How Is the Rise in National Defense Spending Affecting the Tenth District Economy?

By Chad R. Wilkerson and Megan D. Williams

In 2007, the United States spent more than $650 billion on national defense. Even after adjusting for inflation, this was the largest annual amount since 1945, surpassing previous post-World War II peaks reached during the Korean, Vietnam, and Cold Wars. Defense spending has risen rapidly this decade, today accounting for nearly 5 percent of overall gross domestic product—about the same share as residential construction.

National defense represents an even larger share of economic activity in the Tenth Federal Reserve District. The region is home to some of the country's largest military installations, a number of private defense contractors, and a disproportionately large number of reservists and National Guardsmen.

Is the buildup in national defense stimulating the economies of the states in the Tenth District? This article finds that, relative to the nation, increased defense spending is likely to help the region more in the long run than the short run. Since 2001, defense spending has risen more moderately in the district than the nation, due primarily to slower growth in the types of defense activities concentrated in the region. Still, the region is poised for an expansion of defense spending in the

---

Chad R. Wilkerson is assistant vice president, branch executive, and economist at the Oklahoma City Branch of the Federal Reserve Bank of Kansas City. Megan D. Williams is an associate economist at the branch. This article is on the bank's website at ***www.KansasCityFed.org****.*

future. And the region benefits from a less cyclical defense sector than that of the nation.

The article's first section looks at the evolution of defense spending in the United States and reviews research on the effects of defense spending on economic growth. The second section discusses the size and location of defense activities in the Tenth District and then explains how defense spending can benefit state and regional economies. The third section explores how and why the defense buildup has been smaller in the district and how the current buildup compares to past episodes. The fourth section examines why projected defense spending increases may influence the district and national economies differently.

I. NATIONAL DEFENSE IN THE U.S. ECONOMY

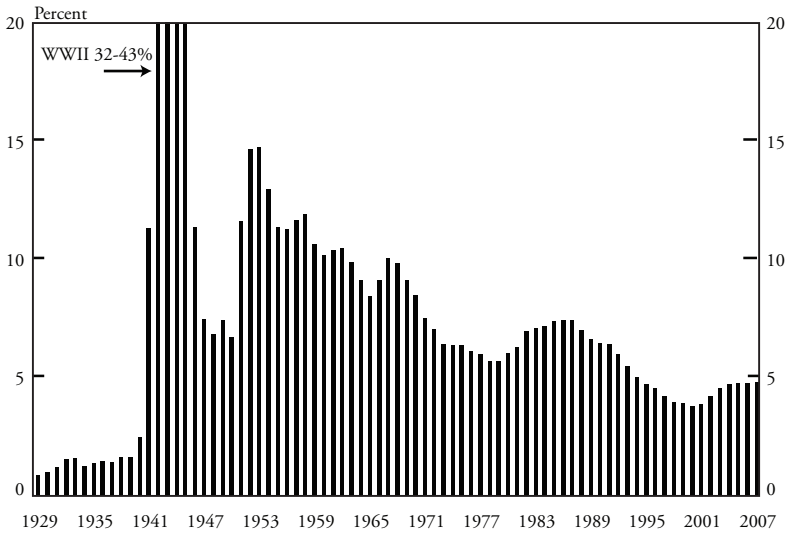
Ever since the United States entered World War II, defense spending has played an important role in the nation's economy. This section looks at the size of the defense sector in the U.S. economy and how it helps shape national economic growth.

How sizable is U.S. defense spending?

The scale of military expenditures in the United States has fluctuated considerably over time. In the decade prior to World War II, defense spending accounted for less than 2 percent of GDP (Chart 1). During the war, defense accounted for more than a third of the nation's economic activity—a boost many economists have claimed effectively ended the Great Depression (Tobin). By 1947, military spending had dropped again to about 7 percent of GDP and remained there for several years. Then, the Korean War, the Cold War, and later, the Vietnam War pushed defense's share of national output into or near double digits throughout most of the 1950s and 1960s.

By 1979, military spending had declined again to less than 6 percent of GDP. The Cold War buildup of the Reagan Administration lifted defense spending back above the 7 percent threshold for several years, but by 1986 it began to slow again and by 2000 dipped to a postwar low of 3.8 percent. Since 2001, defense spending has been rising rapidly, last year accounting for 4.8 percent of GDP. Spending on the nation's defense is generally expected to climb further in the near term.

Chart 1
NATIONAL DEFENSE SPENDING AS A SHARE OF U.S. GDP



Source: Bureau of Economic Analysis

Does defense spending boost economic growth?

A good deal of economic research has been conducted on the effects of defense spending on national economic growth. Results of these "guns versus butter" studies have been somewhat mixed since the first empirical analyses were conducted in the early 1970s.[1] Indeed, a detailed survey of the literature published in 1995 concluded there was no consistent evidence for either overall positive or negative effects of defense spending on national economic growth (Ram). The findings of individual studies appear to depend partly on the time frame of focus.

Theoretically, spending on defense could affect economic growth in both negative and positive ways. On one hand, military expenditures can impose opportunity costs on a nation. That is, aggregate economic growth could suffer as resources used for defense—including capital, labor, and land—become unavailable for potentially more productive uses that could support long-term economic growth. At the same time, defense spending can benefit an economy—for example, by creating or maintaining a climate of national security necessary for both domestic and foreign private investment to flourish. Other examples of benefits

include sizable public infrastructure investments, development of advanced technology, and skilled training of workers.

Past research has generally found that increased defense spending boosts overall economic growth in the short run, especially during times of external security threats (Aizenman and Glick; Landau). Some researchers also find the long-run benefits of defense spending outweigh the long-run costs (Atesoglu 2004). Still, many studies find high levels of defense spending are a drag on economic growth in the longer run, as productivity is generally found to be higher in other sectors of the economy (Cuaresma and Reitschuler; Mintz and Huang). In addition, some researchers suggest that wartime casualties could impose both short-term and long-term costs to soldiers and their families that are difficult to measure (Blimes and Stiglitz).

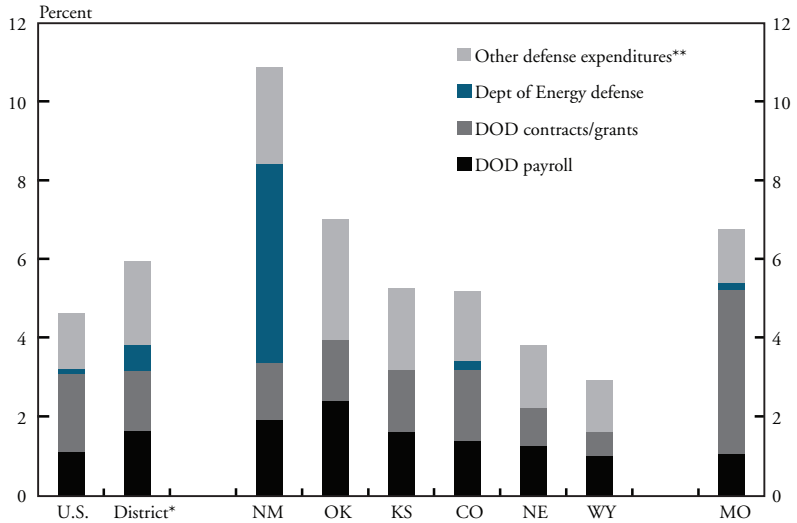
Since 2001, U.S. defense spending has risen at about twice the rate of overall national economic activity and by much wider margins in the earlier part of this period. Recent studies have generally found this massive recent defense increase to have provided a boost to overall U.S. economic growth, along the lines of 0.5 to 1 percent of additional GDP growth per year in the early years of the buildup (Atesoglu 2006; Baker). However, Atesoglu also found that U.S. trade and budget deficits have risen as a result of the buildup, and the model used by Baker suggests that the sizable increases in defense spending will begin to have a downward effect on employment and GDP between the fifth and tenth year of the buildup.

