How Did the Miami Labor Market Absorb the Mariel Immigrants?

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Abstract

Card's (1990) analysis of the Mariel boatlift concluded that the mass influx of mostly less-skilled Cubans to Miami in 1980 had little impact on the labor market outcomes of the city's less-skilled workers. This paper evaluates two explanations for this. First, consistent with an open economy framework, this paper asks whether after the boatlift Miami increased its production of unskilled-intensive traded goods and services, allowing it to "export" the impact of the boatlift. Second, this paper asks whether Miami adapted to the boatlift by implementing new skill-complementary technologies more slowly than they otherwise would have. Though moving in the expected direction, the response of Miami's industry mix to the boatlift appears to be small: following the boatlift, Miami's relative output and employment of different industries trended similarly to other cities with similar pre-boatlift trends in mix. Preliminary support for the second type of adjustment comes from the fact that post-boatlift computer use at work was lower in Miami than in other cities with similar levels of computer sales per worker before the event, even among non-Cuban workers or within the detailed cells defined by industry or occupation.

JEL: J2, F1, O3.
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1. Introduction and Background

This paper asks how Miami's labor market adjusted when a large number of Cuban refugees, most of them less skilled, settled permanently in Miami following the 1980 Mariel boatlift.[1] Despite the size and unexpected nature of the event, it had surprisingly little impact on the wages and employment rates of Miami's less-skilled workers, as Card's (1990) widely-cited paper demonstrated.[2] Motivated by this evidence, this paper first investigates whether Miami responded to the boatlift like a Heckscher-Ohlin (HO) open economy. HO suggests the boatlift may have had little impact on the relative price of unskilled labor in Miami because Miami effectively "exported" the Cuban refugees' labor embodied in unskilled-intensive goods.[3] Besides the fact that the Miami economy is a small part of an apparently well-integrated US economy (e.g. Hanson and Slaughter (2002)), HO is a compelling explanation for Miami's experience because at the time of the boatlift, Miami had a large unskilled manufacturing sector (e.g. apparel) accustomed to absorbing Cuban refugees. This paper evaluates the importance of open-economy adjustments by measuring the extent to which Miami's manufacturing mix shifted toward unskilled-intensive industries following the boatlift. This evaluation serves as a test of HO more generally: as a substantial and one-time shock to Miami's endowment of less-skilled labor, the boatlift can provide unique "quasi-experimental" evidence about the extent to which factor endowments influence industry mix in a way consistent with the HO model.

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[1] Card (1990) reports the boatlift increased the size of the Miami labor force by around 7 percent. The event took place between May and September 1980.

[2] Miami's experience after the boatlift is also consistent with a large body of research that finds immigration has little local impact on native labor market outcomes (Borjas (1994), Friedberg and Hunt (1995)).

[3] Another possibility is that unskilled native workers left Miami in response to the boatlift. However, Saiz (2003) has shown that if anything it was *skilled* natives who left in response to the boatlift – because of a negative consumption amenity (as revealed by a permanent fall in house prices) – which would only tend to reinforce the impact of the boatlift.

This paper also considers a second explanation for Miami's experience: the boatlift induced Miami producers to adopt new skill-complementary technologies more slowly. The early 1980s was a period when the gap between the wages of skilled and unskilled workers widened while the relative supply of skilled workers rose. Some research has attributed to the spread of technologies, such as computers, that raise the relative productivity of skilled workers and replace unskilled workers (Autor, Katz and Krueger (1998)). Though skill-biased technological change (SBTC) is often taken as exogenous, some models suggest the presence of a large skilled work force may *induce* modes of production to become more skill-intensive. In models by Acemoglu (2002, 1998), the size of the potential market for an innovation affects the incentive to invest in R&D, and thus a large supply of skilled labor induces skill-augmenting innovations.[4] A similar model that is perhaps more pertinent too the local labor market can be found in Beaudry and Green (2003, 2005). These papers provide indirect evidence that when plants can chose between a skill-intensive "new" technology (motivated by evidence, such as Auto, Katz and Krueger, 1997, that new technologies are more skill-intensive) and an older less skill-intensive ("traditional") technology, an increase in the relative supply of skilled labor affects induces areas to use more of the skill-intensive method. Further more, like in standard two-sector open economy model, this can occur without any long-run change in relative wages.[5]

[4] In Acemoglu's model, agents have monopoly rights over their innovations, and thus can charge a markup on each unit sold. For this reason, the size of the market is important.

[5] Beaudry and Green (2000) give conditions for the "perverse" result where relative wages rise with relative supply; however, this occurs in part because of the inelastic supply of capital which may not be realistic for a local labor market.

Miami may have adjusted to the boatlift by adopting new skill-complementary technologies more slowly than they otherwise would have. If this were a large part of the adjustment, little shift in industry mix would be required to absorb the Mariel immigrants and maintain unskilled relative wages. Instead, one would observe higher rates of utilization of unskilled labor and slower adoption of these technologies.

Besides Beaudry and Green's work, other evidence on US labor markets during the 1980s suggests that technology shifts in response to local factor supply shocks. Saad-Lessler (2005) showed that in large US states during the 1980s movements in factor-output ratios within industry were related to changes in the state's factor supplies. Lewis (2007) shows that less-skilled immigration shocks induce manufacturing plants to adopt less automated production techniques. Beaudry, Doms, and Lewis (2007) show that returns to skill rise more rapidly in high skill markets than in low-skill markets over the 1980s and 1990s, consistent with faster adoption of skill-intensive technologies.

To evaluate the role of open-economy adjustments to the Mariel boatlift, I look for evidence of a shift in Miami's mix of traded industries following the boatlift. I focus mainly on manufacturing because it is a major traded sector, particularly for unskilled employment and because well-developed measures of output are available for this sector from the Annual Surveys of Manufactures. Initially comparing Miami to a set of 11 mostly midwestern and southern metropolitan areas with similar trends to Miami in manufacturing mix during the 1970s, I find little evidence of an accommodating change in industry mix after the boatlift. To be sure that this not an artifact of the particular choice of comparison group, I show that

the more closely a metropolitan area matched Miami's trends in manufacturing mix during the 1970s, the more similar were its trends to Miami after the boatlift. There is slight evidence in favor of open economy models: low-skill sectors did typically expand more quickly relative to less-skilled sectors. But the magnitudes are small. Open-economy adjustments are at most a small part of how Miami adjusted to the boatlift.

To provide more direct evidence that this might have been partly accommodated by a shift away from (compared to other markets) unskilled-replacing technology, the paper compares the amount of computer use at work in Miami to other cities. Four years after the boatlift, workers in Miami were less likely to use computers at work than workers in the comparison cities used in this study, as well as in the comparison cities used in Card (1990). This computer-use gap diminishes substantially but does not disappear when limiting the comparison to non-Cuban workers or in the same detailed cells defined by occupation or industry.

2. Data

The main outcome of interest in this paper is changes in Miami's mix of industries that resulted from the boatlift.[6] This is measured in Miami (and comparison areas) alternatively with "output" (value added) and employment using data from, respectively, the Annual Survey of Manufactures (ASM), and the County Business Patterns (CBP). For the first, real

[6] It would be idea to observe the factor content of Miami's net exports over time. Local data on net exports do not exist, so other measures of local industry mix – value added and employment – are used as proxies.

value added by metro area and industry is aggregated from the ASM's confidential establishment-level data.[7]

The Bureau's purpose for collecting the ASM is to produce reliable national statistics on shipments by industry, and its design reflects this. Beginning two years after each Census of Manufacturing (which occur every five years in years ending in "2" or "7") a sample of manufacturing firms (and their individual establishments in the case of multi-unit firms) are selected to be in the ASM. Then every year the Census Bureau collects information on each establishment's location (county), four-digit SIC industry, shipments and costs (among other things).[8] Large establishments, and ones that produce a large share of any industry's output, are always included in the ASM. Establishments with fewer than 20 employees are excluded from the survey. Among medium-sized establishments, a random sample is drawn, stratified on firm size. Once selected, an establishment is surveyed every year (unless it shuts down) for the subsequent five years. To maintain the representativeness of the sample within the five-year period, newly active firms may be added using updated records on the universe of manufacturing establishments.[9] However, Davis, Haltiwanger and Schuh (1991) have shown that the Bureau is not successful at maintaining the representativeness of the ASM within a panel, and as a result the ASM does not reliably measure short-term changes in

[7] These data were made available in the Census Bureau's Longitudinal Research Database (LRD), a confidential dataset that links establishment-level survey data from Censuses of Manufactures (CM), occurring once every five years – in years ending in "2" and "7" – and the ASM, occurring every year. The description of the in this section is based upon LRD documentation (US Department of Commerce (1999)), appendices to the Census Bureau's industry series reports (for example, US Department of Commerce (2002)), and ASM and CM survey forms, available on the Census Bureau's website.

[8] An establishment is usually defined a physical location where production takes place. It sometimes happens that a single large establishment produces distinct product lines; when the amounts are significant, the Census Bureau attempts to treat each product line within the same physical location as a separate establishment.

[9] Lists of enterprises come from IRS and Social Security Administration records. In addition, the Census Bureau surveys manufacturing enterprises to obtain lists of new establishments opened by multi-unit enterprises.

manufacturing employment. Comparisons they do with other data suggest, however, that long-run growth rates are reliably measured in the ASM.

Besides the inaccuracy of year-to-year changes in the ASM, the ASM has two weaknesses from the point of view of the present study. First, very small establishments are not observed (output at small establishments is imputed based on IRS-derived records of their employment), which is a problem if much of the response to the boatlift were to occur in small manufacturing firms. While ASM documentation reports that the data are representative of the vast majority of production at the national level, in any particular locality the estimate may be noisy. Second, only manufacturing is covered, and there may be significant low-skill employment in traded sectors outside of manufacturing (such as tourism).

This study also measures industry mix using employment in County Business Patterns (CBP) data. The CBP purports to be an annual census of establishments, and covers all non-farm private sectors. The public use data used in this project reports the number of establishments in each employment "class size" (1-4, 5-9, 10-49, 50-99, 100-499, 500-999, 1000-4999, >5000) by county and four-digit SIC industry. To turn these into estimates of employment, I interacted the average number of employees at each class size nationally (which is observable in the public use "national" file) with the local establishment counts and summed up over class sizes.[10] To verify this approach, I took advantage of the fact that in

[10] I allowed the average number of employees at each class size to vary by year, though there is very little variation. I experimented with also allowing the average number of employees by class size to vary by industry, though again I found little variation, and decided to discard this approach. For more details on the approach used, see data appendix.

county-industry cells which have a sufficiently large number of establishments, the CBP reports the employment directly. In county-industry cells where actual employment is available, estimated employment is typically within one percent of actual. However, in contrast to the ASM, the CBP does not fully capture changes in employment due to changes in the size of very large establishments.[11] On the positive side, CBP measures employment as of mid-March, which in 1980 provides a snapshot of Miami's industry mix just before the boatlift (which occurred later that year).[12]

This study also uses employment and labor force data from the 1980 and 1990 Censuses of Population five-percent Public Use Micro Samples (PUMS). The 1980 Census was taken before the boatlift occurred.[13] To account for changes in the overall size of an area's economy, the value added data from the ASM are deflated by an area's total population, estimated from annual county population estimates from the County Age, Sex, Race files (US Department of Commerce (1985, 1993, 1998)). All of the data were aggregated to the metropolitan area level in a way that matched the 1990 Census definitions of the metropolitan area boundaries as closely as possible.[14]

[11] I have some reason to believe that the behavior of small establishments may be more important for capturing the impacts of a low-skill immigration flow. Lewis (2007) shows that low-skill immigration is associated with an increase in the proportion of establishments which are small.

