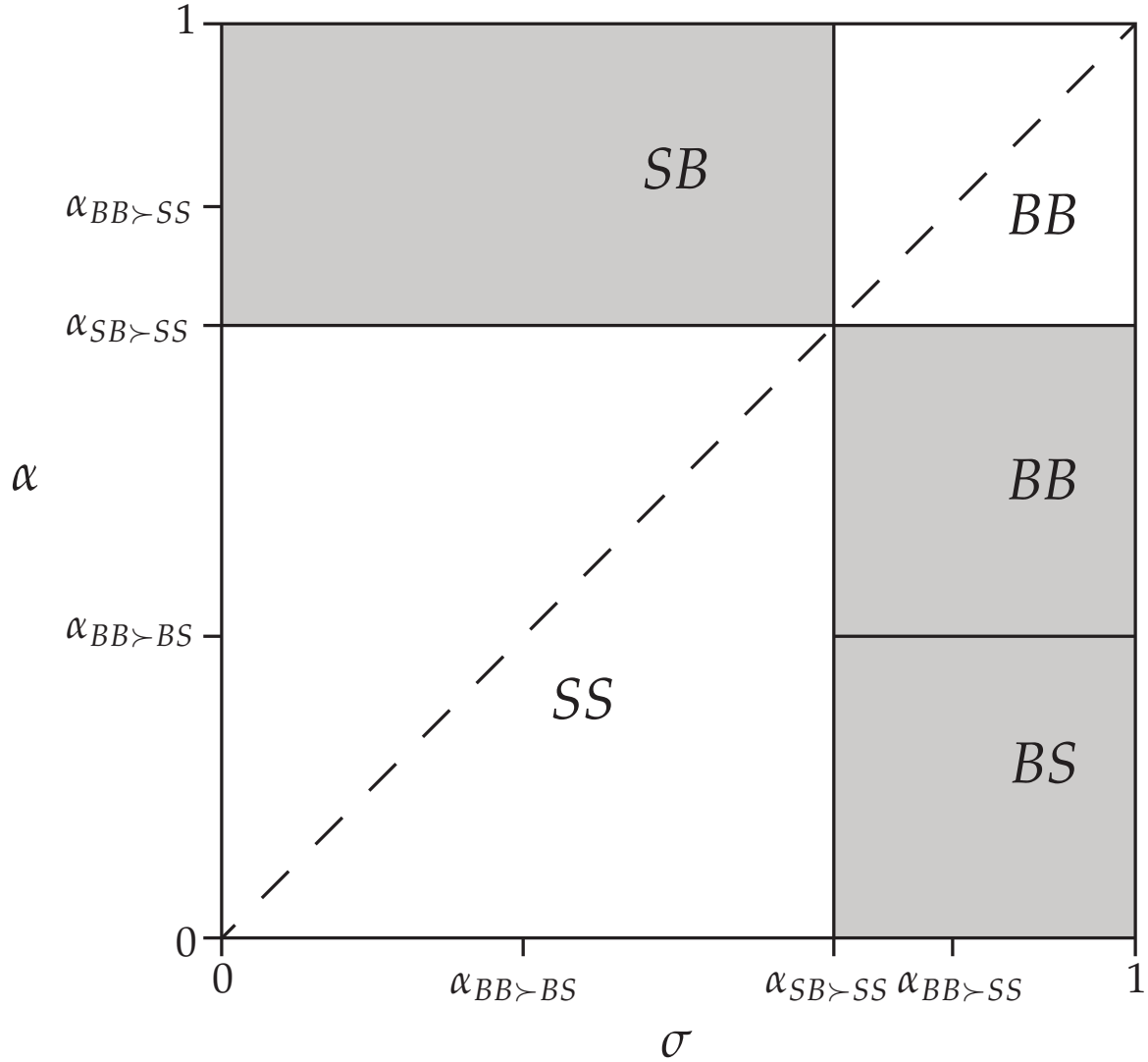
- Junior workers sort on self-confidence instead of on ability
  - more confident workers have a higher probability of locating in big cities initially
- Ability matters more for the location of senior workers
  - sorting on ability can still be quite imperfect
  - some successful high ability workers should relocate from small to big cities
  - some unsuccessful low ability workers should relocate from big to small cities

