Job Vacancies and Immigration: Evidence from the Mariel Supply Shock

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We use the Conference Board's Help-Wanted Index (HWI) to document how immigrant supply shocks change the number of job vacancies. Our analysis reveals a sizable drop in Miami's HWI relative to comparable cities in the first few years after the Mariel shock, followed by recovery afterward. An analysis of the text of the help-wanted ads also documents a significant decline in the relative number of low-skill vacancies advertised in the *Miami Herald*. Miami's Beveridge curve shifted inward by the mid-1980s, suggesting a more efficient local labor market, in contrast to the outward nationwide shift coincident with the 1981–82 recession.

I. Introduction

How do labor supply shocks affect labor market outcomes? This is perhaps the central question in the economics of immigration, in terms of both its economic content and its policy implications. Most important questions in labor economics relate to how labor markets adjust to supply and demand shocks. An immigration-induced increase in labor supply lets us observe

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how firms and workers react and adjust to the changed environment. Similarly, the debate over immigration policy often revolves around how immigration changes the size of the economic pie in the receiving country, particularly with how that pie is split.

The centrality of the question inspired a voluminous amount of empirical research over the past four decades. This literature typically examines how wages change in those labor markets targeted by immigrants. Sometimes the markets are defined by geographic boundaries (Altonji and Card 1991); sometimes the markets are defined by skill group (Borjas 2003). Regardless of how markets are defined, the basic identification strategy is the same. Immigrants tend to target some markets more than others. The impact of immigration is then measured by contrasting the evolution of wages in the markets hit by immigration with the evolution in the markets that immigrants avoided.

Owing to a host of technical issues (e.g., immigrants do not target markets randomly, firms and workers diffuse the impact of local supply shocks by moving elsewhere, and the available data often yield small samples for many cities and skill groups), the existing literature amply demonstrates the difficulty of measuring the impact of immigration on wages (Blau and Mackie 2016). Even more problematic, it turns out that the evidence often depends on researcher choices about how to frame the empirical analysis.

The recent debate over the wage impact of the Mariel boatlift provides a classic example of how those choices influence the answer. Card (1990) reported that the wage of the average worker in Miami was barely affected by the 8% increase in supply that Mariel represented. Borjas (2017) showed that if one focused on the low-skill worker most likely to be affected by Mariel (as represented by the average non-Hispanic man who is 25–59 years old and is a high school dropout), the evidence suggested that the wage fell by at least 15%. In contrast, Peri and Yasenov (2019) used an alternative definition of a low-skill worker (i.e., the average non-Cuban man or woman who is 19–65 years old and has not graduated from high school) and found that the wage remained unchanged after the supply shock.[1]

We contribute to the literature by reporting findings from a "new" data set, one that economists have used often since the 1960s but that has not been exploited in the immigration context. Beginning in 1951, the Conference Board constructed an index of job vacancies in local labor markets by counting the number of help-wanted classified ads in newspapers in 51 metropolitan areas. Although the rise of online advertising obviously reduced the usefulness of this index beginning sometime around 2000, the Conference Board's Help-Wanted Index (HWI) provides a historical series

[1] Notwithstanding the ongoing confusion about the wage impact of the Mariel boatlift, Monras (2021) documents post-Mariel internal migration flows in and out of the Miami labor market that reduced the relative supply of low-skill workers in the city during the 1980s.

of the ebbs and flows of labor demand in local labor markets for the last half of the twentieth century.

The HWI has been used to study such diverse phenomena as the trend of wages and productivity in the stagnant 1970s (Medoff 1983), the sectoral shifts explanation of structural unemployment (Abraham and Katz 1986), the relation between job vacancies and the unemployment rate (Cohen and Solow 1967; Burch and Fabricant 1968; Abraham 1987), the role of job search in a real business-cycle framework (Andolfatto 1996), and the cyclicality of job vacancies (Shimer 2005). An important theme runs through these studies: the HWI provides valuable information about labor demand and is highly correlated with various measures of labor market conditions.

The analysis of the HWI has one very valuable feature in the immigration context. It greatly reduces the number of degrees of freedom available to a researcher interested in estimating the labor market impact of immigration. The index was created concurrently with the supply shocks by independent organizations for a purpose totally unrelated to the immigration question that is at the core of this paper. The historical trends in the HWI in the cities that received many or few immigrants are set in stone.

Even more important, the analysis of the HWI allows us to extend the study of the labor market impact of immigration into areas that have been ignored in the literature, including an examination of the link between immigration and job vacancies and the documentation of some of the macroeconomic consequences of supply shocks.[2] Our analysis begins by revisiting the Mariel episode. The data clearly reveal a marked decrease in Miami's HWI relative to various control groups in the first 4 or 5 years after Mariel, followed by a full recovery afterward. Our empirical analysis also looks beyond Miami and estimates the generic spatial correlation that dominates the literature, correlating changes in the HWI between 1970 and 2000 with immigration across the 51 metropolitan areas for which the index is available. The spatial correlation also indicates that immigration is typically associated with reduced employer effort to find workers by placing help-wanted ads in the local newspaper.

[2] Few studies investigate the quantitative relationship between immigration and job vacancies either in the United States or abroad. Withers and Pope (1985) find no statistically significant relationship between immigration and the Australian job-finding rate, while Pholphirul (2013) reports that immigration reduces short-term job vacancies in Thai manufacturing. Job vacancies are often present as a latent variable in both theoretical (Ortega 2000) and empirical (Davila and Saenz 1990) analyses of immigration's impact on labor market outcomes. Chassamboulli and Peri (2015) use the national HWI to calculate a long-run job-finding rate, which they then fix to calibrate a labor market matching model for evaluating various immigration policies. Albert (2021) uses data from the Current Population Survey (CPS) basic monthly files to examine immigrant-native differences in the probability that an unemployed worker finds a job. The CPS data suggest that unemployed low-skill immigrants are more likely to exit unemployment than unemployed low-skill natives.

One weakness of the HWI is that it does not provide any information on the occupational characteristics of vacancies. We overcome this limitation (in the context of the Mariel supply shock) by directly inspecting a large sample of text drawn from help-wanted ads published in the *Miami Herald* and other newspapers between 1978 and 1984. This type of analysis helps identify the types of vacancies that vanished from the Miami labor market in the early 1980s. It turns out that the drop in the number of job vacancies in Miami was particularly severe in the low-skill sector. The fraction of vacancies for blue-collar positions fell precipitously, and surviving vacancies were for jobs that tended to hire more educated workers. The joint study of the quantity and textual content of help-wanted ads provides complementary evidence strongly suggesting that the labor market fortunes of low-skill natives deteriorated in the aftermath of a large low-skill supply shock, even when focusing on nonwage components of labor market opportunities.

The job vacancy data also let us begin an exploration of the macroeconomic implications of the Mariel supply shock, which coincided with the onset of the 1981–82 recession. The Beveridge curve—the downward-sloping locus relating job vacancies and unemployment—was shifting out in comparable cities during the recession. In Miami, however, after a short-lived outward shift in the first few months after the Mariel supply shock, the curve shifted inward substantially. The inward shift might have been caused by the changed demographics of the Miami labor market, with the search behavior of the Mariel refugees differing from that of native workers (e.g., the refugees may have searched more aggressively, quickly filling up vacancies).[3] By the late 1980s, however, the relative position of Miami's Beveridge curve had moved back to where it was before the supply shock.

The thrust of our evidence indicates that a large supply shock composed mainly of low-skill workers has demonstrable short-run micro- and macroeconomic consequences, particularly affecting the low-skill sector. The literature already documents that such supply shocks have both adverse wage effects on native workers (Monras 2020) and adverse employment effects (Smith 2012). Our analysis suggests that the supply shock also reduces the number of job vacancies available to low-skill job seekers (making it harder for out-of-work natives to find jobs), even though it also makes the labor market more efficient (allowing employers to fill vacancies faster).

[3] Albert (2021) provides a rare study of differences in search behavior between immigrants and natives. His evidence (using post-1994 data) contradicts the conjecture that immigrants search more intensively. The merged data from the CPS and the American Time Use Survey suggests that unemployed low-skill immigrants spend less time in job-search activities than their native counterparts.

II. The Conference Board Help-Wanted Index

Beginning in 1951, the Conference Board contacted 51 newspapers, each corresponding to a major metropolitan area, and asked each newspaper for the number of classified ads published in the previous month. The Conference Board adjusted the count for seasonal trends and day-of-the-week frequency to create a monthly index for each metropolitan area. The metropolitan area indexes were then aggregated to create an index for each geographic region and for the nation as a whole.[4]

Figure 1 illustrates the correlation between the national HWI and the unemployment rate, showing a strong inverse relation between the two variables throughout much of the period.[5] Despite this strong link, several well-known biases in the index influence the interpretation of observed trends.

The first arises from the fact that the number of job vacancies per ad is procyclical. During booms, a single ad might advertise explicitly for two or more job openings. But the algorithm used by the Conference Board to construct the HWI counts this as only one advertised job (Preston 1977). A related problem arises with ads placed by private employment agencies, which often contained several job postings. Some newspapers placed all agency advertising in a section specifically demarcated for labor market intermediaries (and this section may not have been included in the Conference Board counts), while other newspapers made no distinction between agency advertising and ads placed by individuals or firms (Walsh, Johnson, and Sugarman 1975). Further, the HWI counts only ads placed in the official help-wanted section of the newspaper. Some high-skill jobs, especially those in finance, insurance, and real estate (FIRE), were not advertised in the help-wanted section at all; they instead appeared in dedicated FIRE sections.[6]

Finally, there are differences in the market power of the newspapers surveyed by the Conference Board. In some cities, as in Miami (where the sampled paper was the *Miami Herald*), the paper used to construct the index was the key source of job classifieds in the area. In other locations, as in Minneapolis (where the sampled newspaper was the *Minneapolis Star Tribune*), there were other newspapers (the *St. Paul Dispatch-Pioneer*) that also contained many help-wanted ads (Courtney 1991).

[4] Appendix A (apps. A and B are available online) lists the 51 newspapers sampled by the Conference Board. Apart from the removal of the *Newark Evening News* (and the Newark metropolitan area) in 1971 and a swap of the *Dallas Times Herald* for the *Dallas Morning News* in the early 1990s, the newspapers and cities surveyed did not change after 1970.

[5] Friedman (1982, 63) examines trends in the HWI for the Phoenix labor market and concludes that the HWI is "a viable indicator of future employment activity in the Phoenix area, just as it is nationally."