In short, defense spending remains quite important to the U.S. economy. The initial increase in national defense spending in the early part of this decade provided a boost to overall U.S. economic growth. But whether devoting sizable resources to national defense is beneficial in the long term remains an open question.

II. NATIONAL DEFENSE IN THE TENTH DISTRICT

As in the nation, the military has long had an important presence in the Tenth Federal Reserve District.[2] This section looks at the size of defense spending in the district and where the spending occurs. It also explores some of the ways defense expenditures can influence a regional economy differently than the national economy.

Chart 2
DEFENSE SPENDING AS A SHARE OF GDP, 2006



*Excluding Missouri
**Actual for U.S., estimated for District and states
Sources: U.S. Departments of Defense and Energy, Bureau of Economic Analysis

Defense spending in the Tenth District—How much and where?

In 2006, defense spending accounted for an estimated 6 percent of overall GDP in the Tenth District—about 25 percent more than in the nation (Chart 2).[3] The district state with the largest defense presence is New Mexico, where an estimated 11 percent of economic output goes toward defense. Oklahoma's defense sector is also considerably larger than in the nation, at about 7 percent. (Likewise, defense spending accounts for about 7 percent of Missouri's GDP. But because the vast majority of Missouri's defense spending occurs outside of the Tenth District portion of the state, its statewide defense statistics are not included in district totals in this article.[4]) Defense spending also exceeds the national share in Kansas and Colorado.

In comparison to the nation, the Tenth District is much more heavily involved in personnel-related defense spending, as well as in the nuclear defense-related activities of the Department of Energy. The region also has an estimated sizable presence in "other defense expenditures," which are largely personnel or base-related.[5] Meanwhile, the district generally receives far fewer defense contracts than the nation.

Of course, each individual state is different in its defense spending, and even within states some locations are especially concentrated in military-related activities. But overall, most district states are fairly similar in the composition of their defense spending.

The Tenth District is home to a sizable number of military installations, some of which are among the largest in the country (Chart 3). Given the region's lack of a coastline, these bases are primarily either Air Force or Army, with the Navy and Marines having little presence in the region.[6] The Air Force accounts for 43 percent of defense personnel in the region, compared with just 23 percent nationally. Tinker Air Force Base—the nation's largest—is located in metropolitan Oklahoma City and houses more civilian Department of Defense personnel (approximately 14,000) than any other individual site outside of the Washington, D.C., area. Ten other Air Force Bases are also scattered throughout the district.

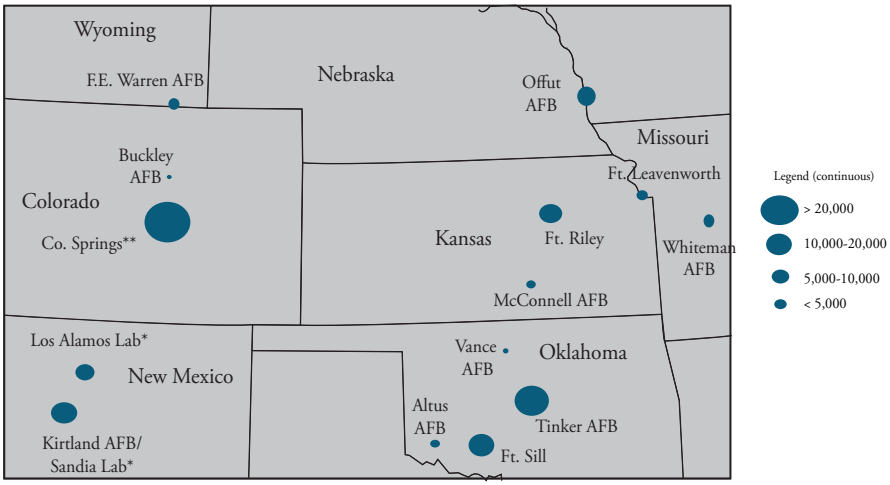
The Army accounts for nearly half of the district's defense personnel, a similar share as in the nation. The region is home to three of the country's 12 largest army bases: Fort Carson in Colorado Springs, Colorado; Fort Sill in Lawton, Oklahoma; and Fort Riley near Manhattan, Kansas. Together, these three large bases house nearly 50,000 defense personnel. Each of these bases is also among those that stand to gain considerable troops from the latest round of Base Realignments and Closures (BRAC 2005).

In addition to traditional military bases, the district has a number of unique defense institutions. The U.S. Air Force Academy is located in Colorado Springs, and the North American Aerospace Defense Command (NORAD)—which provides surveillance and control of the airspace of Canada and the United States—is housed at nearby Peterson Air Force Base. In addition, the headquarters of United States Strategic Command—which controls the use of the nation's space defense infrastructure and nuclear weapons assets—is housed at Offutt Air Force Base near Omaha, Nebraska, as is the Defense Department's weather agency.

Perhaps the most unique defense institutions in the district are actually part of the U.S. Department of Energy. These include, most prominently, the Los Alamos and Sandia National Laboratories in northern New Mexico. These two institutions, along with the Lawrence Livermore National Laboratory in California, are responsible for—in addition to

Chart 3

DEFENSE PERSONNEL CONCENTRATIONS IN THE TENTH DISTRICT, 2006



*Includes Department of Energy employees; **Colorado Springs houses the following institutions: Fort Carson (19,500); Peterson AFB (5,700); Schriever AFB (2,300); U.S. Air Force Academy (7,800)
Note: AFB stands for Air Force Base.
Source: U.S. Departments of Defense and Energy

some nondefense activities not counted in defense spending statistics—ensuring the safety and reliability of the nation's nuclear weapons stockpile and conducting advanced research on national security issues.

Although Department of Defense contracts are relatively less important in the district than in the nation, a number of private defense contractors nevertheless have sizable presences in the region.[7] The largest contractor is The Boeing Company, with total district contracts valued at approximately $550 million in 2006, the majority of which were located in Wichita, Kansas. Other sizable contractors in the region include: Lockheed Martin Corporation in Colorado; Raytheon Corporation in Kansas; and Northrop Grumman Corporation in Colorado, Oklahoma, Kansas, and Nebraska.

Finally, the district is home to a disproportionately large number of National Guardsmen and reservists, individuals who have played an increasingly important role in national defense in recent years. In the nation as a whole, reservists and National Guardsmen represented 0.61 percent of total employment in 2006. By comparison, the only state in the Tenth District with a smaller share than this was Colorado (0.55

percent), while some district states had considerably larger shares, including Wyoming (1.01 percent), Oklahoma (0.90 percent), and Kansas (0.85 percent).[8]

How does defense spending affect state and regional economic growth?

The ways in which defense spending affects state and regional economies have both similarities and differences with national effects. As in the nation, increased defense spending may boost regional economic growth in the short run, while ongoing expenditures could come at the expense of potentially more productive private or nondefense government investment in the long run. However, since different aspects of defense spending can be located in different parts of a country, regional effects can differ. In addition, the overall size of the sector in an area can also make a difference, as having more defense presence could mean more federal tax dollars coming into an area than going out.