Prevalent location choices by self-confidence and ability

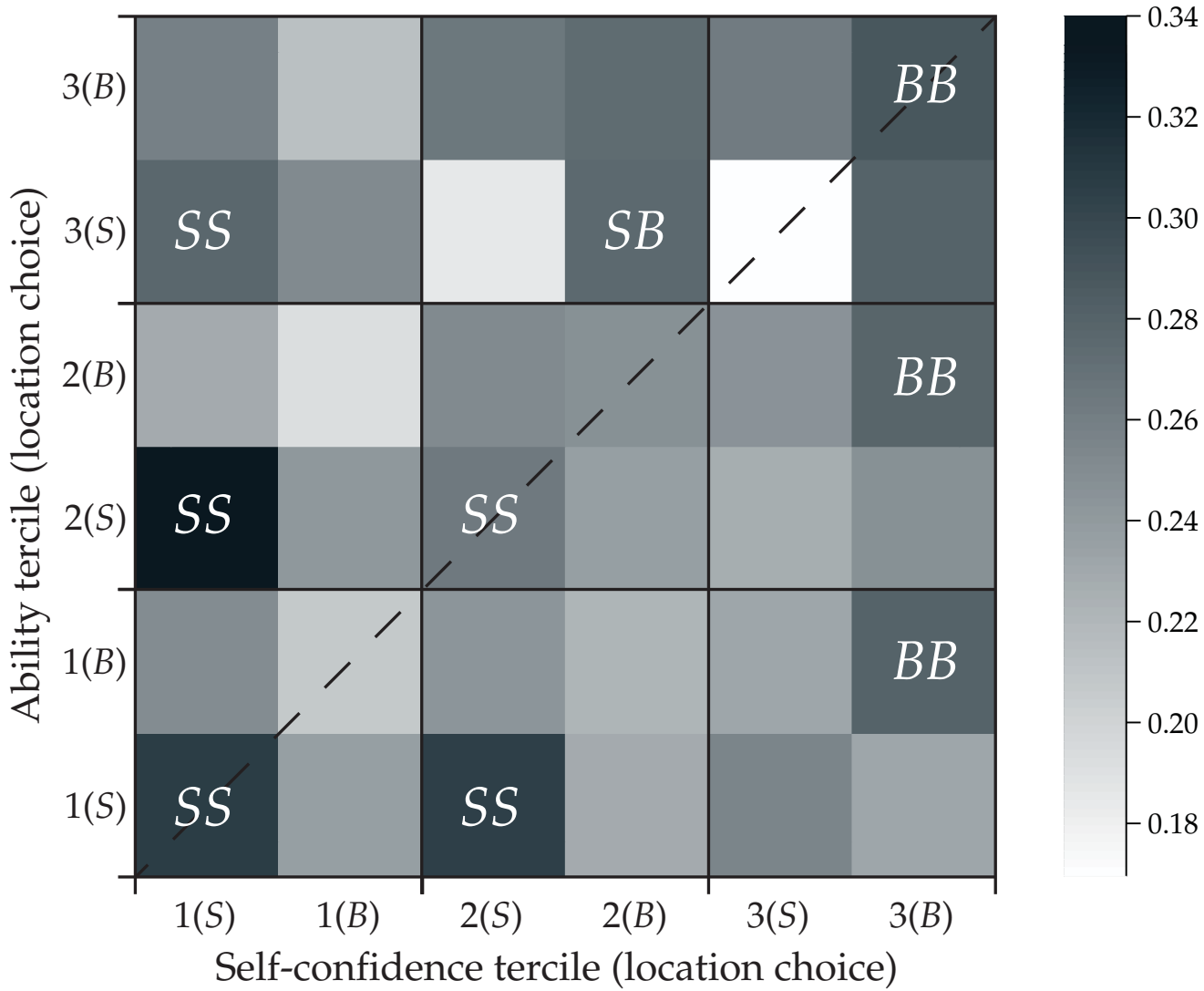


Equilibrium ($\sigma \neq \alpha$): Δe and $\Delta\Omega$ balance out

- Case 2. $\frac{\pi_2 \, e_S{}^2}{\Omega_B} \leqslant \frac{\Delta\gamma \, \Delta e}{\Delta\Omega^2} \leqslant \frac{\pi_2 \, e_B{}^2}{\Omega_S}$



Heatmap of location choice by self-confidence and ability



	Probability of living in big city upon completing education	For individuals living in small city upon completing education, probability of having moved to big city 10 years later	For individuals living in big city upon completing education, probability of having moved to small city 10 years later
	(1)	(2)	(3)
Self-confidence percentile			
Cognitive ability percentile			
Male			
Hispanic			
Black			
High-school graduate			
Some college			
College graduate			
Never married			
Number of children			
Working spouse			
Living in small city at age 14			
% working life unemployed			
Relative wage			
N			
Pseudo R^2			

	Probability of living in big city upon completing education	For individuals living in small city upon completing education, probability of having moved to big city 10 years later	For individuals living in big city upon completing education, probability of having moved to small city 10 years later
	(1)	(2)	(3)
Self-confidence percentile	1.004 (0.002)***		
Cognitive ability percentile	1.000 (0.002)		
Male	0.943 (0.081)		
Hispanic	2.007 (0.722)*		
Black	1.313 (0.340)		
High-school graduate	0.937 (0.137)		
Some college	0.988 (0.167)		
College graduate	2.233 (0.549)***		
Never married	1.983 (0.431)***		
Number of children	0.973 (0.032)		
Working spouse	1.386 (0.288)		
Living in small city at age 14	0.018 (0.004)***		
% working life unemployed			
Relative wage			
N	5,255		
Pseudo R^2	0.462		

