Journal of Economic Geography **19** (2019) pp. 505–534 doi:10.1093/jeg/lby009
Advance Access Published on 15 March 2018

Migration and career attainment of power couples: the roles of city size and human capital composition

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Abstract

Costa and Kahn (2000, *The Quarterly Journal of Economics*, 115: 1287–1315) documented that power couples tended to be located in large cities, postulating a need to solve a co-location problem peculiar to dual-career, highly educated spouses. Using data from the 2008 to 2014 American Community Surveys, I find that young full-power couples are more likely to move to larger, better-educated cities relative to couples in which just the husband has a college degree and wife-only power couples more likely than couples in which neither spouse has a college degree. I also present new evidence that larger, better-educated cities offer superior joint husband-and-wife career outcomes as measured by occupational attainment for wives and husbands with college degrees.

Keywords: Migration, career outcomes, city size, human capital, married couples
JEL classifications: R23, J61, R12
Date submitted: 21 June 2017 **Editorial decision:** 7 February 2018
Date accepted: 26 February 2018

1. Introduction

This paper examines the migration patterns and career attainment of so-called power couples in which both the husband and the wife have a college degree. Costa and Kahn (2000) documented that such couples were increasingly likely to reside in large cities between 1940 and 1990, a tendency that they attributed to the fact college-educated couples, with their presumably more specialized human capital, face a particularly difficult co-location problem and therefore should benefit disproportionately by residing in larger cities.

Since their study, at least two puzzles have come to light regarding the co-location argument. First, Compton and Pollak (2007) reasoned that the co-location argument implies that power couples should be more likely to migrate to large cities, when they move, than couples in which only one spouse has a college degree. In fact, their examination of couples in the Panel Survey of Income Dynamics (PSID) for the period 1980–1993 revealed that the college degree of the wife had no impact on the size of city chosen by migrating couples, whether or not the husband had a college degree (477). The second puzzle concerns the paucity of evidence showing the beneficial effects of living in large cities on the careers of women, highly educated or otherwise. Costa and Kahn (2000) supported their co-location argument by showing that the tendency of power couples to reside in large cities was particularly high when the wife worked. However, neither Costa and Kahn (2000) nor Compton and Pollak (2007) provided direct evidence that college-educated women enjoyed greater career success if they lived in large cities.

Indeed, direct evidence of the career benefits of large cities for married women is rare. Frank (1978) found statistically imprecise evidence consistent with the notion that wives were less likely to be over-qualified for jobs in larger metropolitan areas, but McGoldrick and Robst (1996) found no such evidence using more recent and arguably better data. Mckinnish (2008) found that higher migration rates in an occupation were associated with a higher probability of migration, but the estimated effect was considerably larger for the husband than for the wife (838–839). She also found that geographic mobility that benefited the husband's career was associated with reduced career opportunities for the wife. Neither Mckinnish (2008) nor Compton and Pollak (2007) found a role for city size in improving the career outcomes of married women. Not all evidence has been negative. Ofek and Merrill (1997) found higher market wage returns to city size for married women than for married men. However, as will be seen in Section 4, this approach does not provide a completely convincing explanation for the attractiveness of large cities for highly educated couples.

Given the evidence to date, a study of the importance of large cities for migration patterns and career outcomes of power couples would appear to be an unpromising avenue of research. However, there are a number of reasons to re-examine the question. First, using US Census microdata for 1980, Scheuren and Simon (2008) found that power couples were indeed more likely to move to large cities.[1] Second, the evidence in Compton and Pollak (2007) dates from the 1980s and 1990s and suggests that examination of more recent data is in order. Data from the American Community Survey (ACS) became available starting in 2008 that allow me to do just that. Third, a key strength of ACS data is large sample size, which permits me to examine a related question raised by Compton and Pollak (2007) regarding the possibility that city characteristics other than population might affect migration and career outcomes (479). Because a good deal of research has found a role for human capital in explaining differences in city growth and city size, I consider whether power couples are more likely to locate in better-educated cities as measured by the percentage of the adult population with a college degree.[2]

This paper also presents new evidence regarding the effects of city size and composition on career outcomes. My contribution lies in proposing a new way to characterize career success that incorporates insights by Goldin (2014), who points out that even as women's educational and career trajectories have approached those of men over time, there remains a gap between men's and women's earnings, a gap that is larger in more highly paid careers that reward effort and intensity more highly. She suggests that the remaining gap reflects the fact that women, on average, are still less single-minded in their pursuit of career than their male counterparts. These observations lead me to propose that women may value the *option* of choosing *potentially* monetarily lucrative careers, even if the full monetary returns to such careers are not—for reasons beyond the scope of the current paper—realized. A concentration of such careers in

1 They also examined data from 1990 and 2000, but the absence of one key piece of information, the date of the marriage, meant that it was not possible to determine conclusively whether couples in those years were married prior to migration.

2 Berry and Glaeser (2005) develop a model in which skilled workers are particularly attracted to skilled cities.

larger, better-educated cities could explain why power couples are disproportionately attracted to those cities. I adopt, and adapt, as a measure of career potential the ranking of individuals' occupations in the log wage distribution, popularized recently by Autor and Dorn (2014). This approach has the virtue of allowing me to go beyond existing research to consider the question of whether living in a large city improves the *joint* career outcomes of husbands and wives.

I compare migration patterns across 313 geographic locations over the period 2008–2014 of full-power couples, in which both spouses have a college degree, part-power couples in which just one spouse has a college degree and low-power couples in which neither spouse has a college degree. I use two approaches, one in which cities are classified into discrete size (as in prior research) and human capital (new to this paper) categories and a second in which the effects of size and human capital composition on migration are identified using an explicitly parametric form via high-order polynomials.

To foreshadow my findings, using the categorical specification, I find that power couples are more likely to move to larger cities than husband-only power couples and wife-only power couples more likely than low-power couples, but the differences are not always statistically significant, which is partly consistent with the null findings of Compton and Pollak (2007). However, I show that the categorical approach does not sharply distinguish the effects of city size and human capital composition. Using the polynomial specification, I find the same directional tendencies, but the effects of city size are more consistently statistically significant. Consistent with Compton and Pollak (2007), I find that the effects of husband's college degree are larger and statistically more significant than those of the wife's. I also find strong support for Compton and Pollak's (2007) speculation regarding the possible role of city composition: couples in which the wife has a college degree are more likely to move to better-educated cities. Finally, I find that living in larger, better-educated cities is associated with higher occupational attainment, both singly and jointly, more so for full-power couples than for husband-only power couples and more so for wife-only power couples than for low-power couples.

The remainder of the paper is organized as follows. Section 2 describes the data. Section 3 presents the migration analysis. Section 4 characterizes the career advantages of large cities. The results of a robustness check that uses data only from 2012 to 2014 is discussed in Section 5. Section 6 concludes with a brief summary and suggestions for future research.

2. Data

2.1. Individual-level data

I collected data on native-born, male–female married couples from the ACS 2008 to 2014 supplied by Integrated Public Use Microdata Series (Ruggles et al., 2015).[3] ACS has, since its inception in 2001, included information on residential location in the year

3 The period studied in this paper includes the Great Recession. Saks and Wozniak (2011) show that migration rates are pro-cyclical, but found no evidence that the dispersion of local economic conditions varied over the national business cycle (711). The first version of this paper used data solely through 2011, and the results were similar to those obtained here. Below, I will discuss results that use data solely from the 2012 to 2014 period, well after the recession ended, and which are similar to those presented here.

prior to the survey. Information on location at the metropolitan level first becomes available in 2005 and information on duration of the marriage in 2008. This information permits me to examine changes in metropolitan location over a 1-year period for couples whose marriage began >1 year prior to the survey.

For the sake of comparability with prior research, I restrict the migration analysis to couples in which the husband is between the ages of 25 and 39 years and the wife between 23 and 37 years. However, it makes sense to analyze career outcomes over the entire life cycle and because the analysis of earnings is independent from that of migration, it uses data on individuals between the ages of 25 and 59 years.

No data set, including the (mostly) cross-sectional ACS, is perfect. Other data sets such as the National Longitudinal Surveys and the PSID track individuals over time and contain a wider range of information on respondents' behavior and backgrounds. The single most important advantage of ACS is the availability of large sample sizes, seen in Table 1, which dwarf those available in other data sets and allow for more precise estimation of migration and career outcomes. The migration sample contains 136,556 full-power couples, 5.2% of whom moved within 1 year of the survey date, 37,543 husband-only power couples (4.9% movers), 72,806 wife-only power couples (3.1% movers) and 219,512 low-power couples (3.4% movers). I am also able to estimate more flexibly specified models than would be feasible in smaller data sets.

2.2. City-level data

My geographic unit of analysis is the Consolidated Metropolitan Statistical Area, Primary Metropolitan Statistical Area or Metropolitan Statistical Area (MSA), whichever is largest. For the purpose of exposition, I refer to the resulting geographic unit as the city. The key data at the city level are 2005 population size measured and human capital composition as measured by the 5-year (2006–2010) ACS average percentage of the population age 25 years and over with a college degree. All city-level data are aggregated from the county level up, with averages weighted by 2005 population. Constructed in this fashion, there were 325 potential locations: 276 cities, plus non-urban remainders for all states except New Jersey.

The distribution of population across the 276 cities is skewed, with a mean population of 0.88 million and a median of 0.28 million. Table 2 lists the 30 most populous cities. The largest at 22 million, New York City includes residents of Connecticut, New Jersey and Pennsylvania. It is followed by Los Angeles (17.6 million), Chicago (9.5 million), Washington, DC (8.2 million) and San Francisco (7.1 million).

The human capital composition of cities is nearly symmetric, with mean and median percentage college graduates of 24.9% and 23.6%. The list of the 30 most highly educated cities, seen in Table 3, is dominated by smaller college towns. About half of the residents of Santa Fe, NM and Iowa City, IA and just under half of the residents of Lawrence, KS have college degrees, followed by Corvallis, OR (47.9%), Madison, WI (45.4%), Columbia, MO (45.2%) and Bloomington, IN (42.7%). The best-educated large city is San Francisco (39.6%, ranked 16), followed by Washington–Baltimore (38.8%, ranked 20), Denver (38.4%, ranked 21), New York (36.4%, ranked 25) and Boston (36.2%, ranked 26).