[6] Cohen and Solow (1967, 108) noted some of these methodological issues, writing that "we know nothing, for example, about the number of jobs offered per advertisement." They also make the point that "the index can not be decomposed by occupation," making it difficult to determine whether the index is a better metric of labor market conditions for some skill groups than for others.

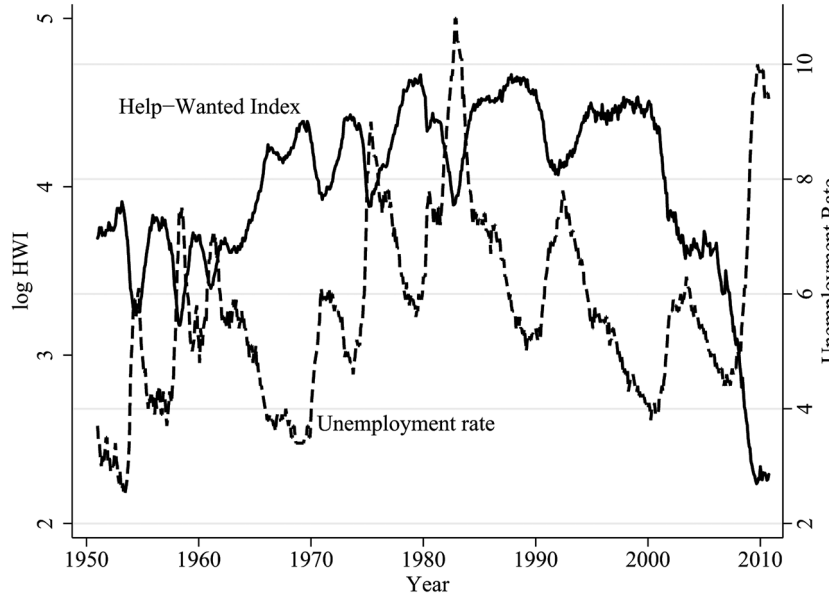

Figure 1.—National HWI and the unemployment rate.

Because of these methodological issues, we focus exclusively on the panel of HWI changes rather than intercity differences in the level of the HWI. Specifically, we rescale the HWI so that the level of the index in each city equals one at some point in the pretreatment period. This rescaling is inconsequential, except when illustrating the trends graphically. Our estimate of the impact of a supply shock on job vacancies uses a difference-in-differences estimator, so that the level of the index washes out in the calculation.[7]

Although the explosion of online job postings reduced the relevance of newspaper-based indexes, the HWI remains useful for historical research.[8] For the time period in our analysis, the HWI is the gold standard for job vacancy data. We obtained the entire HWI time series for the 51 metropolitan areas directly from the Conference Board. Our analysis exploits the historical data in a novel context. How does the tightness or slackness of a local labor market respond to immigration-induced supply shocks?

[7] Medoff (1983) makes a similar point, arguing that although the absolute level of the index in any given region depends on the sample of newspapers surveyed by the Conference Board, cross-region differences in the percent change in the index can capture differences in the growth rate of job vacancies. Abraham (1987) provides the most comprehensive discussion of the benefits and problems with the HWI and shows that the index (or some normalization of it) is correlated with the true number of job vacancies.

[8] Autor (2001, 27) noted that the HWI was "flat throughout the 1990s economic boom" and cited the migration of "vacancy listings . . . from newspapers to the Internet" as a possible explanation. In response to the declining relevance of newspaper help-wanted sections (Kroft and Pope 2014), the Conference Board ceased the public release of the HWI in July 2008 and stopped data collection in October 2010.

III. Job Vacancies and Mariel

The historical details of the Mariel episode are well known. On April 20, 1980, Fidel Castro declared that Cuban nationals wishing to move to the United States could leave freely from the port of Mariel. About 125,000 Cubans left before an agreement between the Carter administration and the Castro regime ended the flow in October 1980. Borjas (2017, table 1) documents that the Mariel supply shock, which increased the size of the workforce in Miami by 8.4%, was composed of relatively low-skill workers: nearly 60% of the adult refugees lacked a high school diploma, and only 7.4% had a college degree. As a result, the supply shock disproportionately increased the size of the low-skill workforce. The number of workers in Miami without a high school diploma increased by 18.4%, but the number of college graduates rose by only 3.4%.

The labor market impact of the Mariel boatlift was first studied in Card's (1990) classic paper. Card's analysis of the Miami labor market, when compared with conditions in other cities that served as a control group, indicated that nothing much happened to Miami despite the large number of

TABLE 1
Difference-in-Differences Impact of Mariel Supply Shock on Job Vacancies

		Synthetic Control	
	Dependent Variable: All Cities (1)	Dependent Variable: Unadjusted (2)	Dependent Variable: HP Filter (3)
A. Log HWI:			
June 1980–82	.029	−.237	−.172
	(.037)	(.036)	(.014)
1983–84	−.296	−.436	−.342
	(.028)	(.023)	(.007)
1985–86	−.493	−.448	−.308
	(.019)	(.029)	(.011)
1987–89	−.041	.138	−.000
	(.028)	(.029)	(.021)
B. Job-finding rate:			
June 1980–1982	.044	−.190	−.151
	(.048)	(.043)	(.019)
1983–84	−.289	−.479	−.427
	(.045)	(.043)	(.016)
1985–86	−.491	−.462	−.491
	(.035)	(.039)	(.010)
1987–89	−.194	.121	−.243
	(.047)	(.046)	(.018)

Note.—Robust standard errors are reported in parentheses. The data consist of monthly observations for each city between 1975 and 1989. All regressions include vectors of city and year-month fixed effects. The table reports the interaction coefficients between a dummy variable indicating whether the metropolitan area is Miami and the timing of the post-Mariel period (the baseline period goes from January 1975 through May 1980). The job-finding rate is the HWI divided by the unemployment rate in the city-year-month cell. The HWI (job-finding rate) regressions that use the "All Cities" sample have 9,180 (8,064) observations, and the respective regressions that use the synthetic control have 360 (336) observations.

new workers. The average wage in Miami did not fall relative to that in the cities that formed the control group.

Following the Borjas (2017) reappraisal, which specifically examined the wage trends of workers who lacked a high school diploma, the debate over the labor market impact of the *Marielitos* intensified in the past few years. It turns out that the wage of this specific low-skill group fell substantially relative to control cities. A flurry of subsequent papers argues that the evidence may be sensitive to the definition of a "low-skill worker," to changes in the racial composition of the sample, and to the sampling error resulting from the small number of observations in the Miami metropolitan area (see Borjas and Monras 2017; Borjas 2019; Clemens and Hunt 2019; Peri and Yasenov 2019; Monras 2021). Our analysis of the behavior of the HWI around the time of Mariel is impervious to these potential problems.

As noted earlier, part of the cross-city variation in the level of the HWI arises because of the idiosyncratic way in which classified ads were counted by different newspapers. We address this issue by rescaling the HWI so that the level of the index in each city equals one in the 1977–79 period. Figure 2 begins the empirical analysis by illustrating the 1975–89 trend in the HWI in Miami, in the South Atlantic region, and in the entire nation. We choose the 1975–89 period because Cuban immigration to the United States was relatively low and stable in the pretreatment period (hovering around 6,000 annually between 1975 and 1978), and it was again relatively

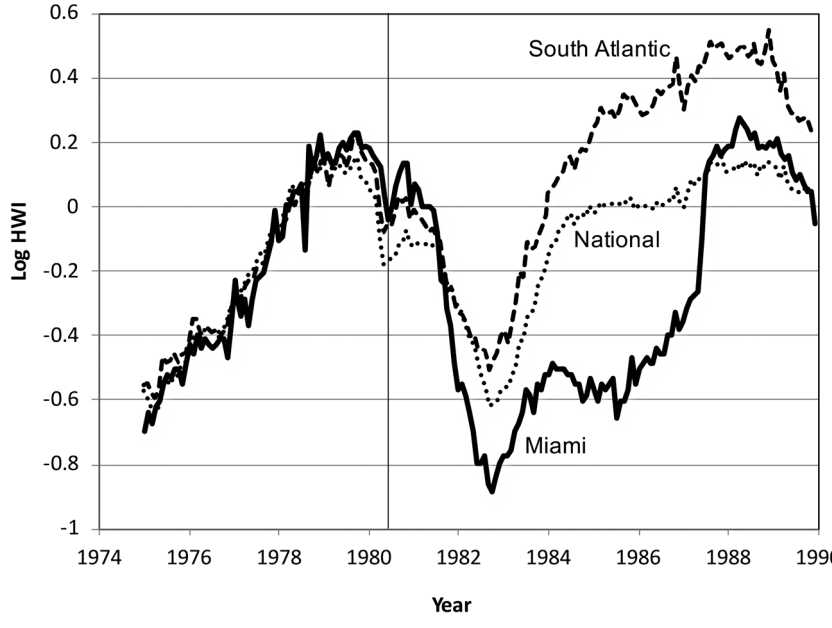

Figure 2.—HWI in Miami, 1975–89. HWI for each city or region is rescaled to equal one in 1977–79. The treatment line is drawn as of June 1980.

low and stable in the post-Mariel period between 1981 and 1989 (hovering around 10,000).[9]

The trends in the raw HWI data are visually striking. Because Mariel coincided with the onset of a recession, the number of job vacancies declined everywhere between 1980 and 1982. The index for Miami, however, declined much more, reaching a nadir at the end of 1982 before beginning a recovery through the 1980s. By 1989, the value of the HWI for Miami was again similar to the national index (although it was still lower than the index for the South Atlantic region).

Of course, Miami's distinctive trend should be contrasted with what happened in "comparable" cities rather than regional or national aggregates.[10] We use the synthetic control method (Abadie, Diamond, and Hainmueller 2010) to construct an appropriate set of comparable cities. We calculate the synthetic control by using a large number of control variables, all calculated from the 1970 and 1980 IPUMS decennial census files. It is important to emphasize that the 1980 census provides information on economic and demographic conditions in the potential control cities as of April 1, 1980—before the Mariel supply shock.

The control variables are as follows: the education distribution of workers in the city in 1980 and the percent change in the number of workers in each education group between 1970 and 1980, the industrial distribution of workers in the city in 1980 and the percent growth in the number of workers employed in each of the industries between 1970 and 1980, the fraction of immigrants in the workforce in 1980 and the percent growth in the number of immigrants between 1970 and 1980, the fraction of workers who are male, the percent growth in the number of male workers between 1970 and 1980, the percent growth in the number of female workers, the fraction of workers who are black (in 1980), and the fraction who are Hispanic.[11] Figure 3*B* illustrates the trend in the HWI for the synthetic control, and it confirms the uniqueness of Miami's post-Mariel experience.