Past research generally finds that at least certain types of defense spending can boost an area's economic activity, especially during short periods. For example, investment-type spending (such as for R&D and equipment procurement) has a consistent positive effect on state incomes, while operations-type spending (such as for service contracts and personnel spending) tends to have a positive impact on state employment, but not incomes (Mehay and Solnick). Likewise, changes in defense investment spending have same-direction impacts on state economic growth (Hooker and Kettner; Bhattacharya).

As for regional differences in the location of the defense industry, some regions may be naturally better positioned than others for obtaining military bases or other types of spending. While political considerations undoubtedly play a role in site selections, other criteria are important as well. For example, when decisions about military base closures or realignments are made every few years, the most weight is given to the "military value" of a site, which includes its mission capabilities, operating costs, and the availability and condition of resources such as land and facilities.[9] As a historical example, in choosing the location of the Los Alamos National Laboratory during World War II, the preference was for "a remote, sparsely populated site that would be safe from enemy attack, and preferably lie in a natural bowl ringed by hills that could contain any accidental explosions" (Weideman). By contrast, de-

fense contracts tend to be awarded largely to metropolitan areas, where defense contractors are heavily located.

In sum, defense spending has a sizable presence in the Tenth District, particularly in terms of the number of defense personnel located in the region. The district's relatively large availability of land and lower labor costs may lend it to such a concentration, while its smaller metropolitan area population may limit its ability to win defense contracts.[10] Since most types of defense spending have been found to have some impact on how state economies grow over time, an analysis of the recent defense buildup in the district may help shed light on the region's recent economic performance, as well as introduce ways in which defense spending could affect the district heading forward.

III. THE RECENT DEFENSE BUILDUP IN THE DISTRICT

Since the terrorist acts of September 11, 2001, defense spending in the Tenth District has grown fairly rapidly, although less so than in the nation. This section looks at the composition and evolution of defense spending in the district to help explain why the region has not received as much of a defense boost recently and why defense spending appears to be less cyclical in the region in general.

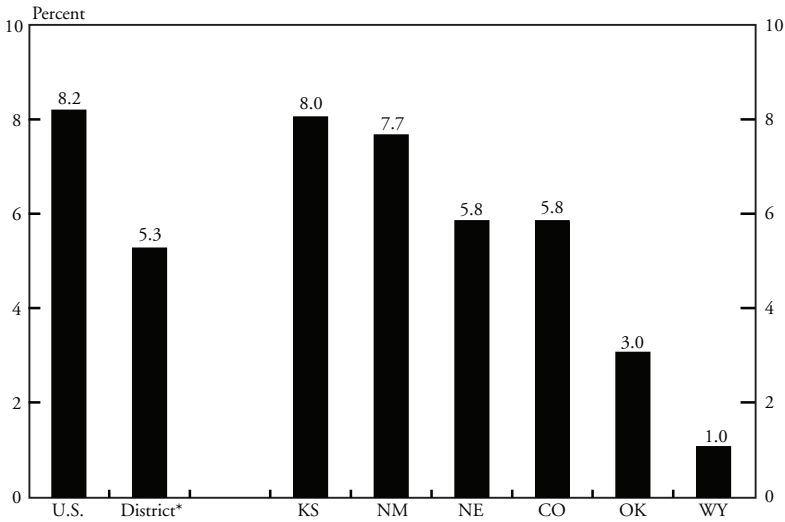
Recent defense spending and regional economic growth

Since 2001, real defense spending in the Tenth District has risen at an annual rate of about 4.5 percent.[11] By comparison, real defense spending in the United States has risen at an annual rate of about 7 percent. Among the six district states whose primary defense activities are located within the Tenth District, only Nebraska has experienced a larger increase in defense spending than the nation since 2001, and its defense sector is relatively small compared with most other district states.

Meanwhile, overall economic growth in the district has been slightly faster than in the nation since 2001. While solid growth in defense spending has played a role in bolstering overall regional GDP in recent years, the region's defense boost has clearly been smaller than in the nation. In the nation, more than 8 percent of the overall increase in GDP since 2001 has come from defense spending (Chart 4).[12] The share from 2001 to 2003 was even higher—about 15 percent. Prior to 2001, defense spending had been a drag on national economic growth.

Chart 4

DEFENSE SPENDING GROWTH, AS A SHARE OF TOTAL GDP GROWTH, 2001-2006



Note: Growth does not include "other defense expenditures," which would likely raise the contributions of defense in all cases.
* Excluding Missouri
Source: U.S. Department of Defense, U.S. Department of Energy

By contrast, for the district, a much smaller share of its increase in GDP since 2001 has come from defense spending.

Not only has the defense boost to overall economic growth been smaller in the overall Tenth District than in the nation in recent years, but it has also been smaller in all six states whose primary defense activities occur in the district. The boost in Kansas and New Mexico has been near the overall national boost, while defense spending has contributed much less in other district states.

Instead of defense, the district's stronger economic growth in recent years has been driven more by strength in other segments of its economy, including energy and aerospace, as well as a boom in commercial construction. Still, if regional defense spending had grown at the national rate in recent years, the district economy may have outpaced national economic growth by an even wider margin. So why has growth in defense spending lagged recently in the district?

Table 1

SHIFT-SHARE ANALYSIS OF TENTH DISTRICT DEFENSE SPENDING, 2001-2006

Figures are in Millions of dollars

State	Category	2006 Spending	2001-06 Growth	Total Shift	Compositional Effect	Regional Effect
District*	Total Defense Spending	25,623	8,788	-3,985	-2,460	-1,525
	Supply & Equipment Contracts	3,474	2,033	940	561	379
	R&D Contracts	963	-211	-1,102	313	-1,415
	Service Contracts	4,549	2,055	162	672	-510
	Constr/Civil Contracts	870	482	187	135	52
	DOD Grants	177	85	16	-6	23
	Defense Activities of DOE	4,433	1,102	-1,426	-1,458	32
	Active Military Payroll	4,452	1,348	-1,007	-759	-248
	Civilian Payroll	3,389	1,286	-309	-530	221
	Reserve/Natl Guard Payroll	816	492	245	137	109
	Retired Military Payroll	2,500	117	-1,691	-1,524	-167

* Excluding Missouri, due to vast majority of that state's defense spending occurring outside the Tenth District
Source: Departments of Defense and Energy

By contrast, for the district, a much smaller share of its increase in GDP since 2001 has come from defense spending.

Not only has the defense boost to overall economic growth been smaller in the overall Tenth District than in the nation in recent years, but it has also been smaller in all six states whose primary defense activities occur in the district. The boost in Kansas and New Mexico has been near the overall national boost, while defense spending has contributed much less in other district states.

Instead of defense, the district's stronger economic growth in recent years has been driven more by strength in other segments of its economy, including energy and aerospace, as well as a boom in commercial construction. Still, if regional defense spending had grown at the national rate in recent years, the district economy may have outpaced national economic growth by an even wider margin. So why has growth in defense spending lagged recently in the district?

Why has defense spending in the district grown more slowly since 2001?

The district's slower growth in defense spending in recent years could have been due to either a smaller concentration in fast-growing aspects of national defense or to less growth than the nation in specific types of defense spending. A standard method in regional economics for decomposing these two effects is shift-share analysis (see Appendix I for a detailed description of shift-share analysis). Table 1 shows the results of a shift-share analysis of defense spending in the district in recent years, which identifies the causes of the region's slower defense growth (full results by state are available in Appendix II).