[12] There is one additional problem with both the ASM and CBP data. The Standard Industrial Classification (SIC) code was revamped in 1987, and 1988 and later surveys use the new system. I have matched industries across systems to the extent possible. In most cases, the code change does not seem to have had a major impact – output and employment tend to be smooth across this year – but I will point out the exceptions.

[13] The census purports to be a snapshot of the US population as of April 1st of the census year. The boatlift began after this date in 1980.

[14] Deaton and Lubotsky's (2003) tabulations (with a couple of minor corrections) are used to construct metropolitan areas in the 1980 and 1990 PUMS.

3. Labor Market Impacts of the Boatlift

In order to account for changes to Miami's manufacturing mix that might have occurred in the absence of the boatlift, I initially compare Miami to eleven metropolitan areas (aggregated), chosen because they had similar trends in output to Miami in four broad skill-rated manufacturing aggregates during the 1970s (The three-digit industries in these aggregates are listed in the appendix table and are described further below).[15] Later I will perform a more general comparison that involves a larger number of cities.

Because these comparison cities are different than the ones used in Card (1990), it is appropriate to begin by re-examining the labor market impacts of the boatlift using these comparison cities. This study can also take advantage of a source not available at the time of the original Card study: the 1990 Census of Population. While this has the disadvantage of being well after the boatlift, it has the advantage of being much larger than the Current Population Surveys which are used to measure labor market outcomes in Card (1990).

Table 1 presents changes in the labor force attributes of Miami and the comparison cities between 1980 and 1990. Miami's Cuban labor force grew by 13 percent during the decade, similar to estimates of the boatlift's impact presented in Card (1989). High school dropouts increased their presence in Miami's labor force by 8 percent and decreased their presence in the comparison cities' labor force by 25 percent. The latter number is typical of the nation

[15] The eleven metro areas are Cincinnati, OH; Cleveland, OH; Minneapolis-St. Paul, MN; Rochester, NY; Pittsburgh, PA; Nashville, TN; Greensboro-Winston-Salem, NC; Richmond-Petersburg, VA; Nassau-Suffolk, NY; Riverside-San Bernardino, CA; Chicago, IL. These cities were essentially chosen to match the rapid decline in the output of Miami's apparel sector during the 1970s.

as a whole – the 1980s was a period of gains in educational attainment. (In part) because of the boatlift, Miami experienced smaller growth in the supply of skills over the 1980s. Table 1 also shows that more educated workers decreased their presence in Miami's work force in comparison to these other cities.

Table 1 provides some suggestive evidence confirming that the boatlift had little impact on Miami's labor force, at least after 10 years, compared to these cities. Statistically significant changes include the 6 percent decline in the employment rates of blacks and non-Cuban Hispanics relative to the comparison cities, but it is worth noting that the fall in employment rates is less than this for the subgroup most likely to be most competitive with the Mariel immigrants, high school dropouts. Changes to the structure of wages in Miami and these other cities are also statistically similar. The apparent 20 percent decline in wages for non-Cuban Hispanics is either spurious – it is not statistically significant – or not causally related to the Mariel boatlift, as it concentrated among more educated Hispanics. Thus the boatlift appears in these data to have had little lasting impact on the labor market outcomes of less-skilled workers in Miami.

4. Changes in Industry Mix

Defining Industry Categories

The section looks for changes in manufacturing mix in Miami following the boatlift. The ASM is a very industrially disaggregated dataset, reporting industry at the four-digit level. But given the size of the sample, it is infeasible to fully exploit this level of detail. Instead, four aggregates, classified on skill intensity (described below), will be examined. First,

apparel will be examined separately. Apparel is Miami's single largest manufacturing industry, it is a major low-skill employer, and other work shows that tends to expand with the availability of less-skilled labor. Manufacturing industries other than apparel are classified into three categories based upon their output responsiveness to the local availability of high school dropouts in US metropolitan areas during the 1980s, which serves to reflect the likely impact of Mariel immigrants on the Miami labor market.[16] "Group 1" industries responded most positively to dropouts, group 2 industries had little response to dropouts, and group 3 industries generally responded negatively to dropouts. The industries in each of these categories are listed in the appendix. The three groups plus apparel partition manufacturing.

These industry groups were designed to be approximately equal in size in terms of the shares of the Mariel immigrants that were likely to be employed by them, ascertained using the employment shares of the Cuban migrants who arrived just before the Mariel boatlift (1975-80) in 1980. Table 2 shows that these pre-Mariel Cubans in 1980 had for the most part similar education levels to "Mariel" immigrants (Cubans who arrived 1980-81, and age 26-64 in 1990) observed in 1990, although more pre-Mariel Cubans completed high school. The

[16] Industries, indexed by *j*, were ranked on the coefficient g_j from the regressions:

$$\%\Delta Q_{jc} = f_j + g_j \%\Delta L_{dropouts,c} + h_j \%\Delta P_c + \omega_{jc}$$

where $\%\Delta Q_{jc}$ represents output growth between 1980 and 1990 in industry *j* and city *c*, $\%\Delta L_{dropouts,c}$ represents high school dropout labor force growth in city *c*, and $\%\Delta P_c$ represents population growth in *c*. Output was measured in the ASM, and labor force and population were measured in the Census of Population. After ranking industries on this dropout-responsiveness measure, they were then grouped into approximately equal-sized sectors based on the employment shares of pre-Mariel (1975-80 arrival cohort) Cubans in 1980. Each regression uses the subset of Lewis's (2003) sample of 179 cities for which there was a plant with nonzero output in 1980. Apparel, not included in the three groups, is second to only to yarn and fabric mills on this dropout-responsiveness measure.

share of employment in each industry group is shown in the lower panel. In total, approximately 30 percent of pre-Mariel Cubans worked in manufacturing. Fewer of the Mariel immigrants actually ended up in these industries by 1990, reflecting a general decline in manufacturing.

Results

Panel A of Figure 1 plots ASM-derived estimates of apparel value added per capita, annually between 1972 and 1996 for Miami and the region of comparison cities, while Panel B presents apparel's share of non-farm employment (from CBP) between 1974 and 1996.[17] Values are displayed as a fraction of pre-boatlift levels, which for ASM data is the average of 1974-79, and for CBP is the average of 1974-80.[18]

Panel A of Figure 1 shows Miami's apparel output per capita declined steeply in the 1970s.[19] By design, there is also a steep decline in the comparison cities, which were chosen to match on this trend (and on the trend in the other three aggregates, described above).[20] The contraction in the 1970s abated around 1980 in the comparison region and apparently in 1984 in Miami. However, the jump in Miami's output in 1984 coincides with an updating of the ASM panel that year the relative increase in Miami's output may have occurred in an

[17] Output or value added in the ASM is measured as the total value of shipments minus materials and energy costs (with adjustments for inventory changes). This definition avoids the double counting of intermediate goods produced in the manufacturing sector. The source for annual population estimates is described in the data section. 1974 is the first year in which county business patterns is available electronically.
[18] CBP employment corresponds to mid-March, which is before the boatlift in 1980.
[19] These trends were estiamted without 1980, which is nevertheless shown in the plot, because the boatlift only had the potential to affect output in part of that year.
[20] The simple average of the four trend differences from Miami during the 1970s was the matching criteria. Each aggregate was weighted equally because each was an approximately equal employer of pre-Mariel Cubans. (See Table 2.) 108 cities were available to be matched (the sample is described below), and these 11 were the top 10 percent of the matches.

earlier year. (See discussion in data section.) In any case, by the mid-1980s Miami's apparel output appears to have grown a bit relative to comparison, but by 1996 these relative gains have disappeared.

When the size of the apparel sector is alternatively measured by its share of an area's (private, non-farm) employment (data from CBP, see previous section), in Panel B, the pattern is also consistent with the conclusion that Miami's apparel sector may have experienced modest growth for a few years relative to the counterfactual in which there was no boatlift. Before the boatlift, apparel roughly maintains its share of Miami's employment, while it declines in the comparison cities. Beginning in 1981, apparel's share of employment declines at a slightly slower rate in Miami than it does in the comparison cities, but again by 1996 the gains have pretty much been erased. In addition, Miami's apparel employment was already declining more modesty prior to the boatlift, a point which will be returned to later.

Results are in other industry groups (shown in Figures 2 – 4) are mixed in their consistency with HO. "Manufacturing Group 1," shown in Figure 2, was constructed to comprise other low-skill industries. There is not much sign of any increase in Miami's output or employment in these sectors in the early 1980s, though there is a late-1980s surge in Miami's employment in these sectors relative to the comparison cities. In the more skilled "Manufacturing Group 2" in Figure 3, there is some sign of a relative decline in Miami in the early 1980s (Panel A), but this result is not replicated using the employment data (Panel B). Results are similar in group 3, skilled manufacturing: Miami's appears to go into steady decline a few years after the boatlift but not in the comparison cities. However, this result is again not replicated in the employment data. According to the CBP data, the share of

employment in these industries declines by a similar amount percentage in Miami and the comparison cities.