A simple exercise further illustrates the striking difference between the Miami experience and that of each of the 50 other metropolitan areas in the Conference Board sample. In particular, for each city we calculated the difference in the log HWI between 1985 and the year before the Mariel shock. The average log point change across the 51 cities was −0.062 (with a

[9] We also conducted an analysis using a longer pretreatment period (going back to 1970), and the measured impact of the Mariel supply shock resembles what is reported below. The 1975–89 period is preferable because the Miami labor market in the early 1970s was still adjusting to the large number of Cubans (over 220,000) who migrated during the 1966–70 Freedom Flights.

[10] We use the three-digit metarea variable (which defines a metropolitan statistical area) in the IPUMS files of the decennial censuses to gather information about the cities for which the HWI is available. The only exception is for Gary, Indiana (which is officially defined as a "metropolitan division"), where we use the four-digit IPUMS code.

[11] The cities in the synthetic control are Charlotte (with a weight of 0.014), Jacksonville (0.023), Los Angeles (0.338), Memphis (0.141), New Orleans (0.053), and San Antonio (0.432).

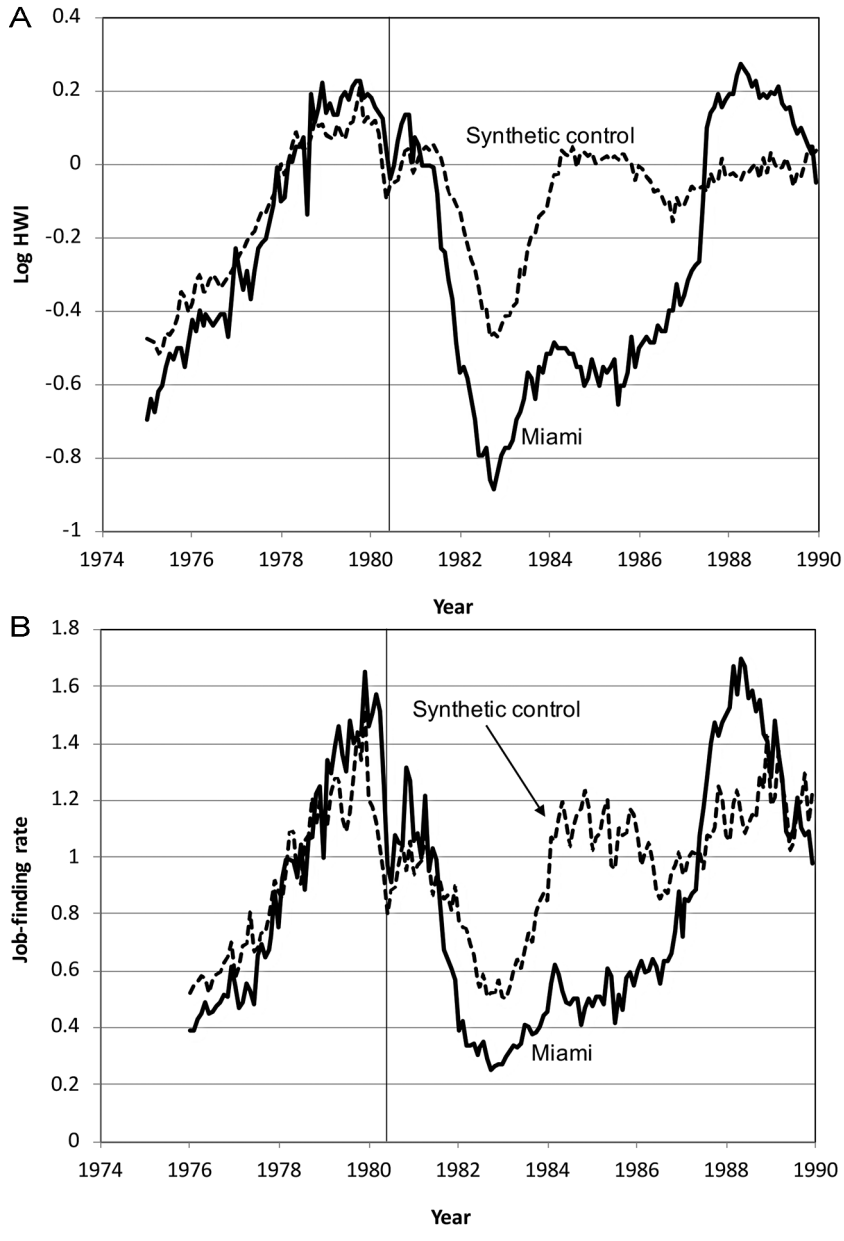

Figure 3.—Job vacancies in Miami relative to the synthetic control, 1975–89. *A*, HWI. *B*, Job-finding rate. HWI for each city is rescaled to equal one in 1977–79. The job-finding rate is defined as the ratio of the HWI to the local unemployment rate and is also rescaled to equal one in 1977–79. The treatment line is drawn as of June 1980.

standard deviation of 0.313). The observed decline in Miami, however, was −0.741 log points, larger than the drop observed in any other city. The city with the second-largest drop was Milwaukee, where the HWI dropped by −0.643 log points.

Similarly, Miami's HWI exhibited a remarkably strong recovery in the second half of the 1980s. The average growth in the HWI between 1985 and 1989 across all cities was 0.158 log points (with a standard deviation of 0.250). Miami's recovery was the second largest in the sample (0.676 log points), with only Gary, Indiana, exhibiting a larger growth (0.702 log points). In short, the distinctive U-shaped trend documented in figure 3 of the number of job vacancies in Miami during the 1980s was unique, with a remarkable drop in the first half of the decade (immediately after Mariel) followed by a remarkable recovery in the second half.

To measure the impact of the supply shock on the HWI, we estimate a generic difference-in-differences regression model where the unit of analysis is a city-year-month cell:

$$\log H_{rtm} = \theta_r + \theta_{tm} + \beta(\text{Miami} \times \text{Post-Mariel}) + \varepsilon, \qquad (1)$$

where H_{rtm} represents the HWI in city r, year t, and month m; θ_r is a vector of city fixed effects; θ_{tm} is a vector of interacted year-month fixed effects (i.e., a fixed effect for every year-month pairing); "Miami" is a dummy variable identifying the Miami-Hialeah metropolitan area; and "Post-Mariel" indicates whether cell (r, t, m) was observed after June 1980. The regression uses monthly data from January 1975 through December 1989. Note that the inclusion of the θ_{tm} fixed effects net out the impact of any transitory shock that affected all local labor markets equally (including economy-wide cyclical fluctuations).

Panel A of table 1 reports the estimated coefficients in the vector β (and robust standard errors) for various specifications of the regression model. Because the graphical analysis shows that the impact of Mariel varies over time, the post-Mariel variable in equation (1) is a vector of fixed effects indicating whether the observation refers to the intervals June 1980–82, 1983–84, 1985–86, or 1987–89. We first estimate a regression that pools the data across all 51 metropolitan areas. The regression clearly shows a sizable relative decline in Miami's vacancy index (of nearly 50%) by the mid-1980s. Column 2 compares Miami to the synthetic control and shows a decline of over 20% by 1981–82 and over 40% by 1985. Regardless of the specification, the regressions show a full recovery in Miami's HWI by the late 1980s.[12]

[12] Trends in the HWI may also reflect changes in the market share of the paper sampled by the Conference Board in the metropolitan area (perhaps due to entry and exit of competing newspapers). We used circulation data from Gentzkow, Shapiro, and Sinkinson (2011) to determine whether changes in market share could be driving the different trends observed in the number of help-wanted ads published in the *Miami Herald* and in the newspapers in the synthetic control. The market share of the *Miami Herald* increased from 78.5% to 87.3% between 1978 and 1984, which was roughly similar to the increase in the market share of the newspapers in the synthetic control (from 62.8% to 70.9%).

Modern work on search theory and job vacancies (Pissarides 1985; Mortensen and Pissarides 1994) relies on the fundamental construct of a matching function $M(U, V)$ that gives the number of new hires, M, as a function of the number of unemployed workers, U, and the number of job vacancies, V. If the matching function has constant returns to scale, the job-finding rate (i.e., the probability M/U that an unemployed worker finds a job) can be written as a function of the ratio V/U. The job-finding rate is frequently interpreted as a measure of labor market tightness. Following Shimer (2005), we proxy the job-finding rate by the ratio of the HWI to the unemployment rate at the city-year-month level.[13]

The Bureau of Labor Statistics (BLS) began to report the monthly unemployment rate for the metropolitan areas used in our analysis in 1976.[14] Figure 3*B* illustrates the trends in the job-finding rate in Miami and in the synthetic control for the 1976–89 period.[15] The figure shows a rapid decline in Miami's job-finding rate soon after Mariel and a full recovery by the late 1980s. The corresponding regressions in panel B of table 1 show that Miami's job-finding rate dropped by 40%–50% relative to the synthetic control by the mid-1980s (before recovering by the end of the decade).

The analysis of the job-finding rate raises the interesting question of how the unemployment rate in Miami responded to the Mariel supply shock. After all, our proxy for the job-finding rate might decline even if there was no change in the tightness of the labor market (as measured by the unemployment rate) if the HWI does not measure job vacancies accurately. For instance, there is a possibility that the number of help-wanted ads published in the *Miami Herald* may not truly reflect labor market conditions because the demographic shift in the workforce encouraged employers to pursue alternative ways of finding workers and filling vacancies. It turns out, however, that the decline in the job-finding rate cannot be solely attributed to trends in the HWI, as Miami's unemployment rate (relative to the control cities) also rose during the early 1980s.

Figure 4*A* shows the close link between the HWI and the unemployment rate in Miami. The correlation coefficient between the two series

[13] It is a proxy because not all job vacancies are advertised in newspapers. We make the standard assumption that the HWI captures variation in the true level of vacancies plus mean-preserving noise.

[14] The data are available in the monthly *Employment and Earnings* series published by the BLS. The 1976–89 unemployment series is not complete for 29 of the 51 cities sampled by the Conference Board. Our analysis of the job-finding rate uses data for 48 metropolitan areas. We excluded cities where the unemployment rate is missing for more than two consecutive months and linearly interpolated the missing unemployment rates.

[15] The job-finding rate for each city is rescaled to equal one in the 1977–79 period. The control cities (weights) forming the synthetic control are Jacksonville (0.106), Los Angeles (0.348), Memphis (0.101), New Orleans (0.056), Providence (0.014), and San Antonio (0.376).