	Probability of living in big city upon completing education	For individuals living in small city upon completing education, probability of having moved to big city 10 years later	For individuals living in big city upon completing education, probability of having moved to small city 10 years later
	(1)	(2)	(3)
Self-confidence percentile	1.004 (0.002)***	1.002 (0.002)	
Cognitive ability percentile	1.000 (0.002)	1.007 (0.003)**	
Male	0.943 (0.081)	0.943 (0.098)	
Hispanic	2.007 (0.722)*	1.582 (0.763)	
Black	1.313 (0.340)	1.162 (0.350)	
High-school graduate	0.937 (0.137)	0.932 (0.202)	
Some college	0.988 (0.167)	1.605 (0.417)*	
College graduate	2.233 (0.549)***	2.214 (0.595)***	
Never married	1.983 (0.431)***	0.972 (0.180)	
Number of children	0.973 (0.032)	0.857 (0.055)**	
Working spouse	1.386 (0.288)	0.768 (0.096)**	
Living in small city at age 14	0.018 (0.004)***	0.271 (0.066)***	
% working life unemployed		1.007 (0.010)	
Relative wage		1.180 (0.147)	
N	5,255	2,908	
Pseudo R^2	0.462	0.081	

	Probability of living in big city upon completing education	For individuals living in small city upon completing education, probability of having moved to big city 10 years later	For individuals living in big city upon completing education, probability of having moved to small city 10 years later
	(1)	(2)	(3)
Self-confidence percentile	1.004 (0.002)***	1.002 (0.002)	0.997 (0.002)
Cognitive ability percentile	1.000 (0.002)	1.007 (0.003)**	0.999 (0.003)
Male	0.943 (0.081)	0.943 (0.098)	1.061 (0.151)
Hispanic	2.007 (0.722)*	1.582 (0.763)	0.449 (0.171)**
Black	1.313 (0.340)	1.162 (0.350)	0.456 (0.150)**
High-school graduate	0.937 (0.137)	0.932 (0.202)	0.807 (0.196)
Some college	0.988 (0.167)	1.605 (0.417)*	0.849 (0.223)
College graduate	2.233 (0.549)***	2.214 (0.595)***	0.986 (0.286)
Never married	1.983 (0.431)***	0.972 (0.180)	0.698 (0.150)*
Number of children	0.973 (0.032)	0.857 (0.055)**	1.131 (0.071)**
Working spouse	1.386 (0.288)	0.768 (0.096)**	1.178 (0.209)
Living in small city at age 14	0.018 (0.004)***	0.271 (0.066)***	3.120 (0.739)***
% working life unemployed		1.007 (0.010)	1.029 (0.010)***
Relative wage		1.180 (0.147)	0.804 (0.145)
N	5,255	2,908	1,796
Pseudo R^2	0.462	0.081	0.073

Robustness

- Ability is multidimensional: aspects beyond cognitive ability matter for labor market outcomes (Almlund, Duckworth, Heckman, and Kautz, 2011)
  - re-estimate logistic regressions including the Eeckhout, Pinheiro, and Schmidheiny (2014) price-theoretic measure of skills
  - this ex-post measure may help capture other dimensions of ability but also other aspects such as luck
- Self-confidence measure may capture other relevant aspects of personality (e.g. extraversion)
  - re-estimate logistic regressions including measures of personality traits as additional controls
  - data from NLSY 79 Children and Young Adults who were subject to a Ten Item Personality Inventory (TIPI) test

	NLSY79			Children of NLSY79
	Probability of living in big city upon completing education	Probability of having moved to big city 10 years later	Probability of having moved to small city 10 years later	Probability of living in big city upon completing education
	(1)	(2)	(3)	(4)
Self-confidence percentile	1.005 (0.002)***	1.001 (0.002)	0.999 (0.002)	1.005 (0.002)**
Cognitive ability percentile	0.999 (0.002)	1.006 (0.003)**	1.001 (0.004)	
Price-theoretic skill percentile	1.003 (0.002)	1.005 (0.003)**	0.998 (0.003)	
Math ability percentile				1.001 (0.003)
Reading recognition percentile				1.002 (0.003)
Reading comprehension percentile				0.997 (0.003)
Extraversion percentile				1.000 (0.002)
Agreeableness percentile				1.002 (0.002)
Conscientiousness percentile				0.996 (0.002)**
Emotional stability percentile				0.999 (0.002)
Openness to experiences percentile				1.004 (0.002)
Living in small city at age 14	0.018 (0.004)***	0.291 (0.075)***	3.279 (0.800)***	0.009 (0.002)***
N	4,614	2,711	1,629	4,336
Pseudo R^2	0.465	0.080	0.083	0.565

Additional robustness checks

- Risk attitude may be the key factor inducing relocations
- Low wealth may deter mobility for credit-constrained workers
- Self-confidence may be correlated with other skills that are valuable in big cities (Bacolod, Blum, and Strange, 2009)