Although the very most educated cities are small, large cities tend to have high levels of human capital. This positive relationship, pointed out by Glaeser and Resseger (2010) among others, is visible in Figure 1, which plots percent college graduates as a

Table 1. Sample sizes, American Community Survey Data 2008–2014

Couple type	Stay	Pct. move
Full power	136,556	0.052
Husband-only power	37,543	0.049
Wife-only power	72,806	0.031
Low power	219,512	0.034
All couples	466,417	0.040

Table 2. Thirty most populous cities

City	Population (million)	Percentage of college graduates
New York, Northern New Jersey, Long Island, NY–NJ–CT–PA	21.995	36.4
Los Angeles–Riverside–Orange County, CA	17.630	26.3
Chicago–Gary–Kenosha, IL–IN–WI	9.505	29.5
Washington–Baltimore, DC–MD–VA–WV	8.169	38.8
San Francisco–Oakland–San Jose, CA	7.112	39.6
Boston–Worcester–Lawrence, MA–NH–ME–CT	7.069	36.2
Philadelphia–Wilmington–Atlantic City, PA–NJ–DE–MD	6.347	28.9
Dallas–Fort Worth, TX	5.885	27.7
Detroit–Ann Arbor–Flint, MI	5.530	27.1
Houston–Galveston–Brazoria, TX	5.229	25.6
Atlanta, GA	4.769	26.5
Miami–Fort Lauderdale, FL	4.154	27.9
Phoenix–Mesa, AZ	3.865	23.5
Seattle–Tacoma–Bremerton, WA	3.752	31.1
Minneapolis–St. Paul, MN–WI	3.143	30.6
San Diego, CA	2.933	34.1
Cleveland–Akron, OH	2.932	25.4
Denver–Boulder–Greeley, CO	2.772	38.4
St. Louis, MO–IL	2.682	26.9
Tampa–St. Petersburg–Clearwater, FL	2.648	22.6
Portland–Salem, OR–WA	2.461	30.0
Pittsburgh, PA	2.315	25.4
Sacramento–Yolo, CA	2.042	32.7
Cincinnati–Hamilton, OH–KY–IN	2.039	23.1
Las Vegas, NV–AZ	1.938	13.8
Orlando, FL	1.933	26.3
Kansas City, MO–KS	1.885	25.1
Hartford, CT	1.761	33.7
San Antonio, TX	1.755	26.9
Indianapolis, IN	1.719	28.9

Notes: The mean population, in millions, across the 30 cities in this table is 4.93, the mean across the 246 remaining cities is 0.385 and the mean for rural remainders is 1.26.

Table 3. Thirty most educated cities

City	Population (million)	Percentage of college graduates
Santa Fe, NM	0.160	52.0
Iowa City, IA	0.117	50.8
Lawrence, KS	0.103	48.3
Corvallis, OR	0.079	47.9
Madison, WI	0.458	45.4
Columbia, MO	0.143	45.2
Bloomington, IN	0.121	42.7
Fort Collins–Loveland, CO	0.272	42.5
Athens, GA	0.161	41.7
Charlottesville, VA	0.173	41.2
Champaign–Urbana, IL	0.185	41.2
Gainesville, FL	0.224	40.9
Barnstable–Yarmouth, MA	0.227	40.5
Bloomington–Normal, IL	0.159	40.4
State College, PA	0.141	40.0
San Francisco–Oakland–San Jose, CA	7.112	39.6
Bryan–College Station, TX	0.156	39.3
Rochester, MN	0.135	39.1
Burlington, VT	0.205	38.8
Washington–Baltimore, DC–MD–VA–WV	8.169	38.8
Denver–Boulder–Greeley, CO	2.772	38.4
Missoula, MT	0.100	38.4
Portland, ME	0.477	38.0
Raleigh–Durham–Chapel Hill, NC	1.369	37.3
New York, Northern New Jersey, Long Island, NY–NJ–CT–PA	21.995	36.4
Boston–Worcester–Lawrence, MA–NH–ME–CT	7.069	36.2
Provo–Orem, UT	0.444	35.5
Lincoln, NE	0.265	35.3
Fargo–Moorhead, ND–MN	0.185	35.3
Colorado Springs, CO	0.566	34.9

Notes: The mean percentage college graduates across the 30 cities in this table is 40.7%, the mean across the 246 remaining cities is 23.0% and the mean for rural remainders is 19.2%.

function of population in millions for the cities in my sample, on a logarithmic scale. The simple correlation is 0.19, statistically significant at the 0.002 level but indicating the presence of ample independent (linear) variation in the two variables so as to be able to distinguish their effects.

For the categorical portion of the analysis, I follow both Costa and Kahn (2000) and Compton and Pollak (2007) by dividing cities into categories of large (2 million and up), medium (between 250,000 and 2 million) and small. To characterize city human capital composition, I divide locations into percent college terciles: 12.2–19.9%, 20.0–26.2% and 26.2–52%. Finally, non-urban locations, which vary greatly in geographic area, are divided into population density terciles: 2.25–28.0, 31.6–67.8 and 69.0–804.5 persons per square mile.

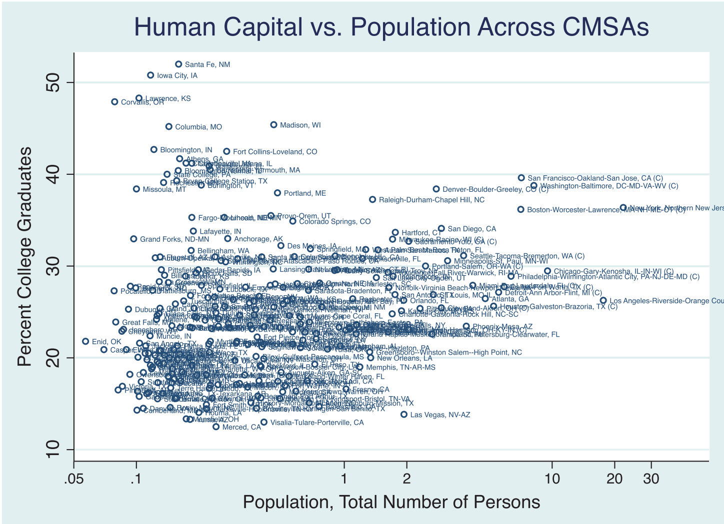

Figure 1. City size and human capital.

2.3. Geographic identification in ACS

IPUMS ACS contains information on residency in metropolitan areas starting in 2005, but this information is, unfortunately, incomplete. In particular, IPUMS ACS does not identify the metropolitan area of residence for individuals who reside in Public Use Microdata Areas (PUMAs) (the most detailed geography reported in IPUMS) that contain any rural component. I therefore enlarged the definition of the city to include the rural component of PUMAs comprising the city via a crosswalk generated using the GEOCORR-Mable online tool.[4] Individuals inhabiting non-city PUMAs were assigned to a state remainder. Individuals residing in 1 of the 17 PUMAs who could not be assigned to a unique city were dropped from the analysis. In the end, 313 of 325 potential locations are identifiable in ACS: 269 cities and 44 state remainders.[5]

2.4. Distribution of couples across cities

Table 4 shows the joint distribution of each type of couple in the migration sample across cities and state remainders by population (rows) and human capital category (columns). Focusing on the figures on the left-hand side, about 42% of power couples lived in large, highly educated cities, compared with 32% and 31% of husband-only and wife-only power couples and 25% of low-power couples. At the other end of the spectrum, just 2% of power couples live in the smallest, least-educated cities, compared with 3% of husband-only and wife-only power couples and 4% of low-power couples.

4 The definition of PUMAs changed in 2012, which raises concerns of consistency. However, the pattern of results is similar when the sample is restricted to the 2012–2014 period, albeit at lower levels of statistical significance.

5 No individuals could be identified as living in the state remainders of Connecticut, Delaware, Maryland, Massachusetts, New Jersey or Rhode Island.

Table 4. Distibution of couples by city size and human capital composition

	Human capital					
	All couples			Movers only		
	High HK	Medium HK	Low HK	High HK	Medium HK	Low HK
Full power						
Large	0.42	0.07	0.00	0.32	0.07	0.00
Medium	0.15	0.16	0.04	0.18	0.17	0.04
Small	0.04	0.02	0.02	0.05	0.03	0.02
Rural	0.00	0.01	0.08	0.00	0.01	0.10
Husband-only power						
Large	0.32	0.07	0.00	0.24	0.07	0.00
Medium	0.15	0.16	0.05	0.18	0.19	0.05
Small	0.04	0.03	0.03	0.04	0.04	0.03
Rural	0.00	0.02	0.13	0.01	0.02	0.13
Wife-only power						
Large	0.31	0.07	0.00	0.25	0.06	0.00
Medium	0.14	0.16	0.05	0.18	0.15	0.06
Small	0.04	0.03	0.03	0.05	0.05	0.04
Rural	0.00	0.02	0.15	0.01	0.02	0.14
Low power						
Large	0.25	0.06	0.00	0.19	0.05	0.00
Medium	0.12	0.16	0.07	0.15	0.16	0.08
Small	0.03	0.03	0.04	0.04	0.04	0.05
Rural	0.00	0.02	0.21	0.00	0.02	0.20
High power						
Large	0.49	0.07	0.00	0.38	0.06	0.00
Medium	0.14	0.15	0.03	0.17	0.17	0.04
Small	0.03	0.02	0.01	0.05	0.03	0.02
Rural	0.00	0.01	0.06	0.01	0.01	0.06
Husband-only high power						
Large	0.33	0.08	0.00	0.26	0.07	0.00
Medium	0.16	0.15	0.05	0.18	0.17	0.05
Small	0.04	0.03	0.02	0.06	0.02	0.04
Rural	0.00	0.02	0.12	0.01	0.03	0.11
Wife-only high power						
Large	0.35	0.06	0.00	0.23	0.03	0.00
Medium	0.13	0.16	0.05	0.22	0.17	0.05
Small	0.03	0.03	0.03	0.06	0.04	0.04
Rural	0.00	0.02	0.14	0.01	0.02	0.13

Note: High power refers to possession of an advanced degree.

A similar if less pronounced pattern emerges for movers only, seen in the right-hand side of Table 4. About 32% of full-power couples moved to the largest, most highly educated cities, compared with 24% and 25% of husband- and wife-only power couples and 19% of low-power couples. Just 2% of full-power couples moved to the smallest, least-educated cities, compared with 3% and 4% of husband-only and wife-only power couples and 5% of low-power couples. These patterns reflect Compton and Pollak's (2007) finding that large (and well-educated) cities tend to produce power couples who end up remaining there. Nonetheless, the patterns for movers strongly suggest that power couples are more likely to move to larger, better-educated cities than husband-only power couples and wife-only power couples more likely than low-power couples.