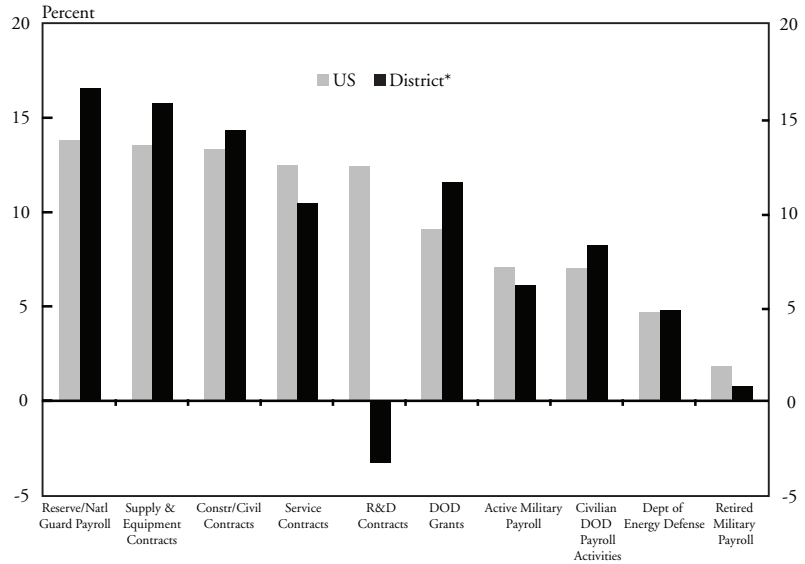
From 2001 to 2006, defense spending in the Tenth District grew by $8.8 billion. However, if defense spending had risen at the same rate as in the nation during this period, the overall district increase would have been $12.8 billion, or 45 percent more than it actually was. This $4 billion "shortfall"—called the total shift in shift-share analysis—can be attributed to either the composition of defense spending in the region or to regional differences in growth rates within types of defense spending.

For the district as a whole, $2.5 billion of the $4 billion shortfall in defense spending since 2001—or 62 percent of the difference—was due to the makeup of defense expenditures in the region, called the compositional effect in shift-share analysis. In other words, if each individual type of defense spending in the region had grown at exactly the rate at which that type of spending grew nationally, the district still would have experienced $2.5 billion less defense spending growth than the nation. Many of the types of defense spending that have grown the fastest nationally since 2001—especially Department of Defense contracts—are not highly concentrated in the district. Likewise, most types of defense activity in which the region is most heavily concentrated—including Department of Energy defense activities and most kinds of Department of Defense payroll spending—have grown more slowly in recent years (Chart 5).[13]

The remaining $1.5 billion of the shortfall in district defense spending since 2001 was due to differences in growth rates between the region and the nation for specific types of expenditures, called the regional effect in shift-share analysis. In other words, even if the district had the same composition of defense spending as in the nation, it still would have experienced $1.5 billion less growth in defense expenditures

Chart 5

ANNUALIZED GROWTH IN DEFENSE SPENDING BY TYPE, 2001-06



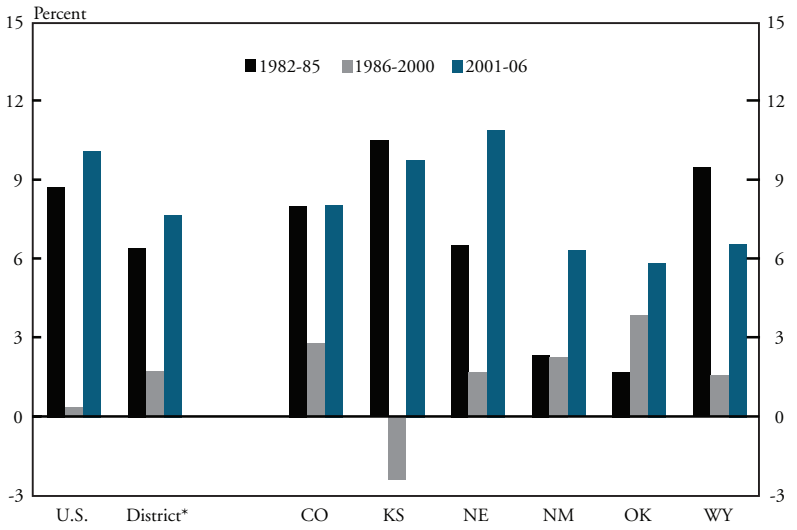
*Excluding Missouri
Source: Department of Energy

because growth in some types of spending was lower than in the nation. The type of defense spending contributing the most to this effect was research and development contracts. R&D defense spending has actually fallen in the district during the recent defense buildup, especially in Colorado, even while more than doubling at the national level. R&D spending has also declined in Nebraska and Oklahoma since 2001 and has risen less than the national average in New Mexico.

This lack of an increase in R&D defense spending in the district during a time of national defense buildup could potentially be an area of concern for the region's defense sector, and perhaps for the regional economy as a whole. R&D is one of the types of defense spending shown to have lasting positive effects on a region's economic growth. The reasons for this weakness in regional R&D defense spending are not clear. However, one recent study found that the types of research and development needed by the U.S. military has shifted in recent years as external threats have become more terrorist group-based, which requires more intelligence-systems technology than weapons-systems

Chart 6

ANNUALIZED GROWTH IN DEPARTMENT OF DEFENSE SPENDING



*Excluding Missouri
Source: U.S. Department of Defense

technology (Trajtenberg). As such, it is possible that R&D contracts may have shifted out of the district because the types of firms capable of producing these new types of technologies could be located in other parts of the country.

How do recent trends compare with previous cycles in defense spending?

Not only has defense spending risen less in the district than in the nation in recent years, but it was also less cyclical in the preceding two decades. Regional defense spending grew less during the last sizable U.S. defense buildup—during the first half of the 1980s—but grew more in the intervening period from 1986 to 2000. This was true, not only for the region as a whole, but also for most states within the district (Chart 6). Were these past differences in defense spending growth also due primarily to the mix of defense spending in the region, or did other factors play a larger role?

Based on the data available, it appears that the mix of defense spending in the district was somewhat less responsible for differences from the nation in the early 1980s than it has been since 2001 (Appen-

dix III).[14] Specifically, only about 25 percent of the slower growth in regional defense spending from 1982 to 1985 can be attributed to the composition of defense spending in the region. That means that 75 percent was due to regional differences in growth rates within types of defense spending. This analysis is consistent with the findings of another study, which attributed regional differences in defense spending during that period largely to political interests (Trubowitz and Roberts).

By contrast, during the long period from 1986 to 2000, the larger increase in the district's defense sector was due largely to the mix of spending in the region. Specifically, 75 percent of the overall difference from the nation during that period can be attributed to the compositional effect in shift-share analysis, while only 25 percent was due to regional differences in growth rates for specific types of spending. Spending on payroll aspects of defense spending increased nationally during this period, while defense contracts declined considerably, especially the supply and equipment contracts that have historically had little presence in the district.

While regional differences in growth rates within types of spending appeared to be a sizable factor in the defense buildup in the Tenth District in the early 1980s, the experiences of the last two decades have been different. Since the mid-1980s, the primary driver of defense expenditures in the region has been its mix of spending and how each type of spending was doing nationally. And throughout this period, defense spending has been less cyclical than in the nation. This relatively high degree of certainty about what drives defense activity in the region is useful in determining the role that the defense sector is likely to play in the regional economy of the future.

