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The Regional Economic Effects of Military Base Realignments and Closures in Germany

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Alfredo R. Paloyo, Colin Vance, and Matthias Vorell[1]

The Regional Economic Effects of Military Base Realignments and Closures in Germany

Abstract

Within the context of the current political discussion over base realignments and closures (BRACs) in Germany, this study provides policy guidance by examining the economic consequences to the surrounding community. We identify the causal effect of a reduction in military personnel on a number of socioeconomic indicators within the peripheries of military bases. The BRACs within the German armed forces is used an exogenous source of variation that allows for the estimation of the causal effect of a particular demand shock on household income, output, unemployment, and tax revenue within a specified buffer zone around each base. The analysis covers 298 communities for the period 2003–2007. Consistent with evidence found elsewhere, we find that these base adjustments have only a marginal impact on the local community in which the bases are located.

JEL Classification: H56, K42, R19

Keywords: Geographic information system; armed forces; regional adjustment

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1 Alfredo R. Paloyo, Ruhr Graduate School in Economics (RGS Econ), Ruhr-Universität Bochum (RUB), and RWI; Colin Vance, RWI and Jacobs Univeristy Bremen; Matthias Vorell, RWI. *– For their contributions to the improvement of this paper, we thank Thomas K. Bauer, Christoph M. Schmidt, and participants at the Scottish Economic Society Annual Conference 2009, the RGSWorkshop at RWI, and the RGS Doctoral Conference 2010 (in particular, Karol Jan Borowiecki). All remaining shortcomings are the authors' responsibility. A.R. Paloyo gratefully acknowledges the financial support provided by the RGS Econ.* *– All correspondence to Alfredo R. Paloyo, Ruhr Graduate School in Economics, Hohenzollernstr. 1–3, 45128 Essen, Germany, e-mail: alfredo.paloyo@rwi-essen.de.*

1 Introduction

The changing geopolitical constellation at the end of the Cold War and the increasing threat from international terrorist organizations necessitated the re-evaluation of many countries' national defense strategy. For many of the prominent military powers, the threat of a border invasion has been replaced by threats from overseas for which the Cold War-era deployment strategies are ill-suited. In recent years, the emphasis has shifted away from large bases within a country towards small and mobile strike forces capable of conducting "expeditionary warfare", i.e., the ability to maintain a theater of military operations abroad, either for peacekeeping purposes or otherwise. This was one of the explicit objectives of the reform of the armed forces in countries such as the UK, France, and Germany.

As a result of the change in the nature of the threat to domestic security as well as fiscal considerations, massive realignments of military personnel and comprehensive programs of base closures and conversions or reuse were implemented in many countries. Up until the First Persian Gulf War in 1991, US budgetary allocations for defense and military spending was shrinking as a share of the total budget. Sweden experienced a substantial reduction in the size of its armed forces during the 1990s, with many of its bases shut down. Canadian Forces dropped from around 90,000 in the 1980s to its current level of around 65,000. In 1993, the UK had 274,800 active personnel; by 2006, it was down to 195,900. France and Germany are in the process of shutting down redundant bases. The drawdown in military personnel and the closure of non-essential military bases are occurring in many other countries as well.

These developments are a concern of public policy to the extent that these bases may positively contribute to the local economy in which they are situated. While bases are typically founded on strategic motives, civilian economic activity has nevertheless tended to flourish in its periphery [Andersson, Lundberg and Sjöström 2007]. For example, the maintenance of the military base is associated with at least some demand for local goods. Bases also contribute to tax-revenue generation within local communities. As Hooker and Knetter [2001] point out, the presence of a military base contributes directly to military and civilian employment in the area, the latter through support jobs catering to the maintenance and operation of a military base. In base locations that are somewhat isolated, the base may be the only major source of employment [Andersson, Lundberg and Sjöström 2007]. The base also necessitates an improvement in the surrounding infrastructure for the obvious purpose of accessibility. In countries with compulsory military service, such as in Germany, which we examine here, draftees often travel to and from the base on weekends. A closure would naturally affect the local and regional transportation infratructure. In practical terms, the base could be considered as a form of regional subsidy from the federal government to the local community. A base closure may therefore be construed as a negative demand shock, which could ultimately translate to a worsening of socioeconomic indicators, such as household income, regional output, and unemployment.

The magnitude of such an effect, of course, depends on many factors, not the least of which is the degree of integration of the base with the local economy.