In order to quantify the impact of the boatlift, Tables 3a and 3b use the data in Figures 1-4 to estimate linear the following linear models:

$$(1)\quad y_{jct} = \beta_{0j} + \beta_{1j} D_{c=Miami} + \beta_{2j} t + \beta_{3j} D_{c=Miami} \cdot t + \beta_{4j} D_{t\geq 0} + \beta_{5j} D_{t\geq 0} \cdot D_{c=Miami} + \beta_{6j} D_{t\geq 0} \cdot t + \beta_{7j} D_{t\geq 0} \cdot D_{c=Miami} \cdot t + \varepsilon_{jct}$$

In this equation *j* indexes industry groups (and all coefficients are allowed to vary across industry groupings); time, *t*, is normalized to 0 = 1981 (the first year after the boatlift); c = Miami or the aggregated comparison cities; $D_{c=Miami}$ is an indicator for Miami; and $D_{t\geq 0}$ is an indicator for post-boatlift observations. To the extent that changes in industry mix evolve in a way which can be captured by linear trends and the comparison cities represent the counterfactual (non-boatlift) outcome in Miami, the relative trend break in Miami after the boatlift, β_7 (the coefficient "Post 1980*Trend*Miami") represents the effect of the boatlift. The even columns in this table show pure trend break models (β_4=β_5=0), while the odd columns also allow also for an intercept shift in 1980. Any immediate affect of the boatlift will be picked up by β_5 (the coefficient on "Post 1980*Miami"). In most cases, allowing for an intercept shift has little effect on the relative trend change estimates. Among these, only the estimate for the second industry group is statistically different than zero, though

consistent with the figures, the point estimate is positive for apparel, and negative for the third industry group.[21]

Robustness – Many Comparison Groups

In order to estimate the impact of the Mariel boatlift, we need to know how Miami's have industry mix would have evolved absent the boatlift. To proxy for this, we have taken the standard approach of comparing Miami to an area which is similar along dimensions we think are a relevant indication of its ability to proxy for Miami's counterfactual outcome, namely, pre-boatlift trends. This method presents some challenges, however. First, though close, the comparison area's pre-boatlift trends do not exactly matched Miami's. In fact, Tables 3a and 3b shows that trend differences before the boatlift (β_4) are partly driving the estimates of the trend breaks: pre-trends tend to be roughly equal in magnitude (and opposite in sign) to the estimated trend breaks. Panel B of Figure 1 presents a nice example of this: the negative "trend break" here is mostly driven by the relatively slower decline in Miami apparel output before 1980; after 1980 the trends are nearly parallel in Miami and the comparison cities. As it is not necessarily the case pre-boatlift trends would have continued in Miami in the absence of the boatlift, this seems problematic. This standard approach of picking one comparison area is also vulnerable to researcher manipulation. Why were the eleven closest matches to Miami chosen as comparison areas and not, say, five or 10? On top of this, this approach throws away data from other parts of the U.S. which might allow the counterfactual to be more precisely estimated.

[21] OLS standard errors are likely to be understated because they do not take account of the high level of serial correlation in the data. See Bertrand, Duflo and Mullainathan (2003).

To both use more of the data and probe the robustness of the results, I re-estimated the trend break model (1) for output per capita several times using each metro area (other than Miami) as a separate comparison city. Some of these more closely match Miami's prior trends than others, and we might give greater credence to the closer matches. So using 80 of the largest immigrant-receiving metropolitan areas,[22] Figure 5 plots (separately for each industry group) the estimated trend break (β_7) in output per capita against the estimated trend difference before 1980 (β_4). Figure 6 shows the same kind of comparisons using employment data for a larger number of areas. Said differently, each point in these figures represents a different metropolitan area; the "y" direction measures the estimate of the effect of the boatlift using that area as the comparison group (that is to say, the difference, between Miami and that area, in the post-1980 linear trend break); and the "x" direction measures Miami's pre-1980 difference in linear trend from this metropolitan area. Like in Table 3, there is a systematic negative linear relationship between the two: the larger is Miami's pre-boatlift relative decline in a sector's output, the larger the estimated "effect" of the boatlift appears to be. As might be expected from the mechanical relationship between pre-boatlift trends and estimated trend breaks, in fact, the tradeoff is about one for one: the slope of the estimated line through these points (weighted by the area's 1980 employment) is near one.

The intercept of this relationship is, in some sense, the estimated trend break one expects to obtain from a city that exactly matched Miami's pre-boatlift trend in some sector. The

[22]I estimate trend-break models without intercept shift (like the odd columns of Table 3). The 80 metropolitan areas: (1) are among the top 100 receivers of (working-age) immigrants during the 1980s or had at least 1 percent of their 1990 population be foreign-born arrivals of the past decade; (2) had at least one plant in each of the four industry groups in the ASM sample in each of the years 1972-1996 (3) Met the Census Bureau's cell-size thresholds for non-disclosure of confidential information. The 179 metropolitan areas used in the construction of the industry groups meet criteria (1). (2) and (3) are basically restrictions on size: (2) eliminates 71 of these areas, and (3) removes another 38.

intercepts tend to be small, which says that trend break estimates different than zero are driven primarily by differences in trend prior to the boatlift. In addition, the figures show that a lot of the potential comparison cities – including the comparison cities that Card used in his original study, highlighted in black – are clustered around the x-axis anyway. That is, it is hard to find evidence of any impact no matter which city you compare to Miami. However, there is a glimmer of support for HO here. The sign of the intercepts tends to be consistent with the theory. Dashed lines in each panel of the figure give the location of this intercept. Using output data (Figure 5) the intercept is positive in apparel and other low-skill industries ("group 1"), and negative in the two high skill sectors as would be expected from a shift in output towards low-skill intensive products. Except for apparel (which is, any case statistically insignificant in both cases) the same pattern emerges with the employment data (Figure 6).

Nevertheless, the magnitude of the estimates are small, and implies that shifts in industry mix are probably not the major way in which Miami adjusted to the boatlift. While one cannot rule out that some of the cities that are far from Miami's pre-1980 trends are a good comparison group, the fact that all of the large estimates in the trend break models come from cities that differed substantially from Miami before the boatlift does not provide much support for the idea that the Mariel boatlift had a major impact on Miami's manufacturing mix.[23]

[23] Another robustness issue is whether the ASM results are particular to output data. In this regard, it is possible to replicate all of the empirical methods used so far using employment data Using employment data in the ASM does not produce evidence that the Mariel immigrants were accommodated by a change in Miami's manufacturing mix either. It is also possible to use capital stock to measure industry mix, though the series is noisier and only available in census years after 1985. The trends in the capital series behave similarly to the output data.

Other Sectors

But why limit the analysis to manufacturing? Even at this time, manufacturing covered less than 20 percent of Miami's employment. Manufacturing, is however, is likely to cover a large share of Miami's less-skilled traded employment, which is what's relevant for trade theory. However, there are other sectors which employ substantial proportions of low-skill workers and some of these, like tourism and other services, are at least arguably traded.

Figure 7 is similar to Figure 6, but includes sectors outside of manufacturing. The sectors presented – construction, apparel, restaurants, hotels, laundry services, and hospitals – were chosen because they are the largest employers of newly arrived Cuban workers; each employed at least three percent of 1975-80 Cuban arrivals living in Miami in 1980. The data present evidence of an (albeit, small) expansion of Miami's tourism sector: Miami's employment at restaurants and hotels appears to grow unusually following the boatlift. In contrast the share of Miami's workers in hospitals, which provide a high-skill service which might or might not be considered "traded," declines compared to other areas. Laundry services and construction, which are probably non-traded, both have negative intercepts, though most comparison cities give a positive estimate for laundry services. Overall, examination of these other sectors does not appear to alter the conclusion that the impact of the boatlift on Miami's mix of industries was small.[24]

[24] As an additional robustness check, Figure 8 limits the data to 1974-1987, a period we uses a constant set of industry codes. This does make some of the estimates larger – especially for hospitals – but does not dramatically alter this conclusion.

5. Changes in Computer Use

[preliminary]

After the boatlift the Miami labor market experienced an expansion of less-skilled employment without major cuts in less-skilled relative wages and with little change in industry mix. This pattern is similar to the rise in the relative employment of skilled workers during the 1980s – very little of which can be accounted for by changes in industry mix (e.g. Berman, Bound and Griliches (1994), Bound and Johnson(1992)) – at the same time as their relative wages went up. Some researchers believe an exogenous demand shock for skill driven by the introduction of new skill-complementary technologies, such as computers, was responsible for this (Autor, Katz, and Krueger, 1998). Acemoglu (2002) argued that the introduction of the new technology was not exogenous but the response of the market to a larger pool of skilled workers who would experience productivity benefits from such technology. Beaudry and Green (2003) use data on multiple countries to argue that the degree to which the new technology was used was endogenous to the availability of skilled labor, and show that under these circumstances skilled wages do not decline as skill supply increases.[25]

Miami may have adjusted to the boatlift in a manner similar to what is suggested by Beaudry and Green. In this view, less-skilled wages did not fall in Miami after the boatlift because the influx of unskilled labor induced producers to adopt skill-complementary technologies at a

[25] For a simple explanation for how this could be the case, consider an open economy model with two factors of production (skilled, unskilled labor) and two sectors (high-skill, low-skill). In this setup, areas within the "cone of diversification" will all have the same relative factor prices regardless of factor mix. In a simplified version of the Beaudry and Green model, high- and low-tech "sectors" are simply relabeled skilled- and unskilled-intensive production techniques for producing an identical final good.

slower rate. To provide some suggestive evidence supporting this interpretation, I examine Miami's use of a canonical skill-biased technology, computers. Recent work suggests that computers may serve to replace unskilled labor (Autor, Levy and Murnane (2003)). However, measuring technology choice with computer use has caveats. DiNardo and Pishke (1997) showed that skilled workers are simply more likely to be in occupations that use computers.[26] Similarly, if Miami has a low rate of computer use after the boatlift, it might simply reflect the lower tendency of unskilled Mariel immigrants to be in jobs that use a computer. To account for this, I will attempt to regression adjust computer use by controlling for industry and occupation mix.

The data come from the October 1984 Current Population Survey (CPS), which asked respondents "Do you use a computer directly at work?" Table 4 estimates linear probability models comparing how computer-use rates in Miami compare to 43 other areas identified in the survey. (The other cities here include nine of the eleven metropolitan areas from the first set of comparison cities above -- Richmond and Nashville are not observed -- plus the four cities used in Card, 1990.) [27]

Column (1) of Table 4 gives the baseline specification with no controls. A Miami dummy indicates that 6 percentage points fewer of Miami's workers used a computer at work than

[26] Krashinsky (2004) has also shown that controlling for a family fixed effect in a sample of twins makes the effect of computer use on wages go away.

[27] In order to account for the fact that there is no individual-level variation in the location dummies, I cluster at this level in the regressions.

those in other large metropolitan areas.[28] This is a cross-sectional estimate, so it is possible that this gap existed before the boatlift. As data on computer use before 1984 are not available, I control instead for the natural log of an area's total sales of mainframe computers, over two-year the period 1978-79, divided by 1980 (pre-boatlift) employment. This control is correlated with 1984 computer use but does not reduce the coefficient on Miami. The results are also robust to choice of comparison cities: dummies for Card's (1990) comparison cities as well as the ones initially used above for changes in manufacturing mix, are both insignificant and small in magnitude.