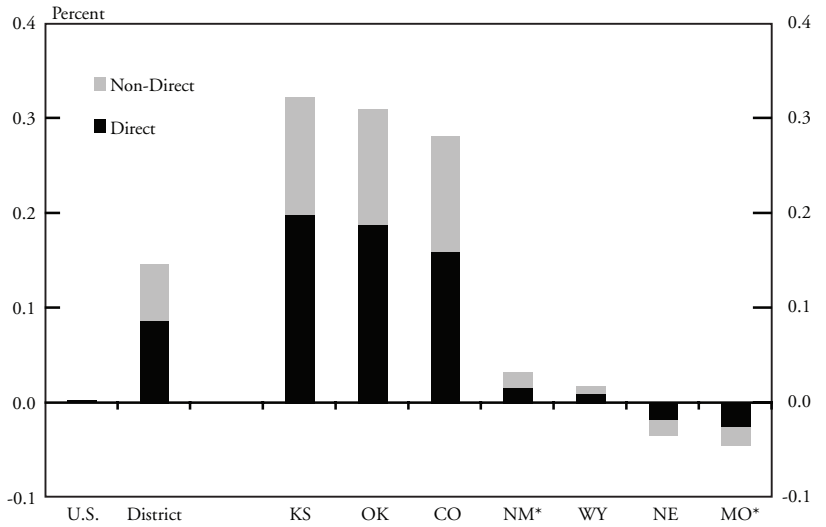
IV. THE FUTURE OF DEFENSE IN THE DISTRICT

National defense is likely to continue to have an important presence in the Tenth District economy in coming years and decades. While forecasting the future size of the sector in the region is somewhat difficult, some insights can be drawn based on current national plans for defense spending. This section looks at the potential impact of military base realignments and other future national defense plans on the district economy.

How will recent base realignment announcements affect the district?

Chart 7

PROJECTED EMPLOYMENT GROWTH FROM 2005 BRAC RECOMMENDATIONS, 2006-2010



*Tenth District only
Source: U.S. Department of Defense

Forecasting one important component of the future of defense spending in the district is fairly straightforward. Every few years since the late 1980s, the Base Realignment and Closure Commission has made recommendations about the future location of military and civilian Department of Defense personnel and bases. The latest round occurred in 2005 and was largely approved by Congress as recommended. These base realignments and closures will be implemented between 2006 and 2010.

The 2005 BRAC round will have little overall effect on the number of Defense personnel at the national level. By contrast, the Tenth District is scheduled to have a net direct gain of more than 11,500 relocated personnel (Appendix IV). In addition, indirect and induced employment gains are expected to be realized as troops arrive, via spillover effects to the local communities.[15] The BRAC commission estimated a net addition of nearly 8,000 such new jobs for district states, bringing the total impact to nearly 20,000 jobs, or 0.15 percent of regional employment (Chart 7).[16] As such, Kansas, Oklahoma, and Colorado are

projected to have fairly sizable employment increases by the time the process is completed in 2010. Specifically, total employment in each of those three states is expected to receive a boost of around 0.3 percent.

Of course, the employment boost in these states will largely occur in specific locations—primarily Colorado Springs, Colorado (Fort Carson); Lawton, Oklahoma (Fort Sill); and Manhattan, Kansas (Fort Riley). While Colorado Springs is a relatively large metropolitan area, with an estimated population of about 600,000 in 2006, the boost to its metro employment by 2010 will still be fairly sizable—about 2.4 percent. Lawton, Oklahoma, is considerably smaller, with a population of around 110,000; and so the boost to that area's employment is projected to be an even-larger 9.1 percent. Manhattan, Kansas, has a similar population as Lawton but will be getting slightly fewer troops. The boost to its employment from the realignment at nearby Fort Riley is projected to be 6.2 percent.

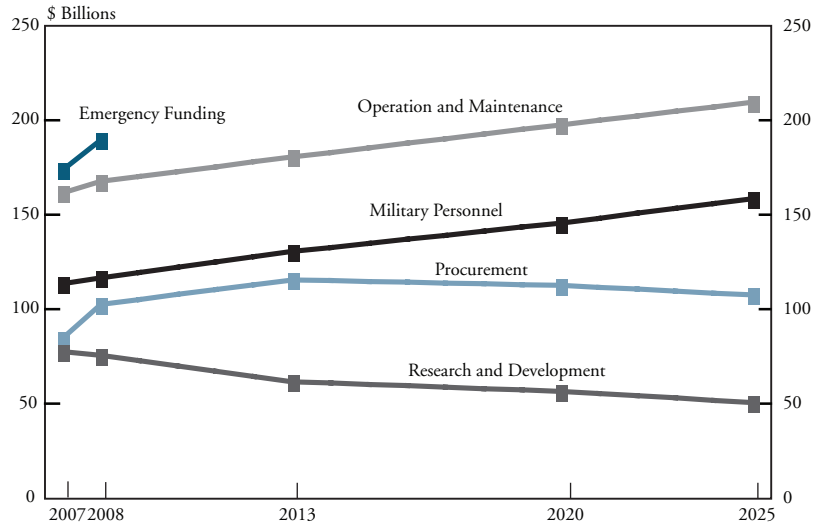
The reasons that these and other specific sites were recommended for expansion by the BRAC Commission may provide further insights into the future of defense spending in the district. For example, one reason forts Riley and Sill were selected was to "take advantage of available infrastructure and training land." Likewise, Fort Carson was chosen in large part because of its "available maneuver training acreage and ranges." In addition, one reason for consolidating some functions formerly stationed at Andrews AFB in Maryland to Tinker AFB in Oklahoma City was to "move federal assets out of the National Capital Region, reducing the nation's vulnerability." Clearly, the district's availability of open land and distance from possible future targets of terrorist attacks were viewed as assets by the BRAC Commission.

How will other future defense spending plans impact the district?

Beyond the relatively certain effects of base realignments on future defense spending, forecasting the future role of defense in the region becomes more difficult. Each year, however, the Congressional Budget Office releases a report on the "Long-Term Implications of Current Defense Plans." In the latest document—released in December 2007—projections of Department of Defense spending, by type, were reported for

Chart 8

PROJECTED U.S. RESOURCES FOR DEFENSE, 2007-2025



Source: Congressional Budget Office

2008, 2013, 2020, and 2025. Combining this information with knowledge of the structure of defense spending in the district allows for some insights into the possible future of the defense sector in the region.

General results of the CBO report showed that current plans call for the maintenance of higher levels of real national defense spending than "have occurred since the mid-1980s." Besides the ongoing military actions in Iraq and Afghanistan, the CBO cited four primary factors that were likely to keep defense spending at a relatively high level over the long term. These included: plans to purchase new military equipment; plans to develop enhanced advanced weapons systems; expected increases in personnel pay and benefits; and increasing costs to maintain aging equipment and new complex equipment.

As in the past, not all types of U.S. defense spending are expected to grow at similar rates heading forward. In 2008, sizable increases are budgeted for operation and maintenance expenditures and, especially, for supply and equipment procurement (Chart 8). In addition, "Additional Supplemental and Emergency Funding" is budgeted to increase from $173 billion to $189 billion. Spending on military personnel is

also projected to grow moderately in 2008, while research and development spending is expected to fall slightly. On balance, these near-term plans—calling for a sizable boost in procurement in particular—suggest that defense spending will likely continue to grow slightly faster outside the Tenth District over the next year, given the region's much smaller presence in defense contracting.