There are both direct and indirect effects induced by a base closure. The obvious direct effect is the immediate loss of employment for those who work on or in support of the military base. The (off-base) indirect effects include "altered patterns of industry and worker expenditures on local inputs and outputs" [Poppert and Herzog Jr. 2003]. Local governments also respond to the base closure by converting and re-using the base for civilian purposes. This poses some difficulties for bases that were set up in regions that are sparsely populated and isolated. In the US, for example, a base in the middle of the desert may not be easily converted for civilian use [Brauer and Marlin 1992]. Note further that a subsidy artificially changes the relative prices of inputs (and, by implication, outputs) in a regional economy. Labor, for example, is cheaper when using conscripts as opposed to relying on volunteers. A base closure could therefore result in a reallocation of resources to more productive uses, which could have a positive effect on some economic outcomes.

A few case studies look at the impact of base closures in the US (e.g., Dardia et al. [1996], Hill [2000], Soden, Schauer and Conary [2005], and Thanner and Segal [2008]). While informative and quite important in their own right, evidence obtained from this line of research can hardly be generalizable by design. An indication of this is the varied conclusions that these studies have reached. While a few found substantial negative impacts of the base closures, others have indicated that the local communities have been quick to adapt to the change in economic landscape. That there are varying impacts imply that we cannot simply set aside these case studies for lack of generalizability. On the other hand, econometrics-based research such as Krizan [1998], Hooker and Knetter [2001], and Poppert and Herzog Jr. [2003] for the US and Andersson, Lundberg and Sjöström [2007] for Sweden have been quite unambiguous in their findings: that the base closures had either no significant regional impact or a small impact that quickly vanishes over time.

This paper contributes to the literature by examining the causal impact of base realignments and closures (BRACs) in Germany. We do so in at least three important ways. First, while studies for the US are numerous, it is not straightforward that the findings across the Atlantic will necessarily apply in Germany, where military deployment is characteristically different from its American counterpart (e.g., German military installations are substantially smaller than bases in the US or American bases in Germany). Second, the implementation of BRACs in Germany is programmed to span 2003–2011, and now is a good opportunity to provide an interim evaluation of the impact of such a program. Third, many other countries are going through a phase of BRACs or at least are considering it. The results obtained in this study can be useful in guiding policymakers in those countries for which the economy and original military deployment is similar to that of Germany. It could also be useful for those countries intending to follow the German model of military deployment.

We also improve on the previous studies in a number of ways. First, the process of BRACs in Germany is less politicized than in the US, from where most of the existing studies originate. The study therefore does not suffer from the typical endogeneity bias that would have otherwise prevailed had the BRACs been associated with unobservable variables that are also correlated with our explanatory variables. For example, the degree of political resistance to a closure decision might be related to the economic situation in a particular area. A depressed area that relies solely on a military base for employment and income might offer stiff resistance to any planned closure of a base. If some planned closures were not carried out because of the potential political fallout, this would make getting an unbiased estimate of the effect of base closures extremely difficult if not impossible given the available data.

The US program for BRACs was controversial and mired with political overtones. Therefore, authors looking at the effects of the military drawdown in the US must contend with the fact that the sample of bases that were closed is selected [Hooker and Knetter 2001]: perhaps those bases that were successfully closed belong precisely to those communities that could quickly adapt to such a change in the local political and economic landscape. Conversely, those communities that could potentially suffer the most from a base closure mounted a successful opposition against a threat of closure. In Germany, the BRAC program was met with little or no resistance. The decision on which bases to close or shrink was entirely based on military considerations as opposed to socioeconomic ones. As a result, most base closures and reductions went as scheduled.

Another improvement is that we derive our results by estimating our econometric models based on buffer zones around the bases generated by geographic information system (GIS) software. This overcomes the problems related to the arbitrariness of politically delineated territories. For example, the closure of a base located at the border of a particular municipality cannot be expected to have the same impact 30 km away on the opposite side of the same municipality as its impact on a neighboring municipality 5 km away.

Overall, the results indicate that the military drawdown in Germany, as captured by the BRAC program adopted by the Ministry of Defense, has had no significant impact on the economic development of the communities around the base as measured by household income, regional output, the unemployment rate, and revenues from the value-added tax (VAT) and income tax. This provides a useful insight for policymakers considering a future reduction of military forces. The so-called "peace dividend"—the economic benefits arising from times of peace—may be usefully spent elsewhere rather than ameliorating the non-existent negative impacts of base closures.

