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LOCAL FISCAL ADJUSTMENTS FROM DEPOPULATION: EVIDENCE FROM THE POST–COLD WAR DEFENSE CONTRACTION

Timothy M. Komarek and Gary A. Wagner

In this paper, we estimate the long-term causal effect of population losses on local government revenue, expenditure, and debt by exploiting a quasi-exogenous change that reduced the number of US military personnel by about 40 percent between the late 1980s and 2000. Aggregating across governmental units within commuting zones, we find that real per capita total revenues and expenditures remained unchanged for remaining citizens. At the same time, however, we note several important compositional effects. First, local governments appear to have offset reductions in state intergovernmental aid by increasing property tax revenues. Second, they significantly shifted the composition of expenditures by making disproportionately large cuts in capital spending, including cuts in K–12 education, to maintain levels for current operations. Third, localities increased their long-term nonguaranteed debt to finance investments not covered by general capital outlays. Taken together, these actions run the risk of hindering a region's relative competitiveness in the long term.

Keywords: local government, fiscal policy, defense, depopulation

JEL Codes: H71, H77, R51, J21

I. INTRODUCTION

Local governments play an integral role in the provision of public services in the United States. Relative to state governments, they are the primary provider of key services such as sanitation, police and fire protection, and primary and secondary education. Local governments also partner with higher levels of government in a shared-services model to implement programs ranging from low-income housing

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assistance to economic development initiatives. As a result, local governments receive more intergovernmental aid than other levels of government.[1] Explicit approval by the legislature is also needed in some states if local governments wish to increase tax rates, modify tax bases, or introduce new taxes. Local governments' unique financial circumstances render the services they provide and the fiscal policies that support those services especially vulnerable to disruptions from adverse economic shocks.

Although studies have explored how local governments adjust their fiscal policies in response to short-term shocks such as recessions (e.g., Skidmore and Scorsone, 2011; Cromwell and Ihlanfeldt, 2015; Ross, Yan, and Johnson, 2015; Chernick, Reschovsky, and Newman, 2017), natural disasters (Deryugina, 2017), and industry-specific declines (Feler and Senses, 2017), few have focused on how they make fiscal adjustments in response to permanent local shocks. This may be because such events are rare and because they tend to be determined endogenously with local economic conditions that may confound empirical estimates. The loss of people will change the demographic composition of the region and shrink the tax base and may even retard future growth prospects. So, how do local governments make fiscal adjustments in response to long-term negative demand shocks? Do they increase taxes to maintain their existing level of public goods provision, or do revenues and expenditures shrink proportionally with population losses? Are there compositional effects that occur on one or both sides of their balance sheets? Do local governments shift the burden of financing current services to the future by increasing their debt load?

To shed light on these questions, we exploit the post–Cold War reduction in military personnel that started in the late 1980s and continued until 2000. During this period, 148 military bases closed, and aggregate military personnel in the United States declined by nearly 40 percent (Lockwood and Siehl, 2004). The military drawdown was driven predominantly by national fiscal considerations and the geopolitical landscape. Moreover, because military personnel are assigned (or reassigned) based on staffing needs, the drawdown provides a natural quasi-experiment for empirical identification.[2] The local reduction of military personnel also resulted in shrinking populations in regions with a military base in 1988. According to estimates by Zou (2018), every military job loss during the drawdown reduced the base county's total population by more than three people.

To estimate the causal effect of depopulation from the military drawdown on local public finance outcomes, we follow a two-step procedure proposed by Zou (2018). The procedure uses a combination generalized synthetic control-weighted, two-stage

[1] According to the 2016 Annual Survey of State and Local Government Finances from the Census Bureau, local governments had total revenues of $1.8 trillion. Of this amount, $68.7 billion was from federal transfers, and $524.8 billion was from state transfers.

[2] In studying how forced moves affect marriage decisions among army personnel, Carter and Wozniak (2018) show that the moves are random conditional on the soldier's military occupation, rank, and years of service.

least squares strategy for empirical identification. The synthetic control approach from Abadie, Diamond, and Hainmueller (2010) helps to mitigate bias that could arise from regions with military bases being on different fiscal trajectories than regions without bases before the personnel contraction began. And, because local economic conditions factored into the decisions to close bases or reduce personnel, we rely on a shift-share or Bartik instrument to address this endogeneity.[3]

Our results show several ways that local governments (aggregated across all governmental units within a commuting zone) adjust revenues, expenditures, and debt for residents who remain in areas experiencing depopulation. Fiscal constraints, like balanced budget rules, seem to keep real per capita total revenues and expenditures roughly in line and largely unaffected by the military drawdown. However, on average, the local governments adjust several of the subcomponents in each headline category in meaningful ways. On the revenue side, state intergovernmental aid, driven by aid for education, declined by almost $40 per capita, a 7.1 percent decrease from 1987 levels. To offset the reduction in state aid, localities raised own-source revenue from property taxes. Property tax millage rates represent one of the few levers available to policy makers. The likely result is that homeowners face higher tax burdens in real estate markets that are declining due to depopulation. Our results also show that local governments focused their expenditure cuts on capital outlays rather than operations and that they used increased long-term, nonguaranteed revenue debt to finance investments not paid for with general capital outlays.

This paper contributes to the literature in several ways. First, we examine how local governments make fiscal adjustments in response to a long-term (over a decade) local demand shock that resulted in decreased local population, thus shedding light on public finance implications for residents remaining. In contrast, the previous literature has concentrated on short-term changes over regional or national business cycles. Furthermore, in studying a reduction in military personnel, we are studying a sector that is largely homogeneous across different parts of the country. Second, in considering adjustments made by localities, we examine more revenue and expenditure categories, including debt, than does the previous literature. Our results highlight the fact that policy makers do not make decisions in a vacuum. Therefore, it is important to consider local government decisions on revenues, expenditures, and debt as a system, where each depends on the other and on institutional constraints. Finally, our empirical strategy allows us credibly to identify the effect of the military personnel decline on public finance outcomes in the face of potential omitted variable bias and simultaneity.

In the following sections of the paper we review the relevant literature, outline our data and identification strategy, present our empirical results, and offer concluding remarks.

[3] The Bartik shift-share instrument has been widely used in a variety of applications. See Goldsmith-Pinkham, Sorkin, and Swift (2020) for recent work on the interpretation and key identifying assumptions of the shift-share instrument.

II. BACKGROUND

A. Local Fiscal Structure and Policy Responses to Shocks

Local governments play a pivotal role in the US system of fiscal federalism. Unlike most other countries, the United States is relatively decentralized across governmental units in terms both of providing services and of the sources that finance those services. As Garcia-Mila, McGuire, and Oates (2018) show, the United States is consistently one of the most decentralized Organisation for Economic Co-operation and Development (OCED) countries, with between 45 and 50 percent of all government revenues and expenditures accounted for by subnational levels of government. This share of activity is divided roughly equally between state and local levels. In 2016, for example, total own-source revenues for state governments equaled 6.8 percent of gross domestic product (GDP), compared to 5.6 percent for local governments.[4]

Although there is state-to-state variation in how public services and own-source revenues are split between state and local governments, there are also general commonalities. Local governments self-generate a much smaller share of their overall revenues than do state governments (64 percent compared to 73 percent), and their revenue sources are much less diversified as well.[5] Roughly half of (own-source) aggregate local revenues are generated from property taxes, which are nearly five times as important as their second- and third-largest own-sources of revenues (sales taxes and hospital fees, respectively). However, states generate about two-thirds of their own-source revenues from personal income taxes and sales taxes (split about equally). In terms of expenditures, approximately half of all local spending is directed toward primary and secondary education. States spend roughly 20 percent of their expenditures on education, but of those dollars more than 80 percent is directed to higher education. States spend considerably more on social assistance than local governments (40 percent of expenditures compared to only 4 percent), whereas local expenditures on public safety and the environment account for 25 percent of overall budgets compared to only 8 percent for the states.[6]

In addition to lacking tax base diversification, many local governments face state-imposed fiscal constraints that limit their policy options. For example, nearly

[4] Figures are from the 2016 Census Bureau's Annual Survey of State and Local Government Finances. Local government own-source revenue comes largely from property, sales, and other taxes along with charges and fees.

[5] These figures are based on the 2016 Annual Survey of State and Local Government Finances.

[6] As Tiebout (1956) and the more recent work of Oates (2008) and Eckhard and Wilson (2011), among others, have shown, the optimal mix of decentralized provision of public goods is a function of certain conditions, most notably taxpayer mobility, the presence of spillover effects in consumption, and the degree of interjurisdictional tax competition between governments. To the extent that general principles can be drawn from this work, greater decentralization appears to be more efficient when there are fewer spillover effects, when taxpayers have greater mobility, and when there is less regional tax competition.

all municipal governments face fiscal-year-end balanced budget requirements that prevent their carrying deficits into the next fiscal year or budgetary cycle.[7] Moreover, as Maher et al. (2016) note, 11 states impose property tax assessment limits and 25 states impose property tax rate limits on local governments. During the Great Recession, local governments were able to offset some of the reduction in home prices by increasing property tax rates and delaying reassessments (Lutz, 2008). More generally, however, local governments with more restrictive tax and expenditure limitation laws (TELs) experience greater budgetary stress over the business cycle and face higher borrowing costs in capital markets when issuing debt (Skidmore, 1999; Maher et al., 2016; Adelino, Cunha, and Ferreira, 2017). In short, relative to higher levels of government, local governments are arguably more vulnerable to shocks because both their policy and their financial options are limited.