3. Random utility model of location choice

3.1. Specification

I estimate a random utility model (RUM) in which couple i of type t is assumed to enjoy utility in location l given by

$$
\begin{aligned}
U_{il}^{t} = {} & \mathrm{CITY}_l \times \{\beta_{\mathrm{C}}^{t} + \beta_{\mathrm{SH}}^{t}\mathrm{SIZE}_l \times \mathrm{HK}_l\} + \\
& \mathrm{ORIGIN}_{il} \times \{\beta_{\mathrm{O}}^{t} + \beta_{\mathrm{OSH}}^{t}\mathrm{CITY}_l \times \mathrm{SIZE}_l \times \mathrm{HK}_l\} \\
& +(1-\mathrm{CITY}_l) \times \{\beta_{\mathrm{D}}^{t}\mathrm{DENSITY}_l + \beta_{\mathrm{RH}}^{t}\mathrm{HK}_l + \mathrm{ORIGIN}_{il} \times [\beta_{\mathrm{OD}}^{t}\mathrm{DENSITY}_l + \beta_{\mathrm{ORH}}^{t}\mathrm{HK}_l]\} \\
& +\beta_{\mathrm{B}}^{t}\mathrm{BIRTHSTATE}_{il} + \beta_{\mathrm{W}}^{t}\mathrm{WEATHER}_l + \beta_{\mathrm{C}}^{t}\mathrm{COAST}_l + \epsilon_{il}.
\end{aligned}
\tag{1}
$$

where SIZE_l a vector of dummy variables for city population (large, medium or small) has been interacted with HK_l, a vector of dummy variables for human capital composition as measured by percentage college graduates (high, medium or low). Although a non-interacted model is certainly feasible, I have found that this interacted model does a better job of characterizing the migration patterns seen in Table 4, The variable CITY_l, a dummy variable equal to 1 if location l is a city and zero otherwise, enters alone as well as interacted with $\mathrm{SIZE}_l \times \mathrm{HK}_l$, and, in the form of its complement, interacted with $\mathrm{DENSITY}_l$, a vector of two dummy variables for high or medium density to characterize non-urban state remainders. Human capital is permitted to affect the utility of locating in non-city (Rural) areas as well. The error term ϵ_{il} is assumed to be independently, identically distributed extreme value, known as the Gumbel and type I extreme value (Train, 2009).

Equation (1) embeds the decision of whether to migrate by allowing utility to vary differ between the initial location and potential alternative locations. In particular, the dummy variable ORIGIN_{il}, equal to 1 if couple i lived in location l 1 year prior to the survey and 0 otherwise, captures the disutility of moving; its estimated coefficient is expected to be positive, indicating that other things the same, utility is higher when staying put. Importantly, notice that I allow for the possibility that the utility of population (density) and human capital composition differs between the city of origin and potential destinations by interacting ORIGIN_{il} with those characteristics.[6]

$\mathrm{BIRTHSTATE}_{il}$ is a dummy variable equal to unity if the city is in the state of birth of either the husband or wife. I expect its estimated coefficients to be positive, indicating a preference for the location in which one grows up. Finally, local amenities enter in the form COAST_l, a dummy variable equal to unity for coastal cities and $\mathrm{WEATHER}_l$, a vector of four variables characterizing the local climate: heating degree-days, cooling degree-days, mean annual inches of precipitation and mean annual inches of snowfall.[7]

6 Compton and Pollak (2007) estimated a multinomial logit model for migrating to a large, medium or small city, corrected for selection into migration.

7 Data on climate normals are from National Oceanic and Atmospheric Administration for 1981–2010, filled in using 1971–2000 data as necessary. Cities were defined to be coastal if they were identified by the Office of Management and Budget (OMB) as containing any coastal county.

3.2. Interpreting the RUM coefficients

Suppressing the subscript for the individual household i, the probability that a household of type t chooses location l is equal to

$$P_l^t = \frac{e^{\frac{\beta^{t\prime}}{\sigma^t i} X_l}}{\sum_k e^{\frac{\beta^{t\prime}}{\sigma^t_i} X_k}}, \tag{2}$$

where β^t/σ^t is the vector of estimated coefficients of Equation (1) for couples of type t. The odds of choosing city l relative to city h are equal to

$$\frac{P_l^t}{P_h^t} = \frac{e^{\frac{\beta^{t\prime}}{\sigma^t} X_l}}{e^{\frac{\beta^{t\prime}}{\sigma^t} X_h}} = e^{\frac{\beta^{t\prime}}{\sigma^t}(X_l - X_h)}. \tag{3}$$

I am interested in whether full-power couples are more likely to move to larger, better-educated cities than husband-only power couples and wife-only power couples more likely than low-power couples, which can be assessed by calculating the difference in odds between, say, full- (type F) and husband-only (type H) power couples. Using Equation (3), this difference is given by:

$$\frac{P_l^{\mathrm{F}}}{P_h^{\mathrm{F}}} - \frac{P_l^{\mathrm{H}}}{P_h^{\mathrm{H}}} = e^{\frac{\beta^{\mathrm{F}\prime}}{\sigma^{\mathrm{F}}}(X_l - X_h)} - e^{\frac{\beta^{\mathrm{H}\prime}}{\sigma^{\mathrm{H}}}(X_l - X_h)}. \tag{4}$$

If full-power couples are more likely to move to, say, large cities than husband-only power couples, the difference in odds for moving to those types of cities should be positive and statistically significantly different than zero. Other comparisons are straightforward extensions of Equation (4).

3.3. Migration odds: does the wife's college degree matter?

Summary statistics for the migration analysis appears in Table A1. Although the estimated coefficients themselves are not the main object of interest, for completeness, estimates of Equation (1) are Table A2 and discussed briefly in Appendix A.1.[8] Omitting the couple-type subscript, and keeping in mind that there are no large, low (O)-human capital cities, the probability of choosing to move to a large city (L) is given by the sum of probabilities of choosing to move to a large city with high (H) or medium (M) levels of human capital (k):

$$P_{\mathrm{L}} = \sum_{\mathrm{k=H,M}} P_{\mathrm{L}\cap\mathrm{k}}. \tag{5}$$

Similarly, the probability of choosing to move to a small city is given by:

$$P_{\mathrm{S}} = \sum_{\mathrm{k=H,M,O}} P_{\mathrm{S}\cap\mathrm{k}}. \tag{6}$$

8 Because the sample size became unwieldy for low-power couples, I sampled 100% of the movers, but just 50% of stayers and weighted the stayers up by a factor of 2 in the estimation.

The probabilities that a couple chooses to move to a city with high, medium or low levels of human capital are, similarly, sums of the joint probabilities over population levels.

These probabilities are used to form the odds given by Equation (3). These odds, while not of inherent interest, help one place the magnitudes of the differences-in-odds in context, and so are reported in Table A3. The odds of moving to a large rather than a small city are 12.6 (SE = 0.6) for full-power couples, compared with 11.2 (SE = 1.1) for husband-only power couples. The odds for wife-only and low-power couples are 8.1 (SE = 0.67) and 7.6 (SE = 0.4). By contrast, the odds (standard errors) of moving to a large versus a medium-size city are in the same order 3.0 (0.9), 2.3 (0.14), 2.2 (0.12) and 1.7 (0.06). These odds are all larger for couples in which the wife (and husband) has a college degree, but it can be seen from the sizes of the standard errors that the large-versus-small differences are not statistically significant at conventional levels for the effects of the wife's college degree. Consistent with Compton and Pollak's (2007) speculation, the effects of city composition—here, human capital—matter a lot. For example, the odds of moving to cities with high versus low levels of human capital are also higher for couples in which the wife has a college degree: 16.9 (1.02), 11.5 (1.24), 11.5 (1.1) and 6.3 (0.3) for full, husband-only, wife-only and low-power couples.

These impressions are borne out by the differences-in-odds [see Equation (4)] reported in Table 5. In particular,

- Large versus small cities: Higher for full- than part-power couples and for part-power than low-power couples, but the differences are larger for the husband's college degree and are not statistically significant for the wife's.
- Large versus medium cities: Higher for full- than part-power couples and for part-power than low-power couples. Although the effects of the husband's college degree are larger than those of the wife, all of the differences are statistically significant.
- High-human capital cities: Higher for full- than part-power couples and for part-power couples than for low-power couples.

How large are these estimated effects? The large- versus small-size difference-in-odds between full and husband-only power couples is equal to 1.4, which is (1.4/(23.8/2)) =11.7% of the simple arithmetic mean odds of those two types of couples. The percentage effect for wife-only versus low-power couples is (0.55/7.85) = 7.0%. These magnitudes do not seem terribly large. By comparison, the large- versus medium-size differences-in-odds are not only statistically more significant, but are also larger in percentage terms as well: 25.6% for full versus husband-only power couples and 23.6%. The percentage effects for high- versus low-human capital differences-in-odds are even higher: 38.7% and 58.4% for full versus husband-only and wife-only versus low-power couples, respectively.