Longer-term projections differ somewhat from the 2008 plans. Over the intermediate term—through 2013—fairly similar trends as in 2008 hold true, although the rapid growth in procurement is expected to slow. Longer-term projections through 2020 and 2025, however, suggest that only spending on military personnel and on operation and maintenance are expected to grow. A recent special report in *The Economist* (2007) also suggests that future spending on defense is likely to focus more on manpower than equipment and technology, given the nature of fighting terrorism as opposed to nation-states. Manpower aspects of defense spending, of course, are those that are most heavily concentrated in the Tenth District, suggesting that defense is likely to remain relatively sizable in the region heading forward—at least based on these current long-term defense plans.

Not included in the CBO's analysis are expectations for growth in the defense-related activities of the Department of Energy. However, the DOE's budget appropriations for FY2008 and request for FY2009 can provide some near-term insights. In 2008, defense-related DOE spending was cut by about 6 percent, while the 2009 budget request was for a 6 percent increase. So overall, very little change in this type of defense spending is anticipated in the near term. The vast majority of DOE defense activity in the Tenth District occurs in New Mexico, of course, where spending from 2007 to 2009 is expected to be generally flat, despite some expected layoffs at Los Alamos.

V. SUMMARY AND CONCLUSIONS

National defense has long played a sizable role in the Tenth District economy, and most states in the region continue to have a larger defense presence than the country as a whole. Yet, the defense sector has grown less in the region than in the nation in the defense buildup that began in 2001. As such, the region's economy has received less of a defense

boost than the national economy. This is primarily because of the types of spending that occur in the region—more personnel and base-related activity, which have grown moderately across the country, and less defense contracting, which has grown rapidly. Another factor, however, is that the region has received far fewer R&D contracts in recent years than would be expected.

The experience of the last 25 years suggests that the defense sector is much less cyclical in general in the Tenth District than in the nation. Defense spending tends to rise less in the district than in the nation during massive national defense buildups—such as during the early 1980s and since 2001—but also to fall less during other periods. As a result, the defense sector could potentially have a more stabilizing effect and provide fewer shocks to the region's economy than in some other parts of the country.[17]

In the years and decades ahead, defense activity is likely to become increasingly concentrated in the Tenth District, providing an overall boost to regional economic activity. The region stands to benefit from the latest round of military base realignments, due in part to its general availability of land and relative remoteness. The district is also concentrated in those types of defense spending areas expected to grow fastest in the longer run—personnel and operations. However, the region's sizable presence in these aspects of defense spending may have some downsides as well. Past economic studies have found personnel and operations spending to have less impact on boosting regional income growth in the long run than other types of defense spending.

APPENDIX I

SHIFT-SHARE ANALYSIS

Shift-share analysis is a standard method in regional economics for analyzing differences over time in subnational (i.e., local, state, or regional) growth rates from national growth rates. It is most often used for determining the sources of differences in local employment growth from national job growth, but it can also be used to decompose the reasons for state or regional differences in the growth of other economic indicators—such as defense spending.

The *total shift* component of a shift-share analysis on regional defense spending reveals the difference between actual growth in regional defense spending and what growth would have occurred if overall defense spending had grown at the same rate as in the nation. The total shift can then be broken down into a compositional effect and a regional effect.

The *compositional effect* (sometimes also called the structural effect or mix effect) reveals how much of this total shift can be attributed to the types of defense spending that occur within a region—which can often differ substantially from the national breakdown. That is, it shows how much more, or less, regional defense spending would have grown than in the nation if each specific type of defense spending had grown at the national rate.

Then the *regional effect* (sometimes called the local effect or competitive effect) of shift-share analysis reveals whether defense spending is shifting toward or away from an area for reasons other than the original composition of spending. That is, it shows which types of regional defense spending grew more or less than would be expected given how that type of spending grew at the national level. For defense spending, this effect could capture things such as political choices about the awarding of defense contracts or placement of troops, differences in bids for defense contracts across areas, or other purely idiosyncratic effects.

Mathematically, a shift-share analysis can be described by:

$$\text{Total shift} = d^{t+y} - d^{t}\left[\frac{D^{t+y}}{D^{t}}\right]$$

$$\text{Compositional effect} = \sum_{i=1}^{n} d_i^t \left[\frac{D_i^{t+y}}{D_i^t} - \frac{D^{t+y}}{D^t} \right]$$

$$\text{Regional effect} = \sum_{i=1}^{n} d_i^t \left[\frac{d_i^{t+y}}{d_i^t} - \frac{D_i^{t+y}}{D_i^t} \right],$$

where overall spending in the region of interest is d, and that in the i^{th} activity is d_i; overall spending is the nation is D, and that in the i^{th} activity is D_i; and the change in spending from time t to time $t+y$ is being analyzed.

APPENDIX II

SHIFT-SHARE ANALYSES OF DEFENSE SPENDING IN TENTH DISTRICT STATES, 2001-2006

Millions of dollars						
State	Category	2006 Spending	2001-06 Growth	Total Shift	Composi-tional Effect	Regional Effect
Colorado	Total Defense Spending	7,966	2,622	-1,432	-561	-872
	Supply & Equipment Contracts	1,344	1,049	825	115	710
	R&D Contracts	527	-395	-1,095	246	-1,341
	Service Contracts	1,932	1,057	393	236	157
	Constr/Civil Contracts	323	203	111	41	70
	DOD Grants	46	17	-5	-2	-3
	Defense Activities of DOE	583	-123	-658	-309	-350
	Active Payroll	1,386	425	-303	-235	-68
	Civilian Payroll	704	239	-113	-117	4
	Reserve/Natl Guard Payroll	120	40	-21	34	-55
	Retired Military Payroll	1,000	110	-565	-569	4
Kansas	Total Defense Spending	3,578	1,534	-17	-55	38
	Supply & Equipment Contracts	881	348	-56	207	-263
	R&D Contracts	75	46	24	8	16
	Service Contracts	493	234	38	70	-31
	Constr/Civil Contracts	256	186	133	24	109
	DOD Grants	46	28	15	-1	16
	Defense Activities of DOE	0	0	0	0	0
	Active Payroll	890	358	-46	-130	84
	Civilian Payroll	373	156	-9	-55	46
	Reserve/Natl Guard Payroll	201	135	84	28	56
	Retired Military Payroll	363	43	-200	-205	5
Missouri	Total Defense Spending	12,214	5,788	912	1,028	-116
	Supply & Equipment Contracts	4,984	1,536	-1,080	1,341	-2,421
	R&D Contracts	3,451	2,884	2,454	151	2,302
	Service Contracts	753	391	117	98	19
	Constr/Civil Contracts	205	74	-25	51	-77

	DOD Grants	46	34	26	-1	26
	Defense Activities of DOE	343	39	-191	-133	-58
	Active Payroll	724	200	-198	-128	-70
	Civilian Payroll	552	162	-134	-98	-36
	Reserve/Natl Guard Payroll	583	406	271	75	197
	Retired Military Payroll	574	61	-327	-328	0
Nebraska	Total Defense Spending	1,690	783	95	-151	246
	Supply & Equipment Contracts	261	202	157	23	134
	R&D Contracts	24	-5	-28	8	-35
	Service Contracts	342	208	107	36	71
	Constr/Civil Contracts	91	75	63	6	57
	DOD Grants	11	2	-5	-1	-5
	Defense Activities of DOE	0	0	0	0	0
	Active Payroll	371	104	-98	-65	-33
	Civilian Payroll	239	99	-7	-35	29
	Reserve/Natl Guard Payroll	108	70	42	16	27
	Retired Military Payroll	244	28	-137	-138	2
New Mexico	Total Defense Spending	6,420	2,018	-1,323	-1,355	32
	Supply & Equipment Contracts	208	90	1	46	-45
	R&D Contracts	309	148	27	43	-16
	Service Contracts	455	152	-77	82	-159
	Constr/Civil Contracts	103	29	-26	26	-53
	DOD Grants	30	13	0	-1	1
	Defense Activities of DOE	3,851	1,225	-767	-1,149	381
	Active Payroll	505	136	-145	-90	-54
	Civilian Payroll	483	155	-95	-83	-12
	Reserve/Natl Guard Payroll	73	42	18	13	5
	Retired Military Payroll	405	28	-259	-241	-17
Oklahoma	Total Defense Spending	5,362	1,552	-1,339	-302	-1,037
	Supply & Equipment Contracts	671	289	-1	149	-150
	R&D Contracts	26	-6	-31	9	-39
	Service Contracts	1,279	398	-271	238	-509
	Constr/Civil Contracts	93	-12	-91	37	-127