2 The Federal Armed Forces of Germany

The Cold War facilitated the entry of what was then West Germany into the North Atlantic Treaty Organization (NATO), which allowed the Federal Republic to rearm itself after World War II. At the height of the Cold War, West Germany's Federal Armed Forces (*Bundeswehr*) had 495,000 military and 170,000 civilian personnel. The *Bundeswehr* is similar to most other armed forces around the world. Its strike forces consists of five branches: Army, Navy, Air Force, Joint Support Service, and Central Medical Service.[1] Excluding the reinforcement reserves, it has a current strength of about 258,000 military personnel, of which 200,500 are professional soldiers, 55,000 are conscripts, and 2,500 are active reservists. Those who are not on foreign missions are distributed domestically to about 500 active military bases located all over Germany.

The end of the Cold War, the fall of the Berlin Wall, and the increasing involvement of Germany in other multinational missions (notably for the United Nations) prompted a reconsideration of the deployment of military personnel. In response to the new defense landscape, as well as the desire to reduce defense expenditures, Germany recently embarked on a rationalization plan for the *Bundeswehr*. In 2001, the Federal Ministry of Defense adopted the Departmental Deployment Concept (*Ressortkonzept Stationierung*), which outlined these changes. This included an 18-percent drawdown of core military personnel from 353,577 to 290,175 and a closure of 187 bases from 575 to 388. This also included a shrinkage of 177 bases, though 90 bases had a planned increase in personnel. These changes are to be implemented in the period 2003–2011.

In a related development, the new Defense Policy Guidelines (*Verteidigungspolitische Richtlinien*) adopted by the German Parliament in 2003 changed the primary tasks of the *Bundeswehr* into international conflict prevention and crisis management. In practical terms, the *Bundeswehr* was transformed from being a territorial defense force into a rapidly and internationally deployable intervention force.[2] The rise of international terrorist organizations and greater integration in Europe have made an invasion of Germany by its neighbors an unlikely event. Instead, Germany faces military commitments from as far away as Afghanistan, where it is part of the NATO-led International Security Assistance Force (ISAF) established by the United Nations Security Council. Germany is the third-largest contributor of military personnel to the ISAF, next to the US and the UK. Aside from the ISAF, it has active participation in Kosovo, Bosnia and Herzegovina, and Sudan. Sea-based missions include those over the Indian Ocean (Horn of Africa) and at the coast of Lebanon.

[1] In German, *Heer*, *Marine*, *Luftwaffe*, *Streitkräftebasis*, and *Zentraler Sanitätsdienst*, respectively. Other components of the *Bundeswehr* include *Territoriale Wehrverwaltung*, *Rüstungsbereich*, *Rechtspflege*, and *Militärseelsorge*. However, these branches have a civilian scope.

[2] "Defense starts at the Hindu Kush" ("*Verteidigung beginnt am Hindukusch*"), Peter Struck, Federal Ministry of Defense, May 21, 2003. The former minister of defense also says, "[The idea] that our country needs to be defended against an attack from the air, [or against] a ground attack across our borders—this scenario is not realistic anymore. The *Bundeswehr* must come to terms with that. The *Bundeswehr* will take on new tasks. Its job will be redefined." [Radio Free Europe 23 May 2003]

3 Data description

The socioeconomic variables are drawn from the federal and state statistical offices of Germany [Statistische Ämter des Bundes und der Länder 2008]. The data are recorded at the NUTS 3 level (*Kreise* and *kreisfreie Städte*, an administrative zone having an average size of 814 sq. km. As of 2007, there are a total of 429 *Kreise* in Germany. The data on military bases, closures, and core personnel were taken from the Deployment Concept of the Federal Armed Forces of Germany 2004 (*Stationierungskonzept der Bundeswehr 2004*) [Bundesministerium der Verteidigung 2004]. This includes a variable that spatially situates the base at the *Gemeinde* level (LAU 2, formerly NUTS 5), a subunit of the *Kreis* whose average size is 65 sq. km. The boundaries of the *Kreise* and *Gemeinde* do not cross so that each *Gemeinde* is associated with a single *Kreis*.

The spatial information contained in the data raises several possibilities for linking the socioeconomic measures with military variables. The most direct linkage is to assign each military base the socioeconomic information of the *Kreis* in which it is situated. However, this approach is deemed problematic because it takes no account of conditions in neighboring *Kreise*. To the extent that these conditions vary from those of the *Kreis* containing the military base, important information may be lost. This problem may be particularly acute for cases in which a base is in a *Gemeinde* that directly shares a border with a neighboring *Kreis*. Such a situation is illustrated in Figure 1, where the *Gemeinde*, indicated by the crosshatch pattern, is located along the southern boundary of its *Kreis*, indicated in gray. Two other *Kreise* are located directly to the south and south east.