In a previous study, Buettner and Wildasin (2006) examine the budget adjustment process of 1,270 municipalities over 26 years using a vector error correction model. Focusing on aggregates for general expenditures, own-source revenue, intergovernmental grants, debt service, and the previous year's deficit, they find that a $1 permanent increase in own-source revenue correlates to a permanent increase in expenditures of $0.78, a reduction in intergovernmental aid of $0.13, and a reduction in debt services of $0.08. The fiscal adjustments also occur within one or two years of a shock, and the basic pattern of adjustment is consistent across cities of different sizes. One particularly noteworthy result from this work is that intergovernmental aid only partially offsets short-term or longer-term fiscal shocks to local governments. This may be due to the fact that credit market constraints on borrowing hinder state governments' ability to provide stabilizing transfers even in the short run (Bayoumi, Goldstein, and Woglom, 1995).

Recent studies by Skidmore and Scorsone (2011); Ross, Yan, and Johnson (2015); Cromwell and Ihlanfeldt (2015); and Chernick, Reschovsky, and Newman (2017) are supportive of both Wolman (1983) and Buettner and Wildasin (2006), finding that local governments made sizable fiscal adjustments in response to recessions and that expenditure reductions were more heavily concentrated on capital spending. Specifically, using data from local governments in Michigan from 2005 to 2009, Skidmore and Scorsone (2011) find that cities reduced real expenditures as a result of fiscal stress created by declining state aid, declining home prices, and a restrictive revenue environment. Although they find that capital and noncapital expenditures were sensitive to fiscal stress, capital spending was found to be roughly five times as vulnerable as noncapital spending. Similarly, Ross, Yan, and Johnson (2015) use data from the individual Consolidated Annual Financial Reports (CAFRs) of the nation's 35 largest cities from 2005 to 2011 and find that cities partially offset revenue losses with property tax rate increases and partially offset spending cuts by

[7] Although considerable attention is given to state balanced budget rules, only half of the states have rules that actually require the budget to be balanced at the end of the fiscal year (Rueben, Randall, and Boddupalli, 2018).

reducing their net assets. Chernick, Reschovsky, and Newman (2017) use fiscally standardized data from the Lincoln Institute of Land Policy for 91 cities and find that real state aid and property tax revenues declined roughly 10 percent during the downturn. To balance the fiscal strain, these cities made large reductions in education and capital outlays that allowed them to slow the decline in spending in other major categories. Relative to 2007, Chernick, Reschovsky, and Newman (2017) find that real per capita education and capital outlays were 6 and 18 percent lower, respectively, by 2014. Finally, Cromwell and Ihlanfeldt (2015) examine how cities and counties in Florida responded to reductions in the property tax base and intergovernmental aid during the Great Recession. They show that not only do municipalities reduce expenditures on capital and public services such as culture and recreation, which might be considered nonessential, but also they increase property tax millage to offset lost fiscal resources.

B. Post–Cold War Defense Drawdown

Following more than a decade of relative stability after the conclusion of the Vietnam War, Congress set a goal to reduce military spending by at least 25 percent between fiscal years 1987 and 1997, a reduction made possible by changes to the geopolitical landscape associated with the thaw in the Cold War (Schroetel, 1993). Zou (2018) notes the Department of Defense budget typically allocates 40 percent of spending to military personnel, 30 percent on procurement, and the remainder on operational costs. During the post–Cold War defense contraction, all of these components declined precipitously. This aggregate policy shift resulted in a permanent local demand shock and provided the setting for a quasi-natural experiment exploring how local fiscal policies adjusted.

Figure 1 shows the aggregate number of active duty military personnel in the United States from 1975 to 2012, with the post–Cold War restructuring period shaded in the background. Personnel shrank by nearly 40 percent during the drawdown, falling from a peak of more than 1.4 million in 1987 to just under 1 million by 2000. When the dust had settled, the number of active duty military personnel had reached the lowest level since before World War II.

Given past political difficulties in realigning or reducing defense personnel and assets, Congress passed the Base Realignment and Closure Act (BRAC) in 1988.[8] This act established a bipartisan commission, appointed by the secretary of defense, to make recommendations to Congress on realignments and reductions/closures that would be approved or rejected as a whole to minimize the effects of politics, at least

[8] Realigning or reducing military assets is a classic example of the distributive political economy model of Weingast, Shepsle, and Johnsen (1981) because a base closure has very highly concentrated costs to a local community while the benefits (a lower tax bill) are widely disbursed. In addition to members of Congress maneuvering to retain bases in their district during the BRAC process, members of the Department of Defense could use the threat of base closures to extract additional resources from Congress.

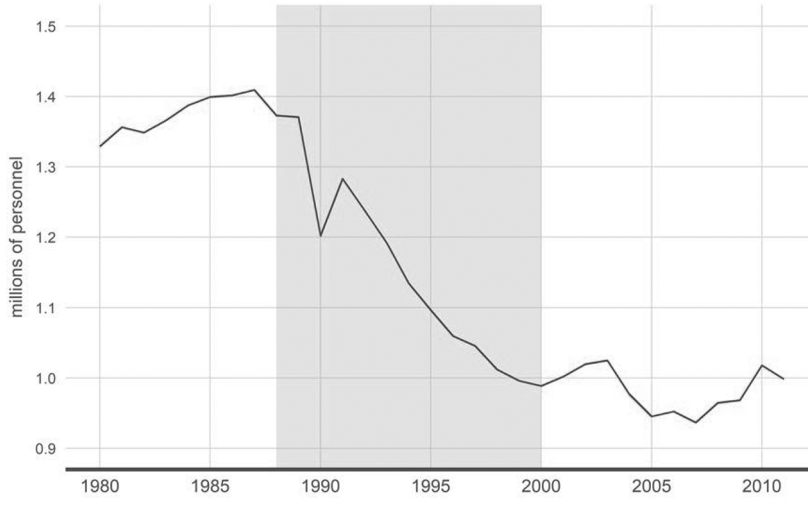

Figure 1. Aggregate military personnel in the United States: 1975–2012. A color version of this figure is available online.

in principle (Lockwood and Siehl, 2004). The commissions were authorized to operate in 1988, 1991, 1993, and 1995, and this process ultimately led to the closure of 148 military bases (Lockwood and Siehl, 2004).

Estimating the effects of military personnel reductions or realignments on local economic activity and fiscal policies is complicated by the fact that the BRAC commissions were required to take into consideration the impact on the local economy when making their recommendations (Lockwood and Siehl, 2004). In other words, installations on the BRAC list were not randomly assigned but rather were endogenous to local economic conditions. Several studies have focused on the labor market impacts of base closures. For instance, Hooker and Knetter (2001), Poppert and Herzog Jr. (2003), and Hultquist and Petras (2012) find that employment multipliers for a single county are generally less than unity in response to a complete base closure. In addition, Poppert and Herzog Jr. (2003) find total county employment (on average) to be roughly 2.5 percent lower immediately following a base closure but that the local employment effects stabilize within two to three years. In an area of disagreement in the literature, Hooker and Knetter (2001) find that job losses are limited mainly to jobs directly associated with military transfers out of the region, whereas Hultquist and Petras (2012) find that military job losses have sizable spillover effects to civilian sectors.

In a recent study, Zou (2018) combines the synthetic control and instrumental variables strategies to identify the causal effects of military personnel reductions on county-level economic activity. Zou (2018) finds that between 1988 and 2000 each single military job loss resulted in 1.3 civilian job losses in the same county. In the long run, the same military job loss also reduced the county's population by

3.1 people. The long-run population loss is driven largely by a reduction in in-migration rather than by an increase in out-migration. This may be because civilian partners and family members who otherwise would have relocated to an area do not do so, or it may be because the relative attractiveness of the area to the population in general diminishes with the loss of military activity.[9] Zou (2018) also finds that the military personnel reduction affects broader local economic activity as well as the housing market. For instance, as the military-to-population ratio declines by 1 percentage point, the number of private business establishments drops by 2.5 percent. Both the rental and owner-occupied housing markets suffer, with rental prices and median home values declining by 1.34 and 0.9 percent, respectively.

The post–Cold War drawdown also impacted defense spending to procure goods and services from private-sector firms. Zou (2018) also examines procurement spending, because it shares similarities to conventional demand shocks, and shows that the population adjustment in a county is similar for job losses due to personnel and procurement reductions. However, the effect of procurement spending on civilian employment and population is estimated imprecisely and does not change the magnitude of the estimates for military personnel. This is likely because the spatial correlation between military personnel and procurement is relatively low, where large manufacturers that are awarded significant contracts tend to cluster in industrial centers rather than near a military base.[10]

Feler and Senses (2017) highlight that local demand shocks can have a direct effect on local revenues through sales and income tax collection and an indirect effect on revenue from property taxes because of their effects on housing prices and because of changes in economic activity more generally. These taxation mechanisms are also important factors in the post–Cold War military personnel drawdown fiscal adjustment. As happens with private-sector, industry-specific demand shocks, the decline in military personnel resulted in a reduction in local economic activity with a sizable spillover to civilian sectors (Zou, 2018).