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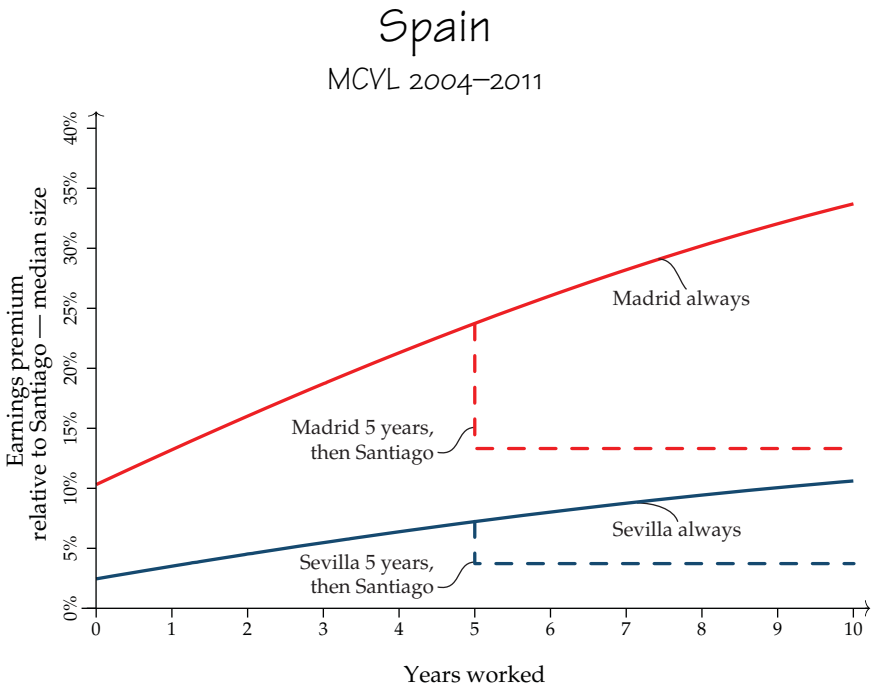
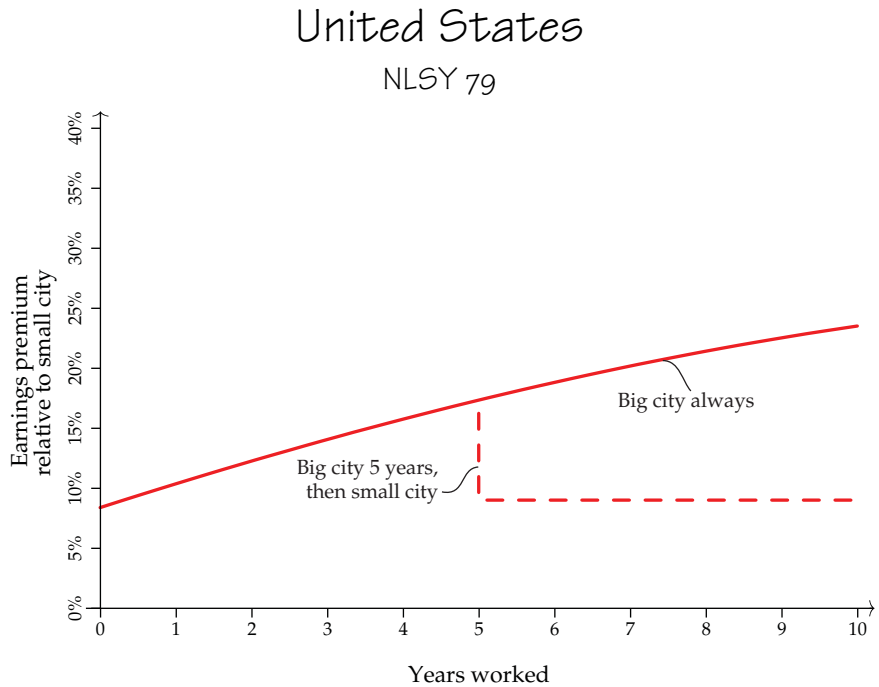
Conclusions

- Flawed self-assessment of own ability can help explain limited sorting of workers across cities of different sizes.
- In line with the model predictions
  - Location of young workers is driven by self-confidence
  - Location of older workers is instead driven by ability
  - Lasting impact of choices when young limit relocations
    - some overconfident young workers start in a big city and remain there
    - some underconfident young workers spend all their life in a small city
  - Workers who seriously underestimate their own ability relocate from a small to a big city when senior
  - Relocations from big to small cities appear to be driven by lack of success in the big city
- Confident young workers on their own ability locate in big cities to pursue their dreams, but those dreams do not come true for everyone


BIG CITY,
BIG DREAMS.