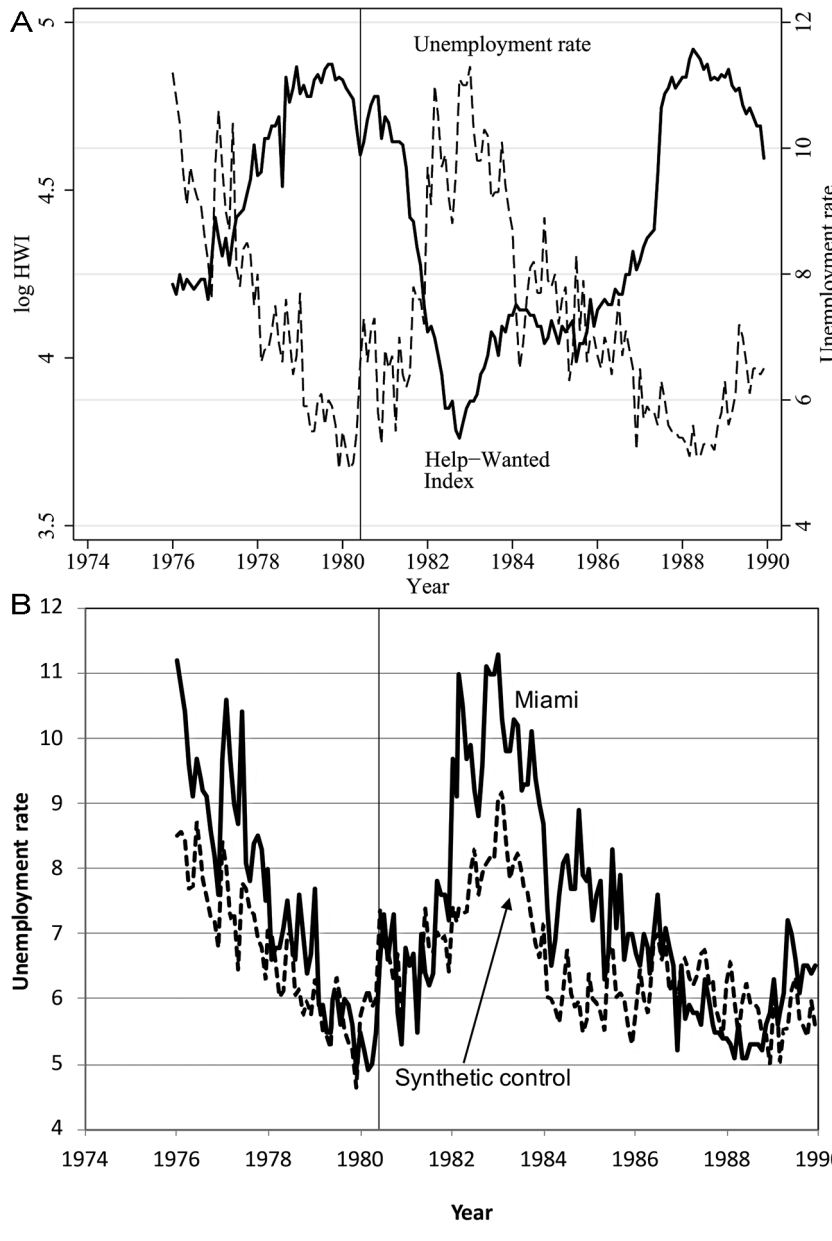

Figure 4.—Unemployment and job vacancies, 1975–89. *A*, HWI and the unemployment rate in Miami. *B*, Unemployment rate in Miami relative to the synthetic control. The treatment line is drawn as of June 1980.

is −0.86 before 1980 and −0.80 after 1980. As with the nationwide trends illustrated in figure 1, the local HWI in Miami closely tracks the economic conditions captured by the local unemployment rate. In addition, as figure 4*B* shows, Miami's unemployment rate in the post-Mariel years rose

relative to the synthetic control.[16] Miami's unemployment rate was roughly similar to that of the control cities in 1979 (5.9% in Miami and 5.6% in the synthetic control). By 1983, Miami's unemployment rate had risen to 9.8%, while the unemployment rate in the synthetic control rose to 7.9%.[17] In short, the observed decline in the HWI in post-Mariel Miami coincides with the deterioration in local labor market conditions.

The trend in the unemployment rate underlines the fact that the Mariel boatlift occurred shortly before the onset of the 1981–82 recession.[18] The HWI has an obvious cyclical trend, and the regression specification in equation (1) nets out cyclical shocks that affect all localities equally. However, the short-term cyclical fluctuations may vary across metropolitan areas (perhaps because of immigration-induced supply shocks). It is easy to illustrate what happens if we net out city-specific transitory fluctuations from the vacancy index by applying the Hodrick-Prescott (HP) filter to our data.

In a panel data context, this widely used filter decomposes the HWI time series for each metropolitan area into a long-run trend and a short-term cyclical component. Note that because the HP filter is applied individually to the time series in each metropolitan area, it ignores the possibility that the intensity of the cyclical fluctuations in a particular city (e.g., Miami) might themselves have been affected by supply shocks. Netting out city-specific transitory fluctuations, therefore, might remove some of the effect of supply shocks on the locality and produces a lower-bound estimate of the impact of the shock.

The two panels of figure 5 show the behavior of the adjusted HWI and the adjusted job-finding rate in Miami relative to the synthetic control.[19] The exercise obviously removes a lot of the cyclical variation in the HWI for the group of cities that make up the synthetic control. It is also obvious, however, that the post-1980 Miami experience was very different from what was observed elsewhere. The long-run trend in Miami's HWI was obviously dislodged after Mariel. As the regression reported in column 3 of table 1 indicates, the permanent level of the HWI in Miami declined by about 30% relative to the synthetic control by the mid-1980s.[20]

[16] The control cities (weights) forming the synthetic control in the unemployment analysis are Jacksonville (0.234), Los Angeles (0.294), Omaha (0.033), Providence (0.055), San Antonio (0.376), and San Diego (0.039).

[17] The increase is statistically significant: Miami's relative unemployment rate increased by 1.67 percentage points (with a standard error of 0.27).

[18] It also coincided with the short recession between January and July 1980.

[19] The long-term trend for the synthetic control in fig. 5 is calculated using a two-step approach. We first remove the impact of the short-run cyclical fluctuation from the HWI time series. We then use the adjusted HWI data to find the synthetic control and generate the trends summarized in the figure. The synthetic control method therefore compares Miami with cities that had similar permanent trends before the supply shock.

[20] In addition to the Mariel boatlift, Miami received other large waves of Cuban immigrants between 1960 and 2000. Anastasopoulos et al. (2019) show that the short-run response of the HWI in Miami to these other shocks was similar to what we find in the Mariel episode: a relative decline in the index of job vacancies within 2 or 3 years after the immigrant influx.

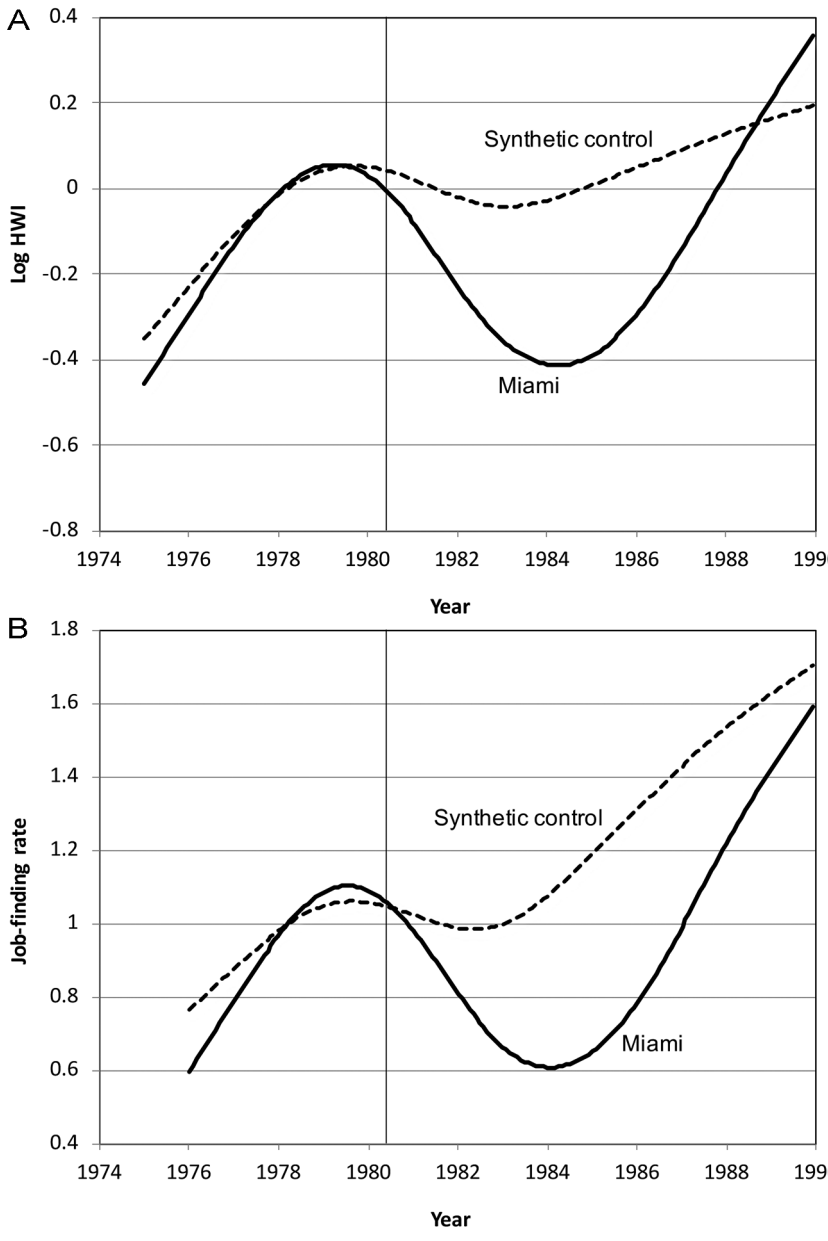

Figure 5.—Removing local transitory fluctuations from the HWI using the HP filter. *A*, HWI. *B*, Job-finding rate. Adjusted HWI and job-finding rates give the long-term trend predicted by the HP filter with a smoothing parameter of 129,600, using all monthly observations between 1975 and 1989. HWI and job-finding rate for each city are each rescaled to equal one in 1977–79.