[FIGURE 1]

To incorporate the information from the home and surrounding *Kreise*, we use a Geographic Information System (GIS) to draw a circular buffer around the centroid of the selected *Gemeinde*. The area of the buffer's overlap with each of the *Kreise* contained therein is calculated and then divided by the total area of the buffer. This quotient is used to construct a weighted sum of the information in each of the surrounding *Kreise* for the variables used in the analysis. This approach is similar to Banzhaf and Walsh [2008], where the authors try to overcome the same difficulties encountered here but with US census data. For example, taking the unemployment rate, the calculation for Figure 1 would draw on three weights corresponding to the overlap of each of the three *Kreise* in the buffer:

$$unemployment_j^{\text{weighted}} = \sum_{i=1}^{3} \left(\frac{overlap\_area_i}{total\_area\_buffer_j} \times unemployment_i \right),$$

where the subscripts i and j denote the *Kreis* and buffer zone, respectively. Note that the weights, given by the first term in parentheses, sum up to 1. This calculation applies to just about all military bases in the dataset, i.e., most buffer zones cover more than one *Kreis*. One advantage of this approach is that, by adjusting the size of the

buffer, it allows us to readily test the robustness of the results according to the scale of the analysis. We set the radius of the buffer at 12 km, which is the average commuting distance in Germany, and at 20 km to validate the robustness of the estimates. We also estimate the models using the untransformed data. That is, we use the politically-delineated district (at the *Kreis* level) the base is in as the unit of analysis instead of the local community surrounding the base. One reason why this approach is relevant is that the creation of the buffer zones disregards natural borders between *Kreise*, such as rivers and mountains.

Table 1 presents the number of bases in each Federal State. Overall, the dataset records 105 base closures out of 298 bases. The majority of the closures occurred in 2007, when 43 bases were completely shut down. The states of Bayern and Rheinland-Pfalz closed the most number of bases (17), followed closely by Nordrhein-Westfalen (16), Schleswig Holstein (14), and Niedersachsen (11).

[TABLE 1]

In Table 2, the top 10 *Gemeinden* in terms of the number of military personnel in 2003 are shown. In the dataset, the largest base, which is located in Koblenz in Rheinland-Pfalz, has a personnel complement of 8,830. Düsseldorf in Nordrhein-Westfalen comes next at 3,020 military personnel, which is quite a big difference compared to the base in Koblenz. Of the top 10 bases, two were eventually closed by 2007 (Memmingerberg in Bayern and Kappeln in Schleswig-Holstein) while another two experienced merely a reduction (Hammelburg in Bayern and Sigmaringen in Baden-Württemberg). Table 2 illustrates further that the personnel complement in each base is not a substantial part of the population, except the base in Koblenz, where the share approaches 10 percent. Typically, the range is between 1 to 2 percent.

[TABLE 2]

To get an indication of the differences between zones where bases eventually closed and zones where there were merely reductions in military personnel (in the dataset, all military bases experienced at least a reduction in military personnel), we test the equality of means of various indicators between the two groups using the first and last year they are observed in the dataset, i.e., 2003 and 2007. The results of the tests are presented in Table 3. For all cases, we find no significant difference between the two groups for both years. The test results from 2003 indicate that these two groups are comparable with each other, which minimizes the possibility of an omitted variable biasing our results, while the 2007 results give a preview of the conclusions obtained from regressions described in the subsequent section. The idea is that, in recovering the effect of a base closure on a particular outcome variable of interest from observational data, one must compare the outcome for a community around a base that closed to what would have happened had that particular base not closed—the counterfactual. Since the counterfactual is never observed, we rely on other communities around bases that did not close to serve as a control group, with which we can compare the outcome for the treated units (where bases did in fact close). These control units should ideally

be similar in observed and unobserved characteristics to the treated units before the treatment occurred. That these units are similar in observed characteristics, as demonstrated by the equality-of-means tests, makes it much more likely that they are also similar in unobserved characteristics. Naturally, since the discussion is about the unobserved, one can never be entirely certain, but this applies just as well to all studies that use observational data.