The lower rate of computer use in Miami is at least partly a compositional effect, however. Column (4) drops all Cubans from the regression, which halves the magnitude of Miami's computer-use gap. Another way to see this by adding occupation controls, which are added as unrestricted the three digit-level dummies in column (5). Though the Miami dummy is still significantly negative, it is reduced in magnitude. However, interestingly, the coefficient on pre-boatlift sales of computers per worker is reduced by a similar magnitude, suggesting these controls may be absorbing pre-boatlift differences in occupation mix, rather than an effect of the boatlift on occupational mix. And consistent with earlier estimates showing the impact of the boatlift on industry mix was probably small, detailed industry controls have no additional effect on the estimate.

With the caveat that computer use is at best a proxy for other forms of factor-biased technological change, these regressions are suggestive evidence that Miami may have partly

[28] The share of workers using a computer at work in some individual areas in 1984: Chicago – 29%, Cincinnati – 24%, Cleveland – 23%, Greensboro – 23%, Minnesota – 32%, Nassau-Suffolk – 32%, Pittsburgh – 27%, Riverside – 23%, Rochester – 32%, Atlanta – 29%, Houston – 36%, Los Angeles – 28%, Tampa – 30%.

adapted to the boatlift by adopting less new technology than they might have without the boatlift.[29]

6. Conclusion

Finding convincing ways to evaluate open economy models is difficult, as conditions in the real world may deviate substantially from theory. Miami's adjustment to the boatlift comes closer to the conditions needed to test the open economy models theory than do cross-sectional studies between countries or between large states within a country. It is a sudden large shock to skill mix followed by a period of relatively little change in factor mix.

This paper looks for evidence that the relative output of unskilled-intensive sectors went up in Miami after the boatlift. Although there is some evidence of this, the magnitude of the shifts are to be too small to fully account for the boatlift's lack of labor market impact on Miami. Miami's trends in output and employment mix after the boatlift were quite similar to other metropolitan areas that shared its trends before the boatlift. There is, in particular, little evidence that apparel production rose significantly as a result of the boatlift, although some skilled sectors seem to have reduced their presence in Miami.

There is also some evidence that production techniques may have been systematically adapted to Miami's change in worker mix, a possibility suggested in models of endogenous technical choice (Beaudry and Green, 2003). The evidence here is only suggestive –

[29] Miami also has more blacks than either set of comparison cities, and blacks have lower computer use rates. After everything else in Table 4 is controlled for, however, neither a black dummy nor its interaction with other controls is significant, and its inclusion reduces the computer-use gap only slightly.

computers appear to have been adopted more slowly in Miami after the boatlift than by similar workers in other markets – but fits with this view.

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Table 1

1980-1990 Growth in Labor Force Attributes, Miami and Comaprison Region

Variable	Miami	Comp Region	Differ-ence
Labor Force/Capita			
Cubans	0.13	-0.04	0.17 *
High School Dropouts	0.08	-0.28	0.36 *
High School Graduates	-0.26	-0.19	-0.07 *
Some College	0.30	0.50	-0.21 *
College Graduates	0.13	0.30	-0.17 *
Employment Rates			
Black	0.00	0.06	-0.06 *
Non-Cuban Hispanic	0.03	0.09	-0.06 *
All…			
High School Dropouts	-0.01	0.02	-0.03 *
High School Graduates	0.01	0.03	-0.02 *
Some College	0.03	0.03	0.00
College Graduates	0.02	0.02	0.00
Black…			
High School Dropouts	-0.03	0.01	-0.04 *
High School Graduates	0.00	0.02	-0.02
Non-Cuban Hispanic…			
High School Dropouts	0.03	0.08	-0.05 *
High School Graduates	0.01	0.03	-0.03
Hourly Wages (CPI-deflated)			
Black	-0.10	-0.07	-0.03
Non-Cuban Hispanic	-0.13	0.07	-0.20
High School Dropouts	-0.12	-0.12	0.00
Black…			
High School Dropouts	-0.17	-0.24	0.08
Non-Cuban Hispanic…			
High School Dropouts	-0.21	-0.13	-0.09

Source: 1980, 1990 5% PUMS. *Significanlty different from 0 at the 5% level.

Table 2
The Education and Manufacturing Industries of Pre-Mariel and Mariel Immigrants

	1975-80 (Pre-Mariel) Cuban Arrivals, 1980		"Mariel" Immigrants 1990	
	All	in Miami	All	in Miami
Education Shares				
<9th Grade	0.353	0.378	0.391	0.405
<12th Grade	0.541	0.576	0.631	0.642
12th Grade	0.217	0.199	0.169	0.158
Some College	0.118	0.115	0.133	0.130
College+	0.124	0.110	0.067	0.071
Employment Shares				
Manufacturing	*0.286*	*0.290*	*0.208*	*0.199*
Apparel	0.061	0.068	0.037	0.047
Group 1	0.073	0.078	0.068	0.059
Group 2	0.072	0.068	0.043	0.041
Group 3	0.080	0.076	0.060	0.052
N	1,243	790	4,814	2,692
Share in Miami….		0.636		0.559

Source: 1980, 1990 5% PUMS. "Mariel" Immigrants defined as Cuban immigrants arriving in 1980-81 who were aged 16-54 in 1980.

Table 3a. Linear Trends in Employment and Output per Capita
Miami and Comparison Cities, Apparel and Industry Group 1

Relative Industry Scale Measure:	Apparel				Manufacturing Group 1			
	Employment Share*		Output/Capita**		Employment Share*		Output/Capita**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	0.997	0.902	0.604	0.648	0.931	0.938	1.052	0.831
	(0.019)	(0.021)	(0.170)	(0.064)	(0.014)	(0.014)	(0.021)	(0.054)
Miami	0.068	0.043	-0.087	-0.075	0.016	-0.080	0.046	-0.051
	(0.039)	(0.038)	(0.190)	(0.087)	(0.044)	(0.023)	(0.086)	(0.120)
Trend	-0.001	-0.020	-0.089	-0.081	-0.017	-0.016	0.012	-0.027
	(0.006)	(0.006)	(0.028)	(0.015)	(0.004)	(0.003)	(0.005)	(0.011)
Trend*Miami	0.017	0.012	-0.019	-0.017	0.004	-0.015	0.010	-0.007
	(0.010)	(0.011)	(0.034)	(0.022)	(0.009)	(0.006)	(0.015)	(0.021)
Post 1980	-0.124		0.063		0.010		-0.322	
	(0.027)		(0.180)		(0.023)		(0.046)	
Post 1980	-0.033		0.018		-0.127		-0.141	
*Miami	(0.053)		(0.210)		(0.051)		(0.150)	
Post 1980	-0.003	0.013	0.061	0.055	-0.001	-0.002	-0.010	0.020
*Trend	(0.006)	(0.007)	(0.028)	(0.019)	(0.004)	(0.005)	(0.007)	(0.015)
Post 1980*Trend	**-0.043**	**-0.039**	**0.036**	**0.034**	**0.010**	**0.026**	**0.002**	**0.015**
***Miami**	**(0.011)**	**(0.014)**	**(0.035)**	**(0.027)**	**(0.009)**	**(0.008)**	**(0.019)**	**(0.031)**
R-squared	0.93	0.89	0.85	0.85	0.88	0.85	0.60	0.33

Robust standard errors in parentheses. For the purpose of calculating linear trends, "time" is years after 1981 (i.e. 1979=-1).

*Data source: County business patterns, 1974-1996; normalized to 1974-80 = 1.0.

**Data source: For "output" (= real value added) is US Census Burea, CES, Annual Surveys of Manufactures, 1972-1996; this was divided by population estimates from US Bureau of the Census (1985, 1993, 1998). Data are normalized to 1972-79=1.0. 1980 data point is excluded from output regressions, as it is both a "pre-boatlift" and "post-boatlift" year.

Comparison cities are: Cincinnati, OH; Cleveland, OH; Minneapolis-St. Paul, MN; Rochester, NY; Pittsburgh, PA; Nashville, TN; Greensboro-Winston-Salem, NC; Richmond-Petersburg, VA; Nassau-Suffolk, NY; Riverside-San Bernardino, CA; Chicago, IL.

Table 3b. Linear Trends in Employment and Output per Capita
Miami and Comparison Cities, Industry Groups 2 and 3

Relative Industry Scale Measure:	Manufacturing Group 2				Manufacturing Group 3			
	Employment Share*		Output/Capita**		Employment Share*		Output/Capita**	
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Intercept	0.937	0.882	1.006	0.859	0.969	0.955	1.017	0.944
	(0.007)	(0.021)	(0.032)	(0.047)	(0.009)	(0.010)	(0.015)	(0.058)
Miami	0.033	0.076	-0.117	-0.214	0.017	0.053	0.021	-0.048
	(0.030)	(0.028)	(0.082)	(0.074)	(0.028)	(0.015)	(0.066)	(0.083)
Trend	-0.016	-0.027	0.001	-0.025	-0.008	-0.011	0.004	-0.009
	(0.002)	(0.005)	(0.005)	(0.008)	(0.003)	(0.003)	(0.005)	(0.011)
Trend*Miami	0.008	0.017	-0.025	-0.042	0.004	0.012	0.004	-0.008
	(0.011)	(0.009)	(0.016)	(0.014)	(0.008)	(0.006)	(0.014)	(0.015)
Post 1980	-0.073		-0.214		-0.018		-0.106	
	(0.029)		(0.056)		(0.015)		(0.080)	
Post 1980	0.057		-0.142		0.048		-0.099	
*Miami	(0.048)		(0.110)		(0.034)		(0.120)	
Post 1980	-0.012	-0.003	0.012	0.032	-0.023	-0.020	-0.002	0.008
*Trend	(0.003)	(0.007)	(0.007)	(0.012)	(0.003)	(0.003)	(0.008)	(0.016)
Post 1980*Trend	**-0.009**	**-0.017**	**0.035**	**0.048**	**-0.006**	**-0.012**	**-0.030**	**-0.021**
***Miami**	**(0.012)**	**(0.011)**	**(0.018)**	**(0.021)**	**(0.009)**	**(0.007)**	**(0.016)**	**(0.021)**
R-squared	0.95	0.95	0.69	0.54	0.97	0.97	0.83	0.80

Robust standard errors in parentheses. For the purpose of calculating linear trends, "time" is years after 1981 (i.e. 1979=-1).

*Data source: County business patterns, 1974-1996; normalized to 1974-80 = 1.0.

**Data source: For "output" (= real value added) is US Census Burea, CES, Annual Surveys of Manufactures, 1972-1996; this was divided by population estimates from US Bureau of the Census (1985, 1993, 1998). Data are normalized to 1972-79=1.0. 1980 data point is excluded from output regressions, as it is both a "pre-boatlift" and "post-boatlift" year.

Comparison cities are: Cincinnati, OH; Cleveland, OH; Minneapolis-St. Paul, MN; Rochester, NY; Pittsburgh, PA; Nashville, TN; Greensboro-Winston-Salem, NC; Richmond-Petersburg, VA; Nassau-Suffolk, NY; Riverside-San Bernardino, CA; Chicago, IL.