Even given all that, it is possible that localities suffer less revenue loss when military personnel and their families leave than they would from a blow to the private sector. This is because military personnel and their families can purchase goods from the base exchange and commissary tax free and because they can maintain legal residence in a state that may differ from where they are stationed because of military orders. Former active duty service members who stay in an area may also be eligible for Veterans Affairs benefits such as disability, aid for education, and a pension. To the extent these opportunities decrease sales and income tax revenue, the loss of a service member becomes less burdensome to the locality.

[9] According to the 1990 census, each military service member has 0.7 dependent whereas a Government Accountability Office (GAO) report shows that 59.2 percent of military households are either married, have children, or both, and 40.8 percent of military households are single without children (https://www.gao.gov/new.items/d02935.pdf).

[10] There are several high-profile exceptions such as the Newport News Shipyard that is located near Naval Station Norfolk, the largest naval base in the United States.

The option to live in base housing, which is owned and operated by military services and not subject to property taxes, is another factor that may mitigate the effect of a loss of military personnel on a locality.[11] A 1997 study of military members' housing choices at 12 bases conducted by the RAND Corporation shows that the majority of respondents (57 percent) lived in off-base civilian housing (Buddin et al., 1999). The percentage of those choosing to purchase or rent in the private housing market increased with seniority and among officers compared to enlisted personnel. As Zou (2018) shows, the reduction in military personnel also could lead to a decline in local housing demand and subsequently affect local property tax collections.

Active military installations, however, are exempt from state and local property taxes (Hoover, 2017). Military bases often take up a large footprint and, in the case of the navy, tend to sit on prime waterfront property. Our sample period saw the closure of 148 military bases along with the aggregate reduction in personnel in bases that remained active. The BRAC process, however, does afford local communities the ability to influence property transfer and disposal decisions, something they could not do in normal (non-BRAC) times. Communities typically organize a Local Redevelopment Authority (LRA) to create and execute a redevelopment strategy for the base.[12] The redevelopment of a base for productive civilian uses can move quickly, as in the transformation of Bergstrom Air Force Base that closed in 1993 and opened in 1999 as Austin-Bergstrom International Airport, or slowly, often due to problems associated with environmental remediation. Furthermore, redevelopment is quite heterogeneous and can range from a commercial shopping center to a public park or private shipyard. Ashley and Touchton (2016) show that land-use outcomes in military base redevelopment are affected by a variety of circumstances including the presence of federal funding, contamination of redevelopment parcels, and economic output in the surrounding county.

III. DATA AND IDENTIFICATION STRATEGY

A. Primary Data

To estimate the causal relationship between military contractions and local fiscal policies, we rely primarily on data from the Department of Defense and Census of Governments conducted by the Census Bureau. Because military bases are in both urban and rural areas and because both economic activity and commuters cross borders, we follow recent studies by Autor, Dorn, and Hanson (2013) and Feler and

[11] Starting in 1998, the inadequacy of base housing caused the federal government increasingly to encourage service members to use the private real estate market and thus to pay property taxes.

[12] The redevelopment strategies outlined by LRAs are not legally binding; however, the Department of Defense gives the plans considerable weight in the decision process and provides grants as well technical support to the LRA (Mann, 2019).

Senses (2017) and use commuting zones (CZs) as the geography of interest. CZs are groups of counties identified on the basis of journey-to-work data so that they reflect local labor markets rather than minimum population levels like metropolitan or micropolitan statistical areas (Tolbert and Sizer, 1996).[13] Across the 50 states, a total of 741 commuting zones exist. However, due to the unique fiscal structures of Alaska and Hawaii, we exclude them from our analysis, which leaves us with 722 commuting zones. Every county is a part of one commuting zone.

Given our focus on how local fiscal policies adjust to the military contraction, CZs, which overlap place of employment and place of residence, are an attractive unit of analysis. Using them helps ensure that any effects from the personnel drawdown occur within a single unit, circumvents issues related to selective migration from residence (e.g., suburbs to city center), and reduces the possibility that overlapping government boundaries (e.g., cities, counties, and school districts) will complicate identification.

The locations of military bases collected by Zou (2018) from the Department of Defense's annual Base Structural Reports include 535 bases with at least 250 personnel in 1988. There are 220 CZs in the continental United States that had at least one military base present in 1988, which covers roughly 30 percent of the total number of commuting zones in the continental United States. We focus on the 205 base CZs that experienced a decline in military personnel between 1987 and 2000 both because of the potential for an asymmetric effect for expansions compared to contractions and because the number of personnel in a small number of bases increased as a result of consolidations from the drawdown (Zou, 2018).[14] The data indicating the number of active duty military personnel are from the Bureau of Economic Analysis (BEA) Regional Economic Accounts. These data are available annually at the county level and are aggregated to the commuting zone. All of the CZs in the continental United States are shown in Figure 2, with the CZ borders outlined in red. Those without a military base in 1988 are shaded in gray.

As Figure 2 shows, there is considerable heterogeneity across CZs in terms of the magnitude of personnel reductions experienced due to the drawdown. The median growth rate for the 15 CZs that experienced positive personnel growth was 5.4 percent, compared to a median reduction of 24.9 percent for contracting CZs. Twenty CZs experienced military personnel losses of less than 10 percent, whereas 19 faced

[13] Although commuting zones generally follow the geographic definitions of metropolitan statistical areas (MSAs), they do subdivide some MSAs based on actual commuting flows. See Tolbert and Sizer (1996) for more information.

[14] We use 1987 as the starting point of the drawdown to match the fiscal outcome data from the Census of Governments. The CZs that experienced an increase in military personnel were Hattiesburg, Mississippi; Clarksville, Tennessee; Columbia, South Carolina; Valdosta, Georgia; Hinesville, Georgia; Macon, Georgia; Pensacola, Florida; Fredericksburg, Virginia; Watertown, New York; Fort Leonard Wood, Missouri; Sioux Falls, South Dakota; Corpus Christi, Texas; Wichita Falls, Texas; Killeen, Texas; and Boise, Idaho.

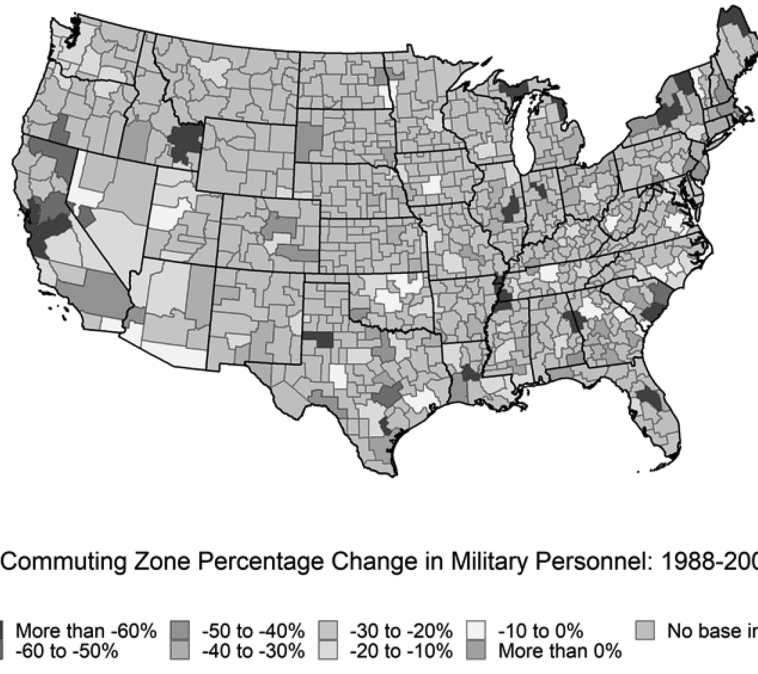

Figure 2. Percentage change in military personnel: 1988–2000. A color version of this figure is available online.

reductions exceeding 60 percent. The Alpena CZ in northeastern Michigan experienced the largest percentage reduction in personnel from the contraction as its military population shrank from almost 3,700 in 1987 to fewer than 190 by 2000 (a 95 percent reduction). Relative to total population levels in the CZs (civilian plus military) before the drawdown, the magnitude of the reduction was as high as 5 percent of total population in the hardest-hit areas.

Local public finance data are from the Census Bureau's quinquennial Census of Governments (completed in years ending in 2 and 7). Fiscal outcomes are formed by aggregating data from all local governments within a commuting zone. Using these data, as opposed to the Annual Survey of Government Finance that samples a fraction of governmental units, ensures that changes in fiscal outcomes at the commuting zone level reflect actual fiscal adjustments rather than which government entities are included in the annual survey in a given year.[15] To match the fiscal data with the Department of Defense drawdown period as closely as possible, we use data from the 1987 Census of Governments to reflect the pre-drawdown period,

[15] The Census Bureau assigns each governmental unit to a single county using the physical address of the unit's administrative headquarters. The survey methodology for the Census of Governments may be found here: https://www.census.gov/programs-surveys/cog/technical-documentation/methodology.html.

and we average values from the 1997 and 2002 censuses to measure the post-drawdown period.[16]

Table 1 shows the mean real per capita level and standard deviation for selected components of revenue, expenditure, and debt across all commuting zones in the continental United States in 1987. We show selected major components of revenue (Panel A), expenditures (Panel B), and debt (Panel C) to provide a broad sense of how local governments operate. Table 1 also shows the (mean) fraction of each fiscal component that is derived from the five types of local governments: counties, municipalities, townships, school districts, and special districts. The median commuting zone in 1987 included 4 counties, 18 municipalities, 52 townships, 13 school districts, and 21 special districts.[17]

Across all commuting zones in 1987, real per capita total revenues and expenditures for all governmental units within the commuting zone averaged $2,638 and $2,585, respectively. General revenue ($2,333) accounts for 88 percent of total revenue, with the largest components coming from property taxes ($660) and state aid ($789). Similarly, general expenditures ($2,343) account for roughly 87 percent of total spending. Expenditures are less diversified than revenue, with expenditures on education operations accounting for almost 45 percent of general expenditures (about $1,000 per capita). Capital outlays and expenditures on utilities are also large components of aggregate spending, coming in at $243 and $329 per capita, respectively.