An intuitive interpretation of the evidence is that a large supply shock composed of newly arrived immigrants makes it easier for firms to fill existing vacancies, leaving few available jobs for the preexisting workforce. Over time, of course, firms would be expected to adjust to the supply shock by increasing their capital stock, leading to a corresponding increase in labor demand and a reequilibration of the labor market. However, as noted by Hamermesh and Pfann (1996, 1,264), "businesses change their demand for inputs more slowly than the shocks to input demand warrant." The adjustment costs faced by firms as they adjust their inputs to the changed circumstances suggest that the number of job vacancies may not increase sufficiently fast after the supply shock, resulting in a relatively low number of job vacancies for some time.

An alternative (and mechanical) explanation of the evidence is that because of the large and sudden increase in the size of the Cuban community in the post-Mariel period, Miami's employers began to shift their advertising to other venues, such as Spanish-language outlets.[21] In fact, in 1977 the *Miami Herald* began to publish *El Nuevo Herald*, a sister newspaper in Spanish. The Conference Board did not enumerate help-wanted ads in *El Nuevo Herald*, perhaps leading to a decline in the HWI in post-Mariel Miami.

To determine the validity of the substitution hypothesis, we counted the total number of ads published by *El Nuevo Herald* in each December between 1978 and 1984.[22] Figure 6 illustrates the trend in Miami's HWI and in the number of ads published in *El Nuevo Herald*. The HWI dropped by 62.7% (from 126 to 47) between December 1979 and December 1982. The number of ads published in *El Nuevo Herald* dropped by 70.1% in the same period (from a monthly total of 2,510 to 750 ads). The data indicate, therefore, that the number of job vacancies advertised directly to Miami's Spanish-speaking community fell by more than the number of vacancies in the aggregate Miami labor market.[23]

Although the objective of this paper is to provide empirical evidence of the strong link between job vacancies and immigration, it is worth noting

[21] As noted earlier, the trend in the HWI may not be a good proxy for the trend in job vacancies when there is a substantial change in workforce composition and an associated shift in the distribution of alternative methods of job search.

[22] Specifically, we accessed issues of *El Nuevo Herald* archived at the Library of Congress in microfilm and manually counted the number of ads that appeared between December 1 and December 30 of each year between 1978 and 1984. As with the calculation of the HWI, a help-wanted ad in *El Nuevo Herald* that advertised several job openings is counted as a single vacancy.

[23] One hypothesis that is consistent with the decline in both *El Nuevo Herald* and the HWI is that the supply shock led firms to utilize preexisting Cuban or Spanish-speaking social networks to fill jobs instead of the help-wanted section of newspapers. Pholphirul (2013) provides suggestive evidence that firms that have used immigrants to fill job openings in the past are more likely to do so in the future. Note that from the perspective of an unemployed non-Hispanic worker, the reduction in the number of posted job ads has the same implications regardless of whether it arises from faster vacancy filling or from a substitution from published job advertisements to unobserved social networks.

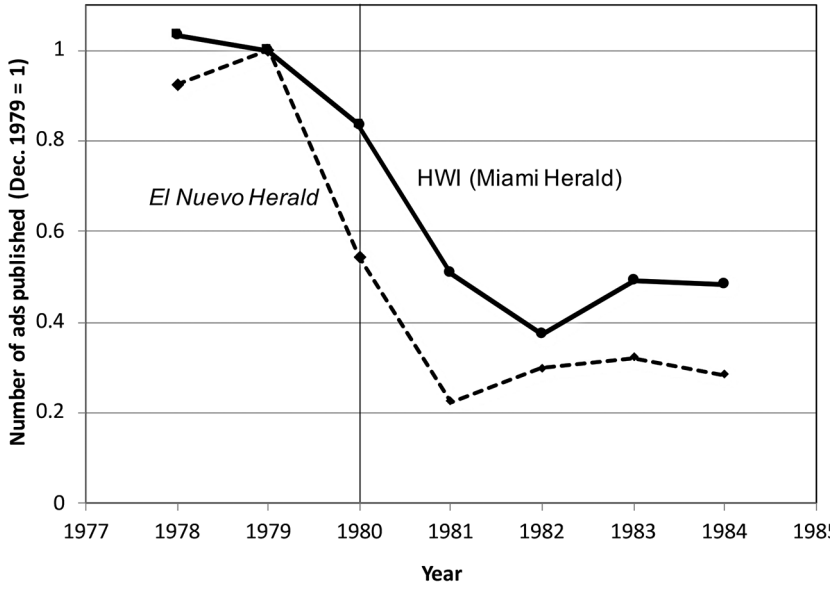

Figure 6.—Number of help-wanted advertisements published in the *Miami Herald* and *El Nuevo Herald*, 1978–84. Number of ads published in the *Miami Herald* is given by the HWI in Miami in December of each year. We manually counted the number of ads published in *El Nuevo Herald* in each December between 1978 and 1984. Each of the trends is rescaled to equal one as of December 1979.

that there are several theories in macroeconomics that can explain such a link. These theories, however, do not necessarily agree on what happens to job vacancies after a labor supply shock.

Shimer's (2007, 1,082, proposition 3) "mismatch" theory predicts that the number of job vacancies per worker will decline in equilibrium if there is an exogenous increase in the number of workers. The logic is straightforward: an economy with more workers yields more matches with existing job vacancies (i.e., increasing employment, reducing vacancies). Firms will also create more jobs if there are more workers in the economy (since the returns to creating a job have gone up), but the mismatch between workers and jobs induces an increase in the number of jobs that is too small to offset the first-order effect of additional workers filling existing vacancies. Since firms create relatively few jobs in response to an increase in the stock of workers, the permanent unemployment rate also increases in response to the supply shock.

In contrast, the canonical Diamond-Mortenson-Pissarides (DMP) model is more ambiguous about how vacancies respond to one-time supply shocks (Pissarides 2000). In the DMP model, which uses the matching function introduced earlier, exogenous parameters fix the ratio of vacancies to unemployment. Let market tightness be defined as V/U. We can normalize both the number of vacancies and the number of unemployed workers by the size of the labor force, so that market tightness is given by the ratio

of the vacancy rate to the unemployment rate v/u. The DMP model predicts that, for fixed values of parameters, v/u equals a constant θ.

If immigrants enter the model as unemployed workers (i.e., initially increasing the unemployment rate) and have no other impact on the model's parameters, the vacancy rate would then be predicted to jump upward in equilibrium. The intuition is that the returns to creating a job vacancy have increased, so that firms post vacancies until those returns are driven back down to zero. As the new workers obtain jobs, unemployment decreases and so should the number of vacancies outstanding, with the vacancy rate returning to its original level.

The evidence of a strong negative relation between the job-finding rate (as proxied by the ratio of the HWI to the unemployment rate) and supply shocks is consistent with the DMP model only if the Mariel shock changed one of the other parameters of the model (Cahuc, Carcillo, and Zylberberg 2014, 598). These other parameters include the reservation wage of unemployed workers, the discount rate, the cost of posting a vacancy, or the output generated by a worker-firm pair. For instance, if the reservation wage of unemployed workers fell because the new refugees are more willing to take on the available jobs, the DMP model predicts that the equilibrium job-finding rate would rise. In contrast, if the new immigrants reduced the output generated by a particular match, then the job-finding rate would fall. In short, a reconciliation of the evidence with the DMP framework requires a detailed examination of how supply shocks shift the fundamentals of that model.[24]

IV. The Textual Content of Help-Wanted Ads

Although the above section documents a short-term decline in the relative number of job vacancies in post-Mariel Miami, the trends in the HWI do not provide information on which types of job vacancies vanished. Because of its skill composition, the Mariel supply shock should have particularly affected the low-skill labor market. To determine whether these are indeed the vacancies that were most affected by the increased supply of workers, we need to examine the text of the help-wanted ads. Modern machine learning and natural language processing techniques allow us to extract the relevant content of help-wanted classifieds from the published text of a newspaper. As the pioneering work of Atalay et al. (2020) shows, the analysis of the text of help-wanted ads can provide important insights into how labor markets evolve.

[24] Attempts to distinguish between the mismatch and canonical models of labor market frictions have focused on their quantitative predictions about variable comovements in equilibrium (Shimer 2007; Şahin et al. 2014). Our reduced-form results suggest that a structural exploration of the response of these models to supply shocks might yield qualitatively divergent (and more easily testable) predictions.

A critical obstacle limits the scope of such a study: digitized files of the text of help-wanted classifieds exist for only a small number of newspapers, and it is an arduous and costly undertaking to expand this small set.[25] We constructed a sample of help-wanted ads from the *Miami Herald* by selecting a random sample of issues published between 1978 and 1984 (essentially one issue from every month in that period).[26] For each of these issues, we (manually) produced digital images of the help-wanted pages from the microfilm archive maintained at the Library of Congress. Using a crowd-sourced, natural language processing pipeline, each ad was then transcribed into text and compiled into a single database, creating a random sample of 95,263 ads. Appendix B describes the process of creating this sample of ads from the *Miami Herald* (as well as two other newspapers discussed below).

The next step involves classifying each ad in terms of the type of job being advertised. This classification is straightforward, as the Department of Labor commissioned a private firm to build an algorithm, the O*NET-SOC AutoCoder, that classifies job titles and other job information into standard occupational codes. Specifically, we fed the entire text of each of the help-wanted ads in our sample into the algorithm, which returned the corresponding SOC-2010 occupation code for that vacancy. The algorithm is very reliable when conducting this type of matching; it "guarantee[s] 85% accuracy for codes assigned to job ads (titles plus descriptions)" (Wilson 2019).[27]

Once each help-wanted ad is assigned an occupation code, it is easy to create a number of variables that describe the skills required by the vacancy. We use several alternative characterizations of the occupation's skill level: (1) whether the vacancy advertises a blue-collar (or service) job opening, (2) the mean years of educational attainment of workers employed in the occupation, (3) the percentage of workers in the occupation without a high school diploma, and (4) the "occupational wage," defined as the (adjusted) log hourly wage of workers in the occupation.[28]

[25] For example, Atalay et al. (2020) use only the ads published in the *Boston Globe*, the *New York Times*, and the *Wall Street Journal* to document the changing occupational structure of the labor market. A private company (ProQuest) archives the digital version of these newspapers and makes the data accessible to university researchers. Unfortunately, ProQuest does not include the *Miami Herald* in its archive. The private firm that archives the *Herald* digitally (NewsBank) does not generally make their data accessible to researchers at educational institutions at a nonprohibitive price.