[TABLE 3]

4 Estimation strategy and results

A least-squares regression is used to estimate the impact of the number of military personnel on the outcome variable of interest within the periphery of the base. This framework is expressed in the following econometric specification:

$$y_{it} = \alpha + \delta DP_{i,\,t-1} + \boldsymbol{\beta}'\mathbf{x}_{it} + \boldsymbol{\theta}'\mathbf{z}_t + e_{it}, \tag{1}$$

where y_{it} is a particular socioeconomic indicator for buffer i in year t, $DP_{i,\,t-1}$ is the number of military personnel (*Dienstposten*) in buffer i in the previous period (rescaled by dividing by 10,000), $\mathbf{x}_{it}$ is a vector of control variables, $\mathbf{z}_t$ is a vector of buffer-invariant year fixed effects, and e_{it} is a random error; α, δ, $\boldsymbol{\beta}$, and $\boldsymbol{\theta}$ are a set of parameters and parameter vectors to be estimated. The estimate of δ represents the causal effect of base realignments and closures (as measured by the once-lagged number of military personnel) on the outcome variable.

We estimate the model in a partial-equilibrium context for the following outcome variables: household income, regional output (GNP), the unemployment rate, and revenues from VAT and income tax. The annual real household income, real GNP, and VAT and income-tax revenues are logarithmized so that a 1-unit increase in the independent variable translates to a δ-percent change in the outcome variable for these four cases. The set of control variables included in $\mathbf{x}_{it}$ are real GNP per capita, disposable income per capita relative to the national mean, population density, the share of employed people, the share of men who are 15 to 25 years old in the population, the share of immigrants in the population, and a dummy for buffers located in the former East Germany. These variables have been used in the literature to control for other factors that affect regional development other than the presence of a military base [Andersson, Lundberg and Sjöström 2007]. To avoid spurious correlations, the variables contained in $\mathbf{x}_{it}$ change with respect to the outcome variable of interest. For example, disposable income per capita relative to the national mean is not included in the regressions for annual real income but are included in the other regressions.

While the possibility of omitted-variable bias can never be completely ruled out, we ascribe a causal interpretation to the estimated coefficient $\widehat{\delta}$ that is free of biases

otherwise emerging from the correlation of $DP_{i,\,t-1}$ with the error term in Equation (1). This is because the decision to realign the base personnel is based on strategic military considerations that are unrelated to the local socioeconomic dynamics that govern the community around the base. As Brauer and Marlin [1992] point out in their survey of the studies in the US, "communities, firms, and labor seldom set about reducing their military dependence in the absence of actual or imminent military cuts. Conversion is usually 'forced from above' by the cuts and the affected actors apply little forethought in anticipating changes in military orders."[3] The same is true for Germany, where closures were met with little or no resistance. Nevertheless, the variable enters the equation once-lagged since the likely effect of the personnel changes does not materialize instantaneously. As a matter of inference over the parameter estimates, we allow for an arbitrary covariance structure within each buffer through time by reporting heteroskedasticity-robust standard errors clustered at the buffer level.

The above discussion nevertheless does not rule out the possibility that there are characteristics specific to an economic community that both could affect the outcome variables of interest and are simultaneously unobserved at least by the econometrician. Therefore, to check the robustness of our results, we include buffer-specific characteristics that could possibly be correlated with the regressors by augmenting Equation (1) with a time-invariant linear fixed effect ϕ_i, which may or may not be orthogonal to the disturbance term e_{it}:

$$y_{it} = \alpha + \delta DP_{i,\,t-1} + \boldsymbol{\beta}'\mathbf{x}_{it} + \boldsymbol{\theta}'\mathbf{z}_t + \phi_i + e_{it}. \tag{2}$$

The model is then estimated as a standard fixed-effects regression model.

Tables 4, 5, and 6 present the regression results following OLS and FE estimates of Equations 1 and 2, respectively. Based on the OLS regressions, we find no significant impact of base closures on the local economy. The same result is observed for the FE regressions, except for the model of real income tax and real value-added tax for the 12-km buffer and the untransformed data, respectively. Both are significant at the 10-percent level. A 10,000-person increase in military personnel depresses real income tax by about 12 percent within a 355-sq. km. area around a base. The same increase would lead to a decline in VAT collection of about 4 percent using the untransformed data. While this results are at first blush counterintuitive, it may reflect the possibility that military bases deflect resources from other more productive activities. That is, the extant resource allocation in the regional economy is suboptimal and the closure of the military base pushes capital and labor towards more productive uses. Taken together, these results thus suggest that base closures have a negligible impact on economic activity.[4]

[3] In fact, "[m]ost communities affected by forced converstion, especially those particularly dependent on the military dollar, react in a surprised and helpless manner, often simply swallowing the job loss when the cuts arrive." [Brauer and Marlin 1992] This phenomenon, while indicating that local governments seem oblivious to the dynamics of regional development, helps in exogenizing our primary variable of interest.