	DOD Grants	33	15	1	-1	2
	Defense Activities of DOE	0	0	0	0	0
	Active Payroll	1,160	291	-368	-213	-156
	Civilian Payroll	1,402	484	-213	-231	19
	Reserve/Natl Guard Payroll	153	61	-9	39	-48
	Retired Military Payroll	544	33	-356	-327	-28
Wyoming	Total Defense Spending	480	153	-96	-37	-59
	Supply & Equipment Contracts	108	55	14	21	-6
	R&D Contracts	1	1	1	0	1
	Service Contracts	48	5	-28	12	-39
	Constr/Civil Contracts	4	0	-3	1	-4
	DOD Grants	12	11	10	0	11
	Defense Activities of DOE	0	0	0	0	0
	Active Payroll	140	34	-47	-26	-21
	Civilian Payroll	56	21	-6	-9	3
	Reserve/Natl Guard Payroll	31	13	0	7	-7
	Retired Military Payroll	79	12	-39	-43	4

Sources: Departments of Defense and Energy

APPENDIX III

SHIFT-SHARE ANALYSES OF TENTH DISTRICT DEFENSE SPENDING PRIOR TO 2001

Millions of dollars						
1986-2000		**2000 Spending**	**1986-2000 Growth**	**Total Shift**	**Composi-tional Effect**	**Regional Effect**
State	**Category**					
District*	Total Defense Spending**	13,412	3,035	2,522	1,882	639
	Supply & Equipment Contracts	1,441	-609	-710	-884	174
	R&D Contracts	1,174	205	157	-31	188
	Service Contracts	2,495	847	766	1,038	-272
	Constr/Civil Contracts	388	-61	-83	79	-162
	DOD Grants	n/a	n/a	n/a	n/a	n/a
	Defense Activities of DOE	n/a	n/a	n/a	n/a	n/a
	Active Payroll	3,104	815	701	428	273
	Civilian Payroll	2,103	656	585	227	358
	Reserve/Natl Guard Payroll	325	23	8	10	-3
	Retired Military Payroll	2,383	1,159	1,098	1,015	84
1982-85		1985 Spending	1982-85 Growth	Total Shift	Composi-tional Effect	Regional Effect
State	Category					
District*	Total Defense Spending**	10,377	1,771	-692	-172	-520
	Supply & Equipment Contracts	2,050	125	-427	142	-569
	R&D Contracts	969	150	-85	-13	-72
	Service Contracts	1,647	798	555	60	495
	Constr/Civil Contracts	449	242	182	116	66
	DOD Grants	n/a	n/a	n/a	n/a	n/a
	Defense Activities of DOE	n/a	n/a	n/a	n/a	n/a
	Active Payroll	2,289	216	-377	-273	-104
	Civilian Payroll	1,447	-16	-435	-198	-237
	Reserve/Natl Guard Payroll	302	51	-21	46	-66
	Retired Military Payroll	1,224	206	-86	-53	-33

*Excluding Missouri, due to vast majority of that state's defense spending occurring outside the Tenth District
**Excluding grants and defense activities of the DOE, for which detailed data were not available
Source: Departments of Defense and Energy

APPENDIX IV

TENTH DISTRICT BRAC 2005 IMPACTS

State	Institution	Direct Job Gain/Loss	Nondirect Job Gain/ Loss	Total Job Gain/ Loss
Colorado	Leased Space	(11)	(11)	(22)
	Buckley AFB	94	78	172
	Fort Carson	4,377	3,310	7,687
	Peterson AFB	510	375	885
	Schriever AFB	95	85	180
	Air Reserve Personnel Center	(108)	(54)	(162)
	US Air Force Academy	(40)	(32)	(72)
	Total	4,917	3,751	8,668
Kansas	Kansas Army Ammunition Plant	(167)	(109)	(276)
	Forbes Field Air Guard Station	247	169	416
	Fort Leavenworth	203	131	334
	Fort Riley	2,855	1,818	4,673
	McConnell AFB	522	308	830
	U.S. Army Reserve Center Wichita	(78)	(76)	(154)
	Total	3,582	2,241	5,823
Missouri*	Defense Finance & Acctg Service, Kansas City	(613)	(549)	(1,162)
	Marine Corps Support Center, Kansas City	(333)	(250)	(583)
	Navy Recruiting District Headquarters, Kansas City	(33)	(23)	(56)
	Rosecrans Memorial Airport Air Guard Station	35	23	58
	Whiteman AFB	61	49	110
	Total	(883)	(750)	(1,633)
Nebraska	Army Natl. Guard Reserve Center, Columbus	(31)	(16)	(47)
	Army Natl. Guard Reserve Center, Grand Island	(31)	(16)	(47)
	Army Natl. Guard Reserve Center, Kearney	(8)	(4)	(12)
	Naval Recruiting District Headquarters, Omaha	(32)	(28)	(60)
	Navy Reserve Center, Lincoln	(7)	(3)	(10)
	Offutt AFB	(104)	(130)	(234)
	Total	(213)	(197)	(410)
New Mexico*	Jenkins Armed Forces Reserve Center, Albq.	(36)	(29)	(65)
	Kirtland AFB	206	206	412
	Total	170	177	347

Oklahoma	Armed Forces Reserve Center, Broken Arrow	6	2	8
	Armed Forces Reserve Center, Muskogee	(16)	(9)	(25)
	Army Natl. Guard Reserve Center, Tishomingo	(30)	(16)	(46)
	Krowse U.S. Army Reserve Center, OKC	(84)	(78)	(162)
	Navy-Marine Corps Reserve Center, Tulsa	(32)	(11)	(43)
	Oklahoma City (95th)	(53)	(55)	(108)
	Fort Sill	3,602	2,129	5,731
	Tinker AFB	355	450	805
	Tulsa Intnl. Airport Air Guard Station	103	83	186
	Vance AFB	99	94	193
	Altus AFB	(16)	(10)	(26)
	Will Rogers World Airport Air Guard Station	(15)	(49)	(64)
	Total	3,919	2,530	6,449
Wyoming	Army Aviation Support Facility, Cheyenne	(23)	(10)	(33)
	Army Natl. Guard Reserve Center, Thermopolis	(19)	(10)	(29)
	Cheyenne Airport Air Guard Station	79	48	127
	Total	37	28	65
	Total District Impact	11,529	7,780	19,309

*Tenth District portion only

ENDNOTES

[1]The phrase "guns versus butter" is believed to have originated from press reports about the passage of the U.S. National Defense Act of 1916 that directed "the Secretary of Agriculture to manufacture nitrates for fertilizers in peace and munitions in war at water power sites designated by the President." The phrase was most prominently used in relation to the World War II-era German and Cold War-era Soviet governments as a way to compare choices on defense spending made by those governments relative to other governments.