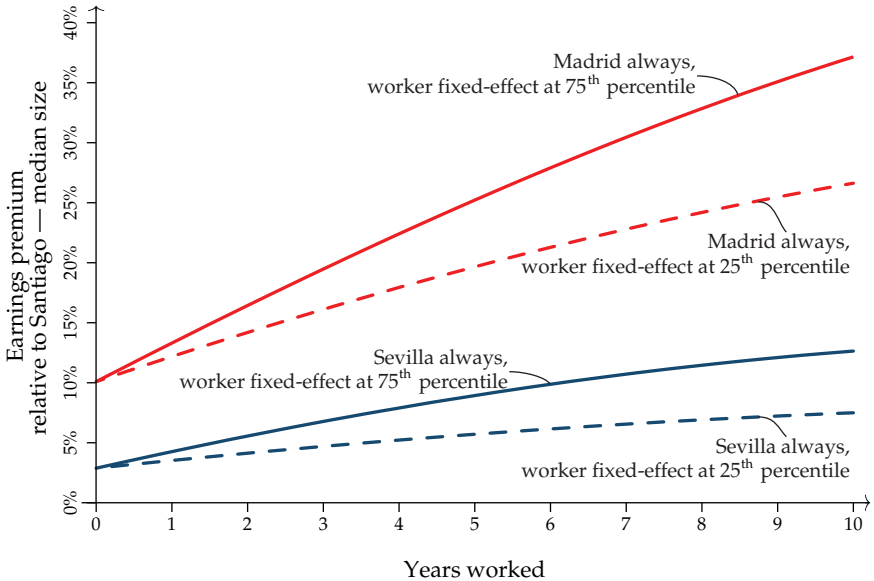




- Glaeser and Maré (2001) and De la Roca and Puga (2012)
- Similar results following De la Roca and Puga (2012) have been obtained for
  - United Kingdom (D'Costa and Overman, 2014)
  - Italy (Matano and Naticchioni, 2013)
  - France (Combes, Gobillon and Lafourcade, 2014)
  - Norway (Carlsen, Rattsø, and Stokke, 2013)