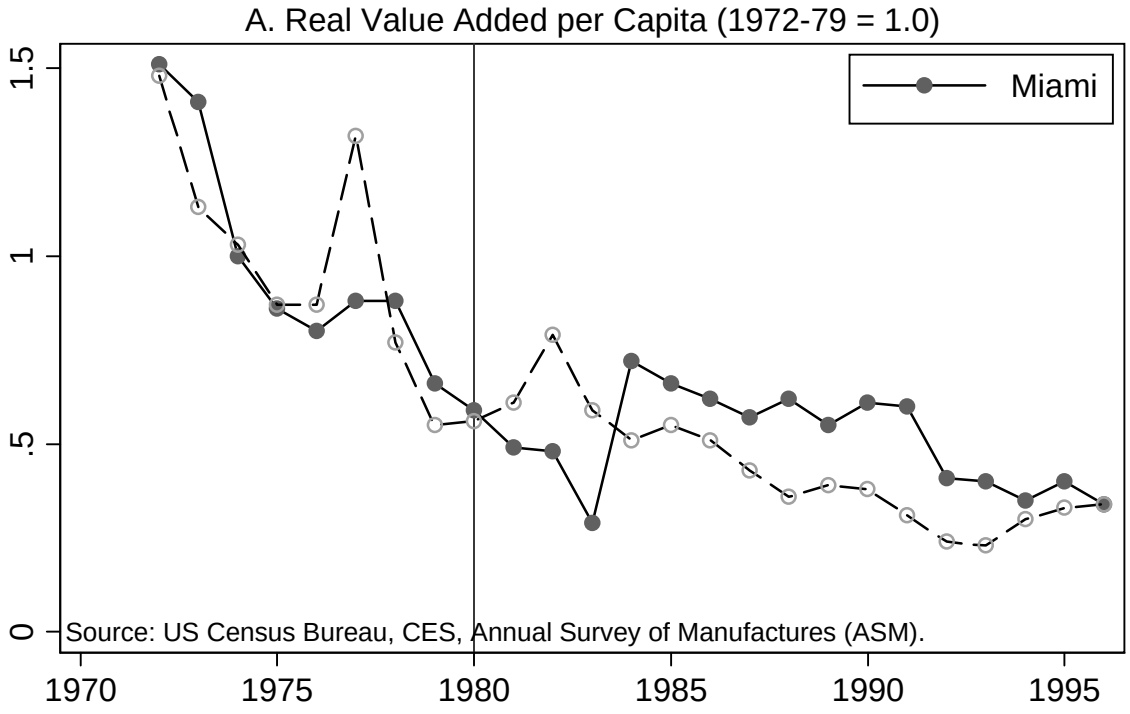
Table 4. Linear Probability Models for 1984 on-the-Job Computer Use in Miami Other Cities

	(1)	(2)	(3)	(4)	(5)	(6)
Miami	**-0.068**	**-0.066**	**-0.071**	**-0.036**	**-0.027**	**-0.025**
	(0.010)	**(0.010)**	**(0.015)**	**(0.010)**	**(0.007)**	**(0.009)**
1978-79 Computer		0.056	0.054	0.057	0.020	0.024
Sales/1980 Emp		(0.024)	(0.023)	(0.023)	(0.019)	(0.017)
Card Comparison			0.002			
City‡			(0.027)			
Mfg. Comparison			-0.021			
City†			(0.017)			
Constant	0.293	0.009	0.026	0.007	-0.104	-0.062
	(0.010)	(0.115)	(0.108)	(0.114)	(0.096)	(0.173)
Cubans Included?	Yes	Yes	Yes	No	Yes	Yes
3-Digit Occupation	No	No	No	No	Yes	Yes
3-Digit Industry	No	No	No	No	No	Yes
R^2	0.000	0.002	0.003	0.002	0.306	0.345
N	18,705	18,705	18,705	18,541	18,705	18,705
N Cities	44	44	44	44	44	44

Source: 1984 October CPS, CBEMA, and 1980 County Business Patterns. Standard errors in columns take account error correlation among observations in the same metro area and are robust to heteroskedasticity. †Cincinnati, Cleveland, Minneapolis, Rochester, Pittsburgh, Greensboro, Nassau-Suffolk, Riverside, Chicago. ‡Atlanta, Houston, Tampa, Los Angeles.

Figure 1. Trends in Apparel

Miami vs. Comparison Cities



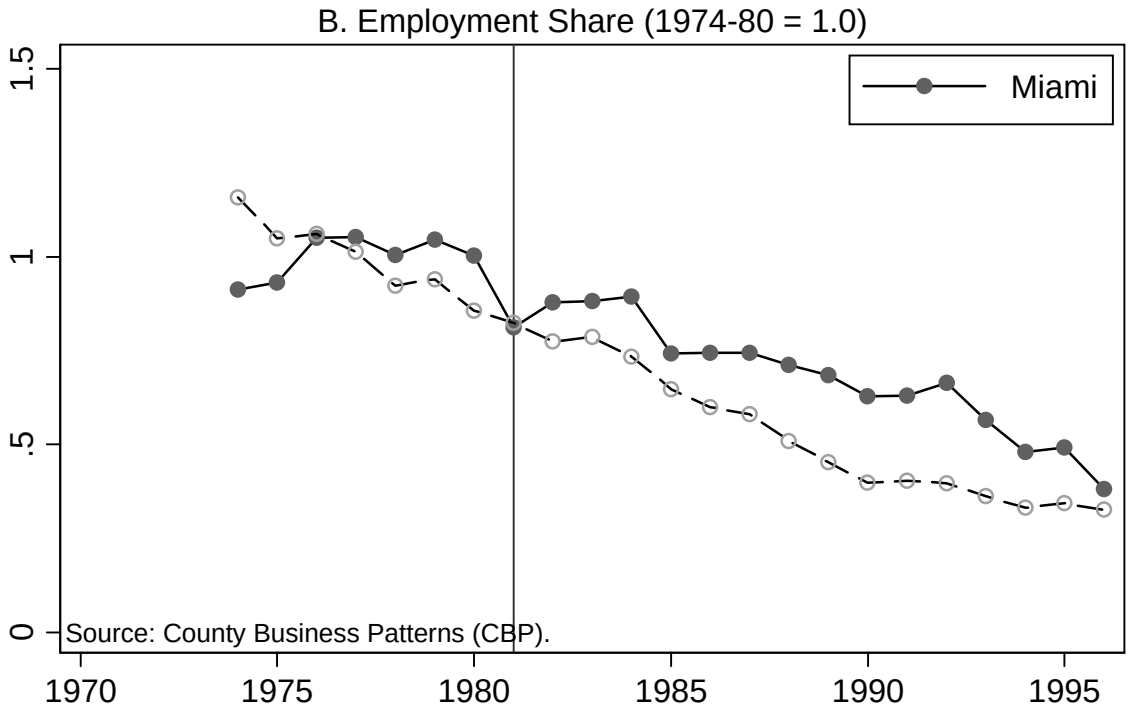
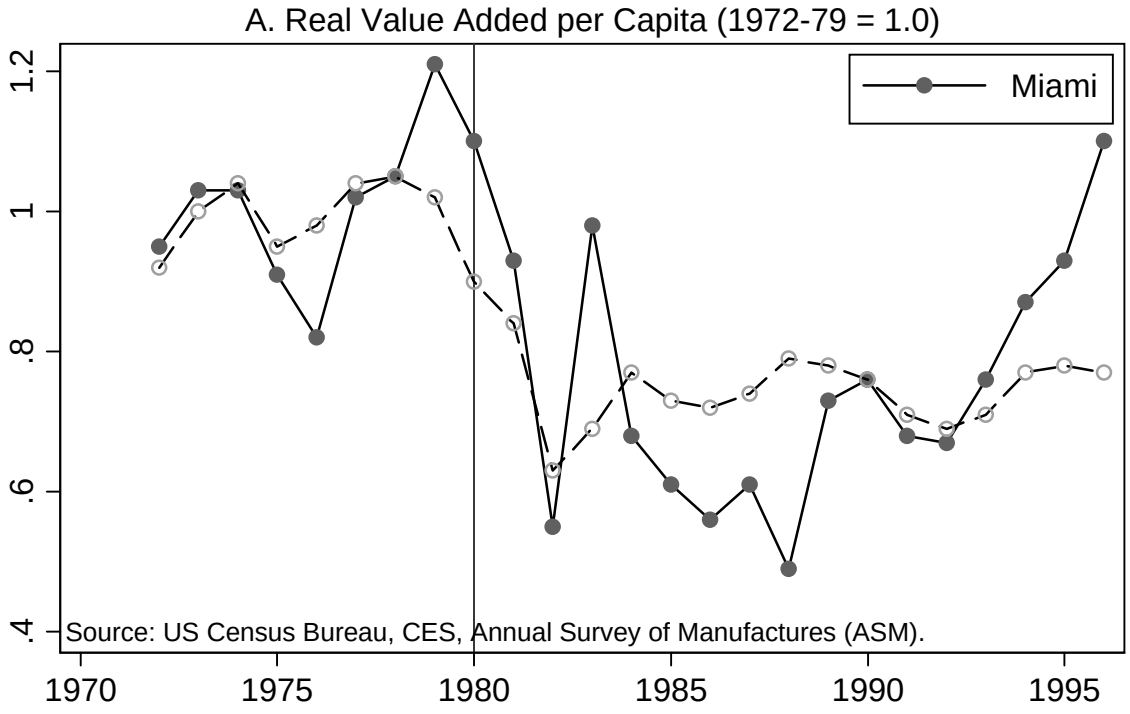