[4] One limitation of the dataset is that we cannot identify in which month a particular base closed

[TABLES 4, 5, 6]

5 Conclusion

The base realignments and closures in Germany and in many other countries highlight the important issue of whether such rationalization programs have an impact on local communities. Throughout its lifespan, a base may integrate itself into the community in which it is located. Such a base contributes to the community's stability and economic development so that when closed, it can severely impact an area's economy. Based on case studies in the US, this has indeed happened. It therefore raises a number of relevant questions for public policy. For example, what type of bases can be closed with the least negative impact to the community (and how should it be closed and possibly converted for civilian purposes)? Should policy instruments be used to compensate for the effects of any closure? How quickly does the community adjust to such an exogenous shock? Answers to these and other similar questions can guide policymakers in countries attempting to reconfigure their armed forces.

We find that in Germany, base closures hardly made a dent on the local economy. Base closures that happened as part of the modernization of the German armed forces beginning in 2003 have had no significant socioeconomic impact on its surrounding community. A few notable features of German military bases contribute to this result. Not the least of these reasons is the fact that German bases are much smaller compared to, say, American bases both in the US and in Germany. In case studies looking at the impact of base closures in the US, those that have had a substantial impact typically involve a closure of a large base. In contrast, the largest base that closed in our dataset is located in Memmingerberg in the county of Unterallgäu, Bayern. At the start of the period of analysis, the Memmingerberg base had a personnel complement of 2,036, which represents 1.5 percent of the population.

Another plausible reason why we find no effect is that most German bases are self-sufficient and autonomous. These bases and the personnel living in them are not as integrated into the local community as perhaps other bases (e.g., in the United States). Since 2002, provisions for German military bases have been administered centrally through the *Verpflegungsamt* (Provisions Office) in Oldenburg, Niedersachsen. Although for obvious reasons fresh produce are sourced locally, goods with a long shelf life are typically procured through the *Verpflegungsamt*. Major construction works and the fundamental infrastructure of German bases are also centrally managed through

or how long the process took for the base to completely shut down. For example, the effects of a base closure in December 2005 might materialize not in 2006 but rather in 2007. To address this issue, we performed the same econometric exercise described above except that we used $DP_{i,t}$ and $DP_{i,t-2}$ in separate regressions instead of $DP_{i,t-1}$, i.e., the variable of interest is used contemporaneously and as well as lagged twice. We find that this does not alter our results in any meaningful way. These supplemental estimations are available upon request.

the *Territoriale Wehrverwaltung*.[5]

Beyond that, closed bases are also rapidly reused for civilian purposes in Germany. One base (Lüttichkaserne, Hessen) is being transformed into a historic train ride; another (Ledebur-Kaserne in Niedersachsen) will be converted into a hospital complex with a planned investment of €80 million; and yet another (Marinestützpunkt Olpenpitz in Schleswig-Holstein) is being marketed as a major tourist attraction called "Hafencity" complete with a yacht club (and a planned investment of €500 million).[6] In the conversion and reuse of these bases, new employment is generated and those who lost their jobs may be re-employed, which mitigates the negative impacts of base closures. These new (civilian) development projects presumably also induce a substantial increase in tax revenue as reflected by the estimates presented above.

Given that defense and military strategies are permanently in flux in a rapidly changing geopolitical configuration, some countries might find it advantageous to rethink their current deployment strategies to take into consideration the effects of a possible drawdown of military strength in the future or indeed also a possible escalation of defensive forces in response to new and resurrected threats. Germany provides a valuable lesson in this regard. The deployment strategy of the *Bundeswehr* seems especially suited for upscaling and downscaling military bases without damaging the surrounding communities. This flexibility is conducive to economic growth and ultimately contributes to the country's security.

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[5]See the website of the Territoriale Wehrverwaltung for details (in German).

[6]These and other examples are from the *Bundesanstalt für Immobilienaufgaben*, *"Verfahren zur Verwertung bundeseigener Liegenschaften"*, 1 April 2008.

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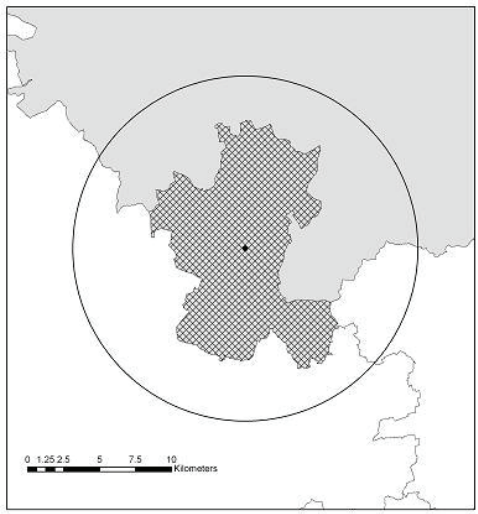
Figures

FIGURE 1 —GIS-BASED CALCULATION OF THE VARIABLES



Note: This base is located in Hammelburg, Bad Kissingen in the state of Bayern.