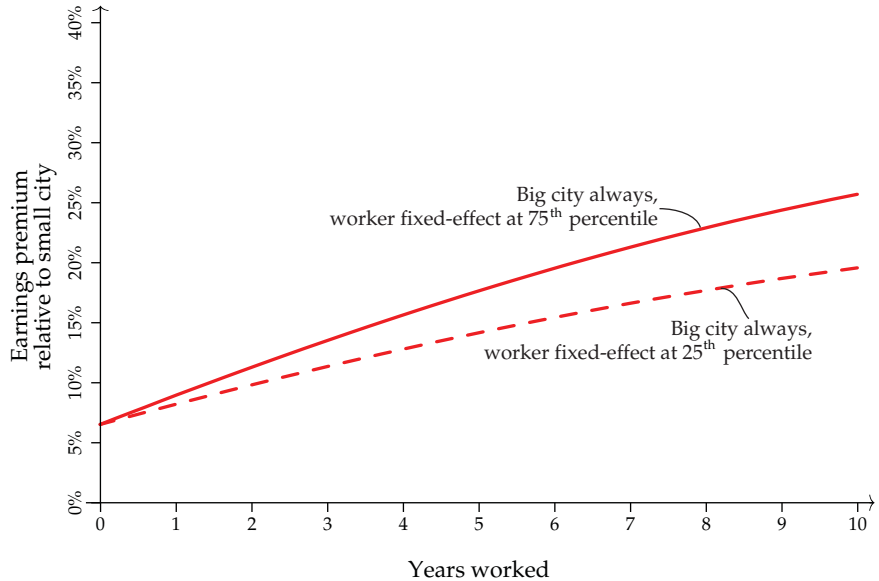
Spain

MCVL 2004–2011

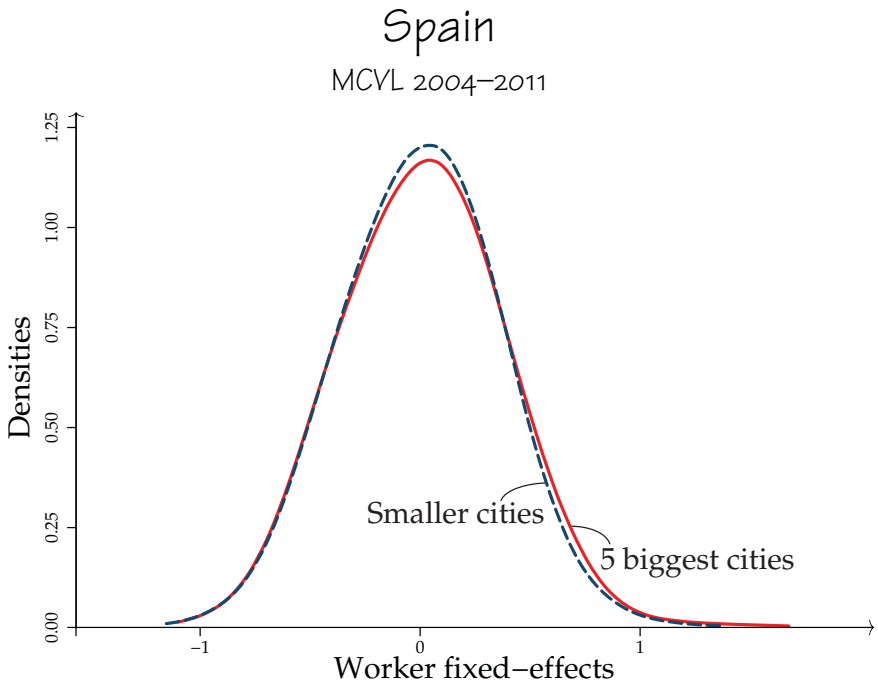


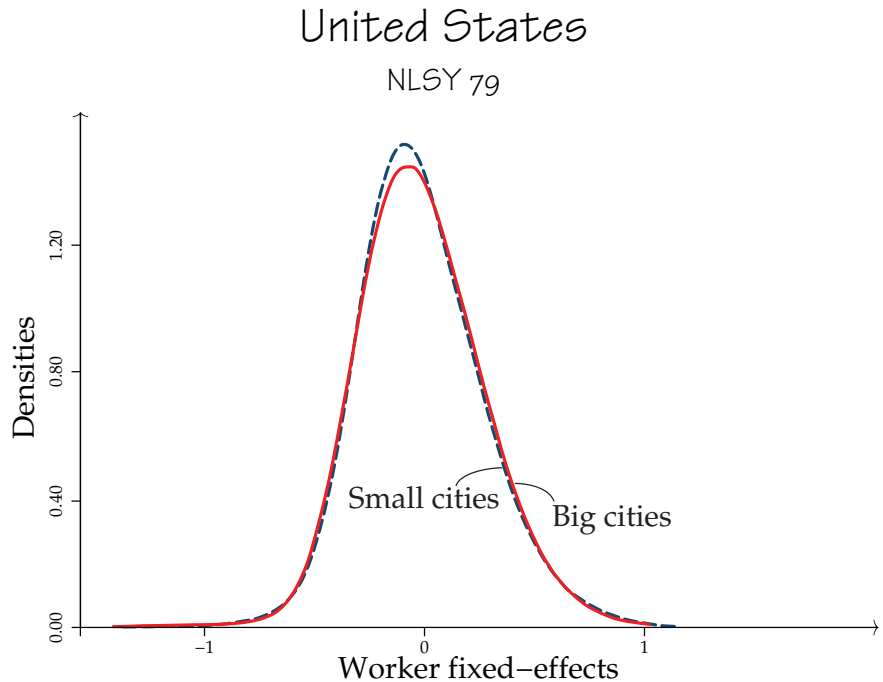
United States

NLSY 79

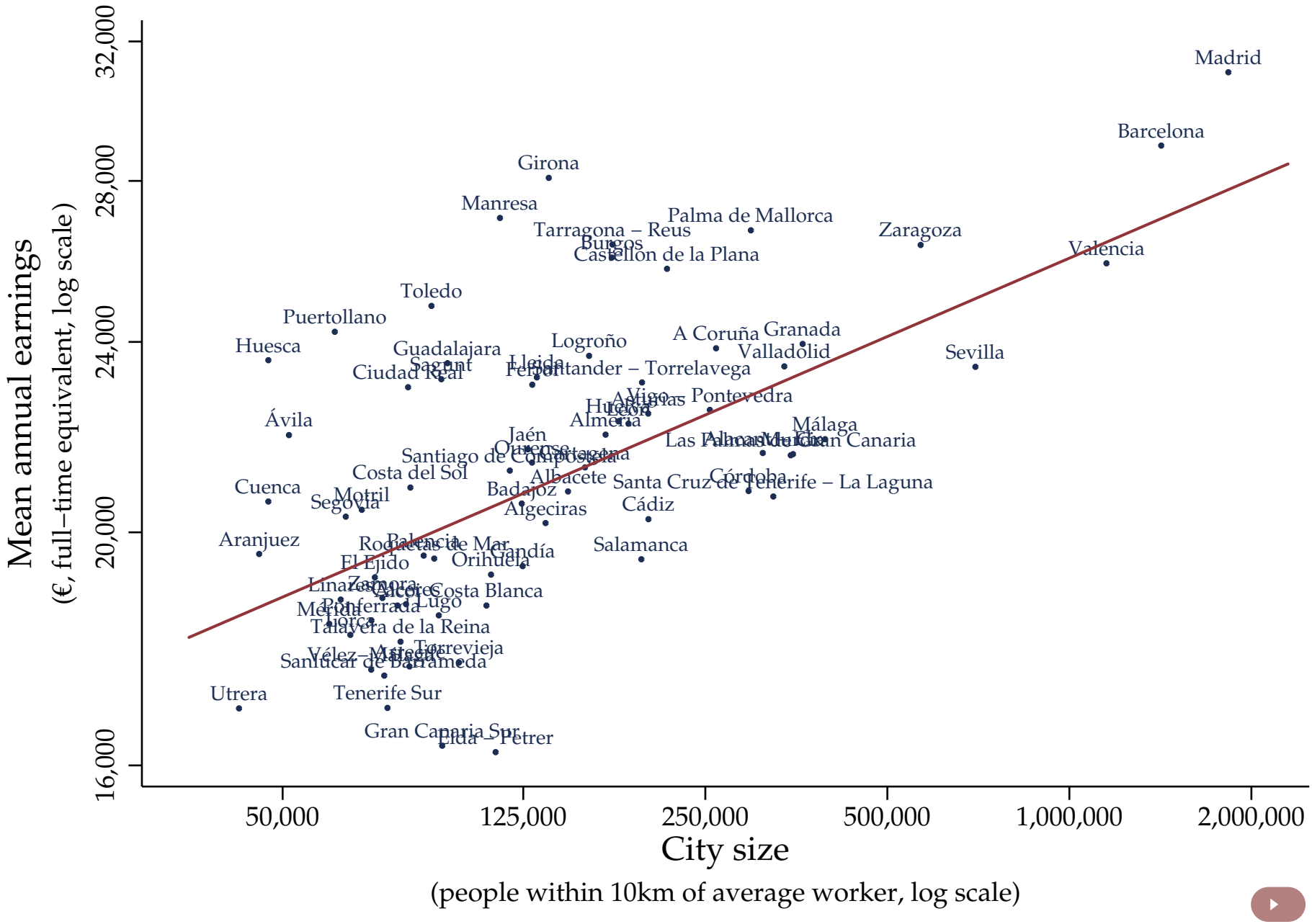


- De la Roca and Puga (2012)
- Baum-Snow and Pavan (2012) find that high ability workers experience steeper earnings profiles in bigger cities