Local governments issue debt (primarily) for capital investments that are not financed directly from their general capital outlays. In 1987, total debt outstanding in the average commuting zone was $2,191.54 per capita. Of this amount, $2,150.23 (or more than 98 percent) is classified as long-term debt because it carries a repayment period of at least one year.

The specific type of debt issued by local governments also varies notably by function. The majority of debt issued for educational purposes is general obligation (GO) debt where the issuing governments pledge to use funds from any available source to repay investors.[18] In contrast, all of the private-purpose debt and the majority of utility debt is nonguaranteed (or revenue debt) because investors are repaid using only revenue generated from the specific investment project. For this reason, revenue debt is riskier than general obligation debt, and issuing governments typically pay a higher interest rate on it to compensate investors for the risk.

[16] We also estimated our regressions using only the fiscal values from 1997 as the post-drawdown period and using only the 2002 values to measure the post-drawdown period. These results do not differ in any meaningful way from the results presented in the paper, and we will provide these additional results upon request.

[17] The Chicago, Illinois, commuting zone had the largest number of governmental units in 1987 at 1,299, the majority of which were school districts (331) and special districts (543).

[18] This is also referred to as full faith and credit debt.

B. Identification Strategy

1. Two-Step Procedure

Our identification strategy follows a two-step procedure proposed by Zou (2018) to mitigate the two biggest threats to identification: the potential for simultaneity between local fiscal conditions and the reduction in military personnel, and divergent secular trends in fiscal outcomes across base and nonbase CZs prior to the military drawdown. We address each of these threats in greater detail below as we outline the case for why this two-step procedure is our preferred identification strategy.

Because we have a sample of treated base CZs, a control group of nonbase CZs, and two time periods, 1987 and 2000, the simplest identification strategy we could pursue is a difference-in-differences design with continuous treatment intensity. The first-differences form of this specification can be expressed as

$$\Delta F_h = \beta \Delta MP_h + \varepsilon_h, \tag{1}$$

where $\Delta F_h = (f_{h,2000}/P_{h,2000}) - (f_{h,1987}/P_{h,1987})$ is the real per capita difference in some fiscal outcome measure for commuting zone h, ε_h is the error term, f denotes the real fiscal outcome of interest, and P denotes population. Let $\Delta MP_h = (mil_{h,2000} - mil_{h,1987})/P_{h,1980}$ denote the change in military personnel in commuting zone h scaled by the CZ's 1980 population. This formulation implies that β is interpreted as the change in the level of the real per capita fiscal outcome as a result of the military-to-population ratio increasing by one. We scale the change in military personnel by the 1980 population value because it is a decennial census year so one would expect the figures to have less measurement error than annual population estimates. By using long-differences we are measuring the long-run change in each fiscal outcome variable, such that the local economy has time to adjust to the military personnel shock. As noted earlier, fiscal outcome values for 2000 were formed by averaging the 1997 and 2002 Census of Governments values as the census is available only in years ending in 2 and 7.

There are two potential threats to credibly estimating a causal relationship between the post–Cold War military drawdown and local fiscal outcomes using the simple difference-in-differences design. First, the change in military personnel is simultaneously determined with local economic conditions because the BRAC process explicitly considers local economic conditions as part of the decision-making calculus. This implies that β may suffer from negative bias if one estimates Equation (1) using ordinary least squares (OLS).

We address the endogeneity by estimating our regressions by two-stage least squares (2SLS) using the shift-share instrument proposed by Bartik (1991). The shift-share instrument for a given CZ is the product of the national contraction in military personnel between 1987 and 2000 (the shift) and the CZ's share of aggregate military personnel in 1987 (the share). Hence, the instrument is the predicted

Table 1

Selected Real Per Capita Fiscal Outcomes: 1987 (Mean Across All Commuting Zones)

	Mean ($)	SD	County (% share)	Municipality (% share)	Township (% share)	School District (% share)	Special Districts (% share)
Panel A. Revenue							
Total revenue	2,638	1,090	25.1	25.1	1.9	37.7	10.2
Utility revenue	284	568	1.5	68.0	0.4	0.0	30.0
Insurance trust revenue	14	42	20.7	69.1	0.6	4.3	5.2
Liquor store revenue	7	24	14.9	85.1	0.0	0.0	0.0
General revenue	2,333	874	28.1	19.4	2.1	42.6	7.9
Total taxes	786	462	30.9	19.2	3.5	43.8	2.7
Property taxes	660	453	29.5	12.4	3.9	51.2	3.0
Sales taxes	89	92	37.7	57.6	0.1	3.5	1.1
Income taxes	11	44	20.2	65.3	4.4	10.0	0.0
All other taxes	26	25	47.6	41.5	4.5	6.0	0.4
Intergovernmental aid	966	360	22.8	12.6	1.5	59.5	3.7
Federal aid	101	92	27.4	31.6	2.8	16.7	21.4
State aid	789	309	23.4	9.4	1.3	65.0	0.9
State aid, education	564	206	7.3	1.4	0.4	90.9	0.0
Local aid	77	107	10.0	20.6	1.6	59.1	8.8
Charges and other revenue	582	426	33.0	31.0	1.2	12.9	21.9
Panel B. Expenditures							
Total expenditure	2,586	1,061	25.1	24.5	1.9	38.0	10.5
Utility expenditures	329	672	2.1	61.2	0.5	0.0	36.2
Utility capital outlays	57	164	4.0	51.3	0.7	0.0	44.0
Liquor store expenditures	6	22	13.9	86.1	0.0	0.0	0.0
Insurance trust benefits	7	21	18.2	73.9	1.1	3.0	3.9
General expenditure	2,243	778	28.5	18.8	2.1	43.8	6.8

Interest on debt	150	301	22.7	33.6	0.8	11.2	31.7
General operating expenditures	1,810	541	26.7	16.7	2.0	48.5	6.0
Education, operations	1,000	340	8.6	1.6	0.7	89.0	0.0
Hospitals, operations	171	197	47.7	13.3	0.1	0.0	38.9
Highways, operations	138	98	64.1	26.5	8.4	0.0	0.9
Police, operations	83	37	37.2	60.3	2.5	0.0	0.0
All other	418	238	47.2	42.4	3.8	−3.2	9.8
General capital outlays	243	155	25.1	30.9	3.1	30.6	10.3
Education capital outlays	81	71	5.4	0.9	1.5	91.8	0.4
Highways capital outlays	47	55	55.2	38.2	5.1	0.0	1.5
Sewerage capital outlays	26	48	5.9	72.6	6.0	0.0	15.5
All other capital outlays	89	77	32.9	42.1	2.5	0.0	22.4
All other general expenditures	40	292	153.0	−18.2	5.2	33.6	−73.6
Panel C. Debt							
Total debt outstanding	2,192	3,801	21.9	33.9	0.9	10.4	32.9
Long-term debt outstanding	2,150	3,791	22.0	34.2	0.8	10.2	32.8
Utility GO debt	48	112	5.3	61.5	2.8	0.0	30.3
Utility revenue debt	601	2,991	1.5	31.6	0.1	0.0	66.8
Private-purpose revenue debt	613	2,077	51.0	39.8	0.5	0.0	8.7
Education GO debt	242	223	6.3	2.1	0.8	90.8	0.0
Education revenue debt	11	50	0.3	22.8	0.2	1.4	75.3
All other GO debt	264	287	26.0	58.1	3.3	0.0	12.5
All other revenue debt	372	579	17.6	30.0	0.2	0.0	52.3
GO debt	553	431	15.6	33.9	2.2	39.7	8.6
Revenue debt	1,597	3,718	24.2	34.3	0.3	0.0	41.2

Note: All fiscal variables are from the quinquennial Census of Governments and are scaled using population data from the Census Bureau. Data were deflated using the Consumer Price Index for All Urban Consumers (CPI-U; 2,000 = 100). The county, municipality, township, school district, and special district shares are the averages across all continental commuting zones. Municipalities are generally incorporated areas and townships are areas generally created to provide services and may vary from state to state. See https://www.census.gov/programs-surveys/gus/technical-documentation/methodology/populion-of-interest.html for more detail. GO denotes general obligation/full faith and credit debt.

decline in personnel if cuts in each CZ were made proportional to the CZ's military personnel level before the drawdown.

The second threat to credible identification is differing location-specific secular trends between base and nonbase CZs prior to the defense drawdown. Although the key identifying assumption in Equation (1) that base CZs and nonbase CZs would have followed parallel fiscal trends in the absence of the military drawdown is stringent without conditioning on covariates, adding covariates or even CZ-specific linear trends may not be satisfactory in this application. Military bases are often located in areas having specific characteristics, such as natural harbors or mountainous terrain, with the potential to influence the growth trajectory of regions independently of the presence of a military base. Such factors may be difficult or impossible to fully integrate into a regression model. Moreover, Ashley and Touchton (2016) point out that the redevelopment of a base after BRAC is heterogeneous and dependent on the local economy in the surrounding area. In this light, base closures in more prosperous areas tend to see swifter and more productive redevelopment than those in areas with weaker economies. Failing to adequately adjust for such observable and unobservable differences that affect the secular fiscal trends would result in biased estimates. Further, adding CZ-specific trends to adjust for potentially different trajectories in fiscal outcomes implicitly assumes that the trends across all CZs follow the same linear data-generating process (Zou, 2018).