Tables

TABLE 1 — TIMELINE OF BASE CLOSURES BY FEDERAL STATE

Federal State	Bases	Number of base closures by year					Bases closed
		2003	2004	2005	2006	2007	
Bayern	50	0	2	2	7	6	17
Nordrhein-Westfalen	43	0	1	6	6	3	16
Schleswig Holstein	39	0	3	4	2	5	14
Rheinland-Pfalz	36	0	0	1	9	7	17
Niedersachsen	35	0	0	3	2	6	11
Baden-Württemberg	29	0	0	0	3	5	8
Hessen	23	0	2	1	2	4	9
Mecklenburg-Vorpommern	19	0	1	0	0	4	5
Brandenburg	13	0	2	1	1	0	4
Thüringen	6	0	0	0	0	2	2
Saarland	4	0	0	1	0	0	1
Sachsen	1	0	0	0	0	1	1
Total	298	0	11	19	32	43	105

SOURCE: *Stationierungskonzept der Bundeswehr 2004.*

TABLE 2 — TOP 10 *Gemeinden* BY MILITARY PERSONNEL COMPLEMENT IN 2003

Gemeinde	*Kreis*	Personnel		Share in population†	
		2003	2007	2003	2007
Koblenz	Koblenz	8,830	8,830	0.0819	0.0832
Düsseldorf	Düsseldorf	3,020	3,020	0.0053	0.0052
Hammelburg	Bad Kissingen	2,490	1,830	0.0228	0.0172
Penzing	Landsberg am Lech	2,360	2,360	0.0215	0.0208
Sigmaringen	Sigmaringen	2,200	1,670	0.0164	0.0126
Strausberg	Märkisch-Oderland	2,200	2,200	0.0115	0.0115
Regensburg	Regensburg	2,140	2,140	0.0167	0.0162
Stetten am kalten Markt	Sigmaringen	2,080	2,080	0.0155	0.0157
Memmingerberg	Unterallgäu	2,036	0	0.0150	0.0000
Kappeln	Schleswig-Flensburg	1,950	0	0.0098	0.0000

SOURCE: *Stationierungskonzept der Bundeswehr 2004.*

TABLE 3 — EQUALITY-OF-MEANS TEST, 2003 AND 2007

Variable	2003		*p*-value	2007		*p*-value
	With closure	No closure		With closure	No closure	
Panel A: 12-km buffer zone						
Annual real household income	17,074.11	17,330.70	0.2698	19,941.70	20,299.21	0.3812
Unemployed ÷ population	0.0454	0.0483	0.3026	0.0389	0.0410	0.3604
Foreigners ÷ population	0.0615	0.0646	0.4352	0.0611	0.0639	0.4625
Males aged 15–25 ÷ population	0.0603	0.0602	0.9173	0.0605	0.0599	0.2064
Persons per square km	284	324	0.3375	284	325	0.3262
Real GNP (in '00,000)	50.2975	54.6876	0.4588	47.0718	51.0428	0.4691
Real value-added tax (in '000)	6,057.65	6,634.98	0.4967	6,745.35	7,396.50	0.4915
Real income tax (in '000)	56,315.51	58,631.43	0.6998	60,329.95	62,933.70	0.6694
Panel B: 20-km buffer zone						
Annual real household income	17,007.65	17,263.16	0.2571	19,940.65	20,248.93	0.4286
Unemployed ÷ population	0.0451	0.0479	0.3013	0.0388	0.0408	0.3879
Foreigners ÷ population	0.0608	0.0633	0.4978	0.0606	0.0627	0.5519
Males aged 15–25 ÷ population	0.0601	0.0602	0.9088	0.0605	0.0601	0.2935
Persons per square km	271	304	0.3640	272	305	0.3632
Real GNP (in '00,000)	51.3316	54.9975	0.5034	48.3141	51.4668	0.5354
Real value-added tax (in '000)	6,209.65	6,721.51	0.5243	6,938.67	7,497.16	0.5328
Real income tax (in '000)	57,808.82	59,691.50	0.7439	61,991.13	64,052.43	0.7242
Panel C: Untransformed data						
Annual real household income	17,116.79	17,429.73	0.2308	19,897.89	20,327.90	0.3386
Unemployed ÷ population	0.0462	0.0489	0.3422	0.0396	0.0419	0.3480
Foreigners ÷ population	0.0665	0.0668	0.9485	0.0662	0.0661	0.9886
Males aged 15–25 ÷ population	0.0602	0.0601	0.9315	0.0605	0.0599	0.2599
Persons per square km	358	361	0.9590	357	359	0.9659
Real GNP (in '00,000)	45.1935	50.1877	0.3111	42.4847	46.6024	0.3616
Real value-added tax (in '000)	5,420.90	5,669.03	0.7001	6,027.65	6,319.62	0.6837
Real income tax (in '000)	48,942.69	53,249.68	0.3886	52,613.31	57,322.03	0.3630
Observations	105	193		105	193	