In contrast to Compton and Pollak (2007), the results here suggest that the wife's degree matters in the choice to move to a large city, if only statistically significantly so relative to medium-size cities. My findings could differ either due to the time period studied or to the data set used. Compton and Pollak (2007) used PSID data for the 1980s and 1990s. However, Scheuren and Simon (2008), using Census data for 1980, found that the wife's college degree mattered for the choice to move to large cities. A more likely explanation, then, for the difference in findings is that although nationally representative, the PSID's relatively small sample size poses challenges for investigation of city-to-city migration. Compton and Pollak's data included just 21,955 couple-year

Table 5. Odds differences of moving to a given type of city

	Full vs. Hus	Full vs. Wife	Wife vs. Low	Husband vs. Low
Population: large vs. small	1.401	4.492	0.553	3.643
	(1.26)	(0.90)	(0.78)	(1.17)
	[0.265]	[0.000]	[0.477]	[0.002]
Large vs. medium	0.683	0.795	0.461	0.573
	(0.17)	(0.15)	(0.14)	(0.15)
	[0.000]	[0.000]	[0.001]	[0.000]
Medium vs. small	−0.634	0.520	−0.656	0.498
	(0.49)	(0.35)	(0.35)	(0.49)
	[0.194]	[0.132]	[0.060]	[0.310]
Human capital: high vs. low	5.477	5.449	5.176	5.148
	(1.61)	(1.52)	(1.16)	(1.27)
	[0.001]	[0.000]	[0.000]	[0.000]
High vs. medium	0.327	0.123	0.263	0.059
	(0.12)	(0.12)	(0.12)	(0.11)
	[0.005]	[0.313]	[0.023]	[0.590]
Medium vs. low	1.589	2.797	2.571	3.779
	(1.28)	(1.10)	(0.90)	(1.11)
	[0.215]	[0.011]	[0.004]	[0.001]

Notes: The figures in this table are calculated from conditional logit estimates of location choice based on a specification in which cities are classified into three size and human capital categories, which are permitted to interact. The estimated coefficients are reported in Table A2. See Section 3.3 for details. Standard errors are in parentheses and probability values for the null hypothesis are in brackets. The comparisons between full- and husband-only power couples test for the effects of the wife's college degree in couples in which the husband has a college degree, and between wife-only and low-power couples, for the effects of the wife's college degree in couples in which the husband does not have a degree. A positive number indicates relatively higher odds in couples in which the wife has a college degree. The remaining columns test for the effects of the husband's college degree for couples in which the wife has a college degree (full—wife-only) and in which the wife does not have a college degree (husband-only—low).

observations with 638 moves in the data. By contrast, my data include more than 466,000 couples, with over 18,500 moves.[9]

That said, the results are consistent with Compton and Pollak's (2007) suggestion that city composition could matter as much as (or more than) city size. Indeed, closer examination of the results reveals that the effects of city size are concentrated among cities with high levels of human capital—see Appendix C for details.

3.4. A flexible polynomial specification

One difficulty with the above analysis is that the effects of population are obtained by summing over the distribution of human capital and the effects of human capital by summing over the distribution of population. While one can condition on, or hold

9 Compton and Pollak (2007) also considered whether—and rejected as inconsistent with the data—the notion that wife's possession of an advanced college degree might matter more for location choice than a bachelor's degree. Little insight was garnered by analyzing these couples, and therefore the details are relegated to Appendix F.

constant human capital category, these categories are rather broad. In fact, small highly educated cities tend to be more highly educated than large highly educated cities, with 34.71% versus 31.59% college graduates. Comparing the odds of moving to large versus small cities with high levels of human capital also means comparing the odds of moving to (slightly) better-educated cities. Similarly, highly educated large cities tend to be larger than medium-educated large cities, with average populations of 6.5 versus 3.2 million.

A polynomial specification not only avoids such ambiguities, but also helps address the question of how sensitive are the results to the defintion of 'large' or 'high'. In particular, large cities contain more than 50% of the urban population of the USA, and yet vary enormously in size, from 2 to 22 million.[10] The question naturally arises whether there is important variation in the preference for city size within this heterogeneous group, or, more generally, within the other groups as well. A polynomial specification sidesteps the issues that would arise from trying different cutoffs.

I settled on a quintic in population size, a cubic in percent college graduates and an interaction between the linear population and percent college graduate terms. The destination population and human capital subcomponent of utility in Equation (1) are now given by

$$\begin{aligned} &\beta_{P1}\mathrm{POP} + \beta_{P2}\mathrm{POP}^2 + \beta_{P3}\mathrm{POP}^3 + \beta_{P4}\mathrm{POP}^4 + \beta_{P5}\mathrm{POP}^5 \\ &+\beta_{C1}\mathrm{CG} + \beta_{C2}\mathrm{CG}^2 + \beta_{C3}\mathrm{CG}^3 + \beta_{PC}\mathrm{POP} \times \mathrm{CG}, \end{aligned} \tag{7}$$

where POP is the population and CG is the percent college graduates and where the couple-type superscripts are omitted to reduce clutter. I also include, for rural state-remainders, a cubic in population density.[11]

Little being gained by examination of the estimated coefficients, I proceed by graphing the probability of migrating to each of the 269 cities in the data. I choose Wyoming as the state of birth because it has the minimum impact on the fitted probabilities [see Equation (1)], and to address the multiplicity of possible origins I set ORIGIN_l equal to zero when calculating the probability of moving to location l, predict out 312 probabilities for each origin $l' \neq l$ and take the arithmetic mean.

The resulting probabilities are graphed as a function of population in tens of thousands in Figure 2 on a logarithmic scale, with vertical dotted lines delineating small, medium and large cities.[12] The fitted probabilities tend to rise with population up to 10 million and then decline, indicating that the positive effects of city size on the probability of in-migration are limited. Notice, too, that the fitted probabilities of moving to larger cities tend to be highest for full-power couples, followed by husband-only power couples, wife-only power couples and then low-power couples.[13]

The same probabilities graphed as a function of percent college graduates are seen in Figure 3. Again, possession of a college degree by either husband or wife is associated

10 I thank Jordan Rappaport for pointing this out to me.

11 The origin component has been omitted from Equation (7) to reduce clutter, but is also a part of the model.

12 The four pairs of points above the lines just below the 100,000 population mark correspond to the birth state of Wyoming.

13 What to make of the fact that the fitted means are rising only up to a city size of 10 million? Only two cities in the sample have populations on the negative side of the slope. Moreover, the fitted probabilities even for these cities are higher than in most other (smaller) cities.

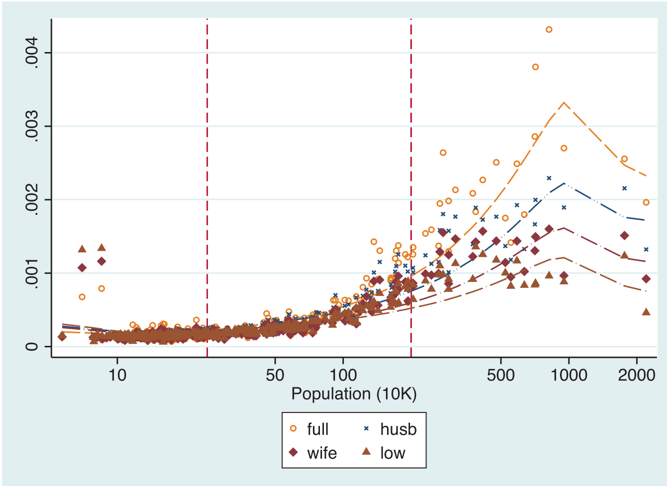

Figure 2. Probability of moving to city as a function of size.

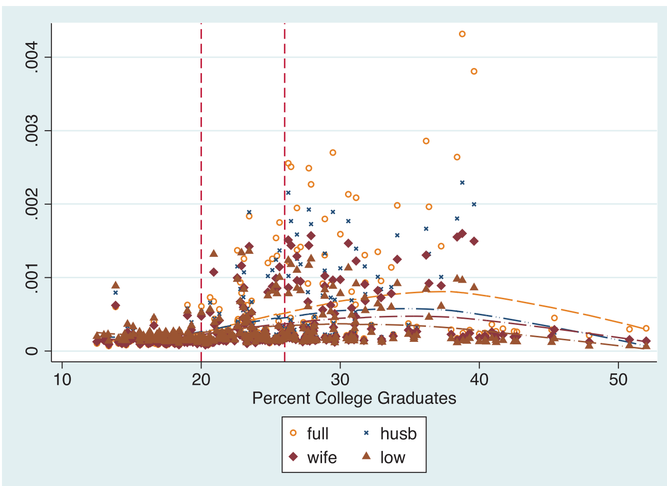

Figure 3. Probability of moving to city as a function of percent college graduates.

with a higher probability of migration to better-educated cities. In all cases, the probabilities peak around the mid to high 30s, likely a result of the fact that the very most educated cities tend to be smaller college 'towns' (see Table 3).

I use the estimates to calculate differences-in-odds of locating in each city of 1 million or larger (one-half the size cutoff used to define 'large' in the categorical specification) relative to those with populations equal to the medians of small- (146,300) or medium-size (513,700) cities. Due to the presence of the interaction of population and human capital composition, I set percent college graduates equal to its median of 23.59%.

The differences-in-odds between full- and husband-only power couples are graphed in the top left of Figure 4, along with 95% confidence bands based on 1000 simulated

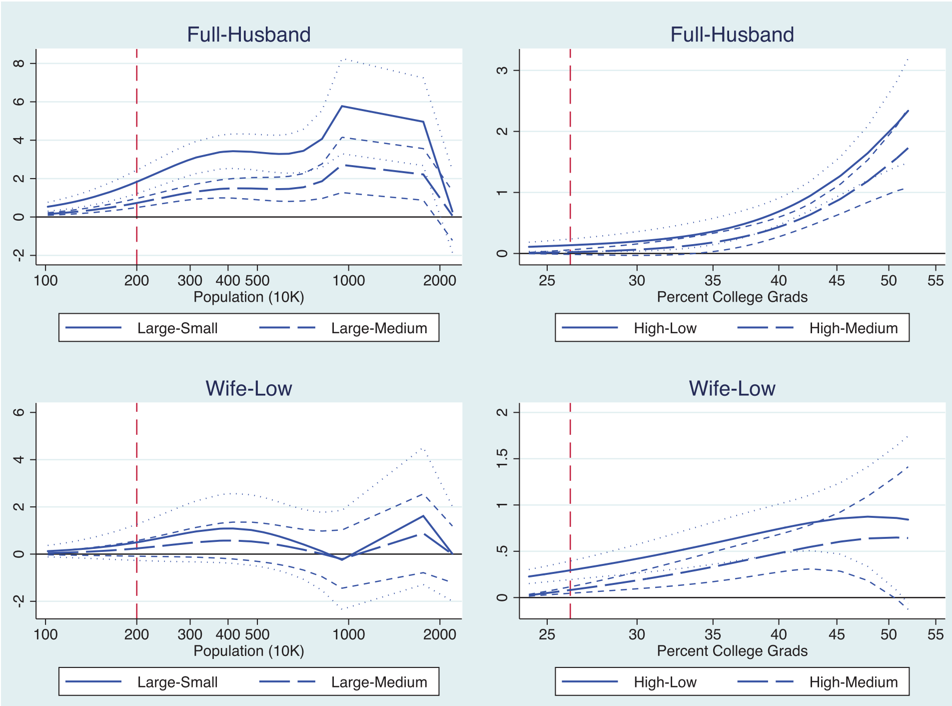

Figure 4. Effect of city size and human capital composition on migration probability.
Notes: These graphs show fitted differences in the probability of locating in larger, better-educated cities based on the polynomial specification of the conditional logit location model. The left-hand side shows DIDs for city size, with the sizes of small- and medium-size cities set equal to their respective means and human capital composition set equal to its sample-wide mean. The right-hand side shows DIDs for human capital composition, with percent college graduates in low- and medium-human capital cities set equal to their respective means and city size set equal to its sample-wide mean. Probability values for these graphs are contained in Figure A1.

draws from a (presumably) multivariate normal distribution.[14] These differences are positive and statistically significantly different than zero for definitions of 'largeness' up to 10 million and indicate that relative to the polynomial approach, the categorical approach understates the role of city size. However, the differences between wife-only and low-power couples, graphed in the bottom left, are consistent with those using the categorical approach: the point estimates are generally positive, but statistically not different than zero.