Figure 2. Trends in Manufacturing Group 1

Miami vs. Comparison Cities



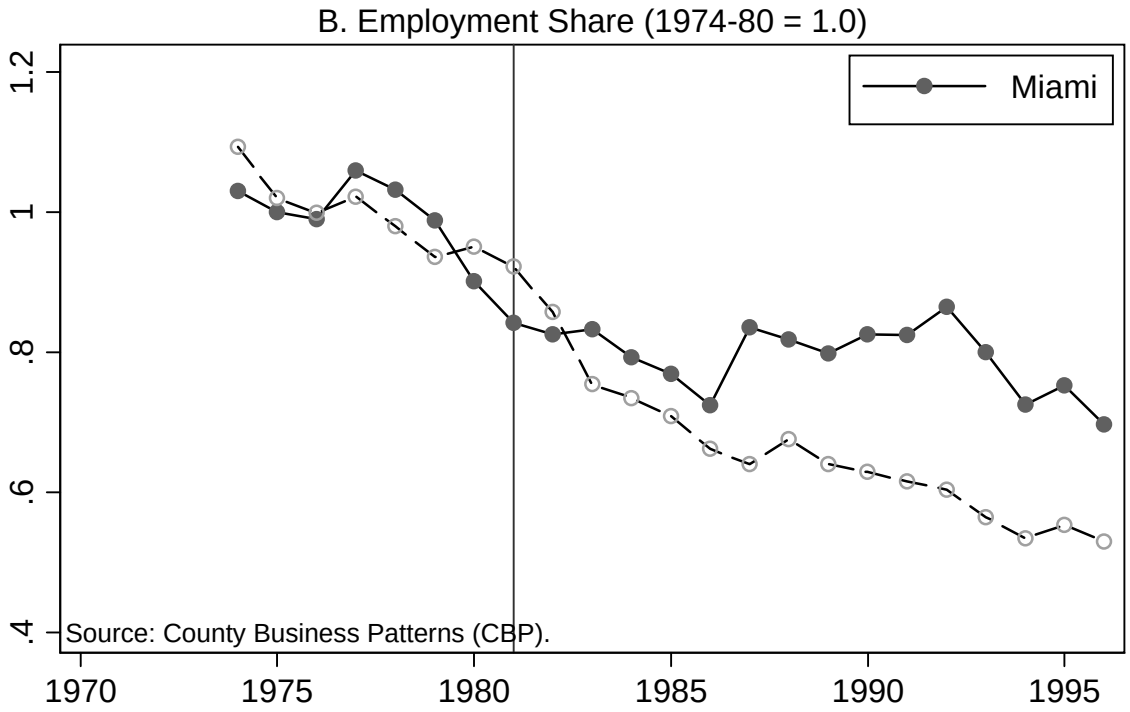
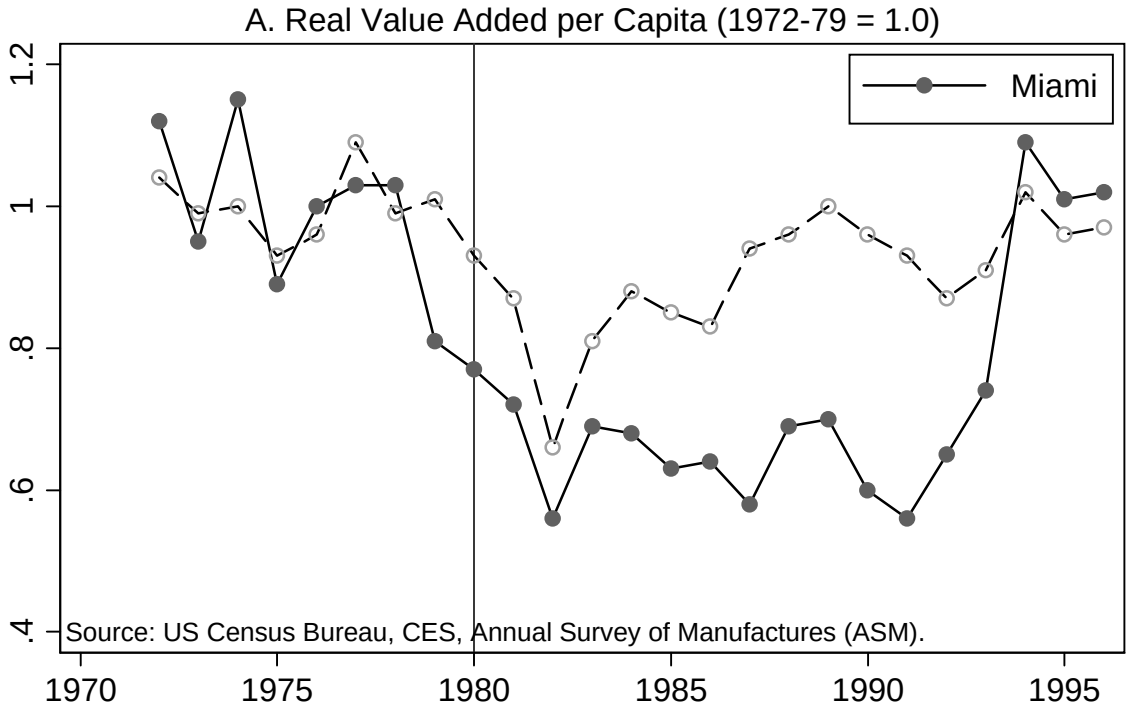


Figure 3. Trends in Manufacturing Group 2

Miami vs. Comparison Cities



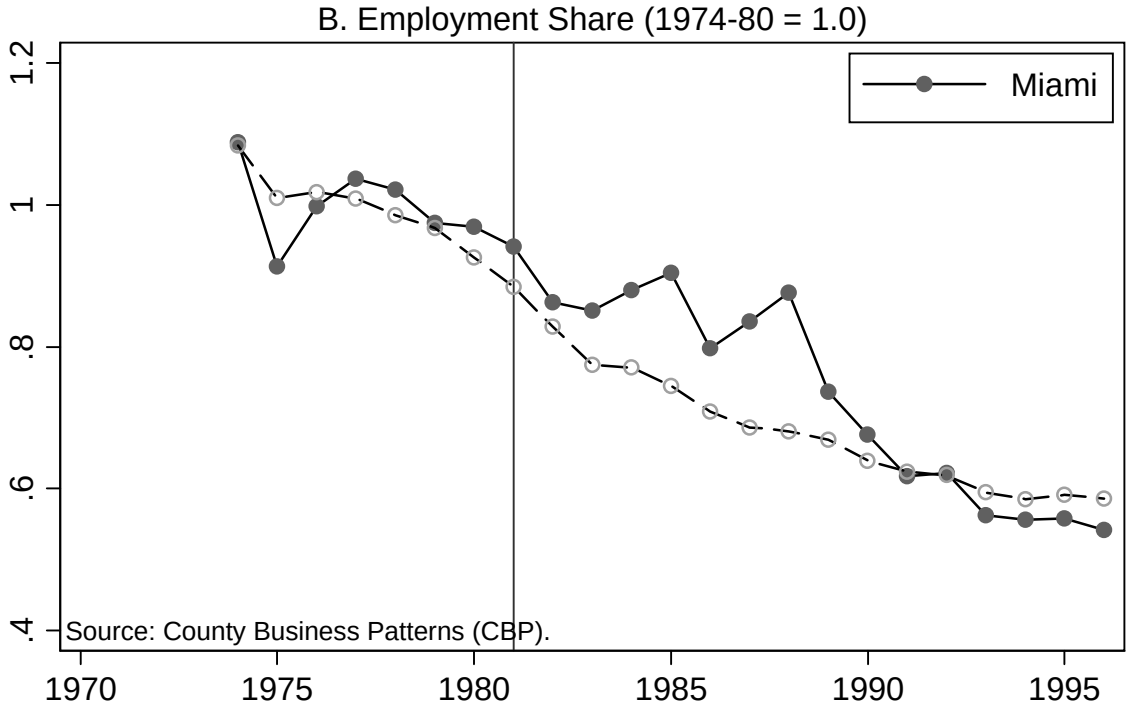
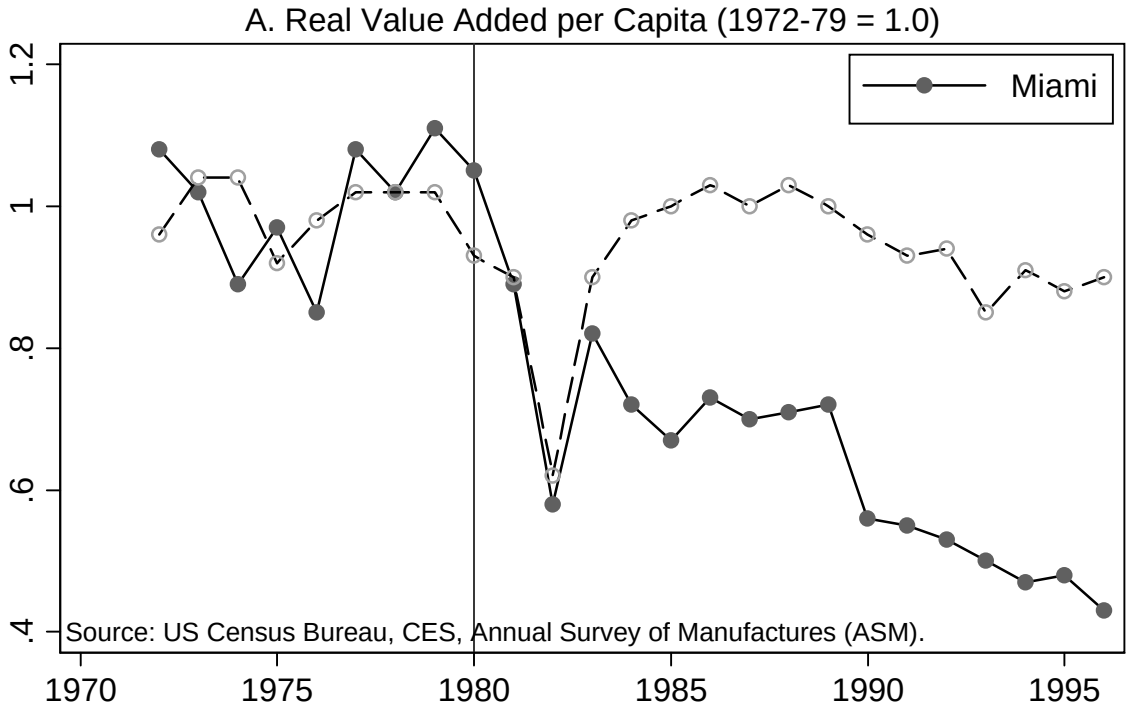