Recently, Zou (2018) proposed a flexible and arguably more robust technique for adjusting for potential differences in secular trends that relies on the synthetic control method developed by Abadie, Diamond, and Hainmueller (2010). This approach partials out any location-specific secular trends in military base CZs by comparing the CZ's actual trajectory to the trajectory of a synthetic version estimated from the (untreated) nonbase CZs.[19] In other words, trends in the fiscal outcome variables are permitted to potentially differ across fiscal outcomes *and* commuting zones without the need for explicit assumptions about underlying data-generating processes.

The synthetic control method developed by Abadie, Diamond, and Hainmueller (2010) provides a data-driven, nonparametric approach to estimate a "synthetic" version of a base CZ's fiscal outcome that reflects how the outcome would have prevailed if no reduction in military personnel had occurred. The synthetic counterfactual is a weighted average of the nonbase CZ donor pool that best matches the fiscal outcomes and other characteristics for base CZs in the pre-drawdown period. Because the 502 nonbase CZs lack a military presence and exposure to the post–Cold War contraction, they are valid control units for estimating synthetic counterfactuals for each outcome in the 205 CZs where the number of military personnel contracted.[20] The key identifying assumption is that the synthetic counterfactual

[19] In the synthetic control literature, these untreated nonbase CZs, referred to as "donors," are used to create the synthetic version of the treated unit.

[20] Recall that there are 722 commuting zones in the continental United States and that 220 of them had at least one military base in 1988. The difference in these sets of commuting zones yields our donor pool of 502 commuting zones.

accurately captures the secular trend in the contracting CZs prior to the military drawdown.

To operationalize the method, let $\lambda_b\gamma$ denote the secular trend for each base commuting zone b, which is determined by a vector of unobserved/unmeasured location-specific characteristics λ_b. The synthetic version of each base b is constructed by using a weighted average of all nonbase (control) CZs $n \in N$ as depicted in Equation (2). Thus, w_{bn} is the weight assigned to each nonbase CZ n for the synthetic base CZ b. The weights are all between 0 and 1 and sum up to 1 as in Abadie, Diamond, and Hainmueller (2010).

$$\lambda_b\gamma = \sum_n w_{bn}\lambda_n\gamma. \tag{2}$$

Equation (3) shows how the weights are calculated for each base CZ b. These weights are chosen to minimize the distance between a vector of pretreatment characteristics we denote as $\boldsymbol{Z}$. Subsection III.B.2 discusses the variables we include in $\boldsymbol{Z}$ in detail. Because a synthetic counterfactual is formed for each contracting base CZ, this approach permits the pre-drawdown trend in the outcome variable to potentially differ across contracting commuting zones to mitigate bias that may arise from unobservable or difficult to measure location-specific characteristics.

$$W_b = w_{bn} \parallel \boldsymbol{Z}_b - \sum_{n \in N} W_{bn}\boldsymbol{Z}_n \parallel. \tag{3}$$

With the synthetic control weights in hand, the two-step procedure outlined by Zou (2018) proceeds as follows. Let g denote each distinct base CZ and all of the relevant CZs that make up its synthetic counterfactual and let h denote either a base or nonbase CZ. Our baseline regression can be expressed as

$$\Delta F_{hg} = \beta\Delta MP_{hg} + \theta_g + \varepsilon_{hg}, \tag{4}$$

where θ_g represents a synthetic control group fixed effect and ε_{hg} is the error term. Equation (4) is estimated by 2SLS using the shift-share instrument to address the potential simultaneity between military reductions and local economic conditions. The key difference between Equations (1) and (4) is that each base CZ's control group is now its synthetic counterfactual. Specifically, for a given group of base and nonbase CZs (g), every nonbase CZ used to form the synthetic counterfactual enters Equation (4) and is weighted according to its optimal synthetic control weights.

As an illustration, consider the Norfolk, Virginia, commuting zone, which has a large navy presence. Suppose the optimal synthetic counterfactual for the Norfolk, Virginia, commuting zone (for a specific fiscal outcome) consists of four nonbase CZs that are weighted 15, 25, 55, and 5 percent, respectively. This synthetic group g enters Equation (4) with a total of five observations: Norfolk, Virginia, which is given a weight of one, along with the four nonbase CZ observations that make up Norfolk's counterfactual and are weighted accordingly. Because a given donor nonbase CZ may be used to form the synthetic counterfactual for more than one

commuting zone with a military base, this donor would enter Equation (4) in every group (g) in which it appears as part of the synthetic counterfactual. However, the donor's weight in each group g will be different if the donor was weighted more strongly or less strongly in constructing group g's counterfactual. Hence, in addition to the 205 CZs with contracting military bases, the total number of observations for a given fiscal outcome depends on the number of nonbase donor CZs that are used to form all the synthetic counterfactuals.

2. Pretreatment Predictors

We estimate the synthetic control weights for each base commuting zone and fiscal outcome variable using pretreatment period data.[21] A broad set of variables is selected for $\boldsymbol{Z}$ to capture the general and fiscal trends in economic activity in CZs prior to the military drawdown, the structure of state and local fiscal institutions, and the pretreatment trend in the fiscal outcome variable of interest. The variables we include in our pretreatment predictor set, including any transformations, are shown in Table 2, and data sources are provided in the table notes.

As noted in Panel A, across all fiscal outcomes we include the mean growth rate in real per capita total revenue, total expenditure, and total debt outstanding to match on broad fiscal trends across commuting zones. We also use the mean growth rate in real per capita personal income and employment between 1970 and 1987 to reflect trends in economic activity more generally.

In addition, the recent work of Das and Skidmore (2018) shows that fiscal institutions affect various fiscal outcomes and produce differential effects in growing and contracting areas. Therefore, we incorporate several institutional measures into the pretreatment predictor set. The variables include CZ measures of whether an active right-to-work law is in place and whether major school finance reforms have been enacted, as well as the stringency of the state and local tax and expenditure environments. For state and local TELs, we rely on the annual indices developed by Amiel, Deller, and Stallmann (2009) for every state ranging from 0 to 30 for state and from 0 to 38 for local, where larger values indicate tighter tax and expenditure restrictions. To form a CZ version of the state and local TEL indices in the pretreatment period, we assign every county an appropriate state and local TEL value in 1987 and construct the CZ version as a weighted average of individual county TEL

[21] A total of 205 synthetic control models are estimated (one for each base commuting zone) for each outcome variable. A less computationally intensive approach would be to exclude the fiscal outcome variables from the pretreatment predictor set so that the set would not vary across different fiscal outcomes. Under this approach, the optimal synthetic control weights would be unchanged for a given commuting zone regardless of the fiscal outcome because the fiscal outcome is not being considered in estimating the optimal synthetic weights. Although less computationally intensive, this approach may result in a trade-off in the quality of the pretreatment fit. That is, the synthetic counterfactuals may not fit the fiscal outcomes as well in the pretreatment period because the fiscal outcomes are not considered in the weighting estimation.

Table 2

Pretreatment Synthetic Control Predictor Variables

Panel A. Predictors for Each Fiscal Outcome
Total revenue (real per capita), mean %Δ, 1977–1987
Total expenditure (real per capita), mean %Δ, 1977–1987
Total debt outstanding (real per capita), mean %Δ, 1977–1987
State TEL index, level, 1987
Local TEL index, level, 1987
School reform index, level, 1987
Right-to-work index, level, 1987
Real per capita personal income, mean %Δ, 1970–1987
Employment, mean %Δ, 1970–1987
Panel B. Predictors That Vary with Fiscal Outcome
Fiscal outcome (real per capita), Δ, 1977–1987
Fiscal outcome (real per capita), level, 1982, 1987

Note: Mean growth rates in total revenue, total expenditure, total debt outstanding, personal income, and employment were calculated using the geometric mean. Personal income and employment data are from the Bureau of Economic Analysis. All real variables were deflated using the Consumer Price Index for All Urban Consumers (CPI-U; 2,000 = 100). Population figures are from the Census Bureau. State and local tax and expenditure limitation law (TEL) indices are from Amiel, Deller, and Stallmann (2009). The adoption dates of state right-to-work laws are from the NBER's Public Sector Collective Bargaining Data Set and the dates of school finance reforms are from the National Conference of State Legislature's education finance litigation database (https://www.ncsl.org/research/education/state-role-in-education-finance.aspx). The commuting zone institutional indices were constructed using the population-weighted average all of the counties located within the commuting zone. See Subsection III.B.2 for complete detail.

values within its CZ using each county's share of the CZ's 1987 population as the weight. Similarly, the right-to-work and school reform CZ indices are the population-weighted averages of the counties within the CZ. In both instances, counties in states that had an active right-to-work law in place in 1987 or are located in a state that had enacted any major school finance reform prior to 1987 are assigned values of unity when forming the CZ indices.[22]

Finally, Panel B of Table 2 depicts how each fiscal outcome in the pretreatment period is included in the predictor set. The first is the difference in the real per capita outcome of interest between 1977 and 1987. This formulation is consistent with our long-difference regressions and ensures that the synthetic counterfactuals take into consideration the trend in each specific fiscal outcome in the 10-year period

[22] We rely on the National Conference of State Legislatures education finance reform database for the dates of school reforms. The earliest reform date in its database is 1968, so we treat counties as having been exposed to school finance reforms (a value of unity in 1987) if their state experienced court-imposed school reforms any time between 1968 and 1987.

prior to the drawdown. Second, we include the real per capita level of each fiscal outcome in 1982 and 1987 in the predictor set to adjust for level differences in the fiscal outcomes across commuting zones.