- Lack of sorting in fixed-effects from wage regression (De la Roca and Puga, 2012)
- Several papers document the lack of sorting on ability in big and small cities
  - no clear sorting on skills inferred from occupations (Bacolod, Blum, and Strange, 2009)
  - mild negative sorting from a structural estimation setting (Baum-Snow and Pavan, 2012)
  - similar mean but greater variance of skills in big cities (Eeckhout, Pinheiro, and Schmidheiny, 2014)


Mean annual earnings
(€, full−time equivalent, log scale)
32,000
28,000
24,000
20,000
16,000
50,000
125,000
250,000
500,000
1,000,000
2,000,000
City size
(people within 10km of average worker, log scale)
Madrid
Barcelona
Girona
Manresa
Palma de Mallorca
Tarragona – Reus
Zaragoza
Burgos
Castellón de la Plana
Valencia
Toledo
Puertollano
Huesca
Guadalajara
Logroño
A Coruña
Granada
Valladolid
Sevilla
Lleida
Ciudad Real
Santander – Torrelavega
Vigo
Pontevedra
Ávila
Almería
Málaga
Jaén
Las Palmas de Gran Canaria
Santiago de Compostela
Costa del Sol
Albacete
Córdoba
Cuenca
Motril
Badajoz
Santa Cruz de Tenerife – La Laguna
Segovia
Algeciras
Cádiz
Aranjuez
Salamanca
Orihuela
El Ejido
Costa Blanca
Lugo
Talavera de la Reina
Torrevieja
Utrera
Tenerife Sur
Gran Canaria Sur

Junior period location (when $\sigma = \alpha$ and $\alpha \leqslant \alpha_{BB \succ BS}$)

- For a worker with $\alpha \leqslant \alpha_{BB \succ BS}$
  - locating in B when senior is never worthwhile
  - but, may locate in B when junior to acquire more valuable experience
- Worker locates in B in her junior period iff

$$U_{BS}(\alpha) - U_{SS}(\alpha) = \alpha^2 \Omega_S (e_B - e_S)\, \pi_2 - (\gamma_B - \gamma_S) > 0$$

or, iff

$$\alpha > \alpha_{BS \succ SS} \equiv \sqrt{\frac{\Delta\gamma}{\Omega_S\, \pi_2\, \Delta e}}\,, \text{where } \Delta e \equiv e_B - e_S$$

- Ability matters in the location choice of junior workers
  - $\uparrow \alpha$ more likely to succeed when junior and acquire experience ($e_B > e_S$)
  - $\uparrow \alpha$ and $\uparrow e$ help complete a complex task when senior
- This ability threshold is lower (more senior workers locate in B) when
  - $\downarrow \Delta\gamma, \uparrow \Delta e, \uparrow \Omega_S, \uparrow \pi_2$

Junior period location (when $\sigma = \alpha$, $\alpha_{BB>BS} < \alpha \leqslant \alpha_{SB>SS}$)

- For a worker with $\alpha_{BB>BS} < \alpha \leqslant \alpha_{SB>SS}$
  - locating in B when senior is worthwhile if she located in B when junior
  - and successfully completed the simple task
- Worker locates in B in her junior period iff

$$U_{BB}(\alpha) - U_{SS}(\alpha) = \alpha^2(\Omega_B\, e_B - \Omega_S\, e_S)\,\pi_2 - (1+\alpha)(\gamma_B - \gamma_S) > 0$$

or, iff

$$\alpha > \alpha_{BB>SS} \equiv \frac{1}{2}\left(\tilde{\alpha} + \sqrt{\tilde{\alpha}^2 + 4\,\tilde{\alpha}}\right)$$

where

$$\tilde{\alpha} \equiv \frac{\Delta\gamma}{(\Omega_B e_B - \Omega_S e_S)\,\pi_2}$$

- More complex functional form: for workers with intermediate ability their junior period location affects their senior period location

Junior period location (when $\sigma = \alpha$ and $\alpha_{SB \succ SS} < \alpha$)

- For a worker with $\alpha_{SB \succ SS} < \alpha$
  - locating in B when senior (conditional on success) is always worthwhile regardless of her junior period location
- Worker locates in B in her junior period iff

$$U_{BB}(\alpha) - U_{SB}(\alpha) = \alpha^2 \Omega_B (e_B - e_S)\, \pi_2 - (\gamma_B - \gamma_S) > 0$$

or, iff

$$\alpha > \alpha_{BB \succ SB} \equiv \sqrt{\frac{\Delta\gamma}{\Omega_B\, \pi_2\, \Delta e}}$$

Location choices (when $\sigma = \alpha$)

Lemma 1. A worker who fails at the simple task when junior, locates in S when senior.

A worker with $\alpha \leqslant \alpha_{BB \succ BS}$ locates in S when senior, while she also locates in S when junior iff $\alpha \leqslant \alpha_{BS \succ SS}$.