Seen on the right-hand side of Figure 4 are differences-in-odds of moving to highly educated cities (>26% college graduates) relative to cities with low and medium levels of human capital (medians of 17.08% and 23.15%), with population set equal to its median of 292,200. These differences are also positive, although the high versus medium

14 Probability values for all simulations based on the polynomial models are contained in Appendix A.2. See notes to the relevant tables for details.

difference is statistically significant at the 5% level only for human capital compositions of 35% college graduates or higher.[15]

To recap, the polynomial analysis suggests a more important role of city size for the location of full versus husband-only power couples than does the categorical approach, while the other findings are consistent with the the categorical analysis.

4. Career benefits of locating in large cities

4.1. Prior research

To support their hypothesis that joint labor market concerns motivated the tendency of power couples to locate in large cities, Costa and Kahn (2000) provided evidence that power couples were more likely to locate in large cities than 'coincidental' power couples, especially when the wife works.[16] That said, there is scant evidence that large cities improve the labor market outcomes of married women. Frank (1978) found that wives were less likely to be over-qualified for their jobs in large metropolitan areas by comparison with their husbands, but cautioned that small sample sizes (444 husbands and 89 wives from the 1967 Survey of Economic Opportunity) precluded precision. More recently, using PSID data, McGoldrick and Robst (1996, 283) found some evidence of better job matches among wives who lived in labor markets with higher percentages of white-collar workers, but no evidence that they were less likely to be over-educated for their jobs.

4.2. The large city wage premium

Not all of the evidence regarding the effects of city size on wives' labor market outcomes is negative. Using data from the March 1992 Current Population Survey, Ofek and Merrill (1997) estimated that the earnings of married women rose at nearly twice the rate with local market population than the earnings of married men. However, they did not distinguish between better-educated and less-educated spouses, either individually or jointly.

To see whether higher returns to city size among college-educated spouses could help explain the differential attractiveness of larger cities, I estimated the following Mincerian log wage equation:

$$W^t_{il} = \beta^t_{\mathrm{S}}\mathrm{SIZE}_l + \beta^t_{\mathrm{H}}\mathrm{HK}_l + \beta^t_{\mathrm{E}}\mathrm{ED}_i + \beta^t_X X_i + \mathrm{YEAR} + \mathrm{REGION} + \mathrm{CF}_{il} + \epsilon^t_{il}, \quad (8)$$

where W_{il} is the log weekly wage of individual i of couple type t who lives in location l, ED_i is a vector of educational indicators, X_i is a vector of potential labor market experience in powers of 1–5, YEAR is a vector of year effects and ϵ_i is an error term. The vectors SIZE_l and HK_l contain indicator variables for city population (small, medium and large) and human capital composition (low, medium and high), in

15 Figure A1 contains probability values for these contrasts.

16 Suppose that there are 100 single power men and women and that 40 of the men are in large cities and 60 are in small cities and that 60 of the women are in large cities and 40 are in small cities. At most 80 marriages could form—40 in large cities and 40 in small cities. The probability of a coincidental couple being in a large city is therefore 0.5 (Costa and Kahn, 2000, 1295).

non-interacted form [in contrast to Equation (1)].[17] Also included are a vector of region dummies, plus the control function CF_{il}, to be described shortly.

I focus on full-time market participants, defined as individuals who worked at least 35 h per week and 35 weeks in the prior year. Because what matters is lifetime earnings, I do not restrict the sample to young couples, but include individuals between the ages of 25 and 59 years.[18] Absent information on earnings prior to the survey date, I make no effort to link the analysis of earnings to the migration analysis. Because my focus is on the returns to city size, I focus exclusively on individuals who currently reside in a city.[19]

Summary statistics on log wages by couple type appear in the first two panels of Table 6. Wages tend to rise with education level and, within education level, with city size. There is also some evidence of positive assortative matching in the sense that college-educated husbands who are married to college-educated wives earn more than those married to non-college-educated wives (7.62 versus 7.50, 7.40 versus 7.32 and 7.27 versus 7.21 in large, medium and small cities, respectively) and college-educated wives who are married to college-educated husbands earn more than those married to non-college educated husbands (7.21 versus 7.08, 7.00 versus 6.91 and 6.92 versus 6.82).

This does not pose a problem because I am not trying to establish causality of the college degree *per se*. College-educated individuals, especially those married to college-educated spouses, could also possess higher levels of skill unobservable to the researcher. Costa and Kahn (2000) argued only that large cities solve a co-location problem faced by particularly highly skilled couples, not that possession of a college degree fully captures all dimensions of skill.

However, issues could arise to the extent that marriage rates differ across locations of different populations and human capital compositions in a way that is systematically related to occupational and educational attainment. Finding a larger effect of city size or human capital on career outcomes in full-power than in part- and low-power couples could reflect merely greater selectivity into marriage among full-power than less-educated couples. The vector of region dummies should help control for differences in cultural and social norms related to these outcomes. In addition, the percentage of women (for wive's wage regressions) or men (for husband's wage regressions) who marry is included as a component of the control function CF_{il}.

Finally, Black et al. (2014) document differences in married female labor force participation, especially less-educated wives, across areas, with especially low rates in New York and several other large cities with considerable congestion and long commute times. To deal with this source of possible selection, CF_{il} also includes as a control function the percentage of married women (wive's wage regressions) or men (husband's wage regressions) who participate in the labor market.

Summary statistics for the regressors are relegated to Table A4. Ordinary least square estimates of Equation (8) by couple type are reported in Table 7, for wives in Columns 1–4 and for husbands in Columns 5–8, with standard errors clustered on city shown in

17 An interacted specification yielded imprecise and uninformative results.

18 Blackburn (2009) finds evidence that the earnings of husbands of white-collar couples who change locations rise following the move, and that any earnings losses of the wife appear to be temporary. This suggests that one should examine labor market outcomes over longer rather than shorter periods.

19 Couples in which either spouse reports earnings >1.4 times the 99th percentile or earns <35 times the federal hourly minimum wage are excluded. These exclusions have no substantive impact on the results.

Table 6. Mean earnings and occupational skill by city size group

	Full power			Husband power			Wife power			Low power		
	Large (1)	Medium (2)	Small (3)	Large (4)	Medium (5)	Small (6)	Large (7)	Medium (8)	Small (9)	Large (10)	Medium (11)	Small (12)
	Wife's log weekly wage											
Mean	7.21	7.00	6.92	6.78	6.65	6.55	7.08	6.91	6.82	6.66	6.50	6.45
SD	0.52	0.48	0.47	0.50	0.47	0.45	0.49	0.46	0.45	0.48	0.45	0.44
N	113,894	73,345	17,444	30,258	24,953	6888	61,630	53,322	16,822	137,597	142,361	49,207
	Husband's log weekly wage											
Mean	7.62	7.40	7.27	7.50	7.32	7.21	7.10	6.93	6.88	6.98	6.83	6.81
SD	0.66	0.64	0.62	0.63	0.61	0.59	0.54	0.50	0.48	0.53	0.51	0.50
N	201,423	122,493	27,346	69,744	54,282	14,031	72,246	59,005	18,191	214,729	217,082	74,895
	Wife's occupational skill											
Mean	67.79	64.51	61.88	58.45	57.71	55.48	64.42	62.75	59.60	53.22	51.71	50.58
SD	24.95	25.16	25.18	26.04	26.27	26.82	25.20	25.21	25.37	26.71	26.58	26.69
N	113,894	73,345	17,444	30,258	24,953	6888	61,630	53,322	16,822	137,597	142,361	49,207
	Husband's occupational skill											
Mean	72.36	68.95	64.55	70.17	67.54	63.67	57.26	55.65	54.76	52.14	50.44	49.68
SD	25.08	26.76	28.15	24.84	25.94	27.29	25.21	24.99	24.20	25.13	24.58	24.06
N	201,423	122,493	27,346	69,744	54,282	14,031	72,246	59,005	18,191	214,729	217,082	74,895

Notes: Wages and occupational skill measures are for full-time, full-year workers age 25–59 years. Occupational skill measures correspond to the percentile of detailed, three-digit occupations in the wage distribution. See text for details.

Table 7. City size and human capital composition effects: husband's and wife's log weekly wages

	Wife's wage				Husband's wage			
	(1) Full	(2) Husband	(3) Wife	(4) Low	(5) Full	(6) Husband	(7) Wife	(8) Low
Large population	0.230	0.191	0.189	0.157	0.299	0.258	0.184	0.158
	(0.020)	(0.020)	(0.020)	(0.018)	(0.020)	(0.021)	(0.020)	(0.020)
Medium population	0.089	0.084	0.078	0.062	0.121	0.107	0.058	0.053
	(0.011)	(0.012)	(0.010)	(0.009)	(0.013)	(0.013)	(0.011)	(0.011)
High HK	0.070	0.064	0.057	0.070	0.073	0.061	0.033	0.031
	(0.017)	(0.019)	(0.016)	(0.016)	(0.022)	(0.021)	(0.019)	(0.019)
Medium HK	0.009	0.010	0.001	0.013	0.018	0.007	−0.016	−0.023
	(0.018)	(0.019)	(0.016)	(0.015)	(0.024)	(0.021)	(0.019)	(0.018)
R-square	0.1580	0.0820	0.1509	0.1165	0.1835	0.1361	0.1086	0.1245
Observation	203,536	61,697	130,971	325,828	350,786	137,886	149,102	504,617

Notes: All regressions control for education (0–4, 5–8, 9–11, high school, some college, MA, PhD), a quintic in experience, region (8), year and selection (percent married and percent of marrieds in the labor force in each city), not shown to save space.

parentheses. The estimated coefficients on the control variables are unremarkable, and so I move on to the effects of interest. Wages are predicted to be higher in large cities, more so for college-educated spouses. For example, the estimated large versus small city wage premium for college (non-college) wives married to college men is 0.255 (0.218) log points, and for those married to non-college men, 0.211 (0.180) log points. A similar pattern holds among husbands: 0.319 (0.21) log points and 0.268 (0.171) log points.