IV. EMPIRICAL RESULTS

A. Synthetic Controls and Preexisting Trends

The credibility of our identification strategy depends on how well the synthetic counterfactual fiscal outcomes match the contracting base CZs trends in the pretreatment period. Table 3 reports the mean *difference* in each real per capita fiscal outcome from 1977 to 1987 for base CZs, nonbase CZs, and the synthetic counterfactuals. The *p*-values for a difference in mean *t*-test and a Kolmorgorov-Smirnov goodness-of-fit test are also reported for the nonbase CZs and synthetic CZs. The *p*-values for the *t*-test will reveal how well the average nonbase and synthetic CZ trends match the average base CZ trend in the pretreatment period. The Kolmorgorov-Smirnov test assesses how well the full (empirical) distribution of the nonbase CZ and synthetic CZ trends matches the distribution of pretreatment trends in the base CZs. The Kolmorgorov-Smirnov null hypothesis is that the two samples are drawn from the same distribution.

The results of the *t*-tests between the base CZs and nonbase CZs suggest that these two groups of commuting zones were following different average fiscal trends for many of the revenue and expenditure outcomes. In terms of revenue outcomes, for instance, which are shown in Panel A of Table 3, the mean difference from 1977 to 1987 across base and nonbase CZs is statistically significant at least at the 5 percent level in 10 of the 16 outcomes. In addition to the average trends being different for many of the outcomes, the *p*-values from the Kolmorgorov-Smirnov tests also indicate that the distributions of revenue trends are significantly different between base and nonbase CZs in the pretreatment period. Of the 16 revenue outcomes, nine of the Kolmorgorov-Smirnov *p*-values are less than 0.05. The results of the same tests for expenditures and debt, shown in Panels B and C, also indicate that the mean and distribution of base CZs and nonbase CZs expenditure and debt trends are significantly different for the majority of outcomes in the pretreatment period, including key components such as total expenditure, general expenditure, capital outlays, and total debt outstanding.

Turning our attention to the synthetic counterfactuals, the *p*-values from the difference in means *t*-test provide evidence that the synthetic base CZs perform very well in matching the average pretreatment trend across nearly all fiscal outcomes. Across all 46 fiscal outcomes, none of the difference in means *p*-values is smaller than 0.05 and only two — namely, highway operating expenditures and GO utility debt — have *p*-values less than 0.10. In terms of the distributions of pretreatment trends, *p*-values from the Kolmorgorov-Smirnov test also yield evidence that the synthetic CZs match the base CZs well for the large majority of fiscal outcomes. Of

the 46 outcomes, five of the Kolmorgorov-Smirnov p-values are 0.05 or smaller. The components where these differences arise — namely, liquor store revenue, insurance trust revenue, sales taxes, liquor store expenditures, and GO utility debt — are also components that have sizable percentages of zero values for many CZs, so those distributions are highly skewed.[23] For all the major components of revenue, expenditures and debt, the results in Table 3 provide evidence that the synthetic base CZs match both the average and distribution of fiscal outcome trends in the pretreatment period. This should give us confidence that the two-stage identification strategy based on synthetic control will be helpful in mitigating bias from differences in preexisting trends.

B. Local Fiscal Outcomes

Shifting the focus to the fiscal outcomes, we present results on the effect of a change in military personnel on CZ revenues in Table 4, expenditures in Table 5, and outstanding debt in Table 6.[24] We also report the number of observations and the Montiel Olea and Pflueger (2013) first-stage effective F-statistic for the strength of our instrument in each regression.[25] For models with a single endogenous regressor, Andrews, Stock, and Sun (2019) recommend this test statistic and a threshold value of 10 for determining whether the instrument is strong or weak. Our instrument exceeds this threshold in every regression.

Recall that the change in military personnel is scaled by the CZ's 1980 census population, and the fiscal variables are real per capita differences. Thus, the estimated coefficient on military personnel should be interpreted as the change in per capita revenue, expenditure, or debt as a result of the military-to-population ratio increasing by one. Because our focus is on the decline in military personnel, a positive (negative) coefficient suggests that the per capita change in the outcome variable decreased (increased) as a result of declining military personnel.

Overall, the headline estimates for revenues (Column R1.1 in Table 4) and expenditures (Column E1.1 in Table 5) suggest that residents who remain in areas

[23] The zero values arise when local governments within a CZ do not utilize a revenue or expenditure instrument. For example, if a state does not utilize a general sales tax, then all of the local governments within that state will have zero values for this component in the Census of Governments data.

[24] Our results are robust to including defense procurement spending as an additional explanatory variable. The estimated coefficients for procurement spending were not statistically significant in most specifications. The Department of Defense procures goods and services that range from uniforms to helicopters. Much of this spending does not take place near military bases. In particular, the correlation between the change in military personnel and procurement spending was close to zero. However, our estimates would represent a lower bound for regions where the procurement and personnel reductions are correlated.

[25] The number of observations can be used to obtain a measure of the average number of matched donors for each base CZ in the synthetic control. For example, there are 205 base CZs, so if the regressions had 2,006 observations, as in Column R1.1 of Table 4, this suggests that each base CZ had, on average, 8.78 donors (2,006 – 205)/205.

Table 3

Pretreatment Fit of Synthetic Counterfactuals (Comparison of Real Per Capita Differences from 1977 to 1987)

	Base CZs	Nonbase CZs			Synthetic CZs		
	Mean	Mean	*pt*-test	*p* KS test	Mean	*pt*-test	*p* KS test
Panel A. Revenue							
Δ Total revenue	412.97	496.09	0.05	0.47	429.41	0.70	0.87
Δ Utility revenue	103.01	90.52	0.61	0.09	80.40	0.32	0.87
Δ Insurance trust revenue	21.06	2.91	0.00	0.00	17.28	0.32	0.03
Δ Liquor store revenue	−0.52	−1.79	0.08	0.87	−1.27	0.15	0.00
Δ General revenue	289.42	404.45	0.00	0.02	334.55	0.15	0.64
Δ Total taxes	33.17	79.89	0.00	0.70	45.56	0.44	0.87
Δ Property taxes	−17.95	41.98	0.00	0.00	−6.21	0.43	0.93
Δ Sales taxes	40.46	35.68	0.27	0.05	44.65	0.37	0.00
Δ Income taxes	5.16	0.91	0.01	0.02	3.41	0.30	0.04
Δ All other taxes	5.50	1.32	0.00	0.00	4.43	0.37	0.56
Δ Intergovernmental aid	31.03	103.69	0.00	0.00	41.53	0.55	0.56
Δ Federal aid	−76.26	−33.38	0.00	0.00	−77.29	0.89	0.97
Δ State aid	98.03	118.21	0.15	0.08	106.93	0.55	0.93
Δ State aid, education	80.06	93.04	0.19	0.18	90.59	0.31	0.80
Δ Local aid	9.26	18.87	0.02	0.31	7.45	0.62	0.73
Δ Charges and other revenue	225.22	220.86	0.85	0.00	246.32	0.33	0.99
Panel B. Expenditures							
Δ Total expenditure	357.85	438.98	0.05	0.41	369.09	0.73	0.87
Δ Utility expenditures	96.76	92.27	0.87	0.48	89.14	0.63	0.97
Δ Utility capital outlays	−18.37	−11.64	0.81	0.41	−4.39	0.51	0.93
Δ Liquor store expenditures	−0.66	−1.67	0.09	0.79	−1.13	0.25	0.00
Δ Insurance trust benefits	3.99	0.65	0.00	0.00	3.93	0.96	0.23

Δ General expenditure	257.75	347.73	0.00	0.13	276.31	0.45	0.97
Δ Interest on debt	94.47	74.87	0.36	0.00	90.64	0.86	0.97
Δ General operating expenditures	207.06	315.54	0.00	0.00	228.41	0.17	0.15
Δ Education, operations	66.26	127.85	0.00	0.00	76.68	0.24	0.80
Δ Hospitals, operations	28.48	46.07	0.04	0.06	33.16	0.56	0.19
Δ Highways, operations	5.95	13.48	0.02	0.00	1.59	0.07	0.56
Δ Police, operations	14.49	16.64	0.12	0.24	15.46	0.47	0.34
Δ All other	91.87	111.50	0.04	0.00	102.15	0.20	0.41
Δ General capital outlays	−5.28	−22.85	0.16	0.27	−9.98	0.69	0.87
Δ Education capital outlays	2.58	−10.90	0.02	0.02	−1.60	0.42	0.87
Δ Highways capital outlays	0.99	−1.49	0.48	0.15	0.61	0.89	0.97
Δ Sewerage capital outlays	−13.80	−1.96	0.03	0.00	−15.11	0.80	0.48
Δ All other capital outlays	4.95	−8.49	0.07	0.04	2.87	0.78	1.00
Δ All other general expenditures	−38.50	−19.83	0.35	0.02	−25.88	0.50	0.34
Panel C. Debt							
Δ Total debt outstanding	747.20	468.99	0.18	0.00	733.36	0.94	1.00
Δ Long-term debt outstanding	765.02	477.47	0.16	0.00	749.87	0.94	1.00
Δ Utility GO debt	−7.98	−24.36	0.43	0.00	−25.57	0.08	0.00
Δ Utility revenue debt	288.19	145.09	0.36	0.09	170.28	0.37	0.64
Δ Private-purpose revenue	650.29	601.64	0.70	0.00	715.52	0.49	0.10
Δ Education GO debt	−143.27	−120.89	0.23	0.29	−119.30	0.20	0.28
Δ Education revenue debt	−15.39	−7.73	0.29	0.09	−16.15	0.93	0.15
Δ All other GO debt	−63.94	−57.56	0.78	0.87	−58.78	0.83	0.64
Δ All other revenue debt	57.12	−58.72	0.07	0.04	38.02	0.71	0.80
Δ GO debt	−215.19	−202.82	0.74	0.24	−222.39	0.84	0.97
Δ Revenue debt	980.21	680.29	0.12	0.00	956.78	0.90	1.00