[26] We first picked a random date 2–3 years after Mariel: December 20, 1982. Once that date was determined, we worked backward to find a similarly situated date before Mariel: December 18, 1978. From these dates, the pre- and post-Mariel samples were constructed by selecting issues published every 29 days from the initial pre- and post-Mariel dates between January 1978 and December 1984.

[27] Using a standard concordance table, we converted the SOC-2010 code into the 1990 census occupation code (which is the code we use when merging all the data sets used in this section).

[28] A blue-collar or service job is in the precision production, craft, and repair occupations (with a code between 503 and 699), the operator, fabricator, and laborer occupations (with a code between 703 and 889), or the service occupations (with a 1990 occupation code

All of these variables were created using the sample of workers aged 25–64 in the 1980 census.

Figure 7*A*–7*D* illustrates the trends for each of these skill measures. To minimize month-to-month sampling noise, we aggregate the *Miami Herald* data to the annual level. Consider initially the trend in the relative frequency of ads for blue-collar vacancies. Before Mariel, about 38% of vacancies advertised in the *Miami Herald* were for blue-collar positions. By 1982, only about 30% of the ads were for blue-collar jobs. Similarly, the mean years of education of workers typically employed in the advertised job rose from 12.2 years before Mariel to 12.5 years by 1982. The average occupational wage in the advertised vacancy rose by 3–4 percentage points. Figure 7 unambiguously reveals that the skill composition of the help-wanted ads appearing in the *Miami Herald* changed in the post-Mariel period, with a noticeable decline in the relative number of vacancies for low-skill workers.

The observed trends in Miami should be contrasted with trends in other cities to determine whether the evolution of the occupational distribution of Miami's job vacancies was unique. We obtained access to the sample of help-wanted ads that Atalay et al. (2020) created for the *New York Times* and the *Boston Globe*. These data reported the number of ads published in each occupation-year-month-day cell for each newspaper.[29] We then collected comparable data for two other newspapers, whose digital archives are maintained by ProQuest. These two other newspapers, the *Minneapolis Star Tribune* and the *St. Louis Post-Dispatch*, were chosen because they sometimes appeared as "control cities" when we estimated synthetic control models of the 1975–89 trend in the HWI using the small subset of newspapers that we could potentially use in the analysis.[30]

The ProQuest files for these newspapers include their entire published content. Using the machine-learning methods developed by Atalay et al. (2020), we isolated the help-wanted ads in each issue published between

between 405 and 469). The occupational wage is constructed by averaging (within each occupation) the residuals from a regression of a worker's log hourly wage on a vector of age fixed effects and on indicators for race and gender.

[29] The Atalay et al. (2020) data file consists of 1,211,616 ads in the *New York Times* and 1,060,920 ads in the *Boston Globe*. The *Boston Globe* data, however, do not contain any ads for calendar year 1984. The data file also contains comparable information for ads published in the *Wall Street Journal*, but we do not use that newspaper in our analysis. The ads published in the *Wall Street Journal* are typically targeted to a very different sector of the labor market than the ads published in other newspapers.

[30] Putting aside the *Boston Globe* and the *New York Times*, we purchased the entirety of ProQuest newspaper holdings that satisfied the following restrictions: (*a*) the newspaper was in the HWI sample, (*b*) the newspaper had already been digitized and optical character recognition software had been applied so that we could in theory work directly with the text, and (*c*) the digital files existed for the years 1978–84. The few newspapers that satisfied these restrictions at the time of purchase were the *Detroit Free Press*, the *Louisville Courier-Journal*, the *Minneapolis Star Tribune*, the *Philadelphia Inquirer*, the *Pittsburgh Post-Gazette*, and the *St. Louis Post-Dispatch*. We estimated regression models similar to those reported in the above section using this small subset of potential control cities, and the Minneapolis and St. Louis papers were the ones that typically showed up as part of the synthetic control.

1978 and 1984. This procedure created a sample of 253,833 ads for Minneapolis and 148,520 ads for St. Louis. We then predicted the ad's occupation code by running each ad through the O*NET-SOC AutoCoder. In sum, the control group consists of help-wanted classifieds published in the *Boston Globe*, the *Minneapolis Star Tribune*, the *New York Times*, and the *St. Louis Post-Dispatch*.

Figure 7 also shows the trend in the skill characteristics of ads published in the control group. It is visually obvious that the Miami trend is noticeably different from the trend in the control. At the same time that the fraction of blue-collar ads dropped rapidly in Miami between 1980 and 1982, the respective fraction rose in the control cities. Similarly, while the average education or the occupational wage of job vacancies advertised in the *Miami Herald* was rising after Mariel, the respective statistic in the control cities was stable.

Table 2 reports the relevant coefficients from the difference-in-differences regression in equation (1) that estimates the impact of the Mariel supply shock on the skill composition of advertised vacancies. The unit of analysis in the regression is a newspaper-year-month cell, and the regression includes newspaper and year-month fixed effects. We estimated both unweighted and weighted regressions (where the weight is the number of ads in the cell). The table reports the interaction coefficients between the Miami indicator and the post-Mariel time period.

The regressions consistently show a significant post-Mariel effect in the skill composition of vacancies in Miami, with much of the effect disappearing by 1984. The relative number of blue-collar vacancies in Miami declined by 6.7 percentage points by 1982, the fraction of workers in the (typical) advertised job who lacked a high school diploma dropped by 2.8 percentage points, the educational attainment of the average occupation being advertised increased by 0.2 years, and the occupational wage rose by 3%. In short, a regression analysis that examines the textual content of advertised vacancies confirms a substantial drop in the relative availability of low-skill jobs in post-Mariel Miami.[31]

V. Beyond Miami

Up to this point, our analysis has focused on documenting the response of job vacancies in Miami to the Mariel supply shock.[32] Immigration also

[31] The O*NET-SOC AutoCoder also reports a "match score," which measures the reliability of the occupation allocation. The data we obtained for New York and Boston, however, do not contain that score. Nevertheless, we estimated regressions in the *Miami Herald* data using a simple difference specification of eq. (1) and weighed the observations by the average match score of the month-year cell. The results are very similar to those that ignore the match score altogether.

[32] The working paper version of this article (Anastasopoulos et al. 2019) shows that job vacancies in Miami also declined after other supply shocks of Cuban immigrants in the early 1960s and mid-1990s.

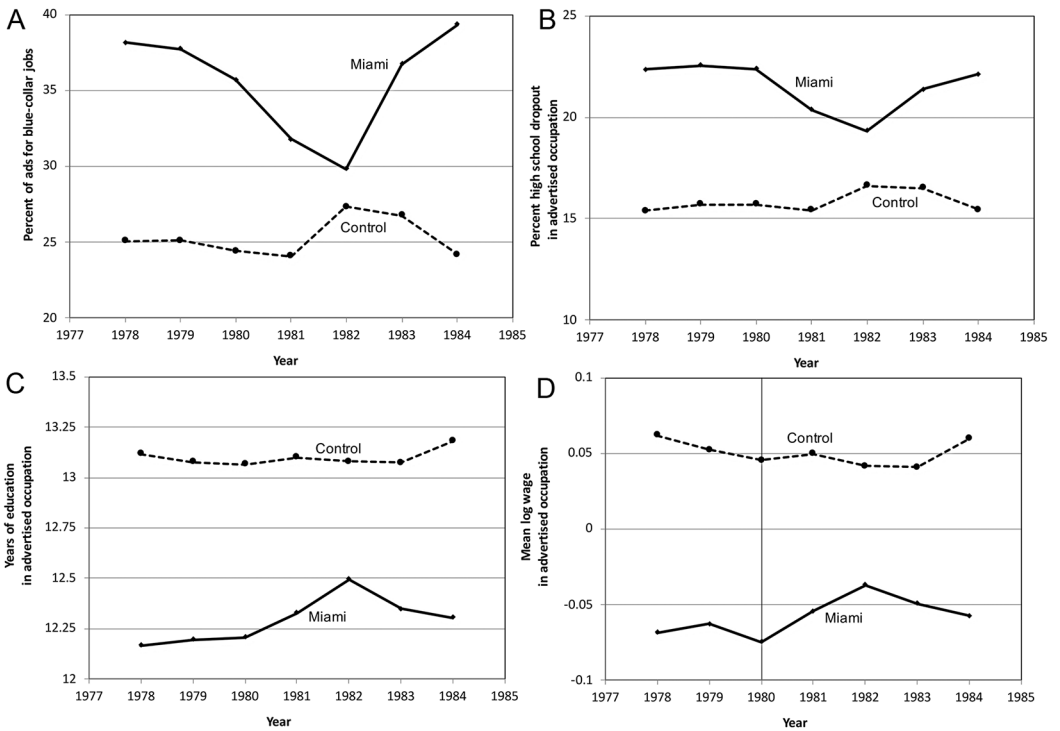

Figure 7.—Trends in the skill composition of advertised vacancies, 1978–84. *A*, Fraction of ads advertising for a blue-collar position. *B*, Fraction of workers who are high school dropouts in the average advertised occupation. *C*, Average years of education in advertised occupations. *D*, Average (adjusted) mean log hourly wage in advertised occupations. The size of the sample in the *Miami Herald* is 95,263 ads; the size of the sample in the control newspapers (the *Boston Globe*, the *Minneapolis Star Tribune*, the *New York Times*, and the *St. Louis Post-Dispatch*) is 2,674,889 ads.

TABLE 2
Difference-in-Differences Impact of Mariel Supply Shock on Skill Composition of Help-Wanted Ads, 1978–84

Regressions	% Blue-Collar	% Dropout	Years of Education	Mean Log Wage
A. Unweighted:				
June 1980–82	−6.705	−2.787	.231	.029
	(1.994)	(.952)	(.068)	(.011)
1983–84	.507	−.761	.069	.013
	(2.707)	(1.030)	(.082)	(.012)
B. Weighted:				
June 1980–82	−6.583	−3.010	.251	.032
	(1.895)	(.817)	(.070)	(.011)
1983–84	−2.971	−2.059	.141	.021
	(2.693)	(1.054)	(.090)	(.012)

Note.—Robust standard errors are reported in parentheses. The data consist of monthly observations for each city (i.e., newspaper) between 1978 and 1984. All regressions include vectors of city and year-month fixed effects. The table reports the interaction coefficients between a dummy variable indicating whether the metropolitan area is Miami and the timing of the post-Mariel period (the baseline period goes from January 1978 through May 1980). The regressions have 403 observations.

affected many other cities, with the annual number of immigrants entering the United States increasing from about 250,000 in the 1950s to over one million legal and undocumented immigrants by 2000.