Formal tests of equality are reported in Table A5. Most of the contrasts of interest are positive, meaning that wages tend to be higher in larger, better-educated cities for spouses in couples with college-educated wives (and husbands). However, we can reject the null hypothesis with consistency only for the full versus husband-only and husband-only versus low-power comparisons, and the differences-in-differences (DIDs) with respect to city human capital composition are negative for wife-only versus low-power couples. One would therefore be reluctant to test the case for the special career advantages of large cities for couples with college-educated wives on the basis of these findings.

4.3. City size and career potential

4.3.1. Career potential versus wage outcomes

I propose that the differential attractiveness of large cities for power couples may lie not so much in *realized* career outcomes, but in *potential* career outcomes. Over time, women's and men's earnings have greatly, albeit not completely converged, much of it a result of the convergence in women's educational and occupational choices (Goldin, 2014). Goldin (2014) demonstrates that the earnings gap between men and women tends to be higher in high-wage occupations, which in turn tend to be those characterized by high equilibrium levels of, and rewards to, work intensity as measured by, for example, hours worked. Goldin (2014) acknowledges that this gap reflects women's decisions to exert lower levels of work intensity than men. Left unanswered by Goldin (2014) is the question of why women would be attracted to careers characterized by high returns to work intensity, and yet choose to exert relatively low levels of work intensity by comparison with men. Whatever those reasons may be, I adopt as a tentative hypothesis that women value high-wage occupations because those occupations offer high levels of earnings *potential*, should a decision be made to exert high levels of work intensity. A higher concentration of high-wage occupations in large cities could therefore help explain why such cities are particularly attractive to power copules.

4.3.2. Occupational skill as a measure of career potential

A natural measure of an occupation's career potential is its place in the log wage distribution, a measure developed for other purposes by Autor and Dorn (2014). Because I am comparing occupational outcomes across couples with different levels of schooling and experience, I adapt their measure to correct for those factors. In particular, I first estimate a model of log weekly earnings for married and unmarried men in the ACS as a function of schooling, experience, ethnicity, a complete set of city indicators and most crucially, a complete set of 1990 occupational indicators.[20] I take

20 I exclude women to avoid the issues raised by Goldin (2014). The sample restrictions for the married sample were applied to this sample as well.

the estimated coefficients on the occupation indicators as my measure of occupational skill. Each husband and wife is assigned the estimated coefficient on the relevant occupational dummy variable. I then compute skill percentiles, by gender.

Table A6 presents the position of selected occupations in the male and female occupational skill distributions, their share of total employment and their share of female and male college graduate employment. The four most skilled occupations, at the 96th–100th percentiles, include physicians, chief executives, lawyers and managers, which comprise about 3.0% of total employment, and 5.3% and 9.8% of female and male college graduate employment. A bit further down at the 88th and 81st female and male occupational skill percentiles, accountants and auditors employ 1.5% of all workers, and employ about 3.7% and 3.2% of female and male college graduates. Still further down are retail sales clerks (59th and 41st female and male skill percentiles, employing 1.3% and 1.5% of female and male college graduates), and primary and secondary school teachers (39th and 48th female skill percentiles, 21st and 25th male skill percentiles), which, combined employ over 16% of female college graduates, but just a bit over 5% of male college graduates. At the 15th (10th) female (male) skill percentile and lower are cashiers, cooks and kindergarten teachers. Taken as a whole, the resulting ranks seem reasonable.

4.3.3. Occupational skill tends to be higher in large cities

The lower two panels of Table 6 show that within couple type, mean occupational skill levels tend to be higher in larger cities. For example, the mean occupational skill levels of wives in full-power couples are 67.8, 64.5 and 61.9 in large, medium and small cities. The figures for their husbands are 72.4, 69.0 and 64.6. The overall pattern is similar for other types of couples. The message conveyed by these means is reinforced by the kernel densities of occupational skill (calculated when men and women are pooled) in large and non-large (i.e., medium and small) cities, seen in Figure A2 for workers as a whole, and in Figure A3 for college-educated workers. The density of occupational skill in large cities (solid lines) tends to lie above that of smaller cities (dotted lines) at or above the 60th percentile; the reverse is true below the 60th percentile.[21]

4.3.4. Large-city occupations tend to be more highly skilled

I next ranked the occupations by the difference in the share of workers employed in large and non-large (small and medium) size cities. This ranking, along with the average occupational skill level, is reported in Table A7, from most to least highly concentrated in large cities. Large-city occupations include managers, with a big-small city employment share difference of 1.65 percentage points, lawyers (1.22), computer software developers and scientists (0.71 and 0.65) and salespersons n.e.c. (0.70), while small-city occupations include pharmacists (−0.21), social workers (−0.38), farmers (−0.47), clergy (−0.48), registered nurses (−1.09) and primary school teachers (−2.9). The simple correlation between the large–small city share differential and the skill

21 The kernel density of occupational skill is not as ‘regular’ as that of wages, spiking upward at percentiles that correspond to large occupations such as teaching (for women) and management (for men), and downward at percentiles that correspond to small occupations.

percentile is a statistically significant 0.22, and is consistent with the notion that highly skilled occupations tend to be 'large city' occupations.

4.3.5. Skill rises faster with size and human capital for college-educated spouses

I re-estimated regression Equation (8), replacing the log of the weekly wage with the occupational skill percentile. Table 8 contains the estimates, Columns 1–4 for wives and Columns 5–8 for husbands. The pattern of estimated effects on the city indicators is similar to that for log wages, but I forego discussion of those coefficients and move immediately to the hypothesis tests of interest, seen in Table 9.

The estimated large versus small city size effects are statistically significantly higher for college-educated wives than non-college-educated wives: 2.764 points (SE = 0.66) for those married to college-educated husbands (full versus husband) and 1.286 points (SE = 0.55) for those married to non-college-educated husbands (wife versus low), the former significant at the 0.001 level and the latter at the 1.9% level. The large versus small and medium versus small city size skill premium differentials are larger for college-educated wives and are all positive and statistically significant in all but one case (large- versus medium-size cities, wife-only versus low-power couples, 0.032, SE = 0.50). There is also evidence that human capital composition matters more for college-educated than non-college wives.

Do these same patterns hold for the occupational attainment of the husband? The DIDs tend to be positive and statistically significant when comparing households with college-educated husbands to those with non-college husbands. However, the full versus husband-only DID are positive, but are generally not statistically significant, while the wife-only versus low-power DIDs are more mixed. One might conclude that in this sense, city size and composition play a more important role in the occupational skill attainment of the wife than the husband, but the results also suggest that large city sizes and high-human capital levels help college-educated wives and do not hurt husbands, whether college-educated or not.

4.4. Joint career outcomes: multinomial logit estimates

Presence in a larger, better-educated city may enhance skill attainment on *average*, but higher occupational attainment of one spouse could still come at the expense of the other within a couple. I therefore now ask whether living such cities is associated with higher occupational skill attainment *jointly*. Define the indicator function $Q_i(q_w, q_h)$ to be equal to unity if in household (of type) i the wife holds an occupation in skill quintile q_w and the husband an occupation in skill quintile q_h, where $q_w, q_h = 1, 2, 3, 4, 5$, ranked from low skill to high. I estimate a multinomial logit model for the probability of each of the 25 possible values of $Q_i(q_w, q_h)$ being observed as a function of city size and human capital composition, controlling jointly for the same husband and wife characteristics as in Equation (8).[22]

22 The assumption of independence of irrelevant alternatives is tenuous in this setting. I could have estimated a series of bivariate logits, but I view this exercise as permitting in an efficient way the summarizing of a wide variety of patterns in the data.

Table 8. City size and human capital composition effects: husband's and wife's skill

	Wife's occupational skill				Husband's occupational skill			
	(1) Full	(2) Husband	(3) Wife	(4) Low	(5) Full	(6) Husband	(7) Wife	(8) Low
Large population	5.341	2.577	3.733	2.447	7.411	6.446	3.170	2.996
	(0.490)	(0.435)	(0.455)	(0.304)	(0.466)	(0.505)	(0.370)	(0.391)
Medium population	2.754	1.420	2.542	1.288	4.205	3.506	1.138	1.280
	(0.407)	(0.418)	(0.340)	(0.233)	(0.436)	(0.458)	(0.324)	(0.283)
High HK	4.627	0.409	4.009	1.087	4.023	2.623	0.992	0.732
	(0.554)	(0.497)	(0.433)	(0.329)	(0.611)	(0.523)	(0.436)	(0.407)
Medium HK	3.555	0.606	3.110	0.356	2.821	1.625	0.235	−0.091
	(0.520)	(0.465)	(0.423)	(0.308)	(0.618)	(0.525)	(0.431)	(0.390)
R-square	0.0842	0.0283	0.0464	0.0475	0.0793	0.0433	0.0532	0.0666
Observation	203,536	61,697	130,971	325,828	350,786	137,886	149,102	504,617

Notes: All regressions control for education (0–4, 5–8, 9–11, high school, some college, MA, PhD), a quintic in experience, region (8), year and selection (percent married and percent of marrieds in the labor force in each city), not shown to save space.