A worker with $\alpha_{BB \succ BS} < \alpha \leqslant \alpha_{SB \succ SS}$ locates in S both periods iff $\alpha \leqslant \alpha_{BB \succ SS}$. If $\alpha_{BB \succ SS} < \alpha$, she locates in B in both periods unless she fails when junior.

A worker with $\alpha_{SB \succ SS} < \alpha$ locates in B when senior unless she fails when junior, while she also locates in B when junior iff $\alpha_{BB \succ SB} < \alpha$.

Equilibrium location (when $\sigma \neq \alpha$)

Proposition 3. When workers' self-confidence while junior does not reflect ability accurately, location and relocation patterns fall in one of three cases.

Case 1. If $\frac{\Delta\gamma\,\Delta e}{\Delta\Omega^2} < \frac{\pi_2\, e_S{}^2}{\Omega_B}$

- During their junior period, workers with
  - $\sigma \leqslant \alpha_{BB\succ SB}$ locate in S.
  - $\alpha_{BB\succ SB} < \sigma$ locate in B.
- During their senior period
  - Workers with $\alpha \leqslant \alpha_{BB\succ BS}$ locate in S.
  - Workers with $\alpha_{BB\succ BS} < \alpha \leqslant \alpha_{SB\succ SS}$ locate in B if $\alpha_{BB\succ SB} < \sigma$ and they succeed when junior; they locate in S otherwise.
  - Workers with $\alpha_{SB\succ SS} < \alpha$ locate in B if they succeed when junior; they locate in S otherwise.

Case 2. If $\frac{\pi_2\, e_S{}^2}{\Omega_B} \leqslant \frac{\Delta\gamma\,\Delta e}{\Delta\Omega^2} \leqslant \frac{\pi_2\, e_B{}^2}{\Omega_S}$

- During their junior period
  - Workers with $\sigma \leqslant \max(\alpha_{BB\succ BS}, \min(\alpha_{SB\succ SS}, \alpha_{BB\succ SS}))$ locate in S.
  - Workers with $\max(\alpha_{BB\succ BS}, \min(\alpha_{SB\succ SS}, \alpha_{BB\succ SS})) < \sigma$ locate in B.
- During their senior period
  - Workers with $\alpha \leqslant \alpha_{BB\succ BS}$ locate in S.
  - Workers with $\alpha_{BB\succ BS} < \alpha \leqslant \alpha_{SB\succ SS}$ locate in B if $\max(\alpha_{BB\succ BS}, \min(\alpha_{SB\succ SS}, \alpha_{BB\succ SS})) < \sigma$ and they succeed when junior; they locate in S otherwise.
  - Workers with $\alpha_{SB\succ SS} < \alpha$ locate in B if they succeed when junior; they locate in S otherwise.

Case 3. If $\frac{\pi_2\, e_B{}^2}{\Omega_S} < \frac{\Delta\gamma\,\Delta e}{\Delta\Omega^2}$

- During their junior period
  - Workers with $\sigma \leqslant \alpha_{BS\succ SS}$ locate in S.
  - Workers with $\alpha_{BS\succ SS} < \sigma$ locate in B.
- During their senior period
  - Workers with $\alpha \leqslant \alpha_{BB\succ BS}$ locate in S.
  - Workers with $\alpha_{BB\succ BS} < \alpha \leqslant \alpha_{SB\succ SS}$ locate in B if $\alpha_{BS\succ SS} < \sigma$ and they succeed when junior; they locate in S otherwise.
  - Workers with $\alpha_{SB\succ SS} < \alpha$ locate in B if they succeed at the simple task when junior; they locate in S otherwise.

	Dependent variable: log earnings			
	1979–2010	1979–2010	1979–2000	1979–2010
	(1)	(2)	(3)	(4)
Big-city experience × cognitive ability ptile	0.0001	0.0001	0.0001	
	(0.0000)***	(0.0000)***	(0.0000)*	
Big-city experience × college				0.0025
				(0.0023)
Big-city experience × self-confidence ptile	0.0000	0.0000	-0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Experience × cognitive ability percentile	0.0002	0.0002	0.0003	
	(0.0000)***	(0.0000)***	(0.0000)***	
Experience × college				0.0172
				(0.0015)***
Experience × self-confidence percentile	0.0000	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Big city	0.1107	0.1116	0.0900	0.1072
	(0.0118)***	(0.0118)***	(0.0106)***	(0.0117)***
Big-city experience	0.0141	0.0131	0.0202	0.0166
	(0.0031)***	(0.0032)***	(0.0037)***	(0.0029)***
(Big-city experience)^2	-0.0005		-0.0009	-0.0005
	(0.0001)***		(0.0002)***	(0.0001)***
Big-city experience × experience		-0.0005		
		(0.0001)***		
Observations	80,020	80,020	64,893	80,020
Worker fixed-effects	Yes	Yes	Yes	Yes
Experience	Yes	Yes	Yes	Yes
Firm tenure	Yes	Yes	Yes	Yes
Year indicators	Yes	Yes	Yes	Yes
Occupation indicators	No	No	Yes	No
R^2	0.2561	0.2557	0.3692	0.2610