Figure 4. Trends in Manufacturing Group 3

Miami vs. Comparison Cities



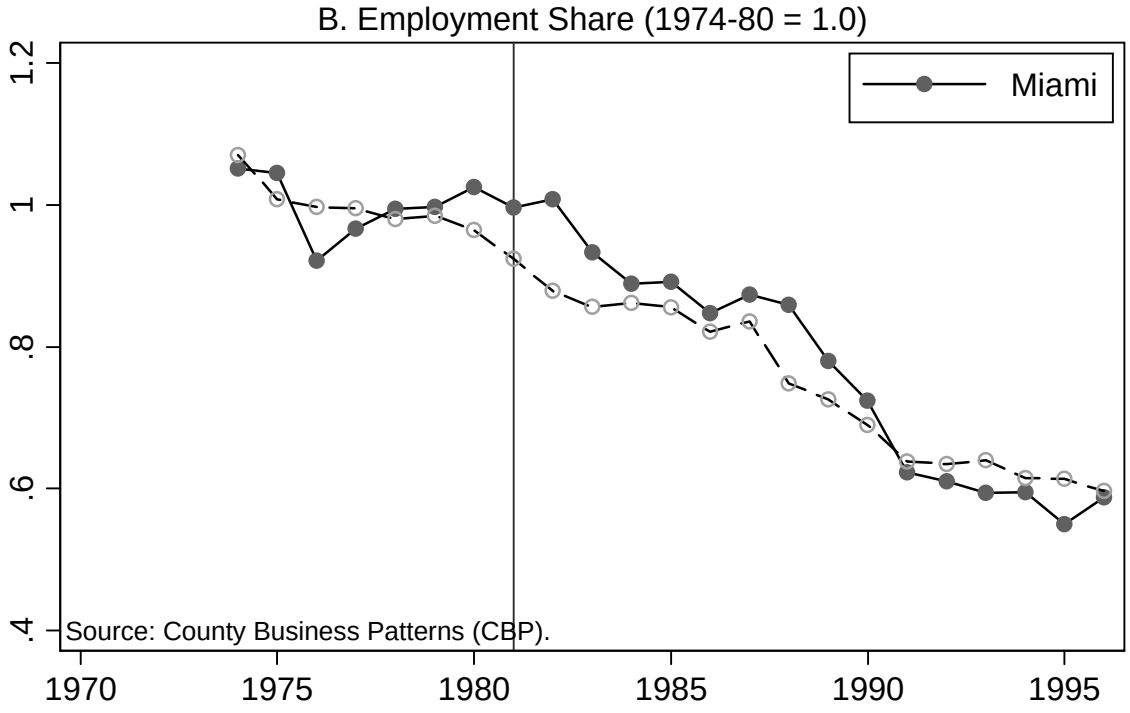
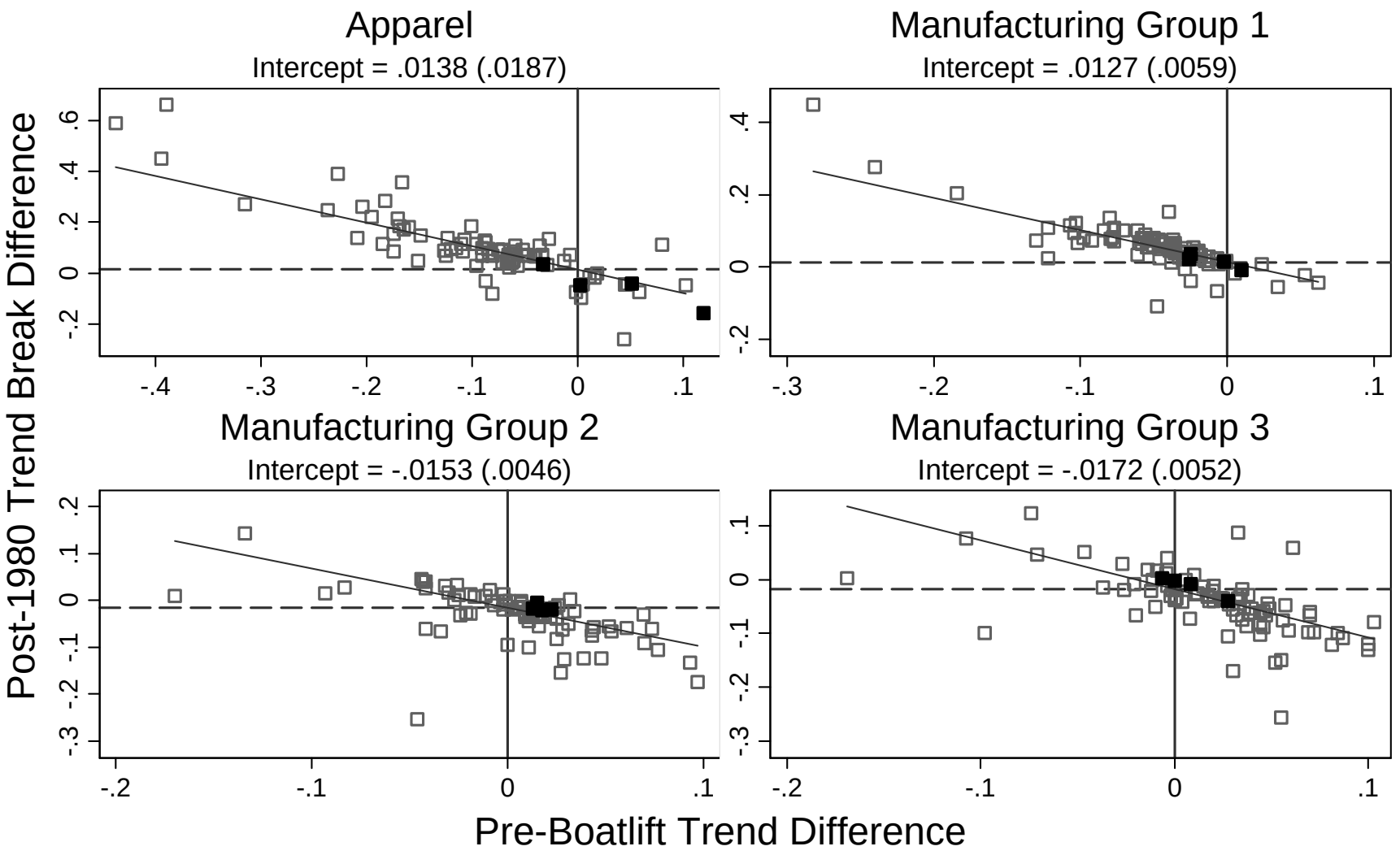
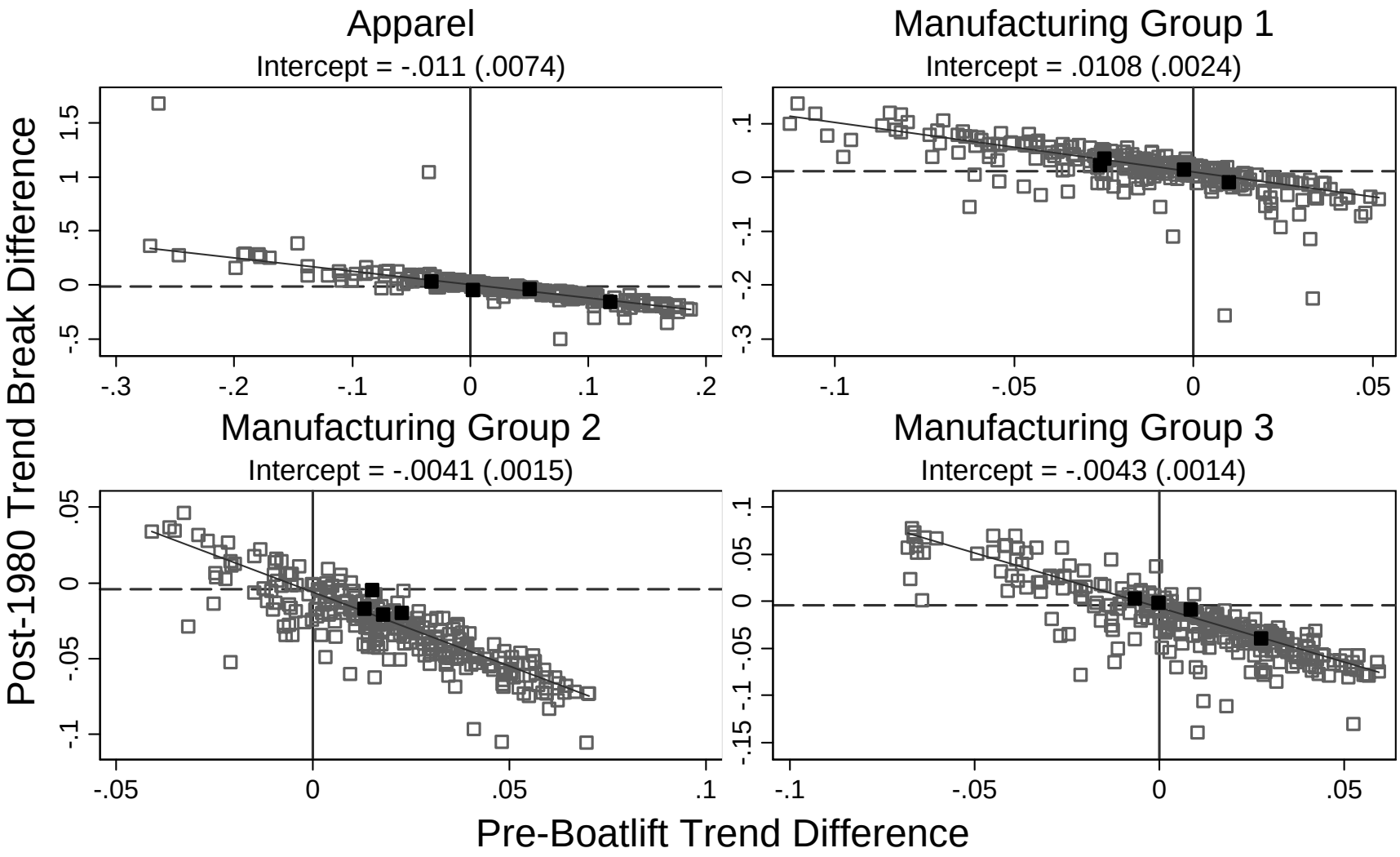


Figure 5. Post-1980 Trend Break Difference vs. Pre-1980 Trend Difference in Real Value Added/Capita (Miami - Comparison)