Table 9. Tests for differences in effects of city size and human capital on occupational skill

	Wife's skill				Husband's skill			
	Full vs. husband	Full vs. wife	Wife vs. low	Husband vs. low	Full vs. husband	Full vs. wife	Wife vs. low	Husband vs. low
Population:	2.764	1.608	1.286	0.130	0.965	4.241	0.174	3.450
large vs. small	(0.66)	(0.67)	(0.55)	(0.53)	(0.69)	(0.60)	(0.54)	(0.64)
	[0.000]	[0.016]	[0.019]	[0.806]	[0.160]	[0.000]	[0.747]	[0.000]
Large vs. medium	1.430	1.397	0.032	−0.001	0.266	1.175	0.316	1.224
	(0.52)	(0.62)	(0.50)	(0.36)	(0.51)	(0.48)	(0.46)	(0.49)
	[0.006]	[0.025]	[0.950]	[0.997]	[0.601]	[0.014]	[0.493]	[0.013]
Medium vs. small	1.334	0.211	1.254	0.132	0.699	3.067	−0.142	2.226
	(0.58)	(0.53)	(0.41)	(0.48)	(0.63)	(0.54)	(0.43)	(0.54)
	[0.022]	[0.690]	[0.002]	[0.784]	[0.269]	[0.000]	[0.741]	[0.000]
HK: high vs. low	4.218	0.618	2.921	−0.679	1.399	3.031	0.260	1.891
	(0.74)	(0.70)	(0.54)	(0.60)	(0.80)	(0.75)	(0.60)	(0.66)
	[0.000]	[0.379]	[0.000]	[0.255]	[0.082]	[0.000]	[0.663]	[0.004]
High vs. medium	1.269	0.173	0.167	−0.929	0.203	0.445	−0.067	0.175
	(0.47)	(0.49)	(0.40)	(0.37)	(0.56)	(0.53)	(0.46)	(0.50)
	[0.007]	[0.725]	[0.673]	[0.012]	[0.718]	[0.398]	[0.886]	[0.728]
Medium vs. low	2.949	0.445	2.754	0.250	1.197	2.586	0.327	1.716
	(0.70)	(0.67)	(0.52)	(0.56)	(0.81)	(0.75)	(0.58)	(0.65)
	[0.000]	[0.507]	[0.000]	[0.653]	[0.140]	[0.001]	[0.574]	[0.009]

Notes: Calculated using the estimated coefficients reported in Table 8. Standard errors clustered on city are in parentheses and probability values for the null hypothesis are in brackets. The comparisons between full- and husband-only power couples test for the effects of the wife's college degree in couples in which the husband has a college degree, and between wife-only and low-power couples, for the effects of the wife's college degree in couples in which the husband does not have a degree. A positive number indicates relatively higher skill levels in couples in which the wife has a college degree. The remaining columns test for the effects of the husband's college degree for couples in which the wife has a college degree (full—wife-only) and in which the wife does not have a college degree (husband-only—low).

4.4.1. Probability of joint career success is higher in larger cities

Calculations of Prob[$Q_i(5, 5)$], the probability that both members of a household of type *i* are employed in occupations in the upper skill quintile, by city type, are reported in Table 10.[23] There is a strong, positive relationship between the estimated probabilities and city size. For example, the estimated probability that both spouses in a power couple are employed in the top occupational skill quintile, Prob[$Q_F(5, 5)$], is 23.2%, (SE = 0.1%) in large, highly educated cities and 21.5% (SE = 1.1%) in large, medium-educated cities (recall that there are no large, low-educated cities). By comparison, the probabilities in medium-size cities, human capital ranked high to low, are 19.3%, 19.1% and 14.9%, and in small cities, 16.1%, 14.3% and 12.4%. A similar pattern holds for other types of couples. A glance at the other entries reveals that the effects of both city size and human capital composition on joint career attainment are generally (but not always) positive for all couple types.

4.4.2. DID estimates of the effects of city size and human capital composition

DIDs in these probabilities are contained in Table 11. The first panel presents the DIDs between full- and husband-only power couples for the probability that both spouses are in the upper occupational skill quintile. For example, the effect of living in a large (L), high-human capital (H) city relative to a small (S), high-human capital city for full-power couples is given by

$$\text{Prob}[Q_F(5,5)|\text{L} \cap \text{H}] - \text{Prob}[Q_F(5,5)|\text{S} \cap \text{H}], \quad (9)$$

which is equal to (0.232–0.161) 7.1 percentage points. The corresponding figure for husband-only power couples is (0.078–0.052) 2.6 percentage points, and the DID is equal to 4.5 percentage points, which has a standard error of 1.0 and is statistically significant at the 0.001 level. The DID for large- versus medium-size, high-human capital cities is 2.9 (SE = 0.7) percentage points, also statistically significant at the 0.001 level. Only two of the five DID effects of human capital composition, seen to the right, are positive and statistically significantly different than zero at the 10% level or better. The DID estimates for wife-only versus low power couples, seen in the second panel, are generally also positive, although just one-quarter to one-fifth the magnitude of those for full- versus husband-only power couples, and statistical significance is somewhat lower.

4.4.3. Do large cities reduce wives' penalty for husbands' success?

My data, being purely cross-sectional, do not permit me to examine whether moves that benefit the career of the husband are less likely to come at the expense of the career of the wife in larger, better-educated cities. However, I examine this possibility indirectly by calculating whether city size or human capital composition related to the joint

23 I assume 10 years of potential experience, education equal to a bachelor's degree for college graduates and a high school degree for non-graduates, and I set race equal to white. Standard errors, reported in parentheses, are based on 1000 Monte-Carlo draws from the (assumed) normal distribution of the estimated coefficients. Little being gained from examination of the raw estimates, they are suppressed.

Table 10. Probability wife and husband jointly employed in top-quintile occupations, by city size and human capital composition

	Human capital		
	High HK	Medium HK	Low HK
		Full power	
Large	0.232	0.215	
	(0.009)	(0.011)	
Medium	0.193	0.191	0.149
	(0.009)	(0.010)	(0.011)
Small	0.161	0.143	0.124
	(0.010)	(0.011)	(0.009)
		Husband-only power	
Large	0.078	0.070	
	(0.009)	(0.009)	
Medium	0.068	0.066	0.058
	(0.008)	(0.007)	(0.009)
Small	0.052	0.052	0.050
	(0.008)	(0.007)	(0.006)
		Wife-only power	
Large	0.049	0.047	
	(0.004)	(0.004)	
Medium	0.040	0.038	0.033
	(0.004)	(0.004)	(0.004)
Small	0.033	0.030	0.025
	(0.004)	(0.003)	(0.003)
		Low power	
Large	0.011	0.011	
	(0.001)	(0.001)	
Medium	0.009	0.008	0.007
	(0.001)	(0.001)	(0.001)
Small	0.007	0.006	0.007
	(0.001)	(0.001)	(0.001)

Note: Standard errors clustered on city are in parentheses.

probability that the husband is employed in skill quintiles 4 or 5 while the wife is employed in skill quintiles 1 and 2:

$$\text{Prob}[Q_i(1 \cup 2, 4 \cup 5)|\text{SIZE} \cap \text{HK}]. \tag{10}$$

The DIDs in these probabilities, contained in the last two panels of Table 11, are uniformly negative, but they are larger in magnitude and statistically more significant for couples in which the husband has a college degree: −3.6 (SE = 0.012) percentage points for large versus small, highly educated cities (prob value = 3%) and −2.8 (SE = 0.7) percentage points for large- versus medium-size, highly educated cities (prob value = 0.001). The DIDs for medium-educated cities are −4.1 and −1.9 percentage points, statistically significant at the 0.6% and 4.5% levels. The estimated DIDs with respect to human capital composition are also negative, but just two of the five are statistically significant. The DIDs for wife-only versus low-power couples are negative,

Table 11. Differential effect of city size and human capital composition on joint skill outcomes: full versus husband and wife-only versus low-power couples

High HK		Medium HK		Big	Medium		Small	
Big vs. small	Big vs. medium	Big vs. small	Big vs. medium	High vs. medium	High vs. low	High vs. medium	High vs. low	High vs. medium
Botd in top quintile, full vs. husband								
0.045	0.029	0.054	0.020	0.008	0.034	−0.001	0.035	0.018
(0.010)	(0.007)	(0.012)	(0.010)	(0.009)	(0.010)	(0.008)	(0.011)	(0.012)
[0.000]	[0.000]	[0.000]	[0.040]	[0.336]	[0.001]	[0.934]	[0.001]	[0.144]
Both in top quintile, wife vs. low								
0.012	0.007	0.012	0.006	0.002	0.006	0.001	0.008	0.003
(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)
[0.000]	[0.002]	[0.000]	[0.017]	[0.341]	[0.051]	[0.559]	[0.011]	[0.361]
Wife in bottom, husband in top two quintiles, full vs. husband								
−0.036	−0.028	−0.041	−0.019	−0.012	−0.023	−0.003	−0.035	−0.016
(0.012)	(0.007)	(0.015)	(0.010)	(0.008)	(0.010)	(0.008)	(0.016)	(0.016)
[0.003]	[0.000]	[0.006]	[0.045]	[0.156]	[0.016]	[0.676]	[0.028]	[0.323]
Wife in bottom, husband in top two quintiles, wife vs. low								
−0.010	−0.002	−0.016	−0.004	−0.004	−0.005	−0.005	−0.012	−0.009
(0.008)	(0.005)	(0.007)	(0.005)	(0.006)	(0.006)	(0.005)	(0.009)	(0.009)
[0.201]	[0.621]	[0.032]	[0.467]	[0.519]	[0.401]	[0.272]	[0.200]	[0.271]

Notes: The entries in the top two rows of this table are based on DIDs of the entries in Table 10. The remaining entries are constructed in a similar fashion. Standard errors clustered on city are in parentheses and probability values for the null hypothesis are in brackets. The comparisons between full- and husband-only power couples test for the effects of the wife's college degree in couples in which the husband has a college degree, and between wife-only and low-power couples, for the effects of the wife's college degree in couples in which the husband does not have a degree. A positive number indicates relatively higher probability in couples in which the wife has a college degree. The remaining columns test for the effects of the husband's college degree for couples in which the wife has a college degree (full—wife-only) and in which the wife does not have a college degree (husband-only—low).

but only one of the nine is statistically significantly different than zero (large- versus small-, medium-human capital, significant at the 3.2% level).

These results suggest that living in a larger, better-educated city reduces the probability of lopsided career outcomes by more when the wife has a college degree, but there is only so much that city size and human capital composition can do for husbands who do not have a college degree.

4.4.4. Differences in joint career outcomes: polynomial specification

Finally, I calculated DIDs in career outcomes from a specification using the polynomial in city size and human capital composition in Equation (7). The DID effects of city size on jointly high occupational skill attainment between full- and husband-power couples, seen in the top left of Figure 5, are positive and statistically significant, and reinforce the conclusions based on the categorical classification of cities. The DIDs between wife and low-power couples, seen in the bottom left, are also positive but are smaller in magnitude, but still statistically significant for most city sizes.