A large literature exploits the geographic distribution of immigrants to estimate the labor market impact of immigration. This literature essentially correlates some economic outcome in the city—typically the average wage of some group of workers—with the number of immigrants in that city. Although some studies report a weak spatial correlation (suggesting that native outcomes may not be strongly affected by immigration), the correlation is contaminated by the endogenous settlement of immigrants in high-wage cities. This sorting makes it difficult to detect the potential adverse effect of supply shocks on the wage of competing workers. Moreover, the widely used shift-share instrument (which is a nonlinear transformation of lagged immigration in the locality) may not truly solve the endogeneity problem and may understate the adverse wage impact of supply shocks (Jaeger, Ruist, and Stuhler 2018).

Given the dominance of this methodological approach (and the rarity of "experimental" Mariel-like supply shocks), it is of interest to estimate the analogous spatial correlation between the HWI and immigration. Ideally, we would have monthly or yearly data on the number of immigrants arriving in each of the cities surveyed by the Conference Board over a multidecade period. Unfortunately, the CPS did not begin to collect immigration data until 1994.[33]

[33] The monthly data from the Job Openings and Labor Turnover Survey (JOLTS) since 2000 could in principle be used to estimate the spatial correlations in the post-2000 period. The JOLTS vacancy rate statistics, however, are available for only 18 metropolitan areas, are model based, and are still in an experimental stage.

We instead use the decennial censuses to calculate the immigration-induced supply shock in each of the 51 cities. We then correlate these supply shocks with the decadal change in the city's HWI. The regression model is given by

$$\log \frac{H_{r,\tau}}{H_{r,\tau-1}} = \theta_\tau + \gamma \frac{\text{Immigration into city } r}{\text{Baseline number of natives in city } r} + \eta, \quad (2)$$

where $H_{r,\tau}$ gives the HWI for city r in census year τ ($\tau = 1970, \ldots, 2000$). The HWI index for census year τ is defined as the average HWI observed in the 3-year interval around τ. For example, the average HWI for Rochester in census year 1980 is the average HWI reported monthly for Rochester between 1979 and 1981. The two variables used to measure the supply shock (the number of immigrants and the number of natives) give population counts for persons aged 18–64 in a particular city. There seems to be some confusion as to how the ratio measuring the supply shock in equation (2) should be defined (Borjas 2014; Card and Peri 2016; Borjas and Monras 2017). We will use alternative definitions of the supply shock to demonstrate the robustness of our estimated correlation.

The same endogeneity problem that plagues estimates of the link between wages and immigration also plagues the regression in equation (2). Immigrants are more likely to settle in cities where there are jobs to be had and employers are actively searching for workers. This endogeneity builds in a positive correlation between the change in the HWI and the number of immigrants settling in that city during the decade.

Table 3 reports estimates of the coefficient γ using a number of alternative specifications. Consider initially the regression reported in the first row. The supply shock is defined as the ratio of the number of immigrants who settled in the city between census year $\tau - 1$ and τ, or $M(\tau, \tau - 1)$, to the number of natives residing in the city at time $\tau - 1$, or $N(\tau - 1)$.[34] This specification ignores the fact that there may have been a supply response as natives moved in or out of immigrant-receiving cities. The estimated spatial correlation is negative and significant, suggesting that a 10% increase in supply reduces the HWI by about 10%.

We address the endogeneity issue by using the shift-share instrument (as constructed by Jaeger, Ruist, and Stuhler 2018).[35] In rough terms, the instrument uses the geographic settlement of earlier immigrant waves belonging to particular national origin groups to allocate new immigration across the cities. The validity of the instrument obviously hinges on

[34] The number of immigrants who migrated to the United States in the interval $(\tau - 1, \tau)$ and settled in city r is obtained from the decennial census in year τ.

[35] We are grateful to David Jaeger, Joakim Ruist, and Jan Stuhler for sharing their data. We use the variant of their instrument that uses the settlement of immigrants as of 1960 to predict the geographic sorting of new arrivals in subsequent census years.

TABLE 3
Supply Shocks and the HWI, 1960–2000
Dependent Variable: Decadal Change in City's Log HWI

	Measure of Supply Shock	
	OLS	IV
1. $M(\tau, \tau-1)/N(\tau-1)$	−1.027	−1.809
	(.399)	(.606)
2. $M(\tau, \tau-1)/N(\tau)$	−1.291	−1.707
	(.402)	(.553)
3. $M(\tau)/N(\tau) - M(\tau-1)/N(\tau-1)$	−.907	−2.108
	(.464)	(.747)

Note.—Robust standard errors are reported in parentheses. The variables $M(\tau)$ and $N(\tau)$ give the number of immigrants and natives (in the relevant city-year cell) enumerated in census year τ, and $M(\tau - 1, \tau)$ gives the number of immigrants who arrived between the two census years. All regressions have 198 observations. The instrument is the predicted size of the immigrant flow settling in a particular city based on the geographic settlement of earlier waves of immigrants belonging to the same national origin group (as constructed by Jaeger, Ruist, and Stuhler 2018). All regressions are weighted by the size of the city's adult population at the time of the census.

whether the local economic conditions that attracted immigrants to a particular place persist for some time after arrival. The instrumental variables (IV) estimate of the impact is also negative and significant and larger in absolute value than the ordinary least squares (OLS) estimate.

The other rows of table 3 use alternative definitions of the supply shock. In the second row, the supply shock is the ratio $M(t, \tau - 1)/N(\tau)$. It differs from the definition in the first row because it does not lag the native baseline (thereby allowing for a potential native supply response). Finally, the supply shock in the last row is defined as the difference $(M_{c,\tau}/N_{c,\tau} - M_{c,\tau-1}/N_{c,\tau-1})$.[36] Regardless of how we define the supply shock, table 3 documents a negative correlation between the change in the HWI and immigration, with an elasticity of about −2. The spatial correlation approach therefore confirms the basic lesson of the Mariel episode: the number of job vacancies falls after an immigration-induced supply shock.

VI. Macro Implications: The Beveridge Curve

The matching function (with constant returns), $M(U, V)$, is a key building block in the canonical derivation of the Beveridge curve, the downward-sloping steady-state relationship between job vacancies and unemployment (Elsby, Michaels, and Ratner 2015). The DMP framework implies that

[36] If there were only two cross sections, the regression relating the first difference in the HWI and the first difference in the ratio M/N is numerically equivalent to a panel regression where the level of the HWI in city r and census year τ is regressed on sets of city and year fixed effects and on the ratio M/N.

as long as a supply shock is composed of persons who enter the labor market as unemployed workers, the vacancy-unemployment locus should immediately shift outward (see Blanchard and Diamond 1989, 17). Unemployment increases instantaneously. Firms then respond by increasing the number of vacancies. The larger number of unemployed workers and vacancies increases the number of matches, helping to reduce both vacancies and unemployment. The Beveridge curve would then tend to shift back to its original position. In short, the simplest model of the Beveridge curve would predict an immediate outward shift in the vacancy-unemployment locus in post-Mariel Miami, followed by a gradual movement back to its original position.[37]

Figure 8*A* illustrates the data scatter forming the national Beveridge curve (using the national HWI and the national unemployment rate) in the two 5-year periods before and after Mariel. The national Beveridge curve shifted out after 1980, concurrent with the deep 1981–82 recession. Figure 8*B* shows the Beveridge curve for the synthetic control, calculated by taking a weighted average of the unemployment and vacancy rates across metropolitan areas (using the weights implied by the synthetic control analysis of the permanent trend in the job-finding rate). The Beveridge curve for the synthetic control also shifted out. Finally, figure 8*C* shows the data for Miami, which generate exactly the opposite pattern, an inward shift in the Beveridge curve. The common interpretation of such an inward shift is that the Mariel supply shock made Miami's labor market more efficient, in the sense that there is less unemployment for a given number of vacancies.[38]

We can estimate the shift in Miami's Beveridge curve in the first half of the 1980s relative to either the national data or the synthetic control. The regressions that estimate these shifts are

$$\text{National}: \quad \log H_{rtm} = \theta_r + \theta_{tm} - \underset{(0.013)}{0.082} u_{rtm} - \underset{(0.028)}{0.273}(\text{Miami} \times \text{Post-Mariel}), \tag{3a}$$

$$\text{Synthetic}: \quad \log H_{rtm} = \theta_r + \theta_{tm} - \underset{(0.014)}{0.117} u_{rtm} - \underset{(0.029)}{0.345}(\text{Miami} \times \text{Post-Mariel}), \tag{3b}$$

[37] Although most discussions of the Beveridge curve focus on national labor markets, Courtney (1991) and Valletta (2005) use the local labor market as the unit of analysis for estimating Beveridge curve regressions, with the vacancy-unemployment relationship differing across metropolitan areas or regions. Bonthuis, Jarvis, and Vanhala (2016) use a similar approach in their examination of Beveridge curve shifts in the European Union. Finally, Anderson and Burgess (2000) estimate the matching function using the local HWI and state-level unemployment data.

[38] Warren (1982) examines the link between immigration and the Beveridge curve in the Australian context. He finds little evidence that changes in Australian immigration policy have shifted the Beveridge curve.

where u_{rtm} gives the unemployment rate in city r, year t, and month m; θ_r denotes a vector of city fixed effects; θ_{tm} denotes a vector of year-month fixed effects (i.e., a fixed effect for each year-month combination); the post-Mariel period goes from June 1980 through December 1984; and both regressions have 216 observations. The Mariel supply shock shifted down Miami's Beveridge curve by about 30% relative to how the curve was behaving in other cities at the time.

The inward shift in Miami's Beveridge curve is still observed when Miami is compared with all other cities in the HWI sample. In particular, we stacked the data across all metropolitan areas over the 1976–84 period (yielding 5,184 observations) and estimated the model:

$$\text{All cities}: \quad \log H_{rtm} = \theta_r + \theta_{tm} - \underset{(0.002)}{0.062}\, u_{rtm} - \underset{(0.029)}{0.179}(\text{Miami} \times \text{Post-Mariel}). \tag{3c}$$

The pooled data again document an inward shift in Miami's Beveridge curve of almost 20% relative to all other cities.