Note: All fiscal outcomes are in real per capita differences between 1977 and 1987. Columns labeled "*pt*-test" show the *p*-value from a difference in mean test between the treatment group and either the control group or the synthetic control group. Columns labeled "*p* KS test" show the *p*-value from a Kolmorgorov-Smirnov goodness-of-fit test for the equality of the distributions of the treatment and control or synthetic control groups. GO denotes general obligation/full faith and credit debt.

Table 4

Regression Results: Revenue

Panel R1. Total and Major Revenue Components

	(R1.1)	(R1.2)	(R1.3)	(R1.4)	(R1.5)
	Δ Total	Δ Utility	Δ Insurance trust	Δ Liquor stores	Δ General
Δ*MP*	9.719	16.836	2.519	−0.191	−21.225
	(34.464)	(13.589)	(1.794)	(0.238)	(36.046)
N	2,006	2,000	1,901	1,877	2,005
Effective *F*-statistic	100.07	99.85	95.38	92.58	97.04

Panel R2. Tax Revenues

	(R2.1)	(R2.2)	(R2.3)	(R2.4)	(R2.5)
	Δ Total taxes	Δ Property taxes	Δ Sales taxes	Δ Income taxes	Δ All other taxes
Δ*MP*	−30.344**	−31.111**	−4.948	0.346	1.691
	(12.809)	(12.155)	(4.452)	(0.314)	(2.043)
N	2,001	2,000	1,977	1,835	1,994
Effective *F*-statistic	98.53	98.68	93.75	95.18	92.93

Panel R3. Intergovernmental Aid and Other Components

	(R3.1)	(R3.2)	(R3.3)	(R3.4)	(R3.5)	(R3.6)
	Δ Total aid	Δ Federal aid	Δ State aid	Δ State aid, education	Δ Local aid	Δ Charges
Δ*MP*	35.895**	−0.569	39.286***	39.930***	−5.944	−9.393
	(14.159)	(4.316)	(12.724)	(12.622)	(4.030)	(25.672)
N	2,001	2,011	2,029	2,006	2,019	2,035
Effective *F*-statistic	101.32	95.34	100.06	100.59	99.59	97.11

Note: All variables are measured as the difference from 1987 to 2000. Asterisks denote significance at the 1% (***) and 5% (**) levels. Standard errors clustered at the commuting zone and synthetic group levels are shown in parentheses. Models were estimated with synthetic control group fixed effects and a constant term that are not reported. Effective *F*-statistic is the Montiel Olea and Pflueger (2013) robust first-stage *F*-statistic; Δ*MP* denotes the change in military personnel.

with declining populations do not experience meaningful changes in per capita revenue and expenditures due to the reduction in military personnel. In contrast, long-term debt (Column D1.1 in Table 6) does appear to increase. We find evidence to support the view that local governments use debt to finance expenditures over the long term in response to localized demand shocks. Taken more broadly, our findings — from a much longer time horizon than previous studies — reaffirm the view that the fiscal environment faced by local governments to issue debt, generate

revenue, and engage in deficit financing appears to be effective in maintaining fiscal stability (Ross, Yan, and Johnson, 2015; Maher et al., 2016).

However, focusing on the headline public finance measures alone masks the ways that local governments make fiscal adjustments. Therefore, to gain more insight into the underlying composition of local fiscal adjustments, we also estimate the causal effect of military contractions on several subcomponents of local revenues, expenditures, and debt. The first panel of each table breaks the category into its major components. For revenues and expenditures, the major components are utilities, insurance and trust, liquor stores, and general, whereas the major categories for debt are long-term debt, long-term general obligation debt, and long-term revenue debt. The subsequent panels of each table further break out important subcategories. For instance, Panels R2 and R3 of Table 4 separate general revenues into two major components, tax revenues and intergovernmental transfers. Table 5 divides general expenditures between operations and capital outlays, and Table 6 considers debt components by function.

Consider first the revenue regressions in Table 4. The estimates in Panel R1 show that the population decline from the military personnel drawdown did not result in statistically significant changes to total revenue per capita or any of the major revenue components. General revenue accounts for the lion's share (88 percent in 1987) of total revenue. Panels R2 and R3 show how local governments made adjustments in the types of general revenue. In particular, revenue generated by taxes increased by $30 (3.9 percent from 1987 levels) as a result of a decline by one in the military-to-population ratio. The change in tax revenue is driven by property taxes, up 4.7 percent from 1987. Property tax revenues appear to increase to partially offset reductions in state intergovernmental aid for education, which declines by over $39 per capita as shown (Column R3.3 in Table 4).

The broader implications from our revenue regressions display just how much most local governments rely on property taxes as a revenue source and fiscal stabilizer. Unfortunately, because local property tax rates and assessed values are not widely available, we cannot decompose the role that housing values or millage rates played in the estimated increase we observe. Cromwell and Ihlanfeldt (2015) find that municipalities in Florida increased millage rates due to shrinking property tax bases and shrinking intergovernmental transfers during the Great Recession. Moreover, state aid to education is the main driver in the intergovernmental losses that localities experience. Our results do not provide evidence that federal aid acts as a fiscal stabilizer for local governments facing shrinking populations. This could be because federal and state governments tend to rely on formulas based on population and poverty rates when they distribute aid (Suarez Serrato and Wingender, 2016). With some sources of aid, states act as a pass-through entity for the federal government, making it difficult to disentangle state and federal aid from each other (Wildasin, 2010).

Table 5 presents results for the major subcomponents of expenditures, further subdivided between current operating (noncapital) spending and capital spending.

Table 5

Regression Results: Expenditures

Panel E1. Major Expenditure Categories

	(E1.1)	(E1.2)	(E1.3)	(E1.4)	(E1.5)	(E1.6)
	Δ Total	Δ Utility	Δ Utility capital	Δ Liquor stores	Δ Insurance trust	Δ General
Δ*MP*	12.880	−2.916	−4.214	−0.567	−3.474***	−7.115
	(32.207)	(11.015)	(8.886)	(0.462)	(1.164)	(32.975)
N	1,991	2,013	2,039	1,871	1,956	2,018
Effective *F*-statistic	100.43	99.95	99.59	92.42	98.58	97.22

Panel E2. Expenditures, Operations

	(E2.1)	(E2.2)	(E2.3)	(E2.4)	(E2.5)	(E2.6)	(E2.7)
	Δ Interest on debt	Δ General operations	Δ Education operations	Δ Hospitals operations	Δ Highways operations	Δ Police operations	Δ Other operations
Δ*MP*	−12.353*	−16.856	−3.463	−17.656	−0.591	−3.769**	26.857**
	(6.843)	(28.492)	(11.886)	(19.413)	(2.152)	(1.716)	(13.632)
N	2,021	2,043	2,018	2,045	2,014	2,023	2,007
Effective *F*-statistic	95.42	97.46	99.55	100.53	95.84	99.88	97.47

Panel E3. Expenditures, Capital Outlays

	(E3.1)	(E3.2)	(E3.3)	(E3.4)	(E3.5)	(E3.6)
	Δ General outlays	Δ Education outlays	Δ Highways outlays	Δ Sewerage outlays	Δ Other outlays	Δ Other general expenditures
Δ*MP*	26.345**	12.439**	9.180	0.560	7.298	−4.745
	(10.382)	(5.986)	(7.902)	(3.189)	(5.973)	(5.729)
N	2,020	2,012	2,046	2,036	2,033	2,001
Effective *F*-statistic	95.02	98.61	99.21	96.45	98.36	95.85

Note: All variables are measured as the difference from 1987 to 2000. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels. Standard errors clustered at the commuting zone and synthetic group levels are shown in parentheses. Models were estimated with synthetic control group fixed effects and a constant term that are not reported. Effective *F*-statistic is the Montiel Olea and Pflueger (2013) robust first-stage *F*-statistic; Δ*MP* denotes the change in military personnel.