NOTES: Income, GNP, and VAT are in €. The *p*-values are based on two-sided *t*-tests.
SOURCE: Authors' calculation.

TABLE 4 — REGRESSION RESULTS (12-KM BUFFER)

	Dependent variables				
	(log) Real annual household income	(log) Regional output	Unemployment rate	(log) Real value-added tax	(log) Real income tax
Panel A: OLS estimates					
Once-lagged DP	0.0030	0.0443	0.0023	−0.0460	−0.1838
	[0.0398]	[0.1057]	[0.0051]	[0.1425]	[0.1462]
Controls	Yes	Yes	Yes	Yes	Yes
R^2	0.7161	0.9256	0.8071	0.9013	0.9201
Observations	1,192	1,192	1,192	1,192	1,192
Panel B: FE estimates					
Once-lagged DP	0.0332	0.0204	−0.0057	−0.0313	−0.1188*
	[0.0601]	[0.0713]	[0.0086]	[0.0177]	[0.0674]
Controls	Yes	Yes	Yes	Yes	Yes
Within R^2	0.8837	0.7709	0.8382	0.9360	0.9361
Observations	1,192	1,192	1,192	1,192	1,192

NOTES: Bracketed numbers are robust standard errors clustered at the buffer level. See text for the list of other control variables.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
SOURCE: Authors' calculation.

TABLE 5 — REGRESSION RESULTS (20-KM BUFFER)

	Dependent variables				
	(log) Real annual household income	(log) Regional output	Unemployment rate	(log) Real value-added tax	(log) Real income tax
Panel A: OLS estimates					
Once-lagged DP	0.0129	0.1470	−0.0009	0.1145	0.2542
	[0.0346]	[0.1042]	[0.0049]	[0.1122]	[0.1671]
Controls	Yes	Yes	Yes	Yes	Yes
R^2	0.7553	0.9397	0.8157	0.9221	0.9256
Observations	1,192	1,192	1,192	1,192	1,192
Panel B: FE estimates					
Once-lagged DP	0.0332	0.0363	−0.0049	−0.0268	−0.0572
	[0.0648]	[0.0548]	[0.0074]	[0.0212]	[0.0803]
Controls	Yes	Yes	Yes	Yes	Yes
Within R^2	0.8988	0.8312	0.8577	0.9429	0.9372
Observations	1,192	1,192	1,192	1,192	1,192

NOTES: Bracketed numbers are robust standard errors clustered at the buffer level. See text for the list of other control variables.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
SOURCE: Authors' calculation.

TABLE 6 — REGRESSION RESULTS (UNTRANSFORMED DATA)

	Dependent variables				
	(log) Real annual household income	(log) Regional output	Unemployment rate	(log) Real value-added tax	(log) Real income tax
Panel A: OLS estimates					
Once-lagged DP	−0.0867	0.1335	0.0041	−0.0513	0.2506
	[0.0514]	[0.1425]	[0.0065]	[0.1615]	[0.1800]
Controls	Yes	Yes	Yes	Yes	Yes
R^2	0.6063	0.8729	0.7532	0.8562	0.8982
Observations	1,192	1,192	1,192	1,192	1,192
Panel B: FE estimates					
Once-lagged DP	0.0502	0.0147	−0.0049	−0.0379*	−0.0723
	[0.0715]	[0.0753]	[0.0114]	[0.0228]	[0.0619]
Controls	Yes	Yes	Yes	Yes	Yes
Within R^2	0.8585	0.7790	0.7793	0.9198	0.9229
Observations	1,192	1,192	1,192	1,192	1,192

NOTES: Bracketed numbers are robust standard errors clustered at the buffer level. See text for the list of other control variables.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
SOURCE: Authors' calculation.