It turns out, however, that measuring the average shift across two 5-year periods hides detectable short-term swings in the relative placement of Miami's Beveridge curve. Following Valletta (2005), we examine the post-Mariel changes in the relative position of that curve by estimating a model where the interactions between Miami and the post-Mariel period are instead done year by year. Table 4 reports the value and standard errors of the (annual) interaction coefficients, while figure 9 illustrates the year-to-year variation. Regardless of the specification, the vacancy-unemployment locus in Miami seems to have shifted out immediately after Mariel. If we use the national data, for example, the intercept of Miami's curve shifted out by about 0.12 log points (with a standard error of 0.029). This outward shift, however, did not last long. By 1982, the relative intercept of Miami's locus was strongly negative in all specifications, reaching a nadir in 1985. Interestingly, all specifications show a return to normalcy in Miami's vacancy-unemployment locus by the end of the decade; the relative Beveridge curve for Miami in 1989 was back at its starting pre-Mariel position.

Although the Mariel evidence shows the immediate outward shift in the vacancy-unemployment locus implied by the simplest search-theoretic approach, that model cannot account for its eventual inward shift.[39] However, heterogeneity in search behavior between immigrants and natives might shift the Beveridge curve because the matching function of the new arrivals may differ from that of preexisting workers (Barnichon and Figura

[39] Shimer (2007) proposes an alternative micro foundation for the Beveridge curve, based on a mismatch model where the firms with vacancies are not located in the same markets as the unemployed workers looking for jobs. The mismatch framework predicts that a supply shock produces an inward shift in the Beveridge curve (see Anastasapoulos et al. 2019, app. C).

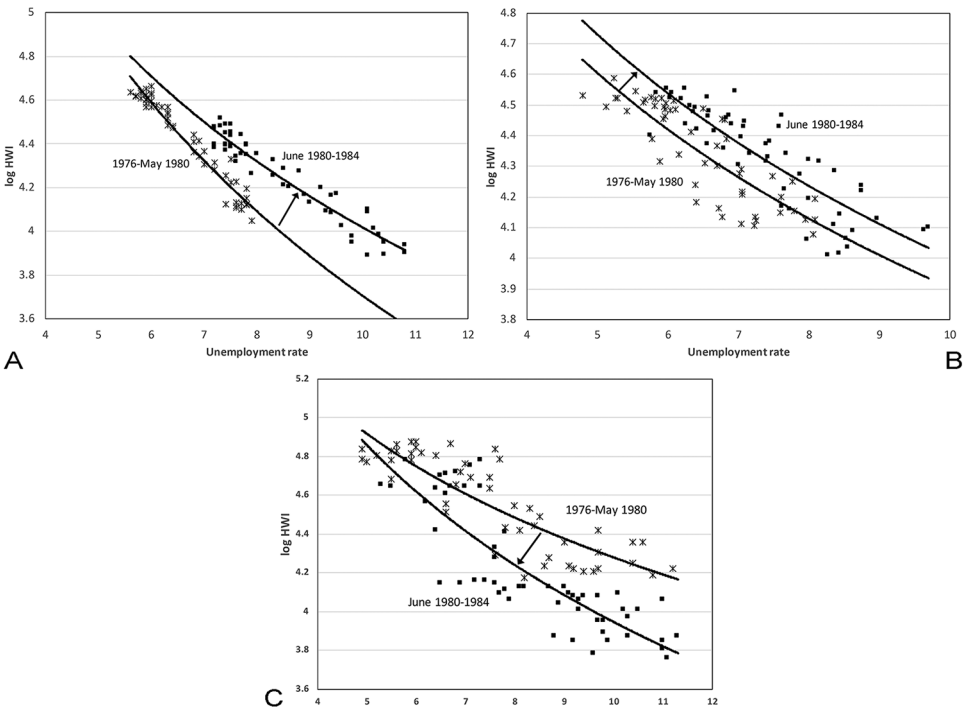

Figure 8.—Beveridge Curve and Mariel, 1976–84. *A*, National labor market. *B*, Synthetic control. *C*, Miami. The panels show the data scatter and the logarithmic trend lines relating the raw HWI and the unemployment rate in a city-year-month cell in the pre-Mariel (January 1976–May 1980) and post-Mariel (June 1980–December 1984) periods. The Beveridge curve for the synthetic control in *B* is constructed by taking a weighted average of the vacancy and the unemployment rate across metropolitan areas for each year-month cell, weighted by the synthetic control weights obtained in the analysis of the permanent trend in the job-finding rate.

TABLE 4
Relative Intercept of Miami's Beveridge Curve, 1980–89

Year	National	All Cities	Synthetic Control
June–December 1980	.117	.167	.042
	(.029)	(.035)	(.027)
1981	−.033	.021	−.178
	(.039)	(.038)	(.041)
1982	−.270	−.214	−.369
	(.017)	(.025)	(.023)
1983	−.290	−.230	−.438
	(.017)	(.020)	(.015)
1984	−.501	−.433	−.595
	(.021)	(.023)	(.016)
1985	−.608	−.574	−.685
	(.016)	(.019)	(.017)
1986	−.499	−.498	−.597
	(.017)	(.020)	(.024)
1987	−.200	−.232	−.300
	(.058)	(.058)	(.063)
1988	.050	.001	−.042
	(.015)	(.017)	(.018)
1989	.032	−.004	−.069
	(.019)	(.021)	(.022)

Note.—Baseline period is January 1976–May 1980. Robust standard errors are reported in parentheses. The data consist of monthly observations for each city between 1976 and 1989. The dependent variable is the log HWI for the city-year-month cell. The regressors include the cell's unemployment rate, a vector of city fixed effects, and a vector of year-month fixed effects. The national regression compares Miami with the national HWI and unemployment data; the synthetic control regression compares Miami with the synthetic control implied by the analysis of the permanent trend in the job-finding rate; the "All Cities" regression pools the city-year-month cells across all 48 cities in the sample. The table reports the interaction between a dummy variable indicating whether the metropolitan area is Miami and the year in the post-Mariel period. The regressions using the national or the synthetic control data have 336 observations; the regression using the "All Cities" sample has 8,064 observations.

2015). The supply shock could, for example, lead to more efficient matching if the immigrants search more aggressively than natives or if Spanish-language social networks became more effective at matching employers and workers after Mariel.

This assumed search behavior by unemployed immigrants ensures a more rapid filling of vacancies after the supply shock. Interestingly, the data suggest that the resulting "efficiency gain" in Miami's labor market vanished after a decade. The eventual return of Miami's Beveridge curve to its pre-Mariel position could perhaps be reflecting the process of immigrant assimilation, with the search behavior of immigrants becoming more like that of natives over time.

VII. Summary

This paper addresses a central economic question in the economic analysis of immigration: how do supply shocks affect the labor market

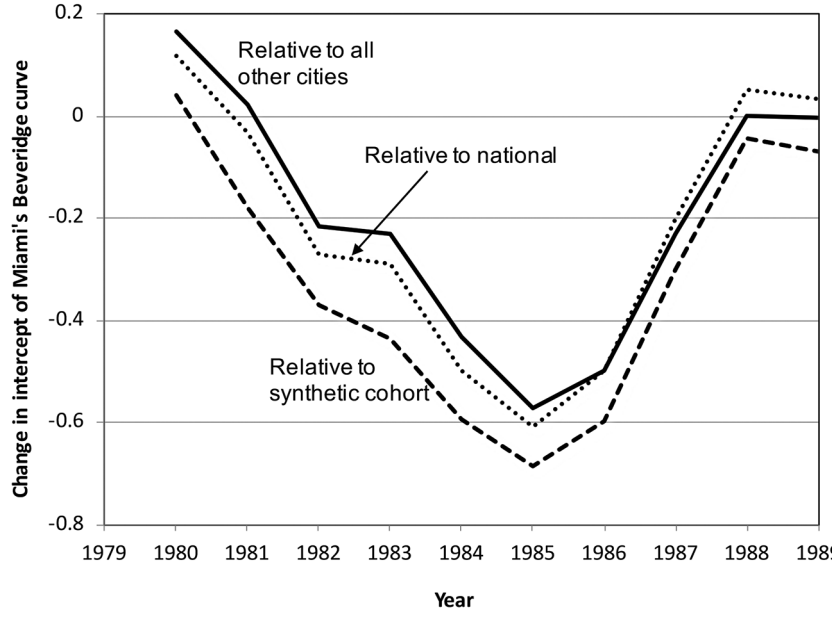

Figure 9.—Year-by-year shifts in the relative intercept of Miami's Beveridge curve (baseline is January 1976–May 1980). This figure illustrates the value of the interaction coefficient in a Beveridge curve regression model between a Miami indicator variable and a post-Mariel year (with the 1980 year being denoted by the June 1980–December 1980 period). The dependent variable is the log of the HWI index in an area. The regressions include the area's unemployment rate, area fixed effects, and year-month fixed effects.

in receiving countries? We contribute to the literature by exploiting a data set that has a long history in economics but has not been employed in the immigration context: the Conference Board Help-Wanted Index (HWI). Beginning in 1951, the Conference Board constructed an index of job vacancies in local labor markets by counting the number of help-wanted classified ads in newspapers in 51 metropolitan areas. It is well known that the HWI provides valuable information about trends in local labor demand and is highly correlated with various measures of labor market conditions.

We use the HWI to document how immigration affects job vacancies in labor markets affected by supply shocks. We both exploit the natural experiment produced by the random and sudden Mariel labor supply shock in the city of Miami and estimate spatial correlations that measure how local trends in job vacancies are related to immigration-induced supply shifts. Our findings include the following:

1. The labor market in Miami responded strongly to the Mariel supply shock in 1980. The HWI dropped relative to the trend observed in control groups between 1980 and 1985. Miami's HWI recovered fully by 1990.

2. We examined the text of a large sample of help-wanted ads published in the *Miami Herald* and other newspapers between 1978 and 1984. The textual analysis documented that the drop in the number of job vacancies in Miami was particularly severe for low-skill jobs.
3. There is a negative cross-city correlation between the change in the HWI and the number of immigrants entering the local labor market. The measured spatial correlation is negative and significant despite the obvious endogeneity bias created by the nonrandom settlement of immigrants in cities where there are job openings.
4. At the same time that the Beveridge curve was shifting out in other cities in 1982–85, Miami's Beveridge curve shifted in. The inward shift might have been caused by reduced mismatch between workers and available job opportunities or by the changed demographics of the Miami labor market, with the Mariel refugees perhaps searching more aggressively and more quickly filling up vacancies. Miami's Beveridge curve returned to its pre-Mariel (relative) position by the late 1980s.

In sum, our evidence consistently indicates that immigration-induced supply shocks are typically followed by a short-run drop in the number of advertised job vacancies, perhaps because the existing positions were quickly filled by the immigrants and firms did not expand fast enough to take advantage of the increase in labor supply. The labor market, however, tends to recover after a few years.

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