[2]The Tenth Federal Reserve District includes the entire states of Colorado, Kansas, Nebraska, Oklahoma, and Wyoming, plus the northern half of New Mexico and western third of Missouri.

[3]Annual regional defense statistics, and their national comparisons, are typically for fiscal years rather than calendar years.

[4]Over 90 percent of the defense contracts in Missouri, which make up a disproportionately large amount of its total defense spending, go to The Boeing Company—formerly McDonnell-Douglas—located in St. Louis. In addition, Missouri's largest military base, Fort Leonard Wood, as well as three-quarters of the state's defense personnel, are also located outside of the Tenth District. By contrast, defense expenditures in New Mexico, only half of which is located within the Tenth District, overwhelmingly occur within the district portion of that state, and so it is included in the analysis.

[5]The estimates for "other defense expenditures" shown in Chart 2, which includes personnel benefits, depreciation expense, and investment in bases, are simply a multiplier of payroll spending in each area, based on the ratio of these other defense expenditures to payroll at the national level. Historically at the national level, payroll expenditures and these other defense expenditures have moved quite closely together, especially over the past decade.

[6]All military deployed overseas (shore-based) are included in the statistics for their parent installation. As of September 2005, all non-shore-based (afloat) personnel were included in the strength counts of their homeport locations. Prior to this date, all afloat service members were included in payroll data but not in the personnel count. This change affects areas with significant concentrations of Navy/Marine Corps military personnel, and thus does not have a large impact on the Tenth District.

[7]Defense contract data by state are for primary contracts only. Subcontracting may occur—and often does—in states other than where the primary contract was awarded.

[8]All reserves and National Guard personnel called to active duty are included in the statistics for the parent installation as national guard/reserves, as opposed to active military.

[9]Less important, but still considered, are the potential costs and savings, the economic impact on local communities, the community support infrastructure,

and the environmental impact, according to the Base Realignment and Closure statute of 2005.

[10]Metropolitan statistical areas account for about two-thirds of Tenth District population, compared to more than 80 percent in the nation as a whole.

[11]From this point on in the article, "defense spending" is taken to mean only those categories of spending for which data are available at the state level, that is, Department of Defense payroll and contracts, plus the defense-related spending of the Department of Energy. At the national level, these categories of spending accounted for 70 percent of total defense spending in 2006.

[12]These figures do not include "other defense expenditures," which would boost the contribution of defense even higher.

[13]The primary exception to this general trend was spending on Reserve and National Guard personnel, which has grown the fastest of all types of defense spending in recent years and is heavily concentrated in the district, so it actually has provided a regional boost to defense spending. A recent study by the Congressional Budget Office, though, estimated that both small and large businesses that employ reservists as key employees can be negatively impacted financially by call-ups, as can the individuals themselves, though the vast majority of U.S. business establishments are unaffected (CBO 2005).

[14]A detailed shift-share analysis of the defense buildup of the early 1980s is somewhat more difficult to conduct than analyses of more recent periods. Data for some types of defense spending are not available for that period, specifically for Defense Department grants and the defense-related activities of the Department of Energy. Moreover, detailed spending data at the state level are not available prior to 1982.

[15]The BRAC nondirect impacts are measured by the sum of estimated indirect and induced job changes in the community associated with the change in Total Direct Jobs. Indirect job changes are the net addition or loss of local nongovernment jobs supporting installation material, service, and infrastructure needs, such as a local motor pool parts distributors or base operations support (BOS) contractors. Induced job changes are the net addition or loss of local nongovernment jobs in industries that provide goods or services to the households of direct or indirect installation employees. Examples include local grocery stores, retail stores, and restaurants.

[16]In this case, the "Tenth District" refers to areas within its actual boundaries, including western Missouri and northern New Mexico.

[17]This is particularly the case since the "other expenditures" component of defense spending, for which there are no data available at the state level, consists mainly of personnel and base-related functions. As such, if these expenditures were included, the district's defense sector would likely appear even less cyclical.

REFERENCES

Aizenman, Joshua, and Reuven Glick. 2003. "Military Expenditure, Threats, and Growth," Federal Reserve Bank of San Francisco Working Paper No. 2003-08, March.

Atesoglu, H. Sonmez. 2004. "Defense spending and investment in the United States," *Journal of Post Keynesian Economics*, vol. 27, no. 1, pp. 163-69

Atesoglu, H. Sonmez. 2006. "Economic consequences of a rise in defense spending after September 11, 2001," *Journal of Post Keynesian Economics*, vol. 27, no. 1, pp. 163-69.

Baker, Dean. 2007. "The Economic Impact of the Iraq War and Higher Military Spending," Center for Economic and Policy Research, May.

Base Realignment and Closure Commission. 2005. *Appendix Q: Text of Defense Base Closure and Realignment Commission Final and Approved Recommendations.*

Bhattacharya, Radha. 2003. "Sources of variation in regional economies," *The Annals of Regional Science,* vol. 37, pp. 291-302.

Bilmes, Linda, and Joseph Stiglitz. 2006. "The Economic Costs of the Iraq War: An Appraisal Three Years after the Beginning of the Conflict," National Bureau of Economic Research Working Paper No. 12054, February.

"Brains, not bullets," *The Economist*, October 25, 2007 issue.

Congressional Budget Office. 2005. *The Effects of Reserve Call-Ups on Civilian Employers.*

Congressional Budget Office. 2007. *The Long-Term Implications of Current Defense Plans: Summary Update for Fiscal Year 2008.*

Cuaresma, Jesus C., and Gerhard Reitschuler. 2006. "Guns or Butter? Revisited: Robustness and Nonlinearity Issues in the Defense-Growth Nexus," *Scottish Journal of Political Economy*, vol. 53, no. 4, pp. 523-41.

Hooker, Mark A., and Michael M. Knetter. 1997. "The Effects of Military Spending on Economic Activity: Evidence from State Procurement Spending," *Journal of Money, Credit, and Banking*, vol. 29, no. 3, pp. 400-21.

Landau, Daniel. 1996. "Is One of the 'Peace Dividends' Negative? Military Expenditure and Economic Growth in the Wealthy OECD Countries," *The Quarterly Review of Economics and Finance*, vol. 36, no. 2, pp.183-95.

Mehay, Stephen L., and Loren M. Solnick. 1990. "Defense Spending and State Economic Growth," *Journal of Regional Science*, vol. 30, no. 4, pp. 477-87.

Mintz, Alex, and Chi Huang. 1990. "Defense Expenditures, Economic Growth, and the 'Peace Dividend'," *The American Political Science Review*, vol. 84, no. 4, pp. 1283-93.

Ram, Rati. 1995. "Defense Expenditure and Economic Growth," *Handbook of Defense Economics*, vol.1, pp. 251-73.

Tobin, James. 2002. "Macroeconomic Strategy in Wartime," Cowles Foundation Discussion Paper No. 1357, March.

Trajtenberg, Manuel. 2003. "Defense R&D Policy in the Anti-Terrorist Era," National Bureau of Economic Research Working Paper No. 9725, May.

Trubowitz, Peter, and Brian E. Roberts. 1992. "Regional Interests and the Reagan Military Buildup," *Regional Studies*, v. 26, issue 6, pp. 555-67.

United States Department of Defense. 2005. *Base Closure and Realignment Report*, vol. I, parts 1-2.

Weideman, Paul. 2004. "A Short History of Los Alamos," Retrieved March 31, 2008, from *Santa Fe New Mexican*, website: http://www.freenewmexican.com/artsfeatures/102.html.