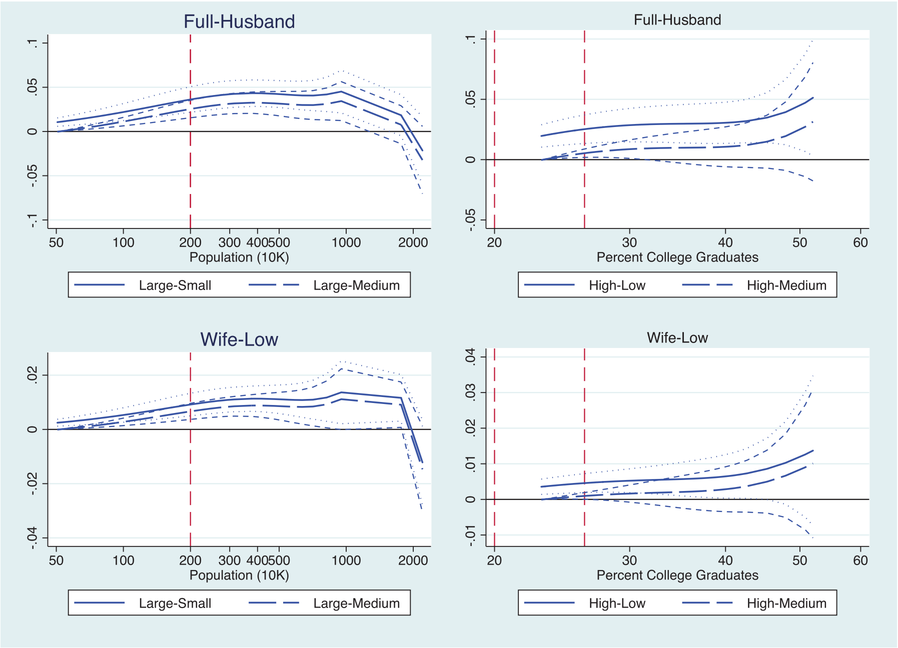

Figure 5. Effect of city size and human capital composition on the probability husband and wife in top occupational skill quintile.
Notes: These graphs show fitted differences in the probability that husband and wife are jointly in the top occupational skill quintile in larger, better-educated cities based on the polynomial specification of the conditional logit location model. The left-hand side shows DIDs for city size, with the sizes of small- and medium-size cities set equal to their respective means and human capital composition set equal to its sample-wide mean. The right-hand side shows DIDs for human capital composition, with percent college graduates in low- and medium-human capital cities set equal to their respective means and city size set equal to its sample-wide mean. Probability values for these graphs are contained in Figure A4.

The DID effects of living in highly educated cities, seen in the right-hand side of Figure 5, are also positive, reinforcing the findings based on the categorical analysis. They continue to be larger for full versus husband-only than for wife-only versus low-power couples, statistically significant for the high versus low comparisons except at the very highest human capital levels for wife-only versus low-power couples, but generally not statistically significant for the high versus medium contrasts.

The question of career trade-offs between the husband and wife is considered in Figure 6. The graphs generally reinforce the story told by the contrasts in Table 11: living in larger cities reduces the probability of college-educated wive's low occupational attainment when the husband achieves high occupational attainment, but the differences are statistically significant only when the husband has a college degree. The effects of living in highly educated cities, seen on the right, are also positive, but again are statistically significant only when the husband has a college degree, and then only for the high versus low contrasts.

Summarizing, the polynomial analysis of career outcomes supports the notion that living in larger, better-educated cities improves joint occupational attainment by more when the wife has a college degree, but only when the husband has a college degree as

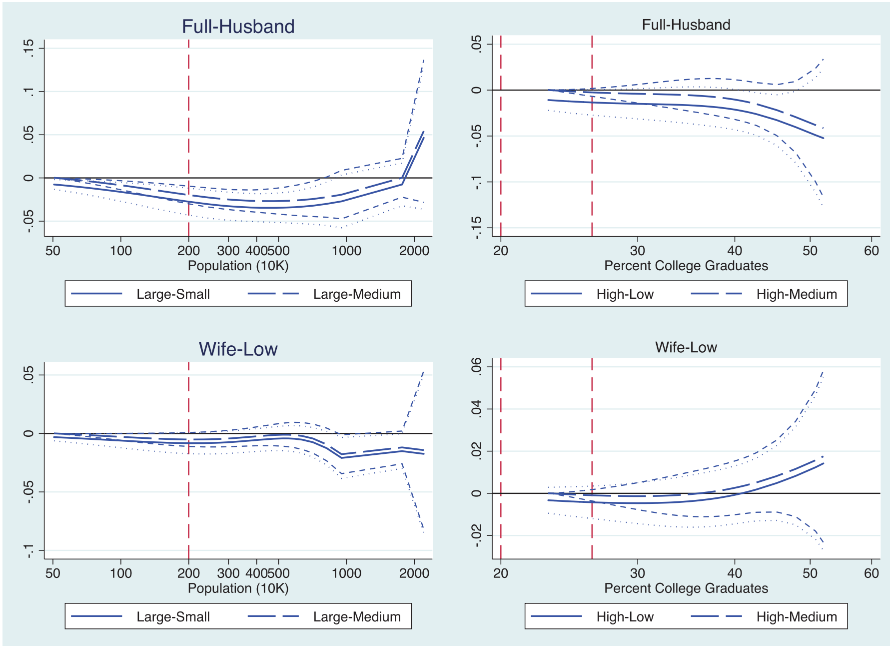

Figure 6. Effect of city size and human capital composition on the probability husband in top, wife in bottom two occupational skill quintiles.
Notes: These graphs show fitted differences in the probability that husband is in the top two, and the wife in the bottom two occupational skill quintiles in larger, better-educated cities based on the polynomial specification of the conditional logit location model. The left-hand side shows DIDs for city size, with the sizes of small- and medium-size cities set equal to their respective means, and human capital composition set equal to its sample-wide mean. The right-hand side shows DIDs for human capital composition, with percent college graduates in low- and medium-human capital cities set equal to their respective means, and city size set equal to its sample-wide mean. Probability values for these graphs are contained in Figure A5.

well. This is not entirely surprising: living in a large city can do only so much for the career of husbands who do not have a college degree.

5. Robustness check: analysis using 2012–2014 data

A number of readers have raised the question of whether the results in this paper are unduly affected by the Great Recession, which the National Bureau of Economic Research dates as starting in December 2007 and ending in June 2009. During that period, the unemployment rate rose from an average of 5.8% in 2008 to 9.3% in 2009. The unemployment continued to rise slightly in the aftermath of the recession to 9.6% in 2010, fell to a still high 8.9% in 2011 and continued to fall to 8.1%, 7.4% and 6.2% in 2012, 2013 and 2014, respectively. I therefore re-estimated all of the analysis using data from just the 2012 to 2014 period.[24]

24 Another reason to examine just this period is that the definition of PUMAs changed in 2012.

The results for the reduced sample are contained in Appendix E. Most of the findings are similar in the full and reduced samples, but are not as statistically significant as in the full sample. Admittedly, the fact that precision is lower in the reduced sample could indicate that the effects of city size and human capital composition are more important during recession periods. I have elected to focus on the results for the full-time period, but acknowledge that more research is necessary to discern whether the patterns found here are sensitive to the business cycle.

6. Conclusion

Costa and Kahn (2000) established that, over the course of the 20th century, power couples in which both spouses have a college degree were increasingly likely to live in large cities, and that this tendency was related to career concerns. Examination of data from the ACS for the period 2008–2014 reveals that full-power couples are relatively more likely to move to larger, better-educated cities than husband-only power couples in which only the husband has a college degree and wife-only power couples more likely than low-power couples in which neither spouse has a college degree. However, the effects of the wife's college degree on the odds of moving to larger cities are statistically significant only when the husband also has a college degree.

New to this paper are the effects of cities' human capital composition as measured by percent college graduates, thus supporting a similar notion in Compton and Pollak (2007). Full-power couples are significantly more likely to choose to live in more highly educated cities than husband-only power couples and wife-only power couples significantly more likely than couples in which neither spouse has a college degree.

Also new to this paper are the findings regarding the effects of city size and human capital composition on joint husband and wife career outcomes. In contrast to most papers, which focus on wages, I measure career attainment by the skill percentile of the occupation. I find that living in larger, better-educated cities is associated with relatively higher probabilities that both husband and wife are employed in highly skilled occupations when the wife has a college degree. I also find evidence consistent with the notion that college-educated wives who are married to college-educated husbands are less likely to sacrifice their career for those of their husbands in larger, better-educated cities.

The magnitude of the effects of living in a larger, better-educated city on occupational attainment are larger and statistically more significant than those on wages. Solving this apparent puzzle is beyond the scope of this paper, but one possible explanation may lie in the work of Rosenthal and Strange (2008), who find that the return to work effort among young, highly educated men employed in managerial and professional occupations is higher in large cities. They interpret this as an attempt by young men to advance their careers by winning the 'rat race,' in which competition is more intense in large cities. Highly educated women may value careers in highly skilled occupations for their option value, and yet choose not to exert effort at the same level as men for family reasons, and hence not reap the full potential returns to city size. Further exploration of these ideas is left for future research.

More work is necessary to understand the attraction of better-educated cities to highly educated couples. One possibility is that better-educated cities have higher amenities. However, Glaeser and Resseger (2010) noted that for this argument to be correct, then the presence of skilled people acts as a 'supply shock' that should drive down earnings in equilibrium. However, the evidence in this paper, and in theirs, finds a robustly positive relationship between earnings in larger, better-educated cities. Another possibility, suggested by Winters (2011), is that better-educated cities might grow via their role as centers of higher education, attracting students who subsequently make the decision to stay. However, the question then becomes what mechanism might keep them there. Still another possibility, advanced by Berry and Glaeser (2005), is that the clustering of skilled people is driven by the tendency of skilled entrepreneurs to innovate in ways that employ other skilled people.

Career concerns are not the sole motivation for locating in larger, better-educated cities. For example, Gautier et al. (2010) argued that singles are attracted to dense areas because they are able to meet more potential partners than in rural areas. Using Danish data, they found that married partners are more likely to move out of the city, which is consistent with their notion that the benefits of meeting more potential partners is lower for them. Nonetheless, that power couples, already matched to a partner, are more likely to move to bigger, better-educated cities suggest that considerations other than the marriage market play an important role in the attractiveness of large cities.

Acknowledgments

This paper was presented at the 2013 NARSC meetings in Atlanta, at the 2014 NARSC meetings in Washington, DC, and in May 2017 at the University of North Carolina at Greensboro. I thank my discussants Daniel Hartley and Dafeng Xu, and Janice Madden for their insights, and acknowledge helpful discussions with Tom Mroz, Jordan Rappaport, Will Strange, Robert Tamura, Tracy Turner and John Winters. I am grateful to two referees for their detailed and thoughtful comments and to the Editor for the opportunity and time to resubmit this paper. I am, of course, responsible for all errors and omissions. No funding was received in carrying out this research.

Supplementary material

Supplementary data for this paper are available at *Journal of Economic Geography* online.

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