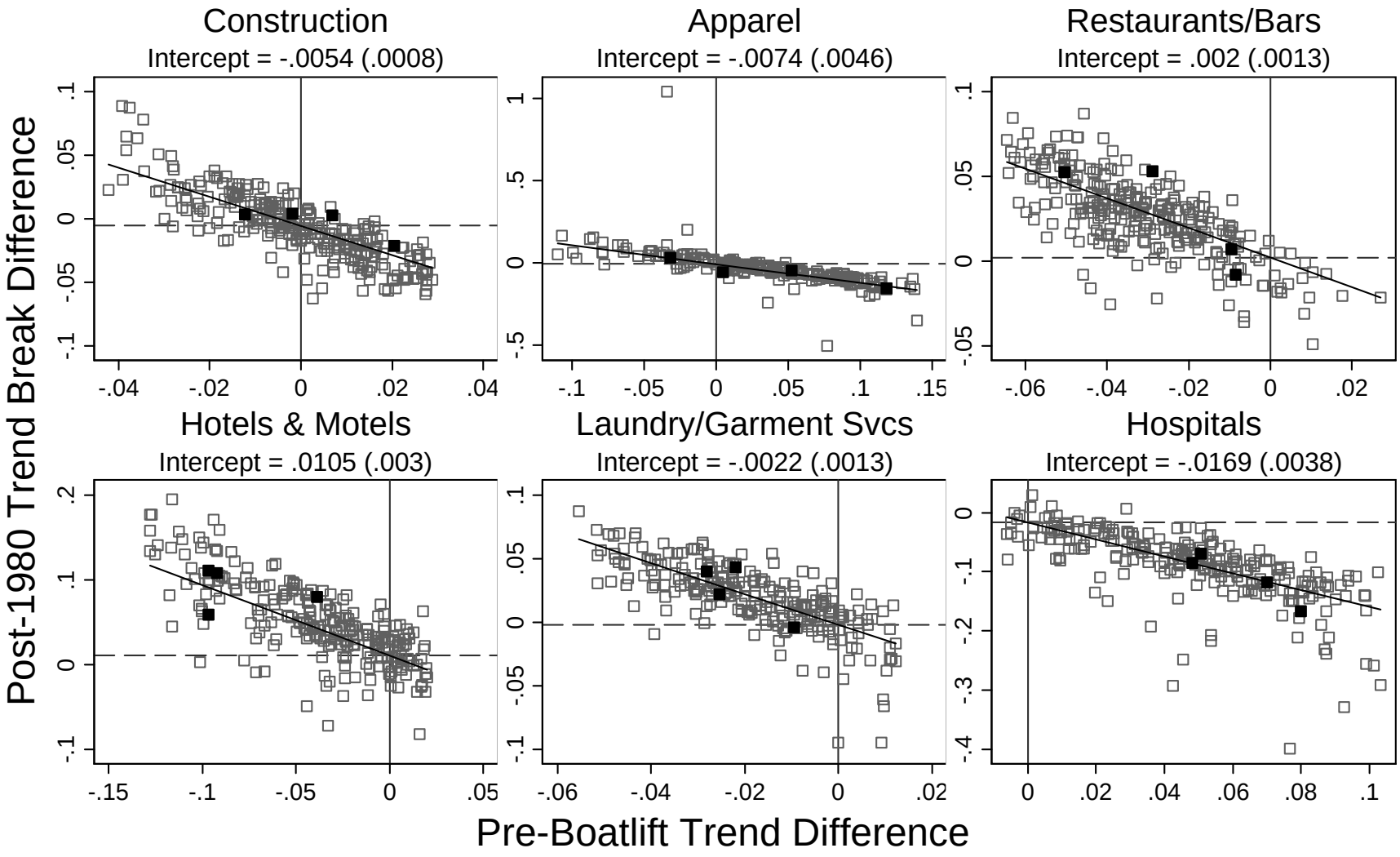
Data Source: US Census Bureau, CES, Annual Survey of Manufactures. Dashed line = intercept. Standard errors in parentheses. Black squares are comparison cities used in Card (1990)

Figure 6. Post-1980 Trend Break Difference vs. Pre-1980 Trend Difference in Share of Area's Employment (Miami - Comparison)



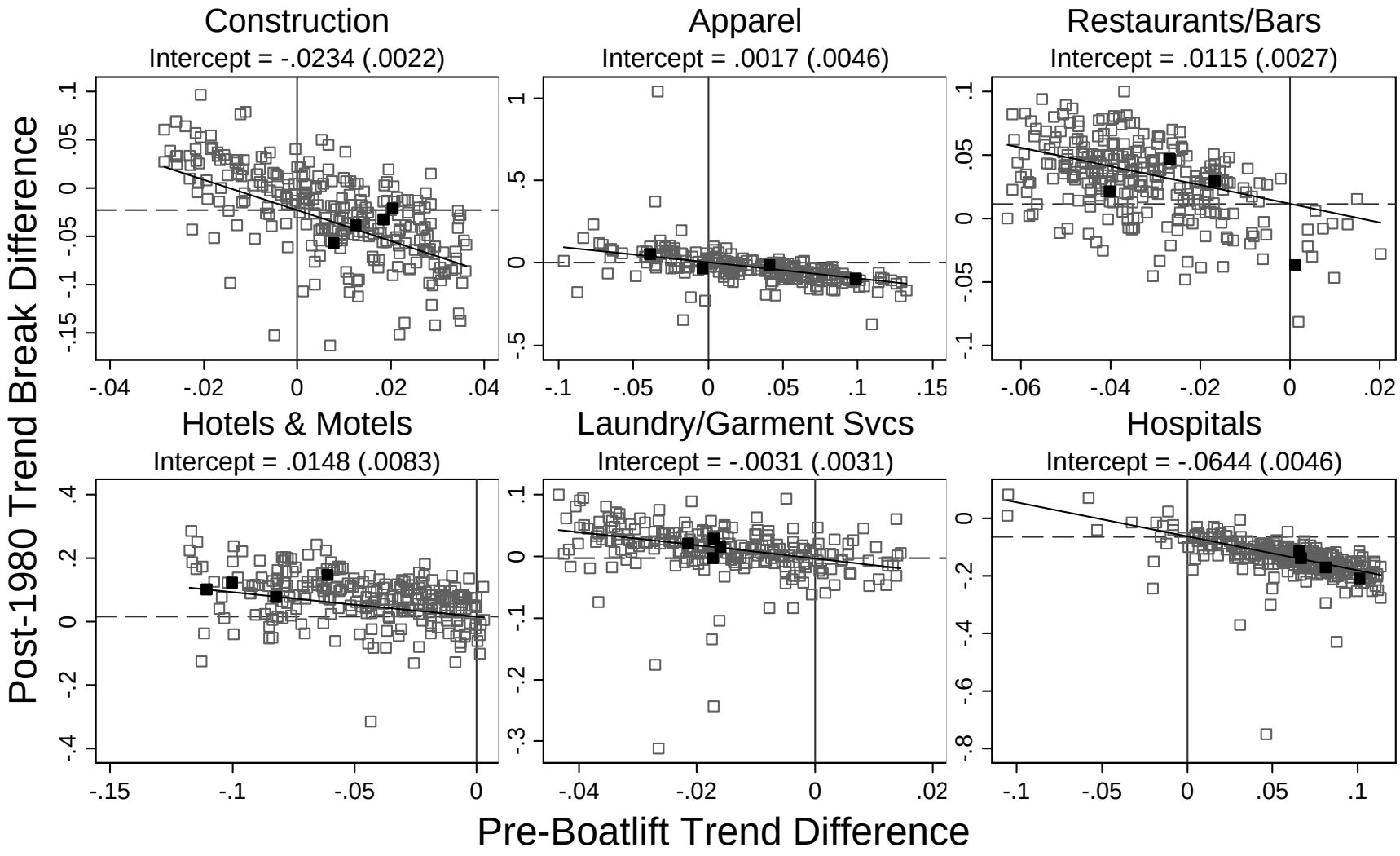
Data Source: County Business Patterns. Dashed line = intercept. Standard errors in parentheses. Black squares show comparison cities used in Card (1990).

Figure 7. Post-1980 Trend Break Difference vs. Pre-1980 Trend Difference (Miami-Comp), Emp. Share, Major Cuban Employers



Data Source: County Business Patterns. Dashed line = intercept. Standard errors in parentheses. Black squares show comparison cities used in Card (1990).

Figure 8. Post-1980 Trend Break Difference vs. Pre-1980 Trend Difference
Using only 1974-87 Data



Data Source: County Business Patterns. Dashed line = intercept. Standard errors in parentheses. Black squares show comparison cities used in Card (1990).

Appendix Table: Census of Population Industies in Each Industry Group

and 1980 Share of Pre-Mariel (1975-80 arrival cohort) Cuban Employment in Each Industry

Apparel	
Apparel/Accessories, Ex Knit	0.061
Group 1 -- Positive Response to Dropouts	
Meat Products	0.002
Bakery Products	0.005
Misc. Food Preparation	
Knitting Mills	0.004
Yarn, Thread, Fabric Mills	0.010
Misc. Fabricated Textile	0.005
Industrial/Misc. Chemicals	0.001
Footwear, Ex Rubber & Plastic	0.012
Blast Furnaces/Steelwrks/roll & fin	0.004
Engines & Turbines	0.001
Metalworking Machinery	0.001
Machinery, Except Electrical	0.005
Electr Machinery, Eq & Supplies	0.010
Guided Missles/Spce Vh/Parts	
Scientific & Controlling Insts	
Cycles & Misc. Trsport Equip	
Health Services Supplies	0.002
Photographic Equip/Supplies	0.001
Misc. Manuf	0.009
Group2 -- Little Response to Dropouts	
Misc Wood Products	0.002
Glass & Glass Pdts.	0.005
Misc. Nonmet Mineral/Stone	0.004
Paperboard Containers, Boxes	0.001

Group 2	
(continued)	
Petroleum Refining	
Dairy Products	0.004
Pottery & Related Products	
Railrd Locomotives/Equipment	
Office & Accounting Machines	
Grain Mill Products	0.004
Canned/Preserved Fruits/Veg	0.001
OthRubber/Plastics Ftwr/Belt	0.001
Tires & Inner Tubes	
Misc. Petroleum/Coal Pdts.	
Household Appliances	0.001
Ship/Boat Building/Repairing	0.006
Cmnt/Concrete/Gypsum/Plaster	
Sugar and Confect Pdts	0.007
Other Primary Metal	0.006
Floor Cover, Ex Hard Surface	0.001
Leather Pdts, Ex Footwear	0.005
Paints/Varnishes	0.001
Misc. Paper & Pulp Products	0.004
Misc. Plastics Products	0.005
Ordnance	0.001
Leather Tanning & Finishing	
Beverage Industries	0.005
Iron & Steel Foundries	
Structural Clay Products	0.001
Plastics/Synthetics/Resins	0.005
Misc textile Mill Products	0.001

Group 2	
(continued)	
Watches/Clocks/Clock Op Dvcs	
Wood Buildings/Mobile Homes	
Construction/Mat Handl Mach	
Agricultural Chemicals	0.001
Dye/Fnsh Text, Ex Wool, Knit	
Group 3 -- Negative Response to Dropouts	
Farm Machinery & Equipment	0.004
Drugs	0.002
Pulp, Paper & Paperbd Mills	
Metal Forgings, Stampings	
Soaps & Cosmetics	0.002
Screw Machine Products	0.001
Primary Aluminum	0.002
Fabiricated Structural Metal	0.006
Pub/Print Except Newspaper	0.014
Logging	
Newspaper Pub/Print	0.005
Sawmills/Planing/Millwork	0.004
Furniture & Fixtures	0.011
Radio/TV/Communication Eq	0.004
Motor Vehicles/Equip	0.006
Cutlery/Handtls/Oth Hrdwr	
Misc. Fabricated Metal	0.001
Tobacco Manufacturers	0.002
Toys/Amusement/Sprting Gds	0.006
Electr Computing Equipment	0.001
Aircraft & Parts	0.006

Source: 1980 PUMS. Blank cells have no pre-Mariel Cuban employment in the 1980 Census.