Table 6

Regression Results: Debt

Panel D1. Headline Debt Components

	(D1.1)	(D1.2)	(D1.3)	(D1.4)
	Δ Total	Δ Long term	Δ GO debt	Δ Revenue debt
Δ*MP*	−180.051**	−170.953**	−6.178	−69.317*
	(88.389)	(86.034)	(8.983)	(38.053)
N	2,020	2,040	2,018	2,002
Effective *F*-statistic	93.74	93.86	95.88	94.96

Panel D2. Debt Components by Function

	(D2.1)	(D2.2)	(D2.3)	(D2.4)	(D2.5)	(D2.6)	(D2.7)
	Δ Utility GO	Δ Utility revenue	Δ Private-purpose revenue	Δ Education GO	Δ Education revenue	Δ All other GO	Δ All other revenue
Δ*MP*	−81.941	4.700	−0.236	−20.264	2.146	−22.240	−163.745**
	(62.814)	(22.965)	(3.099)	(18.258)	(36.781)	(30.327)	(71.184)
N	1,897	2,027	1,870	2,032	2,047	2,014	2,036
Effective *F*-statistic	98.71	96.45	96.89	95.79	97.76	97.2	95.93

Note: All variables are measured as the difference from 1987 to 2000. Asterisks denote significance at the 5% (**) and 10% (*) levels. Standard errors clustered at the commuting zone and synthetic group levels are shown in parentheses. Models were estimated with synthetic control group fixed effects and a constant term that are not reported. Effective *F*-statistic is the Montiel Olea and Pflueger (2013) robust first-stage *F*-statistic; Δ*MP* denotes the change in military personnel.

As with revenues, we find that local governments did not make sizable adjustments to the composition of major expenditures (Panel E1) because of the military contraction. However, Panels E2 and E3 show diverging priorities among governments for operations and capital spending. General operating expenditures account for the largest subcategory of general expenses (81 percent), compared to capital outlays (11 percent), debt interest (7 percent), and other general spending (2 percent). General operating expenses (Column E2.2 in Table 5) did not change appreciably due to the personnel drawdown. Spending on general capital outlays, however, declined $26 per capita or 11.0 percent from 1987 levels while spending on debt interest increased by $12 per capita or 8 percent from 1987. In other words, local governments made disproportionately large reductions in capital spending to safeguard current operating spending and pay for increased debt service.

Several general expenditure categories experienced significant adjustments due to the military drawdown. The most notable changes in operating expenditures came in public safety and other operations. Public safety increased by 4.5 percent (Column E2.6 in Table 5), whereas the all-other-expenditure category, which includes parks and recreation, public welfare, utilities, and government administration, declined by 6.4 percent (Column E2.7 in Table 5). In comparison, about half of the decline in general capital spending can be attributed to education outlays, which fell $12 per capita (15 percent from 1987 levels). This reduction could in part be explained by the decline in state intergovernmental aid for education.

Finally, Table 6 shows the evolution of debt due to declining military personnel. Local governments in CZs impacted by the military drawdown experience higher long-term per capita debt burdens of $170 or 8 percent relative to 1987 levels (Column D1.2 in Table 6). This could be the result of localities issuing higher levels of new debt per capita, a shrinking population base with the same debt issuance, or a combination of these factors. From Columns D1.3 and D1.4 we can see that the higher per capita debt burden is coming almost entirely from nonguaranteed revenue debt. We observe increases in the total level of outstanding debt only in some components and not across the board. This suggests that newly issued revenue debt for selected components did not fall proportionally with the population losses like general obligation debt (keeping per capita burdens unchanged).

Debt is typically used to fund investment, such as building, general maintenance, or infrastructure improvements not financed from general capital outlays. Despite several of the categories being measured imprecisely, our results suggest that most of the increased revenue debt burden is associated with utilities and private-purpose debt for economic development purposes (Columns D2.2 and D2.3 in Table 6). There are several potential explanations. For instance, because both utility debt and private-purpose debt are potentially revenue-generating activities (unlike education debt, for example), local governments may rely on them as part of a strategy to decrease general capital outlays and increase budget flexibility. Of course, localities may also be pushed into debt-financing investments that would otherwise have been funded out of general outlays because population losses have left them with an

oversized infrastructure footprint that is more costly to maintain on a per capita basis. Similarly, the increased private-purpose debt balances could be driven by a formal BRAC redevelopment process or could simply be part of a broader effort to spur economic development in light of reductions in military activity.

C. Discussion

Because business cycle downturns tend to be transitory events, policy makers may make decisions based on a short time horizon. For instance, policy makers may have delayed capital outlays during the Great Recession to minimize cuts in operating budgets with the expectation of catching up once revenue growth stabilized. But the loss of a military base is different in that it reasonably can be viewed as a permanent shock. This raises two questions: Why did local policy makers adjust some revenue sources and shift expenditures away from capital investments? And what are the likely consequences of those decisions for a region?[26]

One potential explanation is that capital is durable so that places with stagnant or declining population have lower current and future demands for these types of expenditures; instead, their capital expenditures tend to be replacement-oriented projects. Hence, the shift away from capital expenditure may simply reflect a lower need for new capital projects that would be associated with growing communities.

Alternatively, our results are also consistent with Wolman's (1983) theory outlining the political economy of local fiscal adjustments resulting from adverse shocks. In this framework, local governments seek to balance the tension between increasing revenue and decreasing services with winning reelection and/or remaining in power. Rather than attempting to maximize the lifetime service value of their capital assets, policy makers seeking reelection will maintain the public sector workforce and make cuts that are minimally visible to constituents. Because the level of services provided in each period depends on the stock of capital assets, policy makers may be able to underfund infrastructure investments for a considerable period of time before there is any noticeable disruption in the flow of services.

The broader implications of these budgetary shifts may also be important. Roughly half of the estimated reduction in capital outlays due to the military contraction is concentrated in K–12 education. As a key input in the educational process, the quality of school facilities has been shown to improve a host of outcomes ranging from student attendance and performance to teachers' attitudes and home values (Neilson

[26] An additional issue to consider is that we are making comparisons across different fiscal outcomes and each fiscal outcome is being compared to a different synthetic control. To ensure that this is not driving our results, we also re-estimated the regressions using the same synthetic control weights for every fiscal outcome to force the comparisons to be made using the same synthetic control unit. We formed three synthetic control units for each commuting zone using (a) total revenue weights, (b) total expenditure weights, and (c) total debt outstanding weights. The baseline results presented in Tables 4, 5, and 6 are robust to comparing the commuting zones to the same synthetic control.

and Zimmerman, 2014; Conlin and Thompson, 2017). Our estimates also show that local governments increased their long-term debt and may have delayed replacement of some facilities, equipment, and outmoded technologies by decreasing capital spending. Such a decrease potentially reduces the value of municipal assets, which in turn could lead to credit downgrades and higher borrowing costs. In addition, as Moody's Investor Services (2014) notes, delaying investments in municipal utility systems may lead to more severe and expensive problems down the road. The cost of fixing those problems potentially crowds out other beneficial spending besides increasing the likelihood that the utilities will run afoul of civil and environmental regulations.

Our results show the adjustments to property tax revenue, capital expenditures, and debt made by local governments in the face of a long-term, seemingly permanent, negative shock. These adjustments include decreasing capital expenditures and increasing debt, potentially increasing borrowing costs for other capital investments, increasing interest payments more generally, and potentially crowding out future expenditures. In addition, higher local property taxes may dampen real estate markets and make these localities less attractive to current and prospective residents. In many instances, the choices made by local governments shift some of the financial burden to future generations. If, in addition, the personnel reduction reduces local wages and amenities, as Zou (2018) suggests, the challenges for the locality are likely to include reduced in-migration and a stunted economic recovery (Roback, 1982).

V. CONCLUSION

In this paper, we estimate the causal effect of population loss on local fiscal policies by exploiting a quasi-natural experiment resulting from the Department of Defense's post–Cold War contraction between the late 1980s and 2000. We use commuting zones as our geographic unit of interest; our fiscal outcome variables are formed by aggregating the revenue, expenditure, and debt measures for all governmental units (cities, counties, and school districts, e.g.) within a commuting zone. Because commuting zones overlap place of employment and place of residence, their use helps to ensure that the estimated effects occur within the same geographic unit of analysis.

Our identification strategy follows a two-step procedure, recently proposed by Zou (2018), which combines generalized synthetic controls and weighted two-stage least squares. The synthetic controls approach allows us to dampen any bias that might arise as a result of commuting zones with military bases being on different growth trajectories before the contraction. Because only one-third of commuting zones in the continental United States had a military base within their borders prior to the defense drawdown, the commuting zones without bases serve as a large donor pool to estimate counterfactual fiscal outcomes. The second step in our strategy, weighted two-stage least squares, uses the weights from the synthetic controls and a Bartik-style instrument to deal with the simultaneity between local economic

conditions and the location of military contractions. Because the Department of Defense was required to take local economic conditions into consideration when making recommendations, the location of personnel contractions may not have been randomly assigned.

Estimating the long-run change in fiscal outcomes from 1987 to 2000 resulting from the defense contractions, our results indicate that total real per capita revenues and expenditures are largely unaffected by the personnel decline. However, local governments did adjust several subcategories of revenue. For instance, to offset a reduction in state intergovernmental aid, they increased revenue generated from own-source property taxes. On the expenditure side, local governments reduced capital spending, particularly for K–12 education, to protect spending for operations. Finally, there was an increase in long-term nonguaranteed revenue debt to finance investments not paid for by general capital outlays.

This paper focuses on adjustments in local public finance outcomes such as revenues, expenditures, and debt over a long time horizon (more than a decade). A useful area of future inquiry would be how the long-term debt and capital spending adjustments subsequently impacted local infrastructure, credit ratings, or borrowing costs.

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